

DEVELOPMENT OF A DECISION ANALYSIS METHODOLOGY FOR PUBLIC TRANSPORT LINE INTRODUCTION

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ABSTRACT

In French cities, various actors are involved in the setting up of a new rapid transit transportation lane (bus or tram). They have different, sometimes conflicting purposes, but they have all to be taken into consideration in the same project. A transport line project takes place in a very complex urban context, so there are a lot of aspects to take into account.

A three-stage methodology can be a good tool to help the decision-maker to make the best choice. The first step entails considering all possible routes and ruling out those which are unfeasible because of technical and urban constraints. During the second phase, an initial analysis is undertaken on a city scale to find out the best possible routes. Finally, in a third stage, these selected layouts are analyzed to find the best compromise for the transport line using in public land, considering all the actors of the project.

Making decision tools will enable the actors involved in the project to find the best solution based on their expectations. These tools could be used to relaunch the discussion on contested points. It will make lead to better knowledge of each actor, helping decision-makers to foster an informed dialogue.

KEY WORDS

Public transport, decision making, multi-criteria, route, methodology.

INTRODUCTION

In the seventies, in France, mobility policy consisted in prioritizing individual vehicles, through the construction of big road infrastructures. Towns were planned to make the movement of private cars easier. Owing to this policy, users favoured the utilization of cars up to the saturation point of road network. However, politicians have become aware of the nuisances generated by cars: traffic jams, noise and air pollution, visual impact of infrastructures etc.

More and more public transport networks have been developed considering environmental aspects. New transit transportation lanes (bus or tram) blossom in the largest

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French conurbations. In 1985, Nantes was the first town to have a new lane for trams. Strasbourg, Grenoble, Montpellier, Bordeaux followed this example when developing their public transport network.

With the appearance of these new lanes, some problems arise in order to decide where the layout must go through the agglomeration and in a smaller scale, where and how the lane must be introduced. At the same time, we have to think about all the other users of public space and about the distribution of the different uses of this space. Public transport is one component of the public space but, notably for safety reasons, it is impossible to consider it alone and not take the others into account.

The first part of the article describes the French context in which a transport project is managed, with the different actors involved and the different useful criteria to estimate it. The second part deals with the methodology and its different stages linked to the different scales: the agglomeration and the street. Finally, we introduce some topics on the reasons for establishing such a methodology by answering the questions why a methodology, for whom and with what means.

I – THE FRENCH CONTEXT OF TRANSPORTATION

1 – THE ACTORS PARTICIPATING IN A TRANSPORT PROJECT

All the actors have to collaborate to obtain a coherent and workable transport project; it means a project which is not violently contested. The actors do not have the same power in the decision; neither their goals nor their motivations are the same. We can therefore classify each actor in function of its relation with the decision.

The first category comprises the actors who have a decision power, i. e. the decision-maker. This or these actor(s) will choose among the projects and mostly will mostly pay for them. Their aim is to work out the best possible project from a compromise between the expectations of the others. This definition of decision-makers is easily understandable but in practice, it is difficult to correctly identify them in France. Regarding the French institutional context, the agents financing of a transport project are numerous because more than one institution has responsibilities in the domain of transportation. Thanks to the surface transport direction (1995), there is the region, which is the organizing authority for rail and road transport on a regional level, the country, which is the organizing authority for extra-urban public transport services and finally the commune or the amalgamation of communes, which is the organizing authority for town public transport once the town or urban area boundaries have been defined. Fortunately all these actors are linked by a common goal: to achieve the project.

The second category contains the actors who provide information and details about the project and its realisation. These express their aims through wishes, constraints, preferences etc. Decision-makers have to choose among the expressed wishes because the purposes are frequently different and even incompatible. Among these actors, we can mention the technical services of the city, travellers, traders, protection association (of trees, of bike users, of handicapped people etc.), inhabitants and so on. Technical services and planning departments have a specific role since they represent, thanks to maps, longitudinal and

transverse sections, what the project could be. They make the different wishes become concrete.

Between technical constraints and political ideas, the project is gradually accomplished. Some important debates often arise because each actor tries to promote the project which is the closest to his or her purposes. Some alliances are also concluded by several actors to be stronger and make their aims prevail. The decision-makers have to take care of these alliances and to deal with when choosing a project according to various criteria.

2 – CRITERIA USED TO EVALUATE A TRANSPORT PROJECT

In the first stage, a difference between constraint and criterion should be established (e. g., Roy and Bouyssou 1993). The constraint is dictated by law or rule. It is impossible to avoid it. We can quote, for example, the rules about noise in conurbations and those about features of the street for fire safety. So, a constraint that is not respected leads the project rejection.

The criteria allow us to evaluate different projects. They are not the same if we have to choose the layout of the lane in the city or when we have to introduce the platform in the public space. In any case, a first classification into five categories can be established. “Urban and environmental integration” contains criteria such as site respect, visual impact, reduction of individual mobility etc. The more important the criteria are, the more the sustained development is considered. The category “cost” concerns not only investing for the building of the transport system but also those financial aspects linked to the running and the maintenance of the system. The category “technical aspects” is made up of the construction of the platform, its timelessness. The category “operation” contains criteria like the traveller’s comfort or the foreseen commercial speed... Finally, the evaluation of the category “interactions with the other flows” permits the different projects according to the global organisation and the spread of all the crossed public space users.

Some criteria, thanks to their relative importance in spread at the heart of the project, will provoke conflicts between the different actors. The reduction of the place took up by individual cars seems really important to a supporter of soft traffic (bike, walk, roller etc.). But this criterion is against the association for the protection of car drivers. On the other hand, some criteria prove quite unifying. It is notably the case of trying to reduce the visual impact of the platform or the decrease of air and noise pollution.

II – THE DEVELOPMENT OF THE METHODOLOGY

1 – BEFORE APPLYING THE METHODOLOGY

To apply the methodology, we have to venture a hypothesis: in the studied conurbation, there is a political will to develop a transport network and this determination is so expressed that the first surveys about transport are conducted. These first studies are declined in three parallel parts.

The first one concerns the transport aspects related to the study of the distribution of population and employment, the position of strategic places to be deserved etc. From this study, we can find the corridor of transport. This is a band around a structuring trunk road, measuring almost 600 meters, where we must locate the lane of transport in order to optimize

the transportation system. The second part of the study caters for the economy and the efforts that the city can and wants to do to implement a transport system. The third part concerns the urbanism, the space used by the system, the image of the transport system. In the new projects of LRT in France, there is always an upgrading of the crossed public spaces whereas it is not so common when the system is a segregated bus way.

From these studies, two things can be deduced: the corridor and an idea of the transport system. We estimate that the corridor is fixed and we will work on it. As regards the method of transport, there is no obligation to choose it at this stage. If there is a hesitation between two or three methods (LRT, tram with tires, bus, trolleybus...), we can keep them all. With these two given premises, we can begin to apply the methodology, which is represented in figure 1.

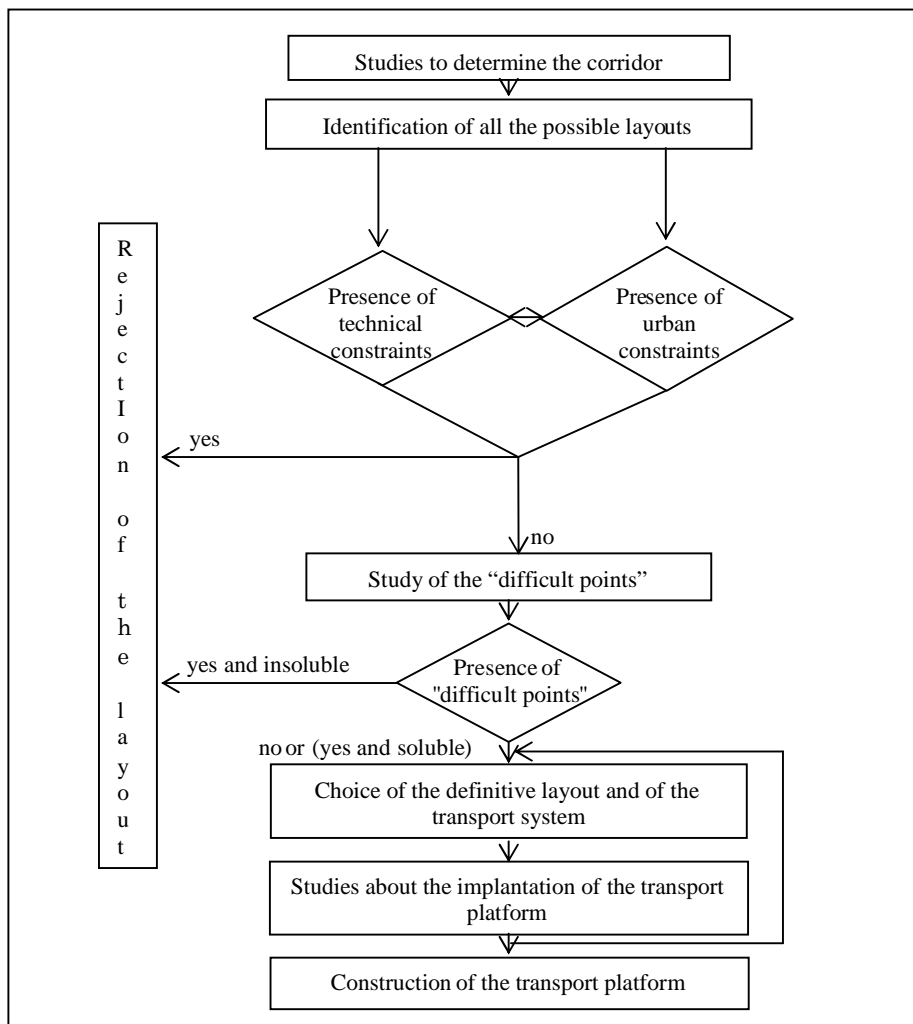


Figure 1: Representation of the methodology

2 – THE FIRST STAGE: A PHASE OF ELIMINATION

From the corridor, we list all the possible layouts for the transport lane. However, some of them will be later eliminated because of different constraints.

The first restrictions are linked to the urban context. In the corridor, there are some important places and the transport system has to serve them. For example, the universities are an absolute must and the first lane of any transport network has to go near them. The train station, commercial centres, hospitals and public facilities are fundamental strategic places for the layout. Some other spaces are linked to the existing transport network. When a new transport lane is introduced in a conurbation, the existing network is restructured so as to accommodate to this new principal lane. Some hubs will not move and there is no choice for the layout but to serve these places. At the same time, some places have to be avoided. It is the case of heliports or buildings containing sensitive machines: some precautions are taken to avoid vibrations and electromagnetism.

Then, technical constraints are examined, which depend on the chosen transport system. For example, we can quote the turning circle of the transport system, the maximum slope the method of transport can get over, the width of the roads. If the transport system is a tram, we can add free height constraints. For safety reasons, a height of about 6 meters has to be free of obstacles to put the catenaries. These constraints can, in most cases, be superseded. All the financing agents have to do is to give more money to the project. An extreme solution can be to expropriate inhabitants to have more ground; but, in that case, the decision-makers have to support the decision on political aspects.

By comparing the two types of constraints, we can eliminate some layouts. Thanks to several feedbacks between urban constraints and technical constraints, some incompatibilities appear leading to the reject of the involved layout. Only those projects technically feasible and urbanly interesting are considered after this stage.

3 – THE SECOND STAGE: THE CHOICE OF THE LAYOUT

A choice must be made among the layouts which have not been discarded. To do it, we study the “difficult points” of the layouts and classify them in function of the cost needed to solve them. An example of “difficult point” is to go through an important crossroads with the raising doubts about the flow organisation. Or, likewise, we can find difficulties serving a building in a particularly difficult urban context. In Strasbourg, the decision-maker preferred to serve the train station with a subway (a more costly solution) rather than pass 200 meters farther and pay less. It is only political wills which can give an answer. We can accordingly classify the “difficult points” in function of their ability to be solved and the costs that the agglomeration has to pay to solve them.

Then, a multi-criteria analysis has to be made in order to compare the layout. The five categories of criteria are to be used; we just list some criteria which seem to us more interesting. From the point of view of transport, the service quality of the places generating some traffic is really important because it is related to the number of probable travellers and, consequently, to the cost-effectiveness of the project. As far as urbanism is concerned, we can have a longer vision if we take into consideration the politics of development of the agglomeration and hence the future urban projects. Concerning technical aspects, the

introduction of the site of maintenance is an important point. This type of building needs a lot of space and has to be near the layout. It would be a choice element between two layouts. We can quote a political factor, with the traumatism created by the phase of roadwork. This stage would probably generate some nuisance for the inhabitants and some politicians are not ready to take the risk of annoying their electors. Last, the impacts of the new lane can be evaluated from the point of view of individual cars, with a new circulation plan, and from the point of view of public transport, with a new network.

With those pieces of information and the “difficult points” of each layout, the decision-makers hold all the cards (that means they are in a strong position) to choose among the layouts in function of financial efforts that the agglomeration is ready to do. It may happen that no layout suits. In that case, either we abandon the project or we start again with a less strict methodology. If several layouts are technically and economically conceivable, it would be better for the population to be associated because, in a general way, the more implicated the inhabitants are, the less contested the project will be.

At the end of this phase, one layout is chosen even if we can tolerate some local variants, for example if all the “difficult points” are not definitively solved. From this layout, we are able to define the position of the platform in the framework of the public space.

4 – THE THIRD STAGE: THE CHOICE OF THE INTRODUCTION OF THE PUBLIC TRANSPORT SYSTEM

For the last stage, we abandon the scale of the agglomeration in favour of the scale of the street. We determine, section by section, the exact position of the transport platform and the distribution of the other users of public space. The three more frequent positions are the axial position (the general circulation is on either side of it), the bilateral position (the general circulation is in the middle of the two lanes of public transport) and the lateral position (the general circulation is next to the two lanes of public transport). The study section by section has to be completed by a linear study to have a unity of position on the entire layout. A final study will account for the particular points such as the stations or the crossroads. We can then have the precise plan of the allocation of the public space on each part of the layout.

To choose between the different possible positions of the platform, we use again a multi-criteria analysis. The criteria are not necessarily the same as for the first time. Obviously, the cost and the security of the project, among others, appear in both analyses. As far as the criteria for the second phase are concerned, we can mention the parking. The number of parking places cancelled is an object of preoccupation for the traders; to avoid their turning against the project, it is necessary to negotiate with them so as to evaluate the accepted number. In France, another sensitive subject is the trees. People do not appreciate trees being cut, even if the project includes the plantation of more trees than the ones that are to be removed. There are a lot of protection associations to look carefully at all the different projects that involve the removal of trees.

To make easier the connection with another transport, a position must be chosen. That is the case for T3, the LRT in Paris (inauguration at the end of 2006) which in a particular section takes a lateral position that permits the connection with the underground directly on its platform. From the point of view of technical aspects, some introductions are compulsory because of the turning circle or because of the presence of a mixed bus-way.

If there is a sticking in the introduction of the segregated site because of the place took to the individual cars and the width of the street, one solution may be to set up a mixed site in a short section. The exploitation would be defaced but it is better to have a system defaced on a section than no system at all. This example shows the link between the layout and the position of the platform and some feedbacks can appear between the second and the third stages, the goal being to have the couple layout/position as best as possible.

III – SOME PRECISIONS ABOUT THE METHODOLOGY

1 – A METHODOLOGY: WHY AND FOR WHOM?

Before anything else, we would like to state that this methodology is not a magic formula. It is important to be aware of the myth that the methodology can provide a so-called right answer (e. g., Bana e Costa, Fernandez and Correia 2005). Every project context and agglomeration is different from the rest; so, the methodology used has to be adapted to each case.

One reason for these differences is the political aspects. In fact, in any case, the most influential actor is the mayor. He has the power to manage the roads of his town and can decide whatever he wants in that respect. If he does not wish a public transport lane, he can prevent the project from being successful. The success of a project of public transport depends totally on the political will and the conviction of the mayor. An example of the influence of the mayor is the priority established between public transport and individual cars. On the one hand, mayors prefer to give all the priority to the public transport lane and there is no matter whether car drivers are annoyed. On the other hand, some of them want a transport lane even if the private cars are not too penalized. Even in the choice of the layout, and in its influence on the plan of the private cars mobility, the mayor has a role to play.

Behind this influence which can make two projects completely different in the same context, we decided to knowingly forget the political criteria, which seem to us rather difficult –indeed impossible- to model. Thanks to this omission, the methodology becomes as objective as possible and the criteria become rational. With its objective features, the methodology can be used as an information source. Planning departments or technical services of an agglomeration can use such a methodology to collect the wishes of the different actors. By asking them to classify the criteria according to their preference, it is easy to compare the priorities of each of them.

This phase allows everyone to express his / her opinions about the project. It prevents the project from becoming “the law of the jungle” and for the actor who shouts loudest to obtain all he wants. Thanks to this discussion, everyone can know what the objectives of each actor are and the reasons for asking something in particular. To facilitate the comprehension of the different goals entrains the best possible agreement between the actors. As everyone understands the aims of the others, concessions can be more easily made and it can be accepted that maybe the scheme is not the project of his / her dreams. This methodology, for lack of giving the ideal layout and position of the platform, favours the dialogue and the understanding of the stakes linked to a public transport project.

2 – A METHODOLOGY: WITH WHAT MEANS?

a – The historical research

The goal of the methodology is to help the mayor and the town counsellors to carry out the best project of public transport. It must be necessarily usable, which means it is realistic with regard to the actual practices of the actors and not merely a theoretical work. Moreover, for the methodology to be accepted in the transport world, it is essential to understand correctly the aims of the actors, to understand what their alliances are to be able to set up some pertinent criteria.

The research about the past transport project and the future projects allows us to understand in a better way these different aspects. Nantes, Strasbourg, Marseille, the region of Paris, Bordeaux... are some French conurbations that have developed their public transport network and thus permit us to get to know how it really happened. With the analysis of the interplay of the actors, we can find out some fundamental ideas that help us to understand the real expectations of everybody. And by a thorough understanding of how the choice of the position of the platform has been made, it is easier to determine who has to intervene at each stage of the methodology and what the criteria needing a formalisation are.

This analysis of the past and current projects can let us know if the methods of work have evolved between the first LRT project, in the eighties, and today. We can then deduce from this study the influence of the institutional changes on public transport projects (and notably the withdrawal of the French State in the financing of the projects), the ambition of the projects, the urban insertion of the platform... And past research, by means of the interviews, lets us know the methodology favoured by professionals and permits to collect their opinions to make the methodology as suitable as possible to their needs.

b – The multi-criteria decision aiding methodologies

In the context of public transport, in the view of the numerous involved criteria, a multi-criteria decision aiding tool is essential. This tool, like Electre, can be used in two scales: the choice of the layout and the choice of the position of the public transport platform. In any case, that sort of tools forces the actors to choose the criteria that will be used and the weighting of these criteria with respect to the others. If the criteria can be created objectively, it is not the case of the weights which depend on each actor and on his goals. The phase of weighting would initiate dialogues and debates.

To better understand the expectations of everyone, we can apply the decision aiding tools more than once, with different weights. The obtained results can then keep the debate going and serve as a reference with regard to the wishes of everyone. Having a concrete view of what the future transport project could be, the actors often have a best comprehension of the stakes. Thanks to Morand (2004), the word “aid” in the terms “decision-aiding tools” thus takes on its full meaning of assisting the progressive construction of a solution, keeping the discussions going and not being viewed as the promise of obtaining the miraculous solution with which every actor should agree.

Again with the will of keeping the debates going and of catering for, in the best way possible, of the expectations of everyone, it may be interesting to use an ergonomic method of collecting information in order to determine the weighting of different criteria like Simos’

game of cards (e.g., Damart 2003). The criteria are represented by cards and the actors, alone or in groups, have to arrange them, from the most to the least important. Some white cards can be used to represent the amplitude of the difference between two criteria. This method involves a constructive exchange about the relative importance of the criteria because a comparison of the choices between two actors is immediate and it is easier to discuss by moving cards than by using real data.

CONCLUSION

The context of the development of a public transport network is really complex by the number of actors involved and also by the number of different points of view which are confronted. As a transport project deals with a lot of urban and environmental elements, it does not leave people indifferent. Everybody has an opinion about the project. This multiplicity of views and the complexity of the context make the evaluation of the projects rather difficult. A lot of criteria are thus created to make a project as consensual as possible. Multi-criteria decision aiding tools are used to help decision-makers to choose among all the projects.

As there are not two identical projects, it is difficult to build a methodology that corresponds to every case we could meet. It is then necessary for each technical service of the agglomeration to be able to adapt the methodology so as to use it. A relevant aspect will thus be to learn how to construct a criterion and how to be sure that no criterion is forgotten. This process is really important because it shows that we take care of the specificity of each town and each agglomeration and once again, that we do not intend to provide a magic formula.

One of the last phases of the study will be to apply the methodology to a real transport project to see how it could be done. It will permit us to know how long its implementation will take and what the difference with respect to traditional methods is. In a world where everybody must do more things more quickly, the methodology will never be used if it is too time-consuming. This use will also permit us to verify that the methodology exactly corresponds to the expectations of each actor.

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