SQUARING THE CIRCLE: THE BHLS CONCEPT

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ABSTRACT

The transport system known as Bus Rapid Transit (BRT) was launched in Curitiba, Brazil, in 1974 as a means of offering efficient and effective bus travel within the fast expanding city. This experience, together with other such Ottawa (since 1983) or Quito (since 1994), has proven to be an efficient and effective solution to mass transport.

Throughout Europe similar experiences have started to be developed, but addressing a different concept in terms of quality of service.

Indeed, bus systems such as the “trunk network”, in Sweden, the Metrobus, in Germany, or the BHNS (Bus à Haut Niveau de Service in France), approach the quality of service from a wider perspective than the BRT, as it considers aspects such as image and comfort, apart from speed, frequency or reliability.

These new systems - BHLS (Buses with a High Quality of Service) - allow to combine quality of service of tramways with the lower costs and higher flexibility of bus systems, offering very interesting solutions in terms of accessibility, as well as a wide range of service levels, that allows the system to be adapted to the different urban contexts (size, population, density , etc)

The economic situation we are facing has beard a lack of funds that, at the end, means an opportunity for BHLS, called to play an important role in public transport: less costs with the same quality of service seems to be a very attractive option.

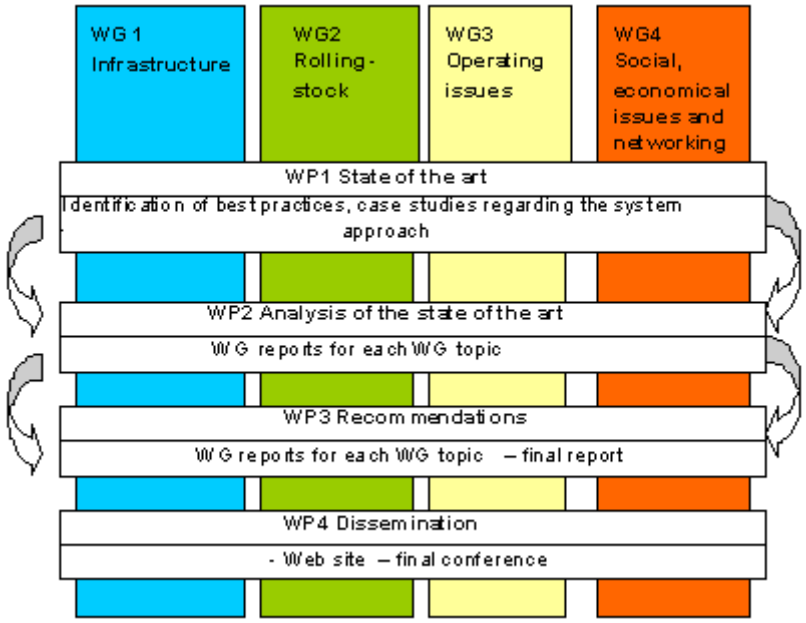
The aim of this article is to compare the different European experiences of tramways and BHLS, especially from the economic point of view, considering their respective costs, benefits and advantages.

1. INTRODUCTION

"Trains are sexy; buses are not": to break this statement and help to improve the image of buses, the *COST ACTION TU603 Buses with a High Level of Service* (BHLS), was launched in December 2006.In fact, this ACTION is based on a strong belief in the potential of buses as a real alternative not only to private car, but to train systems in their particular circumstances.

Starting from the French concept of BHLS –which considers the American BRT (Bus Rapid Transit) model-, this ACTION aims to increase the public transport use by a better understanding of the model, improving, in this way, urban mobility throughout Europe.

This COST Action is split into 4 Work Packages (WP) and 4 Working Groups (WG) represented in the chart below:



COST Action TU-603 structure. Source: www.bhls.eu

As stated by the COST ACTION, "*it is important from the outset to understand that BHLS, such as the BRT approach, stays as a concept or a method for designing routes, which structure and finally improve the bus network, and hence the whole mobility network*" (COST ACTION TU0603 Technical Annex, www.cost.esf.org). In fact, this approach allows each city to choose the most appropriated way according to its own needs and characteristics.

Actually there are many cities within Europe developing BRT strategies but in the framework of a low level of capacity: France, Sweden, United Kingdom, Spain, etc. have developed its own BHLS concept under different *labels*: Triskel, TEOR, BUS-VAO, Quality Bus Corridor, etc.

Implementation conditions and socio-economic assessment of BHLS systems are the key issues to be addressed by the different working groups merged from the COST ACTION; and, following the same scheme, this paper explores

similar topics of different European approaches, through a benchmarking exercise that will help to analyze the main elements of efficiency, starting from the state of the art regarding differences and objectives, through indicators such as patronage, travel time, cost, etc.

So, paraphrasing the famous André Malraux' quotation[1], we could also say that "*mobility in XXI century will be sustainable or will not be at all*" and the challenge must encourage public transport sector to play a leadership role beyond fashion and opportunism, reinventing old recipes that have proved their efficiency under their specific circumstances.

2. FASHION IN TRANSPORT

As Umberto Eco's stated seems that we move forward by going back (Umberto Eco, "*A passo di gambero*").

In 1879, came into service, in the city of Berlin, the first electric tramway. Successively, during the next decades, this means of transport starts to be implemented in many European cities.

Nevertheless, around the mid XXth century, this trend changes, and almost all the tramways were replaced by a new rising transport means: the bus.

[1] According to the phrase attributed to the French author André Malraux : "*The 21st century will either be spiritual or will not be*", probably apocrypha.

During the second half of the XXth century, traffic in big cities increased, making congestion one of the main problems that cities have to deal with. This new situation brings back the interest in trams, and European cities, such as Bordeaux, Nice, Strasbourg, Rome, Barcelona, Valencia, among others, start a new process of implementing tramway lines.

Strasbourg's tramway (1994)

Valencia's tramway (1996)

So, the tram reemerges as a new and modern transport system, whilst buses suffer a loss of image, as they are considered a slow system, providing little comfort and low reliability since they have to deal with congestion.

Bordeaux is a good example of this revival of trams: in the last century the city had already a tram network, into service until 1958, when the mayor decided to remove it, to be, again, reintroduced it in 2003. The city currently has 3 tramway lines.

Bordeaux's tramway (2003)

The total length of the tramway network is 43.9 km. It runs with an average speed of 18.2 km/h, and it moves around 165.000 passengers (end of 2007).daily.

The cost of this new infrastructure amounts to 29 M€/km

Madrid is another interesting case. The city has recently included the tramway into its transport network, with three new lines inaugurated in 2007. The first two – ML1 and ML2 – known as *Metro Oeste*[2], connect the municipalities of Pozuelo de Alarcón (79.826 inhabitants) and Boadilla del Monte (39.791inhabitants), located in the west metropolitan area of Madrid.

[2] In fact, the term used for the tram system is *Light Rail Train*, probably in an attempt to avoid the reference to which is considered– according to the dominant opinion- an old fashion system.

Metro Oeste (Madrid, 2003)

The total length of *Metro Oeste* is 22.4 km, with an average speed of 24-25 km/h. The cost of the new infrastructure was 24.5 M€/km. The capacity of vehicles used, CITADIS, is 186 passengers/ veh. Currently, *Metro Oeste* moves around 30.000 passengers.

And while this happens in Europe, in America arises the concept of BRT – Bus Rapid Transit - , a solution which allows providing an efficient and effective service at a lower cost than rail systems.

Until the end of the 90's, BRT systems were defined as "*a fast transport system that allows combining the quality of rail transport systems with the flexibility of buses*" (Levinson et al, 2002).

The spread of experiences, as well as the development of the concept, brought about a scale of the BRT systems, from the BRT-Lite to the full -BRT (Gray et al, 2006). This last one has the same characteristics as Metro lines: segregated platform, ticket sale previous to boarding, frequency, speed, modern and clean vehicles, marketing, etc.

This system has been implemented in Curitiba, (Brasil,1974), Ottawa (Canada 1983), Quito(Ecuador 1994) o Bogotá (Colombia 2000).

Curitiba's BRT (1974)

Bogotá's BRT (2000)

At the beginning of this century, the bus reemerges in Europe, as a transport system of quality, being France the pioneer regaining the bus as a modern transport system and, despite the fact that Buses with a High Level of Service – and BRT share some similarities, the BHLS appears adapted to the European context. So, on one hand, European cities have an urban structure totally different from American cities: whilst the first ones have high urban density, employment and residential places assembled, the second scheme is a more disperse city, with a CBD where most of employments are located. The travelling structure is, hence, different, and, as a consequence, the transport system also has to be.

As a result, in the European context, this new system, BHLS differs from BRT in terms of capacity, as BRT is conceived as a massive transport system, a characteristic that is not present in the BHLS, but it takes, instead, from the BRT the idea of including on buses *qualities* that in Europe have always been associated to modern trams, such as dedicated platform, crossing priority systems, ITS, modern design and so on.

In this sense, the Busway of Nantes, a French city located in the northwest of France, can be considered the paradigm of the BHLS system.

The urban area of Nantes has a population of more than 570.000 inhabitants. The city, which had already three tramway lines, decided in 2006 to open a BHLS line.

The BUSWAY of Nantes (2006)

This line – called BUSWAY – has a length of 6.9 km, 87% in segregated platform. The operating vehicles are articulated buses, natural gas, and 100% low floor. It has an average speed of 21 km/h, and it moves 25.000 passengers daily.

The average cost of this new infrastructure is 7.5 M€/km, 460.000 €/bus. The operating cost is around 3,6 €/km.

This new line, totally conceived as a tram line, but operated by buses, also has ITS tools such as dynamic information system - on board and at the stop points -, or crossing priority.

Another example of BHLS is the TEOR lines of Rouen. This city, located in the northwest of France, has a population of more than 400.000 inhabitants including the urban area.

Rouen, also with a tramway line since 1994, decided to implement three bus lines, called the TEOR lines.

The first phase of these TEOR lines – T1, T2 and T3 – was opened in 2001, with a total length of 29.8 km, from which 13.4 km (45%) run on a segregated platform. The investment cost of this new infrastructure is 5.5 M€/km.

Two types of vehicles are used: the Irisbus Agora, which has capacity for 115 passengers / vehicle, and the Irisbus Citelis, for 110 pass. / km. The average speed of the TEOR lines is 17.5 km /h.

Rouen: the TEOR line (2001)

Conceived as a modern system, the TEOR lines have characteristics just conceived for trams normally, such as optical guidance at the stop points, dynamic information system - on board and in stop points -, or crossing priority.

Also, Rouen is an example of urban renewal, as it can be seen in these two pictures: the same street, before and after opening the TEOR lines.

Rouen: urban renewal as a result of the TEOR implementation

3. DISMANTLING THE MYTH

Comparing the experiences previously detailed, it could be said that BHLS investment costs are around 30% of the investment cost of a tramway line.

System	City	Investment cost (M€/km)
BHLS	Rouen	5.5
	Nantes	7.5
Tram	Bordeaux	29
	Madrid: Metro Oeste	24.5

Source:COST Action TU-603 and own data from the munipalities

And are not only the investment costs which are cheaper, but the cost of the vehicles or those for maintenance and operation

	Tramway	BHLS
Cost of vehicles (€/veh)	2.5	0.4
Maintenance cost (€/km)	0.15	0.05
Operation cost (€/seat-km)	0.03	0.05

Source:COST Action TU-603 and own data from the munipalities

This brings up several questions:

Are trams so efficient and sustainable from the 3 well known points (economic, social and environmental), to make profitable such a big investment instead of buses?

Are buses a real competitive alternative in terms of capacity, speed and even attractiveness?

Indeed, there are still some myths to break. Under this epigraph, and using the examples previously defined, we will try to do so regarding some of the most embedded common beliefs in the transport planners' minds.

- Dedicated platform

Trams, which had disappeared from the cities surface since they were considered old fashioned, have reemerged recently as a medium capacity transport means whose key success feature is based on the dedicated platform. But dedicated platform is not concerned with the vehicles running on it.

Moreover, buses can use not only the dedicated platform but the whole road network, which means more flexibility.

- Capacity

If we should only consider the vehicle capacity, then it is true that buses cannot compete with trams.

System	City	Commercial speed (km/h)
BHLS	Rouen	110
	Nantes	110 - 115
Tram	Bordeaux	220
	Madrid: Metro Oeste	186

Source:COST Action TU-603 and own data from the munipalities

But capacity does not depend on the means of transport, but on the design of the whole system, i.e. vehicles, frequencies and service organization. In this sense, by fostering BHLS corridors it is feasible to get the “magic” number of 6,000 passengers/hour and direction. And, even more important, buses flexibility makes possible its design for smaller demands.

- Speed

Buses are slower than trams, they said. Wrong again: with an adequate prioritization system, such as traffic lights, exclusive platform, contactless card, etc., buses could easily get a 15-25 km/h speed, more or less the same as tram: 18-25 km/h.

System	City	Commercial speed (km/h)
BHLS	Rouen	17.5
	Nantes	21
Tram	Bordeaux	17
	Madrid: Metro Oeste	24

Source:COST Action TU-603 and own data from the munipalities

- Attractiveness / image

BHLS does not have to do with old buses at all, since they use the modern tram technology for the tire’s tread with a similar design. It is even possible the use of hybrid or electric feed and optical or electronic guidance, which permits a softer movement, and a considerable reduction in terms of noise and emissions together with an increasing comfort.

- Environment

Excluding *upstream* emissions, the comparison between buses and trams leads to the conclusion that these last are the most ecological means of transport. But is that true? Maybe the answer is not so clear. First because, as stated before, *upstream* emissions are not taken into consideration and, second, because BHLS introduce clean technologies into the conventional network, such as trolley, hydrogen, hybrids, etc.

- Economic impact on cities: urban regeneration such a way to attract investors, residents, business, etc.

In this aspect, designed as trams, buses could generate a very positive impact on the cities, providing greater accessibility and contributing to remove private cars from the streets, which helps to attract investors and residents to the area.

As an example, the city of Nantes has removed lanes from the roadway when implementing the Busway line.

Hence, it is a matter of political decision rather than of the means chosen.

- Facilities

Do really trams provide a better service than buses? Again, it depends. Big investments in BHLS may lead to achieve similar results than tram, keeping at the same time flexibility regarding demand.

- Investment costs

System	City	Investment cost (M€/km)
BHLS	Rouen	7.5
	Nantes	5.5
Tram	Bordeaux	29
	Madrid: Metro Oeste	24.5

Source:COST Action TU-603 and own data from the munipalities

4. CONCLUSIONS: INTERMODALITY, AS USUAL

This exercise of reflection leads to the following conclusions:

The first one has to do with the concept of BHLS: should this term only apply for bus lines totally conceived as tramway lines, or should include a wider range of solutions, having in common the incorporation of quality of service?

Since mobility is a complex problem, influenced by several factors,that have to be taken into consideration when defining the transport network,elements such as the size of the city, urban density, distribution of activities or congestion problems, will always result in different transport needs and, hence, in different transport modes. .

And we should be aware that constraining the BHLS definition, together with the success of the first experiences in Europe, may bring about the fashion of BHLS, as it occurred with trams, and we could be assisting to a scenario with all the municipalities willing to implement this kind of system, instead a cheaper solution that could provide the same level of quality. Indeed, there is no a “one *system* fits all” formula, since each city has its own needs and demand.

The ÖPNV-Trasse of Oberhausen is a good example of particular solutions to fit its own needs.

Oberhausen (Germany) has a population of 215.600 inhabitants. The city had an old industrial area, no longer in use, programmed to become a commercial area. As it was located in the city outskirts, this urban development should include public transport facilities attractive enough to compete with car.

So, the solution implemented is an exclusive platform for collective transport, shared by buses and tramways. At the same time, one of the existing tramway lines has been extended to the commercial area, and the bus lines running along the corridor also enter the platform, being better off due to the new infrastructure not only people acceding from the city to the commercial area, but also those acceding from the surrounding municipalities, or coming from these municipalities to Oberhausen.

The cost of the new infrastructure (22 M€/km) includes not only one line, but one corridor which has gained with this investment.

On the other hand, the users do not make distinction when boarding bus or tram, because it doesn't matter which one choose. This is very important since reveals that is not a matter of the system, being tramways preferred to buses, as tramway defenders argue.

However, evidence shows that one size does not fit all: public transport networks must be based on intermodality. Each means has its own advantages, so they are complementary into an intermodal network; always through and adequate analysis aiming to the most efficient solution, since not always the big cost investments are fully justified.

5. BIBLIOGRAPHY

Acción Cost TU-603 BHLS: Buses with a High Level of Service: www.bhls.eu

Finn, B., Heddebaut, O., Rabuel, S. (2010) Bus with a high level of service: the European BRT concept. Transportation Research Board – 89th Annual Meeting. Washington D.C.

Gray, G., Kelley, N., Larwin, T. (2006). Bus Rapid Transit, A Handbook for Partners. Mineta Transportation Institute Report 06-02, San José State University, 66 pp.

Levinson, H.S., Zimmerman, S., Clinger, J., Rutherford, S.C. (2002). Bus Rapid Transit: An Overview. Journal of Public Transportation 5 (2), pp. 1-30.

Rabuel, S. (2009) Tramway et Bus à Haut Niveau de Service (BHNS) en France : domains de pertinence en zone urbaine Transport/Environnement/Circulation (TEC), n° 203