

ZBIGNIEW KONOPACKI-MACIUK*

TRAMS AS TOOLS OF URBAN TRANSFORMATION IN FRENCH CITIES

TRAMWAJ JAKO NARZĘDZIE TRANSFORMACJI URBANISTYCZNEJ W MIASTACH FRANCUSKICH

Abstract

After the almost total disappearance of trams in the first half of the 20th century, a rapid growth of tram networks has been observed in French cities since 1985. Initially, trams were perceived only as a means of public transportation, however, they gradually became an important urban tool and a catalyst for the thorough restructuring of public spaces. At present, tram lines in France are a symbol of a modern approach and an expression of pro-environmental ambitions of French cities.

Keywords: city, urban, tram, public transportation

Streszczenie

Po prawie całkowitej likwidacji tramwajów w pierwszej połowie XX w. od roku 1985 nastąpił gwałtowny rozwój sieci tramwajowych w miastach francuskich. Początkowo tramwaj traktowany był jedynie jako środek komunikacji miejskiej, stopniowo jednak stał się ważnym narzędziem urbanistycznym oraz katalizatorem powodującym gruntowną restrukturyzację przestrzeni publicznych. Obecnie linie tramwajowe we Francji są symbolem nowoczesności oraz wyrazem proekologicznych dążeń miast francuskich.

Słowa kluczowe: miasto, urbanistyka, tramwaj, komunikacja miejska

* M.Sc. Eng. Arch. Zbigniew Konopacki-Maciuk, doctoral student at the Chair of Urban Design, Institute of Urban Planning, Faculty of Architecture at the Cracow University of Technology.

1. Introduction

The appearance of the tram in the city was like a revolution, (...) it became synonymous with important transformations in the habits of the residents of the city and its suburbs and it enhanced the value of urban space [2, p. 165].

After the almost total disappearance of trams in the previous century, one can effectively talk about the French phenomenon of tram line restoration in the last 25 years. The number of French cities dynamically investing in tram lines over this period has been unique in Europe. What is characteristic about French investments connected with the implantation of tram lines is the comprehensive and many-sided approach to the city structure. Route-planning decisions are primarily determined by the transportation needs of cities and metropolitan areas, however, they provide a stimulus to reconstruct not only the city infrastructure, but to introduce a new approach to the management of the local public spaces on the whole. The development of tram networks is consistent with a double trend connected with mobility. Firstly, there is an evidently growing demand for further means of transportation resulting from an increase in social mobility and from the dynamic development of cities. Secondly, there is a need for a counterbalance and an alternative to excessive car usage.

Within the transformation of cities that were very industry based into post-industrial cities, there are changes to dedicated mass transportation spaces in France and there is a visible departure from the model of separated functions towards multi-functional spaces available for everybody, especially for people with disabilities. Decentralisation and competition between cities both in France and across Europe, and the evolution of urban doctrines has forced public transportation to be treated as high-standard, multi-functional urban space [15, p. 96].

Early in the life of industrial cities, the tram was a tool which enabled the introduction of some distance between working-class districts located on the industrial fringes of the city and the rich, central, downtown districts [3, p. 20]. However, nowadays it is becoming the means of connecting the mono-functional housing districts with city centres, which tend to be more service and office orientated.

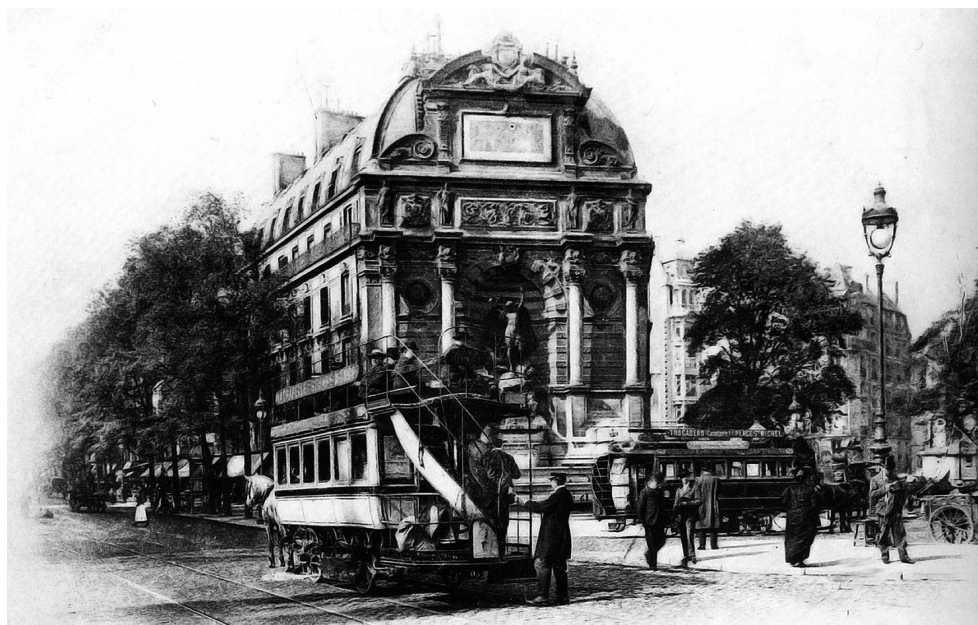
2. History of Tram Line Development in French Cities

The first commercial tram line in France was opened in Paris, in September 1855, under the then Prefect of the Department of Seine, Georges Eugène Haussmann. It was created by French engineer Alphonse Loubat, the design engineer of the New York tram line (1832). The 'Iron American Rail', as the tram was called in France at the time, gradually started to replace omnibus lines in Paris and in other French cities.

At the beginning, they were horse-drawn¹, and later, steam-engine trams were introduced. There were also attempts to use trams powered by compressed air. The first line of this type was launched in Nantes in February 1879.

Nantes is a pioneering city with regard to urban transportation. It was here where the first omnibus in the world was introduced for the employees of the shipowner Stanislas Badura.

¹ Approximately 140 horses were required to operate just one line in Paris.



Ill. 1. Horsebus on *Place Saint-Michel* in Paris, early 20th century. Source [19] *Le tramway à Paris et en Il-de-France*

In the early 20th century, Nantes boasted a 39 km tram line transporting 11 million passengers per year [17, p. 101].

The next stage of transformation for tram lines was the transition to the more efficient electric drive. By 1914, all the lines in the Paris region were electrified, however, they could not use overhead lines in the city centre due to aesthetic reasons, thus, they had to be powered by batteries.

Tram system development in France was very dynamic until the interwar period. The year 1925 was the peak of development with 122 lines of a total length of 1,111 km in the Paris region – these transported 720 million passengers that year alone [18, p. 39]. The cities swarmed with horse carriages, steam and electric trams, pedestrians and the first cars. Public space was common ground and it was equally divided between all its users [8, p. 118].

Gradually, trams started to be replaced by cars – the symbols of progress and modern technology. *Trams became solely responsible for numerous traffic jams and accidents* [18, p. 43]. From the end of World War II, individual cities began disassembling their tram lines, considering them unadjusted to modern cities and interfering with car traffic. By 1950s, only 3 tram lines had remained in Lille, Marseille and Sante-Etienne out of the total of 48 [10, p. 2] tram lines in France. Bus transportation, significantly less expensive as far as infrastructure is concerned, became the alternative for tram mass transportation.

By the end of the 1940s and in the 1950s, public transportation was not a priority for public authorities, who considered individual car transportation as the main source



Ill. 2. Tram on busy streets of *des Halles* district in Paris, 1920. Source [21]
Le tramway à Paris et en Il-de-France

of mobility. Old, deteriorated, slow and rusty trams on worn out tracks, often with bad route planning, lost their value in the eyes of society, while the new buses and trolleybuses appeared as the embodiment of progress. Urbanisation based on highways penetrating the cities, expressways, and traffic lanes stretching along river banks contributed to more extensive use of cars. Space for public transport, bicycles and pedestrian traffic was reduced as car traffic and the demand for parking space grew significantly [8, p. 79].

Prioritised car and road infrastructure were the only support for enormously expanding metropolitan areas until the 1980s [8, p. 63] (in 1971, only Paris had an underground train system and the first section of RER line).

The fuel crisis of the 1970s as well as an excessive number of cars blocking the cities became the negative catalysts for a new approach to mass transportation. At the same time, people started to notice environmental protection problems. The first critical opinions on the *tout-automobile* dogma (everything by car) began to be voiced. The drawbacks of excessive car traffic became evident: traffic jams; noise; pollution; occupancy of physical space; energy consumption [17, p. 102].

Due to the above reasons, trams once again became objects of interest as an alternative to the excessive reliance upon motor transportation. In Nantes in 1985, in Grenoble in 1987, and in Strasbourg in 1995, trams were reintroduced as environmentally-friendly, reliable and comfortable means of city transportation – in Grenoble, this included the first tram designed specifically with access for the disabled in mind. Gradually, they were joined by other



III. 3. In 1985, the first modern tram line was launched in Nantes. Photo by the author

cities, e.g. Rouen, Montpellier, Lyon. Some cities, like Bordeaux, abandoned plans for an underground system in favour of a tram network as a less expensive solution that was better adjusted to the city scale. In the Paris metropolitan area, the first tram line was launched in 1992, and in the city of Paris, in 2006.

3. Tram Renaissance in France

In the 20th century, characterised by social and individual acceleration, the idea was to build extensively in France, very quickly and wherever possible. A lot of products, buildings, new suburban areas, as well as *non-lieux* (*non-places*)² were manufactured and constructed with record-breaking speed. Between 1945 and 1975, more housing units, public service buildings, factories and offices were constructed than in the previous centuries, to such an extent that eleven million out of the twenty million currently occupied flats in France were built after 1945 [4].

Car urban planning was characterised by plenty of car parks included in plans for housing, office and service development. Monumental urban projects, expansions of service or housing centres, as well as new cities built *ex nihilo* according to existent or non-existent programmes, regardless of whether they were connected with local centres or not, were engulfed by the cities and included in their borders. This led to a situation in which questions

² The term *non-lieux* introduced by Marc Augé, French ethnologist and cultural anthropologist (*Non-Lieux, introduction à une anthropologie de la surmodernité*), Le Seuil, 1992.

concerning their reason for existence, meaning and form began to be raised. Currently, the status of such areas is being changed from ‘non-urban’ to ‘city fragments’ [8, p. 79].

Cars also interfered with the already existing city structures, enforcing changes in the use of public spaces. Motor transport took over more and more of the available space leaving less and less of it to other users.

The modern tram has a role to play in this deformed city landscape as an effective tool for urban transformation.

3.1. Reasons for Success

There are many reasons for the success of the tram in France, and they can be divided into two main groups. The first group includes advantages mainly related to modern tram transportation. Factors resulting from French realities, French legal regulations, and specifically, spatial planning belong to the second group.

3.1.1. Contemporary Tram Transportation

The first group includes the tram system’s transport capacity of ten to twenty thousand p/h (passengers per hour), which is significantly greater than that of passenger cars at 700–900 p/h, and also exceeds bus line transport capacity of 720 p/h, yet it is relatively lower than that of the underground at 20 to 40 thousand p/h [14, p. 156]. Despite the fact that the underground is more efficient as far as the number of transported passengers and the speed of transportation are concerned, the distances between its stations are greater and, therefore, it services smaller city areas rather than the city as a whole [13, p. 25]. It should also be pointed out that the cost of constructing a tram line is on average, four times lower than that of an underground line. In some situations, such as junctions with railway lines (e.g. in Rouen and Strasbourg) the tram traverses through subterranean sections, and such a solution is approximately seven times more expensive than maintaining the transport on the surface level. In order to ensure better accessibility, subterranean stops have to be serviced by lifts and escalators [14, p. 16].

The list below illustrates the profitability of building a tram line compared to other means of transportation. One billion EUR enables building:

- 8 km of underground line (Francois Mitterand – Madeleine section, line 14, Paris),
- 300 km of highway (A20, Verzon – Brive section),
- 30 km of Seine-Nord Europe channel with large cross-sections (between l’Oise–Compiègne and Dunkerque-Escout–Cambrai channels),
- 35 km of tram line (Bordeaux),
- 96 km of high-speed railway – estimated cost, 54 km – real cost (TGV Est, section between Vaires-sur-Marne–Seine-et-Marne and Baudrecourt en Moselle),
- 8 km of basic tunnel (estimated cost on route from Lyon to Turin),
- new harbour in Le Havre as part of the Port 2000 project (2001–2006),
- purchasing 20 Airbus A320s [7, p. 13].

The tram is more efficient than the bus or trolleybus as far as the number of transported passengers is concerned. At the same time, its running costs are lower despite higher initial

infrastructure costs, especially in France, where 86.3% of electric energy is provided by nuclear power plants³.

It is an environmentally-friendly means of transportation in the traditional meaning with emissions of only 2.4 g CO₂ per one passenger per km in comparison to buses at 66.7 g, and cars at 173.7 g⁴. In France, 50% of car trips are shorter than 3 km, and transportation as a whole is the second biggest power-consuming sector of the economy. Transportation in cities and suburbs is responsible for 41% and 26% of CO₂ emissions respectively [9].

Modern trams are relatively quiet – they generate less than 65 dBA, and vibrations are reduced thanks to dilated platforms and flexible vibration absorbing materials. Constructing new tram lines is accompanied by new tree-planting and green track projects, e.g. in Strasbourg, Paris or Bordeaux.

Trams are also consistent with the policy of economical utilisation of space – one set of carriages transporting 244 people occupies 112 m², replacing 177 cars occupying 1,600 m² [13, p. 55].

Environment protection is not the only advantage of tram transportation, it is also a user-friendly and highly comfortable means of transportation.

The floor level in modern tram-cars is below 30 cm above ground level⁵, thus similar to passenger cars. Due to raising tram stop levels to this very height, tram-cars are accessible without any steps or thresholds. Modern tram cars are accessible not only for people with disabilities, parents with baby carriages, the elderly and people travelling with luggage, but also the time taken to get in and out of tram-cars is reduced, which increases the transportation speed of trams [16, p. 6]. Systems of trams ‘enforcing’ green lights on junctions and tracks mostly separated from traffic ensure faster movement in the city centre, averaging at approximately 20 km/h, compared to cars (10–15 km/h). Connecting tram lines with railways (*Tram–Train*) eliminates the necessity to change means of transportation, thus reducing travel times. Tram lines planned today are included in the modal city transportation system, connected to P+R car parks, equipped with passenger information systems, monitoring systems and traffic management systems, and they are becoming a comfortable alternative to motor transportation.

New tram-cars can provide highly frequent services. The interval between services is often four minutes in rush hours (e.g. the Saint-Denis–Bobigny–Noisy line and in Bordeaux). In Grenoble, the rush-hour frequency of line A is three minutes. In Strasbourg and in Nantes, tram-cars in rush hour come every two minutes [16, p. 5]. Service frequency is adjusted to the number of passengers and it is often increased in downtown sections⁶. Modern tram-cars are highly comfortable and equipped with air conditioning, sometimes with Wi-Fi hotspots, and ergonomic seats.

Tram transportation meets the constantly rising mobility requirements to increasingly higher degrees. Thanks to good accessibility and short distances between stops, it is a perfect

³ According to 2008 data from EDF (<http://energies.edf.com>).

⁴ l’Agence de l’environnement et de la maîtrise de l’énergie (ADEME) quoted after [1, p. 21].

⁵ In Alstom, *Citadis 301 model*.

⁶ It is possible due to two-side tram-cars using simple N or X junctions in any track locations for reversing – without the necessity of using tram termini.



Ill. 4. Green track, and the ‘third’ power line, *Quai Richelieu* in Bordeaux. Photo by the author

connection between city areas, and, as one element of multi-modal systems, it fulfils the role of structuring urban space.

In pedestrian zones, from which car traffic was completely or nearly completely eliminated, the streets were revived and at the same time, access to space improved and increased [14, p. 16].

Today’s trams are becoming the symbol of a modern city, its openness and care for its inhabitants. They bring advantages in creating a positive image and raise competitiveness in comparison to other cities.

3.1.2. French Realities

Implementation of public transportation lines in the communication system modifies the way in which it is used. As public space, the street forms an ‘ecosystem’, similar to ecosystems in the natural environment. Every modification of a given parameter changes the status of the global balance of a whole given route. This balance is not limited only to the street space, it also includes the built area that delineates it and the districts in which it is located. The voice of inhabitants and their activities conducted in street frontages are significant in this process. Therefore the inhabitants’ opinions about the way the space is used, as well as their needs concerning public transportation, have to be taken into consideration (CERTU⁷) [5, p. 8].

⁷ CERTU – *Centre d’Études, sur les réseaux, les transports, l’urbanisme et les constructions publiques*, Infrastructure, Transportation, Urban Planning and Public Investment Research Centre.

This approach is not merely the wish of urban planners working for *Ministère de l'Écologie, de l'Énergie, du Développement durable et de la Mer* (Ministry of Ecology, Energy, Sustained Development and Sea), but it is consistently implemented by means of appropriate legislation, developing planning tools and administrative structures. At the same time, extensive information policy, as well as social consultations contribute to better social reception of the introduced changes which are often substantial, take a long time to make and frequently cause much inconvenience⁸.

The reintroduction of the tram transportation system was accompanied by three main urban transformations:

- decentralisation, increasing importance of local communities, withdrawal of state authorities from territorial administration and transfer of competence to local governments;
- urban development and population covering extended metropolitan areas;
- urban renovation [12, p. 23] as a preferred type of actions taken by authorities [13, p. 6].

In France, the organisation of public transportation has been managed by decentralised local administration since the early 1980s. For over thirty years, local urban communities have had full autonomy in shaping their public transportation networks in the context of dominant car transportation [10, p. 1].

When speaking about the development of tram networks in France, one should emphasize the role of the legal and planning regulations that contributed to the success of implanting trams into the urban environment (SRU, LOTI, ScoT, PLU, PDU).

Thanks to the SRU Act (*Loi sur la Solidarité et le renouvellement Urban*, Act on Solidarity and Urban Renewal), tram transportation projects are consistent with other urban projects. Urban development is organised on the basis of public transportation axes. Its purpose is not only to ensure a balance between the need for mobility and environmental protection, but also to strengthen social and urban cohesion at the same time [10, p. 4].

The LOTI Act (*La loi d'orientation des transports intérieurs*, Act on Directing Internal Transportation) from 1982, introduced after the decentralisation of authority, assigned the competences of public transportation organisations to various local government levels. Additionally, it “guarantees all users the right to move and to free choice of means of transportation”. The global policy of “ensuring harmonic and complementary development of various types of individual and collective transportation” puts special emphasis on their pros and cons. Competition rules, economic and social costs and other variables have been quoted as reasons for this choice “Global policy, by supplementing the general domestic framework, enables the assumptions of a transport development model based on a multimodal approach”. The act postulates giving priority to collective transportation [13, p. 16].

SCoT (*Schémas de cohérence territoriaux*, Territorial Coherence Model) is aimed at integrating multi-directional activities conducted by a given territorial unit. The SCoT model is supposed to present the assumptions for management and sustained development necessary for defining the goals of urban policy regarding housing, economic development,

⁸ In France, it requires virtually 10 years to realise a proper tram line project from first analyses to launch.

recreation, the movement of people and goods, vehicle parking and the regulating of car traffic. Also to specifically determine the main guidelines for organising space, establishing the balance between its various types and evaluating the influence of this organisation on the environment, to define goals concerning the balance between urban planning and the development of public transportation services. The SCoT model may also define large projects relating to transportation services, specify the conditions for priority urban planning development of areas serviced by collective transportation, determine urban planning of undeveloped areas due to collective transport services and use of the developed areas that are already serviced.

POS plans (*Plan d'Occupation des sols*, Area Development Plan), recently replaced by PLU (*Plan Local d'Urbanisme*, Local Urban Plan), are required to be compatible with PDU (*Plans de déplacements urbains*, Urban Transportation Plan).

The LAURE Act (*Loi sur l'air et l'utilisation rationnelle de l'énergie*, Act on Air and Rational Energy Usage) from 1996 concerns the relations of PDU to the problems of environment protection. Since then, the purpose has been to decrease car traffic, and the PDU plan has become obligatory for all cities above 100,000 inhabitants. It has become the tool for programming and for public transportation policy, with its structure organised around trams, reforming the bus network, providing transport on demand, social tariffs, information systems and accessibility, *parcs-relais* (*Park and Ride*).

In order to help realise the tasks resulting from effective legislation, a special tax system (*Versement transport*) was introduced to maintain and develop public transportation.



Ill. 5. *Porte d'Aubervilliers* in Paris, present state and the designed extension of T3 line.

Source: materials from *Le tramway, l'exposition* exhibit, Pavillon de l'Arsenal in Paris, March 2009

The comprehensive approach to the problem of urban renewal makes the introduction of trams strongly influence changes to urban space. Not limited only to *laying* tracks, but starting with a radical replacement of the existing infrastructure, through rebuilding public spaces, often inciting revitalisation of adjacent architecture, the realisation of new accompanying objects, and ending with the restructuring of the districts that the tram passes through.

3.2. Present situation

Today, France has 240 networks of urban public transportation which service populations of between 10 thousand and 10 million inhabitants [10, p. 2]. French metropolitan areas with more than 200 thousand inhabitants are capable of building tram networks. It is possible that in the future, this threshold will be lowered, and cities with 150 thousand inhabitants will also be able to construct tram networks, as is the case in Germany [13, p. 9]. Out of thirty-nine French cities above 200,000 inhabitants, over thirty already have, are realising or are planning the construction of tram networks (Tab. 1). In most cases, it is a staged process, but there are cities like Bordeaux, which in a single effort, realised most of the network including 3 lines of 35 km in total. Currently, further works are being conducted to extend the existing lines and to build new lines.

Table 1

Chronological list of realised tram lines in individual cities

	Year of launching first line	City	Number of inhabitants in metropolitan area	Comments
1	Line existing before 1985	Marseille	1,350,000	
2	Line existing before 1985 (1881)	Saint-Étienne	290,000	
3	Line existing before 1985	Lille	1,001,000	2 lines, 23 km VAL 45 km
4	1985	Nantes	570,000	3 lines
6	1987	Grenoble	428,000	4 lines
7	1992	Paris metropolitan area	10,200,000	3 lines
8	1994	Rouen	399,000	METROBUS (31 stations, including 5 subterranean, 15.4 km)
9	1995	Strasbourg	441,000	5 lines
10	2000	Montpellier	288,000	2 lines
11	2001	Lyon	1,349,000	4 lines, underground
12	2000	Orléans	263,000	1 line, 17.9 km
13	2001	Nancy	331,000	1 line, 11 km
14	2001	Caen	199,000	1 line, wheel tram, 15.7 km
15	2002	Rennes	273,000	Metro VAL
16	2004	Bordeaux	754,000	3 lines, 35 km
17	2006	Valenciennes	357,000	1 line, 18.3 km

18	2006	Clermont-Ferrand	259,000	Wheel tram
19	2007	Nice	889,000	1 line, 8.7 km
20	2007	Le Mans	195,000	13.5 km
21	2009	Toulouse	761,000	VAL
22	2010	Mulhouse	235,000	2 lines, 12 km
23	2011	Angers	227,000	1 line, 12 km, including 400 m of single track
24	2011	Reims	216,000	Lines 1A and 1B: 11.2 km
25	2011–2013	Toulon	520,000	2 lines, 18.3 km
26	2012	Le Havre	182,000	
27	2013	Besançon		1 line, 14 km
28	2013	Brest	221,000	
29	2013	Dijon	237,000	2 lines, 10 km
30	2013	Tours	297,000	
31	2014 (?)	Lens-Liévin	250,000	2 lines, 37 km

Only ten years ago, the level of 300 thousand inhabitants was adopted in all the planning discussions as the threshold below which, a tram network could not be realised.

In the geographical respect, trams do not go beyond the central parts of metropolitan areas and their presence is not justified in low-density development. The radius



Ill. 6. Housing investments in the vicinity of T1 tram line, in *Clos* district, La Courneuve, Paris metropolitan area. Photo by the author

of the typical tram network is from 15 to 25 km from the town/city centre, while the interest in construction and investment areas goes far beyond 35 km radius to areas where the car is the only means of transportation.

For four of the million-inhabitant metropolises (Paris, Marseille, Lyon and Lille), to which Toulouse can be added, as it is going to reach 800,000 inhabitants in the near future, the tram system is complementing the underground system. The other metropolitan areas made tram systems their central tool of public transportation [13, p. 30].

4. The Effect of the Tram on Urban Space of French Cities

A tram system influences the whole city structure. It directly and visibly joins the centre with the peripheries (*La Source* district in Orléans and *La Paillade* district in Montpellier). In peripheral areas of the city, it can be the structural element connecting public spaces [10, p. 5]. It is a visible element, linking important points in the city, not only by transportation connections, but also through regulating and composing the space it occupies. Thanks to the use of uniform materials and elements of small architecture, it creates a composition bond between diverse parts of the city. It becomes a tool enabling the constant and clear reading of city space for pedestrians as well as for travellers. In contrast to the underground, which connects the city in an abstract way, or to buses lost in car traffic, a tram system materializes in the city through its physical and symbolic presence [13, p. 56].

Trams introduce dynamics to the districts through which they pass. Tram investments are accompanied by projects of new development, rehabilitation and ZAC (*Zone d'Aménagement Concerté*, Appointed Investment Zone) and DSQ (*Développement Social de Quartier*, Social Development of Districts) urban projects.

A tram system, the initial task of which is to connect individual important points in a city, generates activity development as the next step, especially within a radius of 400 m from each stop.

Demographic changes, a growth in the number of people practising liberal professions, services and new residential housing developments are visible within tram corridors. For example, in some districts of Grenoble, which are serviced by tram, the size of working class and immigrant populations has diminished while middle class population has increased in number [16, p. 10].

Transportation within the districts is no longer pushed to the peripheries, but on the contrary, cars are reintroduced into the city fabric but on different principles and in a more orderly fashion. This is accompanied by new technologies, a new way of road development, promoting diversity of road users, improving connections with city fabric. As a result the car presence is becoming more acceptable [8, p. 39].

A new division of public space is taking place, with priority going to public transportation, pedestrians, bicycles, reduced car traffic and parking spaces. The space acquired in this way is given new functions. The first examples were the realised projects of the radical transformation of *Cours des cinquante otages* in Nantes, where eight traffic lanes were replaced by an esplanade with trees and a tram line, and only 2 lanes of motor traffic. Another example is *Boulevards* in Grenoble, which was transformed into a *30 zone* (an area

with a 30 km/h speed limit) where two-level crossings were eliminated and green areas were introduced [10, p. 4]. New space management with different modes of transport that combine the use of cars and public transportation improves the safety of pedestrians by limiting speed along collective transportation lines. In Grenoble, the construction of A line decreased the number of accident black spots.

Streets of a new type appear in the city, with important pedestrian places of much better quality. Intermodal connections are becoming standard practice: tram–bus, tram–car, tram–bicycle (as in Strasbourg), or tram–underground (as in *Saint-Denis* and *Bobigny* in the Paris metropolitan area) [16, p. 11].

Tram investments are accompanied by support for urban restructuring projects in tram corridors along its lines.

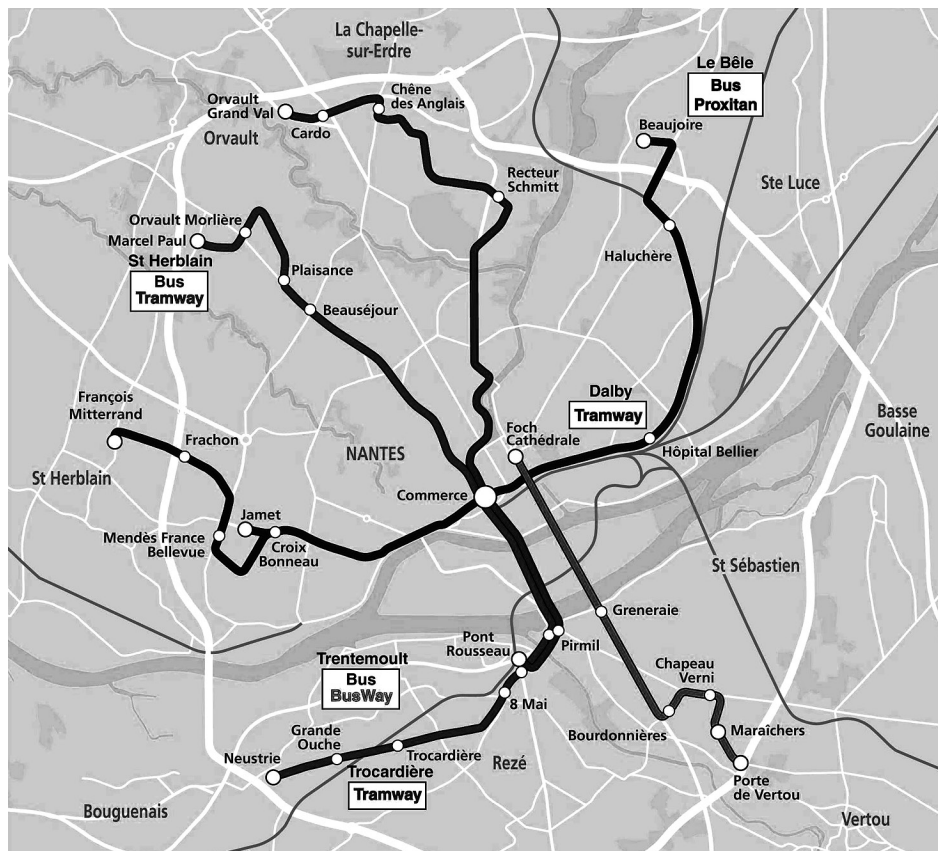
Issues of two metropolitan areas are presented below – Nantes, which was the first to launch a new tram system in 1985, and in which numerous urban planning operations were conducted along the construction of the first tram line, and Bordeaux, which realised three tram lines at the same time with major reconstruction of public spaces as a whole.

4.1. The tram in the Nantes metropolitan area

The Nantes tram network of 36 km is the longest in France. It has become the main theme and symbol of the urban policy conducted by that metropolitan area. The tram has shown its influence on the city in respect of clear structure, improved aesthetics, urban renewal operations, comfort, and specifically in the area of ongoing changes of public spaces. On the basis of data from 1995, in parallel with lines 1 and 2, approximately 140,000 m² of pedestrian and bicycle spaces were realised, along with the accompanying infrastructure, as part of small district-related projects or projects of greater significance in the scale of the whole city or metropolitan area. The implementation of the tram system required rearranging space, which meant looking for a way to reduce the existing motor transportation. This was realised by installing a tram line and reducing the number of traffic lanes, as well as their width. Numerous traffic lights and traffic islands were eliminated, mini-roundabouts were introduced and junctions were simplified. The number of traffic lanes was reduced to two single lanes, and their width was decreased from 3.5 m to 2.8 m, which limited traffic speed, but paradoxically, improved the traffic flow. Motor traffic volume was also significantly reduced, as was its intensity near the city centre. Nantes gives the impression of a peaceful, less noisy city, with space for bicycles not only along tram lines. The implementation of a tram line freed up transportation routes through their new division and simplification. Pedestrians and bicycles discovered areas without the predominance of cars. The linear management of inherently urban spaces strengthened by their structure and small architecture, makes the whole space of transport corridors more consistent. The traffic flow within them becomes easier, more peaceful while the space is more user friendly and aesthetic.

The introduction of a tram system is an important urban event, and it is accompanied by public and private projects. At the metropolitan level, the whole tram line and network has become the beneficiary of added value. A total of eighty-five construction projects covering 450,000 m² of usable area were catalogued. They introduced significant changes into the way

of using public space (32 of them related to housing development, 48 were public utilities and 5 were office/commercial spaces). Apart from the above mentioned projects carried out within tram corridors, thirty-eight local projects related to public spaces (squares, bridges, quays etc.) could be regarded as directly connected to the introduction of the tram.



III. 7. Simplified diagram of the tram network in Nantes. Source: www.tan.fr (2/2010)

Whether significant or small, all the projects contribute to strengthening the downtown character of Nantes city centre and the districts linked by the tram line [13, p. 56].

4.2. The tram in the Bordeaux metropolitan area – CUB (*Communauté urbaine de Bordeaux*)

Bordeaux, with 660,000 inhabitants and area of 55,000 ha is the seventh largest metropolitan area in France, as well as one of the city complexes with the lowest population density.

The Bordeaux tram project became a unique opportunity for the restructuring and modernisation of the city and metropolitan area, and for improving its image. It was no

longer just a transportation project, it became an urban project based on the realisation of three tram lines.

The project was supposed to address the following problems as defined in an urban diagnosis: pauperisation of the city centre, especially of the districts adjacent to Garonne; high levels of activity of the peripheral districts, draining activity from the city centre and post-industrial areas near the city centre; isolation of problematic social housing districts.

On a city-wide scale, the project had three goals: emphasising the architectural and urban legacy, especially the building development on the frontage of Garonne, designed by *l'atelier Gabriel*⁹ (currently, Bordeaux city centre is on the UNESCO World Heritage List); revitalising three great post-industrial complexes, *3B, Bacalan* in the North, *Bercier* in the South of *St Jean* Railway Station, and *Bastide* on the right bank; connecting the city to the river by managing quays.

On a metropolitan scale, the project faced two challenges: activating the metropolitan area centre; qualitative control over the expanding suburbs.

Seven 'park and ride' car parks were realised as part of the project, the target number being fifteen, each of 5,000 parking spaces.

Aesthetics and care, visible in the work of architects, designers and landscape architects, are the most surprising aspects of the Bordeaux tram project. CUB (*Communauté Urbaine de Bordeaux* – Bordeaux Municipality) decided to entrust the project to talented authors: architects Brochet, Lajus et Pueyo, designer E. De Portzamparc, and landscape architects from *Signes* agency founded in 1990 by Alain Cousseran.

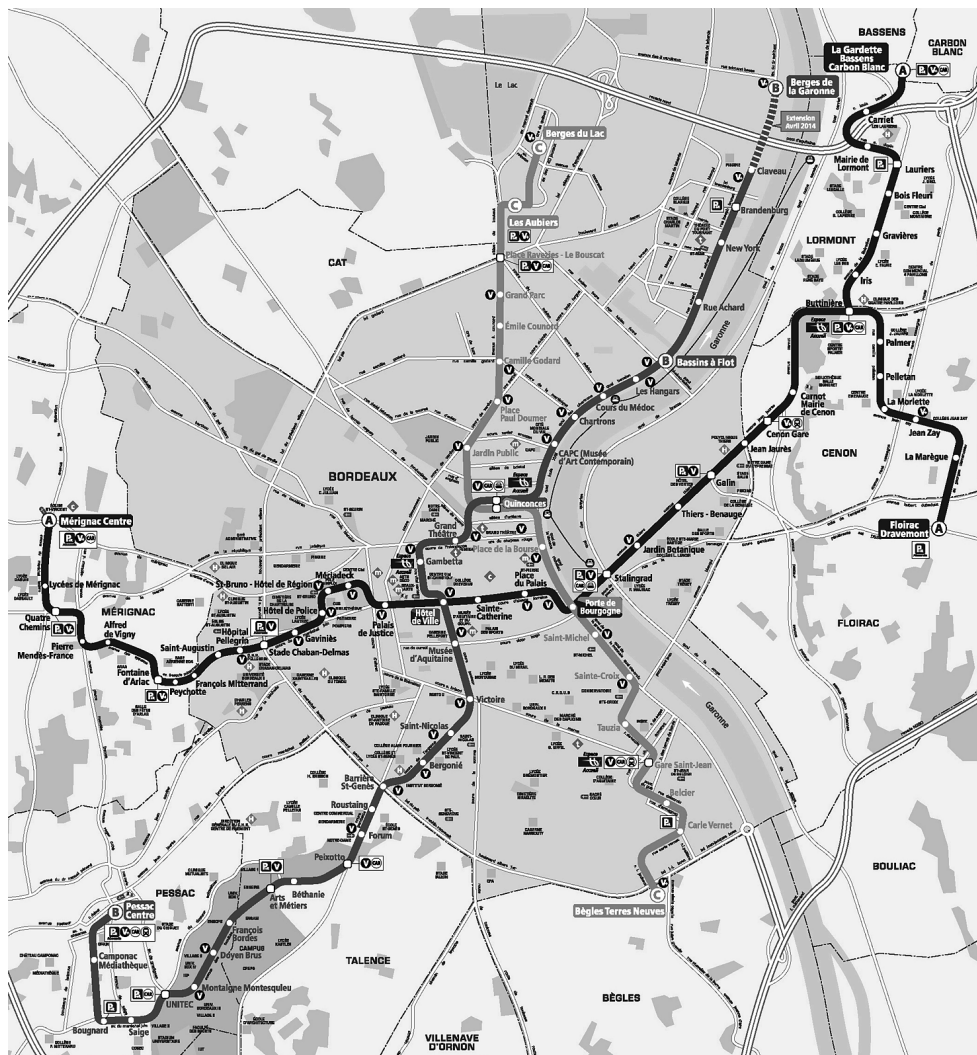
Every line and stop was designed with special care, and their vicinities were redesigned and restructured very thoroughly, restoring the quality of public spaces that was lost due to motor transportation and traffic infrastructure. The development of the Garonne quays, where wide green areas were introduced, emphasized the value of eighteenth-century frontages designed by Gabriel, which were cleared of two lanes of motor traffic. It is an exceptional example of great care for the urban landscape.

Outside the city centre, tram network is planned to spread radially to prevent parallel connections, e.g. with the tracts leading to the ring-road which services main industrial areas. When the paper was written, the international airport, the Convention Centre and the exhibit areas had not yet been serviced. The tram service crosses the Garonne at only one location, on the *Pont de pierre* bridge, the building of which was ordered by Napoleon I in 1807. The design of the new bridge on the Garonne between *Bacalan* and *Bastide* districts is at the stage of social consultation (*l'enquête publique*). The project involves making traffic lanes for public transportation, but without a tram line [11, p. 4].

Directing tram lines through historic protected areas required the implementation of an innovative technology to power tram cars by means of a third track in the track bed. For the first time in the world, a solution without overhead lines was implemented along a 10 km length of commercial line. Bordeaux was followed by Orléans, in which the newly designed East-West line will have no overhead lines along a 1 km section in the very heart

⁹ 18th century architect family that designed e.g. *Le petit Trianon in Versailles and Place de la Concorde* in Paris.

of the city centre so as not to ‘pollute’ the view of the cathedral and the mayoralty building [17, p. 117]. Also, the city of Angers realised a tram line powered by a ‘third track’ for its city centre.



III. 8. Bordeaux tram network plan. Source: www.lacub.com

5. The Tram as an Efficient Urban Tool

Social mobility has been rising for almost two centuries in the developed and the developing countries alike. On average, every Frenchman between the ages of five and ninety-nine covers a distance of 15,000 km every year. The French work one day per week

to pay for their travels and they devote the equivalent of one working day per week for movement.

Urban mobility has two facets – it accompanies and stimulates economic growth, but it also generates unwelcome social, territorial and environmental effects [6, p. 3].

The tram meets expectations and realises tasks of contemporary cities as far as transportation is concerned, not only without generating negative effects, but positively influencing the process of shaping public spaces.

Thanks to modern technological solutions and comfortable tram-cars, it is possible to eliminate inconveniences traditionally associated with trams such as noise; vibrations; neglect; bothersome tracks. Today's tram-cars are environmentally friendly and move almost noiselessly through green areas. Overhead lines and posts do not degrade the valuable downtown areas.



III. 9. *Place de la Bourse*, Bordeaux. Photo by the author

Fast, stable, frequent connections, integrated ticket and information systems, and the inclusion of trams into efficient modal transport systems, all ensure reliability and comfort for passengers.

Numerous examples of realised projects slowly but steadily change the habits of inhabitants as far as movement is concerned. The tram, despite ongoing discussions, is getting increasingly higher social support thanks to significant promotional and informational efforts, as well as due to the participation of future passengers in consultations at the stage of project analyses.

Modern trams seem to be an efficient urban tool. Along with their reintroduction to French cities, the values lost in modernistic urban planning are also resurfacing. Streets and

squares are again becoming urban spaces accessible for pedestrians and other users. City structure is becoming more consolidated, and distant peripheral districts are 'brought closer' to the city centre.

Tramway oriented development (paraphrase of the term *Transit Oriented Development*) enables the designing of more environmentally friendly districts, less dependent on cars and urban phenomena generated by them (deglomeration, huge car parks). Districts with less intensive car traffic are developed along tram lines, the city gets more concentrated and the streets become more pedestrian and inhabitant friendly [13, p. 138].

References

- [1] Antonini J.-C. (ed.), *A la découverte de votre tramway*, Maison du Tramway, Angers Loire Métropole, Angers 2008.
- [2] Ascher F. (ed.), *Bougel'Architecture, Villes et Mobilités*, Institut pour la Ville en Mouvement, Paris 2003.
- [3] Ascher F., *Les nouveaux principes de l'urbanisme*, Editions de l'Aube, 2008.
- [4] Belmont J., *Villes du passé, villes du futur*, Editions du Moniteur, Paris 1989.
- [5] CERTU, *Guide d'aménagement de voirie pour les transports collectifs*, Collections du Certu, 2000.
- [6] CERTU, *La mobilité Urbaine en débat, Cinq scénarios pour le futur?*, Collections du Certu, 2005.
- [7] Documentation photographique, *Les transports en France*, Dossier no. 8066, 2008.
- [8] Dolowy E., *Impact de la Mobilité sur les Formes Urbaines et Architecturales*, Rapport PREDIT, 2003.
- [9] GDF SUEZ, *Dossier de presse GNVERT*, Paris 2009.
- [10] Gouin T., *Planification urbaine et tramway en France: les leçons de l'expérience du tramway français moderne* (www.euromedina.org), 2007.
- [11] Guet J.-F., *Le tramway, axe central du projet urbain de Bordeaux* (www.certu.fr from, 25.07.2009), article published in ISOCARP Review, No. 3, 2007.
- [12] Kantarek A.A., *Paryskie kwartały. Współczesna koncepcja kwartału zabudowy w strukturze miasta*, Wydawnictwo PK, Kraków 2004.
- [13] Laisney F., Grillet-Aubert A. (eds.), *Tramway – espaces publics et mobilités*, Architectures du Transport – Rapport final, Vol. 3-A, IPRAUS, Paris 2006.
- [14] Richards B., *Future Transport in Cities*, Spon Press, London 2001.
- [15] Sandèr A., *Faire la ville avec les noeuds de réseaux?*, [in :] A. Bourdin (ed.), *Mobilité et écologie urbaine*, Édition Descartes & Cie, Paris 2007.
- [16] Stambouli J., *Les territoires du tramway moderne: de la ligne à la ville durable*, [in:] *Développement durable et territoires*, Dossier 4: La ville et l'enjeu du Développement Durable, 2007 (<http://developpementdurable.revues.org>).
- [17] Tricoire J., *Le tramway en France*, La vie de Rail, Paris 2007.
- [18] Tricoire J., *Le tramway à Paris et en Il-de-France*, La vie de Rail, Paris 2007.