BRUSSELS STUDIES
the e-journal for academic research on Brussels
www.brusselsstudies.be
Issue 7, 24 May 2007

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# The direct cost and geography of Brussels mass transport's operating delays

**Abstract**

*Automobile traffic causes a decrease in the surface mass transport's effectiveness in Brussels as in other cities. In economic terms, this corresponds to lower returns and productivity for the operator. This article documents economically– in terms of direct costs – and geographically how road traffic slows down the region's urban buses and trams. Such a computation appears to be unprecedented, although it offers a different way to state the problem of financing public transport and of analysing the conflict between automobile transport and mass transport.*

*The aggregation of spatially and temporally fine data enables the authors to conclude that at least 18% of the supply's production cost serves only to offset these running delays. Moreover, a detailed map of service along the various routes that allows for the frequencies of the vehicles' runs reveals the trouble spots where urgent action is necessary and shows that creating exclusive rights of way is not enough.*

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*The authors are expressing their own opinions, completely separate from their professional activities. The research and drafting of this article were done before Yves Fourneau was hired by the Brussels interborough transport operator STIB/MIVB.*

## Introduction

Whereas the commercial speeds of mass transport in many cities are reduced because of automobile traffic, this seems to interest economists and geographers little. From a geographic point of view, mapping the inefficiency of mass transport can show the places where action is urgently needed while setting the local authorities before their responsibilities. In economic terms, traffic jams create direct monetary costs for mass transport to the extent that the commercial speeds, frequency of service, and number of vehicles are directly related to them. If the service frequency is kept constant, a slower operating speed forces the operator to put more vehicles on the road, which increases both the investment costs (by increasing the number of vehicles and depot requirements) and operating costs, given the costs inherent in the mileage covered by the vehicles and the cost of labour, which accounts for a large share of the operating budget. In a comparative study of the costs and productivity of mass transport networks across Europe, Wunsch (1996) effectively confirmed the favourable impacts of the commercial speed on these two variables [1].

Yet whereas the phenomenon of congestion is very widespread, we have found no trace of research that circumscribes and quantifies exhaustively the costs that it incurs for the municipality. This is all the more amazing in that it is a real cost, and thus one that can be set objectively, without having to go through a myriad of valuations that are subject to debate. In addition, there are a great many studies of mass transport network productivity and the costs of road congestion. The latter focus on the costs or additional costs of congestion as external costs, especially when it comes to the value of lost time, and, moreover, usually for motorists or lorry drivers only.

[1] With an elasticity between the cost per vehicle-km and speed of -0.392 for buses and -0.121 for trams.

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For example, Beuthe and co-workers (2002) studied the external costs of goods carriage on Belgium's intercity networks and calculated the cost of congestion for transport operators (costs linked to the lorries and to the value of the merchandise) based on lost time. They estimated these costs for passenger cars and small commercial vehicles, but produced nothing for mass transport. Levinson and Gillen (1998), in studying the internal and external costs of intercity highway transportation, included in the cost of congestion only the value of the time lost by travellers in passenger cars. Prud'homme (1999) and Prud'homme and Sun (2000), in studying the economic cost of congestion in Paris and on the Paris beltway, respectively, did not take the trip time differential between unused or fluid roads and congested situations as their starting points, but calculated the deviation from optimal congestion[2] using a method that, although admittedly original, allowed as well only for the case of the motorists who were directly concerned. When it comes to marginal external costs, Mayeres *et al.* (1996) and Boniver and Thiry (1994) extended their computations to mass transport ridership and lorries, but also limited their calculations to the value of time lost. Finally, the "Boiteux 2 Report" (Commissariat Général du Plan, 2001) contains a chapter on "urban congestion and [its] interactions with passenger car traffic and other road users". However, the report does no more than point out the lack and age of the data describing and quantifying the interactions between passenger cars and mass transport. The corollary is to call for studies in this area to be carried out.

Despite the varied literature that we consulted, there does not seem to exist any quantification of the direct costs of the reduced efficiency of mass transport due to road traffic in Brussels. Now, while one may think that this cost is marginal with regard to the internal and external costs generated by road traffic, one can on the contrary suppose that it is significant if it is compared with the mass transport operators' outlays, which are largely financed by the community or municipality. What is more, we must stress the fact that this additional cost for mass transport budgets is a direct cost, one that is actually spent by the public authorities, and not an indirect cost obtained by setting a monetary value to a type of bother that, while bothersome, does not necessarily correspond to a real monetary outlay ("cost" of noise, vibrations, ugliness, and so on).

This article tries to plug some of these gaps using the example of Brussels. The aims are to approximate the direct cost of the lower speeds for the operator of the Brussels-Capital Region's transport network and to map these poor performances for analytical purposes (to understand them) as well as for practical purposes (to determine the places where action should be taken first). The article is structured as follows: It first gives a brief overview of the context plaguing Brussels' mass transport and justifies the fact that we shall focus on the surface network. Next comes a precise quantitative inventory of the running delays that this mass transport network sustains, drawn up using time losses and their consequences in terms of the size of the rolling stock fleet that is required. The direct cost is then estimated from these data. Finally, the segments characterised by reduced commercial speeds are mapped and their spatial distribution discussed.

[2] Defined as congestion that maximises the surplus to the extent that, according to the authors, roads are not built to be empty of vehicles.

Given the magnitude of this work and the availability of data, this article is nevertheless limited to the trams and buses of the Brussels Interborough Transport Company (STIB/MIVB), that is to say, the network of the city's major urban operator[3], while the map concerns the tram lines only.

## 1. The Brussels Context

### *1.1. Massive use of the passenger car*

Brussels' surface mass transport lines – buses and trams – are generally rather inefficient, especially due to automobile traffic, even though the latter is not the only cause of the buses and trams' poor commercial speeds[4]. Automobile traffic in Brussels is effectively very heavy, especially, but not only, during rush hours. This is because it is a rather monocentric city that suffers from a wide peri-urban settlement ring and an employment pool that extends much farther than the morphological agglomeration (Vandermotten *et al.*, 1999) but concentrates a large share of its jobs and shops in its central areas while at the same time offering motorists comfortable infrastructure (urban motorways and a large number of parking spaces in the streets and under office buildings). More than half of the jobs in the city are filled by people who live in its suburbs or in other towns, and individual motorised transport dominates the picture. According to the 2001 socio-economic survey, 55% of the working-age people employed in Brussels go to work by car[5]. The percentages are 59% for outside residents and 49% for Brussels residents, which puts a damper on the oft-heard gripe that the city is clogged with and polluted by commuters' vehicles alone.

In the face of steadily rising automobile traffic and road congestion[6], dedicated mass transport lanes account for only a part of the network, are not always well designed, and are not always heeded by motorists. On the other hand, traffic light management continues to privilege automobile traffic rather than the trams and buses, thereby limiting the efficiency of many lines, including those running on their own rights of way. Road traffic thus interferes with the movements of the city's buses and trams, to the point where it erodes their quality of service and attractiveness. Moreover, this finding is far from new. Despite the rise in the proportions of surface mass transport vehicles circulating in dedicated lanes (or on segregated tracks) or underground, their commercial speeds have continued to fall (**Tables 1 and 2**).

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[3] The public transport serving Brussels is run by four operators, as follows: The STIB/MIVB for Brussels' urban mass transport (generally limited to the territory of the Brussels-Capital Region); De Lijn for the Flemish regional buses and TEC for the Walloon regional buses that enter Brussels; and the national railways (SNCB/NMBS).

[4] The trams' narrow doors and high floors, the purchase of tickets directly from the driver, and overcrowding on certain lines during rush hours are all "internal" causes that also help lower commercial speed.

[5] Own calculations.

[6] The regional administration predicts that if policies do not change, traffic will come to a standstill by 2010.

***Table 1. Changes in tram track layout***

| | 1970 | 1980 | 1990 | 1995 | 2001 | 2004 |
|---|---|---|---|---|---|---|
| On roadway | 64,4% | 58,5% | 50,8% | 49,3% | 49,3% | 48,1% |
| On segregated tracks | 32,3% | 34,9% | 43,4% | 41,5% | 41,5% | 42,3% |
| In tunnels | 3,4% | 6,5% | 5,8% | 9,2% | 9,2% | 9,6% |
| Route length (km) | 175,6 | 150,3 | 132,8 | 133,6 | 131,0 | 128,6 |

*Computed for the length of a route. Source: STIB/MIVB, annual reports.*

***Table 2. Change in commercial speed by mode***

| | 1970 | 1980 | 1990 | 1995 | 2001 | 2004 |
|---|---|---|---|---|---|---|
| Metro | N.C. | N.C. | 29,9 | 19,4 | 29,2 | 29,4 |
| Trams | N.C. | N.C. | 17,5 | 17,0 | 16,9 | 16,7 |
| Buses | N.C. | N.C. | 19,3 | 18,9 | 18,0 | 17,0 |

*Weekly mean in km/hr, winter service, for the STIB/MIVB network only..*
*Source: STIB/MIVB annual reports.*

There is thus considerable potential to improve the lines' commercial speeds, provided that appropriate management and roadwork measures are taken, as **Figure 1**, which compares the minimum and maximum commercial speeds for each line of the STIB/MIVB network (see next page), shows. To give only one example of the links between the number of vehicles, commercial speed, and frequency, a line as crowded as the 71 bus line, which serves downtown Brussels, the Central Station, some densely settled and sometimes working-class neighbourhoods, shopping districts, and two university campuses, could run at the frequency of twelve buses an hour at rush hour instead of the current nine per hour if it operated as efficiently as it does when traffic is moving along.

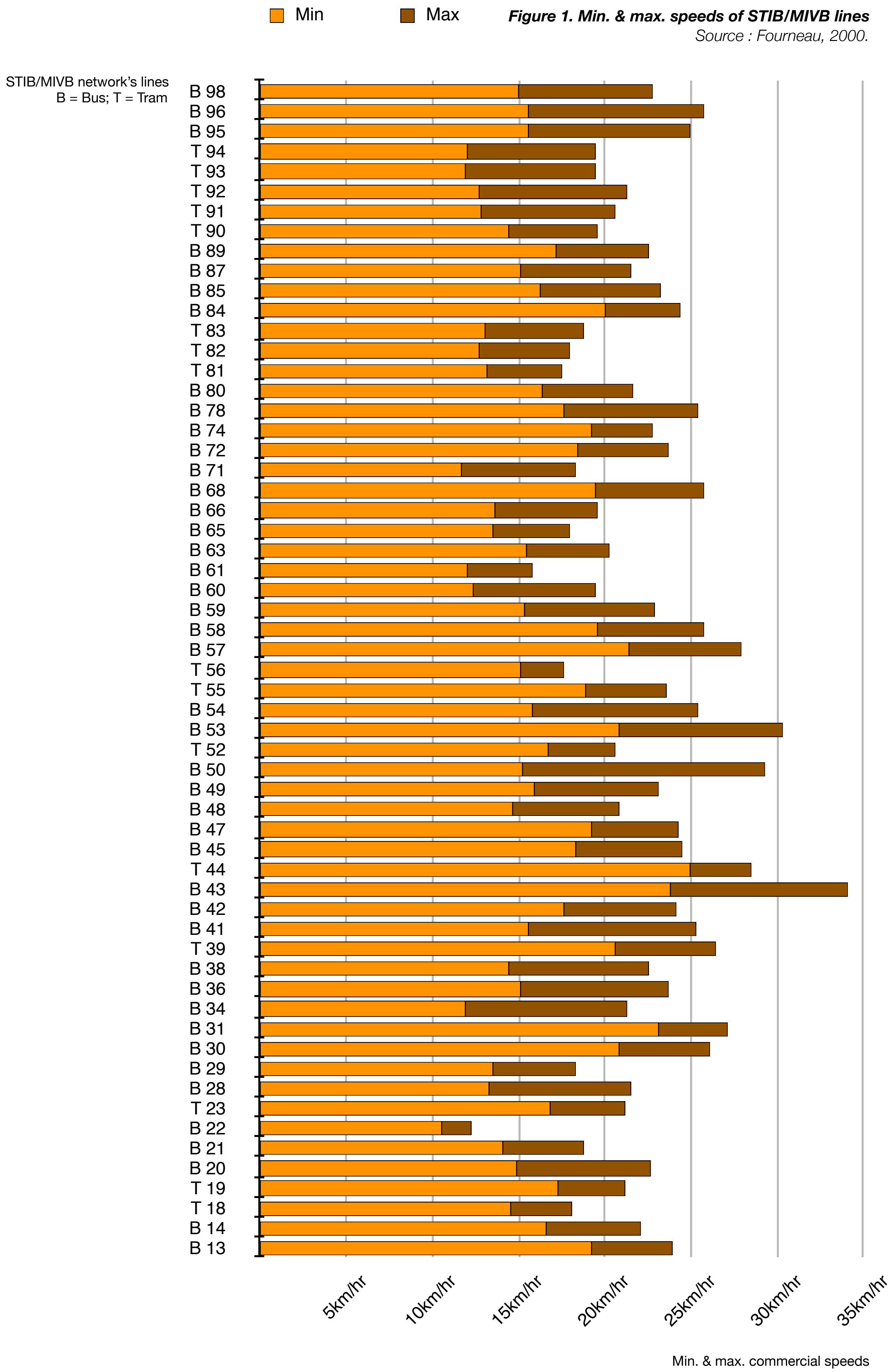


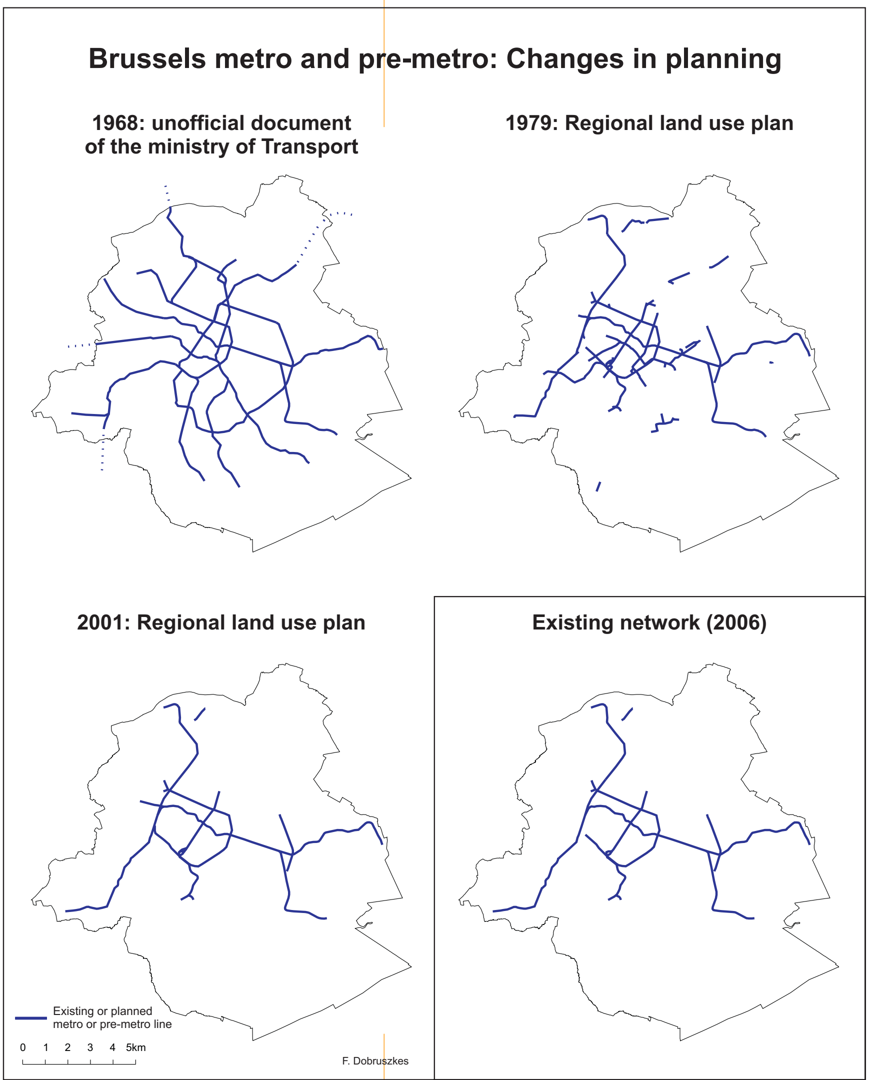

***Figure 1. Min. & max. speeds of STIB/MIVB lines***

*Source : Fourneau, 2000.*

*1.2. A surface network to be enhanced*

Brussels' surface network of trams and buses is thus rather inefficient, unlike the underground network of three metro lines and two pre-metro axes served by underground tram lines. In a comparison of 54 European networks, Wunsch (1996) showed that Brussels ranked only 38th by cost per seat-km produced[7], despite the existence of the metro, which tends to reduce the unit costs because of its efficiency (for more about the link between the STIB/MIVB's productivity and the metro network, see Wunsch and Berquin, 1997). It is significant that Brussels was ranked almost on the same level as 36th-place Zurich, which has only buses and trams, but particularly efficient trams. In other words, without a metro, Zurich manages to achieve a level of productivity slightly better than that of Brussels. We must also point out that Brussels was one of the worst ranked cities in the group with a metro.

***Figure 2.***




This attests well to its surface network's poor performance and prompts us to ask whether Brussels' coverage by (pre-)metro lines should be increased or if the city must content itself with improving its surface network. The answer is both political and geo-technical. From the political viewpoint, the planning tools announce a stabilised (pre-)metro network: Only some marginal extensions are still foreseen (**Figure 2**), in part because of the high level of underground infrastructure investment costs compared with the Brussels-Capital Region's investment capacity. From a technical and geographic viewpoint, two factors have been shown to go against covering Brussels with a fine-meshed (pre-)metro system, namely, (1) the (pre-)metro already serves the city's two major employment centres (downtown Brussels, including the North and South RR Stations, and the European

[7] Deflating the cost by the wage level.

district), and (2) the city's relatively low population density limits the potential passenger volume, whereas the metro and pre-metro are reserved for routes for which there is strong demand, given the great capacity per hour that characterises them. Even from the perspective of very determined regulation of the modal choice to offset the low population densities and increase mass transport's market share to 60%, the demand could be met by large-capacity trams that circulate efficiently, without having to resort to costly investments in metro lines and the like (Dobruszkes and Duquenne, 2004).

Brussels thus appears to be "doomed" to content itself with being served mainly by the surface transport network. Making it efficient would help achieve several aims, *i.e.*,
~ not wasting a limited regional budget in which financing mass transport accounted for 18% (514 million euros) in 2006[8];
~ helping to promote an environmentally friendly modal choice, at least when it comes to people sensitive to the supply, since it is known today that transport modes' comparative efficiencies explain only part of the reasons for choosing a travel mode (Bovy, 1999, and Kaufmann, 2000);
~ enabling the riders of mass transport not to spend too much time in the vehicles, provided that the increases in speed are not transferred to decisions to live farther away (Kaufmann, 2000). Such arbitration between time and distance can happen, but the effect depends on various factors, such as the home ownership structure, households' abilities and willingness to move, the availability of building plots or real property and the prices practiced, etc.;
~ improving service in the second intra-urban ring, especially in conjunction with the future regional express train stations of the first and second rings. Employment in the second ring has effectively boomed over the past ten years or so, with car use rates well above the regional average (ULB-IGEAT, 2006).

## 2. The importance and cost of the slower travel times for the STIB/MIVB's budget

### *2.1 Methodological aspects*

Rather than using theoretical speeds or trip times, we decided to use figures that corresponded to times that the operator actually measured in his network[9]. The STIB/MIVB effectively provided us with data on journey times and commercial speeds for 1999 that were totally disaggregated in time and space: The day was cut up into several slices (dawn, morning rush hour, off-peak interval, evening rush hour, and evening) and the geographic scale was that of the segment between two stops, *i.e.*, the finest interval that existed. The trip time or commercial speed for each period and segment was a mean value for a large number of runs, thereby

[8] Forecast outlays for 2006, including the STIB/MIVB's general endowment (€350.6 million) and the investments financed by the Region. The costs borne by the other official bodies are not counted. Source: the Brussels-Capital Region's general budget of expenditures for 2006, available at the following site:
www.bruxelles.irisnet.be/fr/region_de_bruxelles-capitale/le_budget_regional.shtml.

[9] Thanks to the operating assistance system and in situ manual measurements.

minimising the effects of situations that strayed from the usual situation. The statistics broke the time down into time spent at the stops and time spent between stops.

We thus computed the deviations in the route travel times – outside of time spent at the stops – from the evening travel times (which was taken as the baseline, since automobile traffic does not bother mass transport much in the evening) for each period of a weekday. Multiplying the deviations by the frequency of service for each line in each period gave us the daily time losses for all of the segments between stops for the STIB/MIVB's buses and trams. Aggregating these results enabled us to estimate the direct cost by computing the additional rolling stock required and associated costs (drivers, energy, etc.).

It is important to point out that we did not include the time spent at each stop in these computations. This was done deliberately in order to exclude a time factor due essentially to the passengers[10]. On the other hand, our method does not enable us to detect all of the traffic light management flaws (which have partial knock-on effects on the time spent at the stops). Our results can thus be considered to be closer to minimal markers and the potential gains are higher than those that show up here.

Two additional methodological reservations must be made. First, we took the yields of scale to be constant. Knowing whether the yields of scale are constant, decreasing, or increasing is currently a subject of scientific debate. To take just one example, if an operator needs to acquire more vehicles, he may be in a position to parley a better unit price (which does not prevent a higher total expenditure). Second, the financial impact of raising the buses and trams' commercial speeds should be analysed more finely, in the interest of completeness. While, for the same frequency of service, increasing the commercial speed will allow savings on the rolling stock, it can also incur additional costs, due, for example, to more intense use of the rolling stock, meaning faster wear and tear and thus a shorter lifespan and faster depreciation.

### *2.2. Estimation of time losses and additional rolling stock requirements*

In 1999, the deterioration of traffic conditions between the various periods of the day in our analysis and the reference period was responsible for a loss of 703 hours per weekday for the STIB/MIVB's trams and buses and forced the company to add no fewer than 54 trams and 99 buses to the 229 trams and 405 buses already in service during the morning and evening peak periods. During off-peak hours, this surplus was 21 trams and 33 buses (Fourneau, 2000).

[10] The higher the number of passengers, the longer boarding and disembarking will take. While the time spent at the stops is indeed something to take into account if one is to act upon commercial speed, it is influenced little by road traffic conditions. Aside from the cases of throngs of passengers' accruing when the service is thrown out of kilter because of clogged roads, poor performance at the stops is usually due to inappropriate layouts of public areas, the circulation of trams with high floors and narrow doors, on-board ticket purchases from the driver, and so on.

In other words, the influence of automobile traffic in Brussels is such that the STIB/MIVB has to have a fleet of trams and buses that is 32% greater than the number required to ensure service frequencies to meet the demand.

### *2.3. Direct cost of this surplus*

The rolling stock surplus estimated above was translated into monetary value by allowing for the outlays linked to the fleet that was required (acquisition, insurance, registration, depot space, etc.) and actually running the vehicles on the road (labour and energy) (**Table 3**). Our computations were based on the cost of T2000 trams (35 year lifespan), standard buses (13 year lifespan), and unit costs that were either provided by the operator or estimated.

The two main costs are the wages of the drivers required to drive the additional vehicles (6/10) and the vehicles' purchase prices (1/4). The other estimated budget items (energy, miscellaneous costs linked to the fleet, and miscellaneous variable costs linked to the mileage travelled) weighed less heavily on the outcome, although they could not be discounted for all that.

Ideally, one must also estimate the additional payroll expenses in the company's various departments (dispatching, cleaning, maintenance, and repairs) and the cost of the land and buildings required to park the additional 153 vehicles. The former item is very difficult to estimate. So is the latter, given the great variability of real estate values between the various cities of Europe as well as within cities. Moreover, the cost of extending the capacities of existing depots on land that the operator already owns differs from that of building new depots, especially if land must be purchased for this. As we did not compute these two factors, for lack of realistic working hypotheses, it is clear that our cost estimate is a minimum.

All in all, it appears that road traffic in 1999 cost the STIB/MIVB at least 17.34 million euros in direct costs, and this does not include the items that could not be estimated (as explained above).

***Table 3.***
***Annual cost of automobile traffic for the STIB/MIVB's budget (in $10^6$ euros))***

| | | |
|---|---|---|
| Drivers'wages | 10,32 | 59% |
| peak hours | 5,00 | 29% |
| off-peak hours | 4,27 | 25% |
| weekends | 1,04 | 6% |
| Acquisition of additional vehicles* | 4,11 | 24% |
| trams | 2,47 | 14% |
| buses | 1,64 | 9% |
| Energy | 1,62 | 9% |
| electricity | 0,86 | 5% |
| fuel | 0,75 | 4% |
| Other costs linked to the fleet (insurance, registration, etc.) | 1,30 | 7% |
| Other variable costs (cleaning, maintenance, etc.) | not determined | |
| Depots | not determined | |
| **Total** | **17,34** | **100%** |

** Costs discounted over the life of the vehicle*
*Source: Fourneau (2000)*

This figure takes on its full significance when it is compared with the production cost of the supply, that is, the cost of putting the vehicles on the road for the passengers (vehicles or trains x km), or €97 million (**Table 4**). In so doing, we see that the estimated cost of the overall reduction in commercial speed is equal to at least 18% of the supply's production cost, or 20% if we drop the metro from the denominator, given that the metro is by definition not directly concerned by automobile traffic. This cost is also equal to 11% of the income that the STIB/MIVB got from ticket sales in 2005 or 61% of the regional budget allocated to the STIB/MIVB to finance its preferential rates.

| | Million euros | % |
|---|---|---|
| Metro | 9,30 | 9% |
| Trams | 34,43 | 35% |
| Buses | 54,24 | 55% |
| Total | 97,98 | 100% |

***Table 4.***
***Estimated annual cost of the production of vehicles or trains x km (in 1999, excluding depot operating costs).***

*Sources: MRBC-AED, STIB/MIVB, Federal Ministry of Mobility*

*2.4. Useful potential gains to increase the capacity on offer*

We calculated the vehicle "surplus" that raising the minimal commercial speed on each line of the tram and bus network would produce, keeping the frequencies unchanged (**Table 5**), and its impact on the operating budget[11].

***Table 5. Surplus of vehicles if each tram and bus line's minimal commercial speed were raised (keeping demand constant)***

| Minimal commercial speed | Surplus of vehicles | | Surplus operating cost ($10^6$ euros) | |
|---|---|---|---|---|
| | surplus | % of fleet on the road (peak hours) | total | driving costs |
| 17,0 km/h | 64 | 10,1% | 6,20 | 4,61 |
| 17,5 km/h | 74 | 11,7% | 7,74 | 5,76 |
| 18,0 km/h | 88 | 13,9% | 9,12 | 6,78 |
| 18,5 km/h | 94 | 14,8% | 10,76 | 8,01 |
| 19,0 km/h | 107 | 16,9% | 12,41 | 9,23 |
| 19,5 km/h | 112 | 17,7% | 14,05 | 10,46 |
| 20,0 km/h | 118 | 18,6% | 15,69 | 11,68 |

*Source: Computed from 1999 operating data.*

The corresponding costs are once again far from negligible if we compare them, for example, with some mean investment or operating costs in Brussels (**Table 6**).

***Table 6. Urban trams and buses in Brussels: Estimated investment costs ($10^6$ €)***

| Investment | per | trams (T2000) | standard buses |
|---|---|---|---|
| Infrastructure* | 1 km | 1,50 | ≈ 0 |
| Rolling stock** | 1 vehicle | 1,75 | ≈ 0,2 |
| Lifespan of the rolling stock | 1 vehicle | 35 years | 13 years |

** including electrical substations; not including depots*
*** excluding depreciation*

*Sources: MRBC-AED and Federal Ministry for Mobility*

The term "surplus" that we used above is abusive. We must effectively understand it as follows: Increases in the trams and buses' commercial speeds would follow from automobile traffic management and public area engineering measures that would in part not fail to penalise automobile traffic. This consequence, coupled with the rise in the efficiency and thus attractiveness of mass transport, would not fail to generate both additional demand and a certain modal shift from the passenger car to public transport that is not estimated here. The foregoing figures are thus intended solely to illustrate the relationship between commercial speed and the net-

[11] Excluding amortisation of investments.

work's operating costs, keeping all other factors constant, and not to estimate what would happen to these costs if a major modal shift occurred.

A modal shift would inevitably increase the load on mass transport, which would require an increase in capacity at a time when the network is already heavily used, even saturated at peak hours. We therefore deduce from this that a strong rise in the network's commercial speed would not allow the operator to reduce the fleet significantly, but would rather create the right conditions for absorbing the additional demand that would result from a modal shift from cars to trams and buses.

In addition, we must point out that the measures to improve the mass transit system's efficiency also entail costs for the public authorities. However, these costs are very difficult to estimate overall, to the extent that they vary greatly with the type of measure (instituting one-way traffic to detour traffic towards another street or changing the lights' phases does not cost much, unlike the cost of setting up an exclusive right of way, which would require redoing the rail or road infrastructure). We can nevertheless consider that these investment costs are by definition paid back by the gains that they generate, especially when it comes to the operator's productivity. This is all the more so in that these are generally one-off costs, except for the infrastructure's maintenance, which is, however, of a smaller magnitude, whereas the productivity gains are recurrent each year.

Finally, we must not forget the risk of the relocation of certain activities outside Brussels if automobile traffic is penalised too heavily. However, one must be aware of the fact that if policies do not change, Brussels will sooner or later be saturated with cars and thus characterised by greatly hampered mobility that will be a factor of unattractiveness that would also help fuel increasing urban sprawl.

## 3. Rough geography of mass transport's reduced commercial speeds

### *3.1. ography of the trams' inefficiency*

Now that we know how high the cost of Brussels' trams and buses' reduced commercial speeds is, it is useful to map these slow-downs. Such an exercise meets two objectives, one analytical (to help identify the causes) and political (to locate the trouble spots where the need to improve the situation and fuel public debate is most urgent).

**Figure 3** (on the following page) depicts the geography of the tram network's inefficiency[12], expressed as the sum of the time lost by the trams on a weekday.

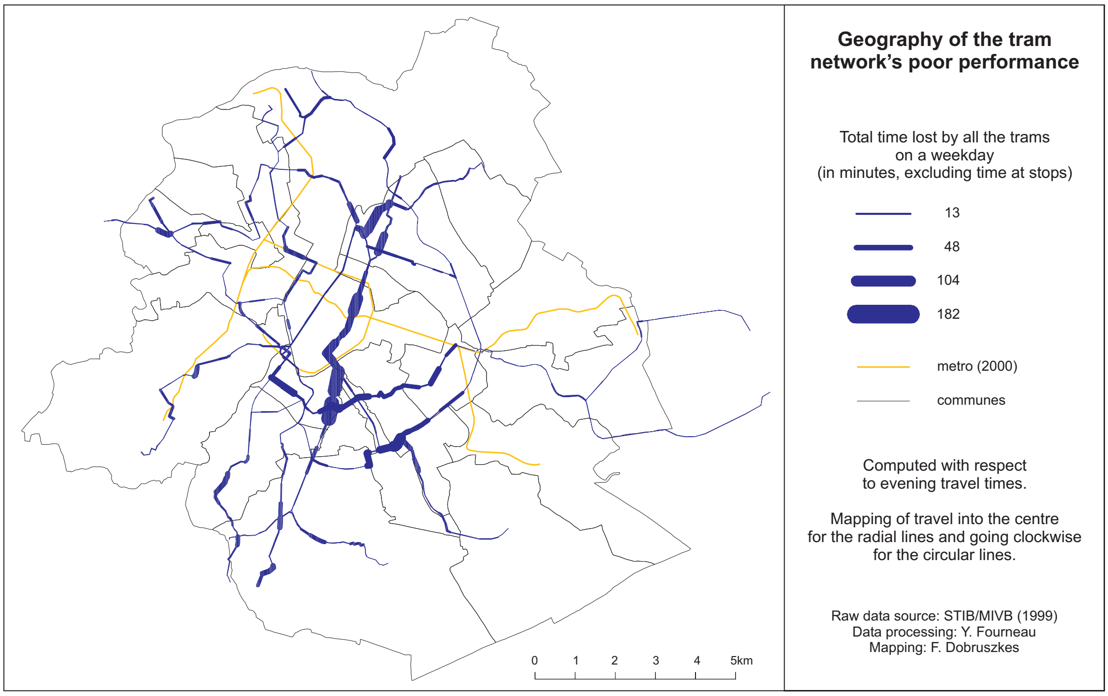
It shows the huge trouble spots that are well known to the trams' riders (who feel their direct consequences) and the operator (who tries to reach negotiated solutions to them with the public authorities). These trouble spots consist of segments where the increases in travel time are:
~ moderate but affect a very large number of trams (for example, General Jacques Boulevard);
~ high but affect low frequency tram traffic (for example, trams 81 and 82 in the

[12] Given the cumbersome nature of geo-encoding, mapping the bus network could not be completed.

boroughs of Ixelles/Elsene and Saint Giles); and
~ high and affect high frequency tram routes (typically Chaussée de Charleroi/ Charleroise Steenweg).

From an analytical point of view, the map does not enable one to establish a geography of the slow-downs attached to any given spatial model: the logic is not one of the centre versus the periphery, spokes versus the "wheel", dense neighbourhoods versus well spaced out neighbourhoods, rich versus poor neighbourhoods, etc. In fact, the map shows above all a mixture of typologies of places (type of artery, type of transport lane, and organisation of available public areas) and the general organisation of traffic (with in particular the vital matter of traffic light management) – two factors that directly affect both regional and municipal (borough) decisions and political stalemates.

***Figure 3.***



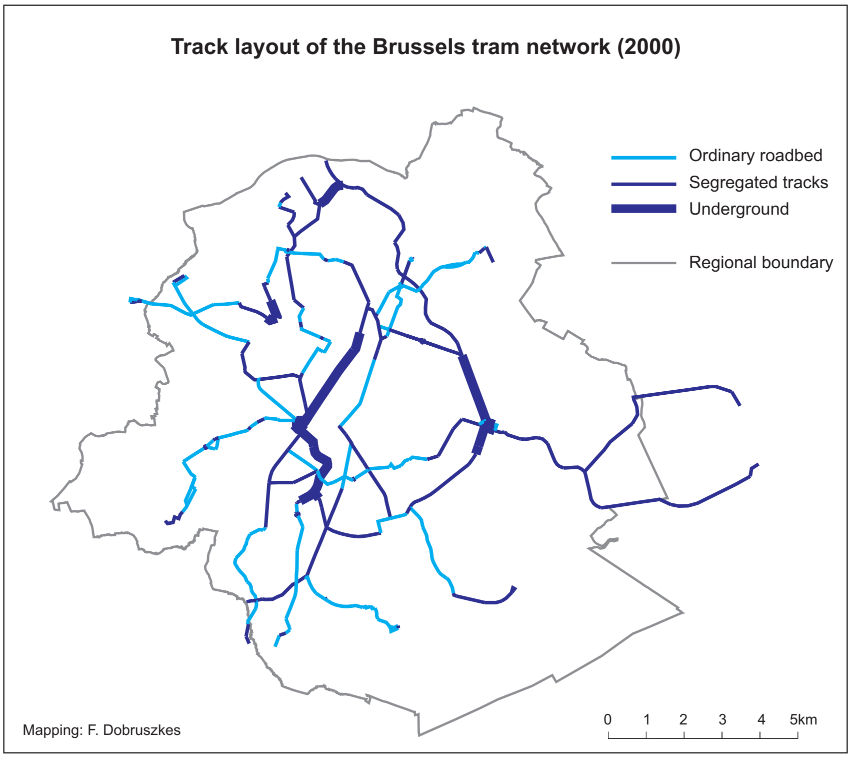

*3.2. The partial influence of the type of tram track layout*

If we compare **Figure 3** with the types of tram track layout (**Figure 4**, next page), we see that the poor performances are of course posted on the parts of the segments where the trams circulate on rails set into the ordinary pavement, but on segregated tracks as well! This apparently paradoxical situation is explained by three non-exclusive factors, to wit:
~ Some of the segregated tracks can be crossed and in such cases are not respected by motorists.

~ The traffic lights' management takes account of the trams only marginally: While a large percentage of the lights detect the trams' presence, they are influenced little by this presence in actual fact[13]. On a larger scale, the lights are managed according to the "constraints" of automobile traffic rather than those of public transport (for example, in the form of green waves calibrated for the automobile traffic).
~ The tram tracks are often obstructed at crossroads, especially by cars turning left or right.

This shows clearly that setting up exclusive rights of way is not enough to guarantee good commercial speeds. You still have to manage the traffic lights, clear the crossroads, and get motorists to observe the Traffic Code.

***Figure 4.***




*3.3. Borough (municipal) but also regional political hobbles*

Unlike many cities, such as a number of German, Swiss, and French cities, that have taken clear measures to free up their surface transport networks or create new

[13] In practice, the light management algorithms are influenced by the presence of trams, but with just a few seconds' margin. For example, a given artery may be given four additional seconds of green lights if a tram is detected, and if five seconds is needed for the tram to pass, that's too bad.

tram lines wholly with exclusive rights of way and systematic, effective traffic light management, the public authorities of Brussels, both the regional and local ones[14]

, cannot seem to manage to adopt similar measures, despite the good principles enshrined in the relevant regional planning tools (regional development plan and regional mobility plan) and generally borough plans.

The regional officials very often advance the interests of the lobbies of the neighbourhoods or boroughs from which they come. This is all the more true if there is a certain confusion and reversibility of roles between borough and regional elected officials (Misonne and Hubert, 2003), for the local officials often have positions in the regional government at the same time and, inversely, the members of the regional government are in part also local elected officials[15], while the political leaders skip back and forth between the local and regional level in line with election results. This leads to matters' being guided by "consensus at all cost" (Misonne and Hubert, 2003). In actual practice, this denatures and weakens the region's policies.

So, Chaussée de Charleroi/Charleroisesteenweg, in Saint Giles Borough, was in 1999 the main trouble spot in the tramway network. A relatively narrow main artery with heavy automobile traffic that ends in a bottleneck at one end and a major crossroads, the capacity of which is limited by the many streets that feed into it, at the other end, this segment is also lined with busy shops whose keepers actively defend automobile traffic and the presence of many parking places that are allegedly necessary to keep their businesses flourishing. The rails' recent replacement[16] could have provided an opportunity to apply the measures that the regional tools foresaw for this axis: detouring part of the automobile traffic[17] and installing partially segregated rights of way. Adopting the positions of the local lobbies, the borough opposed the plan and, given the political clout of its representatives, the street was redone almost exactly as it was before, thus, without truly solving the atrociously slow commercial speed that characterises it.

We must also point out that while the Region issues the town planning permits requested by public institutions in the exercise of their duty (for example, the STIB/MIVB or regional mobility administration), the boroughs have the possibility of stalling things by filing an appeal with the Town Planning Board (up to 8 months' delay) and then with the government[18]. This was the path chosen by Anderlecht's Borough Council in 2002, when it echoed strong opposition from residents to oppose the creation of a new tram line in Marius Renard Avenue, despite the fact that a borough councilman belonging to the Ecolo (Green) Party was the Alderman for Mobility and

[14] The 19 "boroughs" of Brussels are actually separate municipalities with commensurate powers. (Editor's remark)

[15] Even though, legally, their "hands are tied". (They are legally prevented from serving on the borough councils.)

[16] Made necessary because of their poor condition.

[17] Via Rue Defacqz/Defacqzstraat and Avenue Louise/Louizalaan.

[18] Never mind the possibilities of working all the way up to the Council of State.

the Environment[19]. The permit was finally confirmed and issued by the Regional Government and the work was then done. However, the new segment was completed three years after the metro's extension to Erasmus Hospital, on the city limit, although the two projects were supposed to advance together.

Besides planning tools, the administration's drawers are stuffed with commercial speed studies to improve the effectiveness of mass transport that it commissions from engineering firms and then either never carries out or implements in part only. For example, we saw the Region censor itself about a few hundred metre long dedicated bus lane[20]. The Region withdrew the town planning permit itself, under the orders of the minister responsible for such matters, who was more concerned about the discontent of the municipal authorities and local garages (relayed by the local authorities) than about the very low commercial speeds characterising a segment used by twenty buses an hour in each direction during peak hours.

If the boroughs want to hamper the implementation of regional policy, that is one thing. Still, we cannot overlook the contradictions within the Brussels-Capital Region itself. Its various components and subcomponents (such as the different general directorates of the mobility administration) themselves are unable to converge in deeds and actions, despite a certain convergence in words. Here, too, the culture of compromise prevails, and improvements in mass transport's effectiveness can generally be envisioned only provided that they do not disrupt automobile traffic. Thus, dedicated bus lanes are placed in segments where they do not reduce the road's capacity, even where they are not useful, and end before reaching the light in a crossroads so as not to have to reduce the number of traffic lanes[21]. We can also cite a case where the creation of an exclusive right of way for trams led to the expropriation of unbuilt-up adjacent land in order to enlarge the street and thus maintain its traffic flows and parking capacity[22]. This is totally contradictory to the scientifically fairly well documented fact that reducing automobile traffic calls for coercive measures against the use of cars (reducing parking possibilities and road capacity, etc.), in addition to improving the mass transport supply (Kaufmann, 2000).

In any event, the will not to upset automobile traffic is what is preventing progress. Given the narrowness of most Brussels thoroughfares, creating protected corridors often means encroaching on traffic or parking lanes or having mass transport circulate in even narrower streets that are closed to cars. As for timing the traffic lights so that they are truly effective for mass transport, the situation is so bad that at peak hours the STIB/MIVB drops segments of routes so as to ensure constant frequencies on the most heavily used segments. Consequently, the fact that one of the main axes of the 2007-08 tram and bus master plan is to reduce the lengths of

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[19] The reader should remember that in Belgium the Green parties advocate both environmental protection and public participation, which can explain positions that are not always easy to reconcile.

[20] Avenue de la Couronne/Kroonlaan in Ixelles/Elsene. A partial, denatured test project has since been put in place.

[21] Boulevard du Souverain/Vorstlaan near the Val Duchess estate is a textbook case. Another one is Boulevard du Triomphe/Triomflaan, near the Delta Depot.

[22] Rue du Château d'Or/Gulden Kasteelstraat in Uccle/Ukkel.

most of the routes, given the inability to guarantee sufficient regularity along them, comes as no surprise.

## Conclusions

Automobile traffic greatly slows down the STIB/MIVB's tram and bus network, to the point where both the quality of the service offered and operator's productivity and financial return suffer. The direct financial cost that results directly from this could be estimated with a certain degree of accuracy, based on objective, disaggregated operating statistics. In contrast, and in addition to the estimated social costs of congestion, based largely on valuation of the time lost rather than on the direct costs actually incurred, our research raises a corner of this veil on an admittedly singular but nonetheless interesting item, in that it translates a divergence between individual and collective interest and the costs that we estimated are real costs that are actually paid.

This research also shows that if the public powers decided to act in a determined manner in favour of mass transport as the modal choice, the number of people that this network could move in an hour could be improved significantly without increasing the number of vehicles and drivers, meaning that the additional cost would be linked only to the additional mileage covered, minus the additional income that would be generated. If we reason along such lines, measures to engineer public areas and manage traffic so as to give priority to mass transport would at the same time increase the mass transport's efficiency (commercial speed), hourly capacity (through an increase in the frequency of runs on each route), and passenger load (through a modal shift).

Our findings set the public authorities before their responsibilities, as they show that the public monies that they invest will yield higher returns, provided that they take the right measures themselves. To date, we are sad to say that these authorities are undecided and unable to arbitrate between the inevitable dialectics that link individual means of transport and mass transport, individual interests and those of the commons, supposed local interests and the general interest, and finally, short-term problems and long-term needs. Of course, it is also possible to weigh restricting automobile traffic and improving mass transport's commercial speed against the risks of relocations and urban sprawl. One must also take account of "complications" due to a constricting institutional setting, especially given the Brussels-Capital Region's confined area. Still, is that sufficient reason to let the region run the risk of generalised gridlock for lack of efficient mass transport?

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Acknowledgements:

The authors would like to thank Michel Hubert and *Brussels Studies*’ editorial committee for their help and constructive comments.



Brussels Studies, the e-journal for academic research on Brussels - www.brusselsstudies.be
Editor-in-Chief: Michel Hubert, Facultés Universitaires Saint-Louis, RIB - Réseau Interdisciplinaire de recherches sur Bruxelles
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