LIGHT RAIL IMPLEMENTATION: SUCCESS AND FAILURE ASPECTS OF DUTCH LIGHT RAIL PROJECTS

Prepared for the 94th Annual Meeting of the Transportation Research Board 2015

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November, 2014

Word count:
Abstract (250) + Text (5394) + Figures/Tables (5*250) = 7494

ABSTRACT

Light rail has been successfully implemented in many urban regions worldwide. Although light rail has been a proven transport concept in many cities, there is much debate on the (societal) cost-benefit ratio of these systems. In addition to the success stories, several light rail projects were not that successful or even failed. In recent years, many light rail plans have been cancelled in The Netherlands, some after many years of planning and some even after the start of the tendering process or during trial operation. We want to know why this happened, so we will be able to support future design and decision making. This paper describes our research aiming at the answer to the question: what are the success and failure factors of light rail planning based on the Dutch experiences? This research has been performed as a survey, in which we investigated five projects, being light rail projects in the Netherlands (and one reference project in France) that either succeeded or failed in different project stages. The main conclusion is that several, multidisciplinary factors make a success or failure out of a light rail project. Projects do not fail just because a lack of funding, small political support or technical obstacles only. Rather than that, a combination of factors causes projects to fail. Subsequently, projects will only be successful if they are based on more than one success factor. Just a high potential ridership or political support is for instance not enough to guarantee a project to succeed.

Keywords: light rail, success and failure, Dutch projects

1. INTRODUCTION

Light rail has been successfully implemented in many cities and urban regions worldwide (see e.g. *1, 2, 3*). Light rail is a relatively new mode, which is a hybrid form of existing modes, serving travel distances about 10-40 km. Figure 1 shows the position of light rail compared to the most common public transport modes train, tram/streetcar and metro. Due to its hybrid form it is able to combine strengths of two systems and therefore it often offers a solution to regional mobility problems.

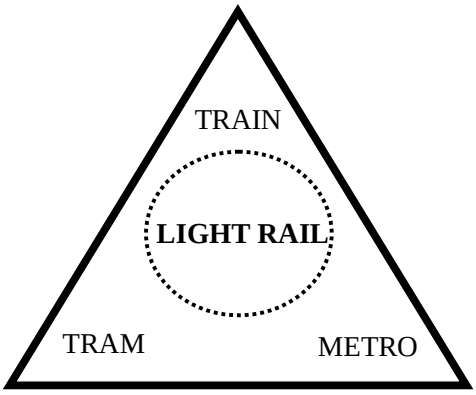

FIGURE 1 Light rail is a hybrid form of train, tram and/or metro (*4*).

Although light rail is successful in many cities, there is much debate on the (societal) cost-benefit ratio of light rail systems. In addition to the success stories, several light rail projects were not that successful or even failed. As shown by (*5* and *6*) for instance, an optimistic bias may exist with regard to ridership forecasts in the US and the UK, respectively. On the other hand, in *(7)*it is illustrated that in cost-benefit analyses in the Netherlands, substantial gains with regard to enhanced service reliability (which is potentially one of the main advantages of light rail) are often neglected. Other researchers *(2)* illustrate in a survey of 101 public transport routes (bus rapid transit (BRT), light rail transit (LRT) and streetcars) in Australia, Europe and North-America that on average LRT is able to attract more passengers compared to BRT and the service level of BRT is lower (although variety is large). Dutch researchers *(8)* reported on a rail bonus, showing that in the Netherlands, rail systems attract up to 10% more passengers than bus systems (if supply characteristics (e.g. frequency and reliability) are equal). Researchers *(3)* state that in the debate on the performance of light rail an in-depth look at light rail being part of an integrated transit system is lacking. Furthermore, in (*3*) it is shown that fully integrating light rail in an urban transport network could be a factor for a successful project. It seems that a proper framework on the success and failure aspects of light rail is missing. In this paper, we will investigate what these aspects are, based on Dutch projects. Our found insights might be useful for planners and decision makers concerning system choice. Although light rail enables a quality leap, research *(3)* shows, for instance, light rail system becoming backbones of the total public transport system and *(9)* illustrates the increased level of service reliability. The focus of this paper is not solely on operational quality, but also on governance and all the related aspects like the political process, the project financing and the way of tendering and controlling the project. As stated by *(10)*: “its successful implementation is not solely dependent on light rail suitability for the mobility patterns in the region, but very much on the approach of the implementation of those supporting the option.” Other researchers *(11)* present that “One of the most important factors is cooperation between many actors, including transit operators, railways, and cities.”

The outline of this paper is as follows. After a short introduction on light rail systems, our objective and methodology are explained. Then an overview of the cases and the most important findings are given. Eventually, an overview of failure and success factors is provided. Subsequently, a final conclusion is drawn.

2. LIGHT RAIL SYSTEMS

Although light rail seems to be a very modern mode, TRB already defined it in 1978:
"Light rail transit is a metropolitan electric railway system characterized by its ability to operate single cars or short trains along exclusive rights-of-way at ground level, on aerial structures, in subways or, occasionally, in streets, and to board and discharge passengers at track or car-floor level." (12)

This definition is still valid, although nowadays, the hybrid form of light rail is more stressed. Figure 2 shows the possible combinations of the three traditional modes (i.e. train, tram/streetcar and metro). Six new forms are distinguished, which are illustrated by actual examples in Table 1. Numbers 1-5 are considered to be light rail (*4*). Internationally, high quality (regional) tramways are often considered to be light rail as well, unlike regular streetcars. Table 2 shows the main characteristics of light rail compared to the traditional modes (*4*).

	Lightrail		**Non- lightrail**
1	(Regional) tram	6	Train
2	TramTrain	7	Metro
3	TrainTram	8	MetroTrain
4	TramMetro	9	TrainMetro
5	MetroTram		

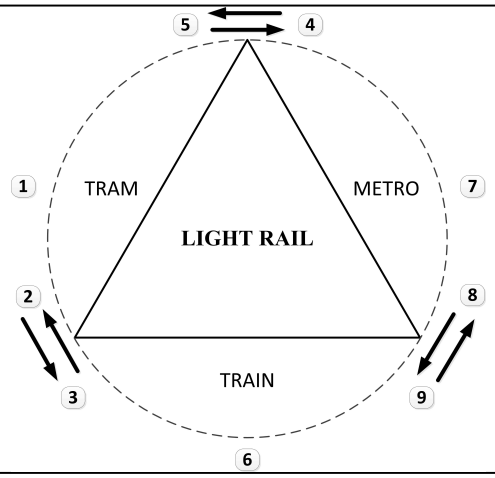

FIGURE 2 Different hybrid forms (*4*).

TABLE 1 Examples of hybrid forms (types 2-5 in Figure 2)

Type of operation	**The Netherlands**	**International**
2. TramTrain	The Hague	Karlsruhe (Germany) Saarbrücken (Germany) Kassel (Germany) Manchester (UK) Paris (France)
3. TrainTram		Zwickau (Germany) Camden (UK)
4. TramMetro		Cleveland (USA) Brussels (Belgium) Köln(Germany) Düsseldorf(Germany)
5. MetroTram	Amstelveen Rotterdam	

As a hybrid mode, light rail features characteristics of train, tram and metro. It has become an efficient and pragmatic solution for high quality, rail-based public transportation. The ability of light rail to serve different transport objectives and levels makes it an adaptive system that can easily be integrated with different types of existing infrastructure. In contrast to other urban rail systems like metro and tram, a light rail system (to some extend) is able to share traffic space with other means of transportation (cars,

bikes, etc.; including pedestrians) at one part and may have own right of way on another part. Light rail can be pragmatically integrated in different urban environments (*4*).

TABLE 2 Some characteristics of light rail compared to other modes (*4*)

	Light rail	**Train**	**Tram**	**Metro**
Covering area of the system	Medium	Large	Small/Medium	Small/Medium
Connection to environment	Integrated	Exclusive	Integrated	Exclusive /closed
Crossings with other traffic	Several	Few	Many	None
Priority at junctions	Often	Always	Sometimes	NA
Stopping distance	0,4-2 km	2-100 km	0,2-0,8 km	0,4-2km
Train signaling applied	Often	Always	Sometimes	Always
Vehicle capacity	Medium	High	Low	Medium/high

The attractive characteristics of light rail systems make them suitable to be implemented in urban areas of all kinds. Light rail systems exist in many forms and disguises. Light rail is a container expression, which makes it sometimes confusing to use. It represents many types of different systems like metro style urban systems, regional tramways, enhanced streetcar circulators, or improved and modernized classic tramways that can be found all over Europe and North America. The multiple existences of different light rail systems that collectively form a very successful transport concept, forms also the pitfall of light rail. The perplexity of different system layouts with the same names, sometimes confuses those who decide on constructing light rail systems.

3. RESEARCH OBJECTIVE AND METHODOLOGY

Researchers (*10)* mention that in 1997 the Dutch government noted about 30 light rail initiatives. Fifteen of them were acknowledged and gained support. At this moment, only one of them is actually in operation, being the RandstadRail line in The Hague and Rotterdam (*9*).

In recent years, many light rail plans have been cancelled, some after many years of planning and some even after the start of the tendering process. We want to know why this happened, so we could support future design and decision making. This paper describes our research aiming at the answer to this question: what are the success and failure factors of light rail planning based on the Dutch experiences? We also investigated a French case to compare to the Dutch projects. More details may be found in (*13*).

This research has been performed as a survey, in which we investigated five selected actual projects, being light rail projects in the Netherlands that either succeeded or failed in different project stages. Some of these projects failed in the design stage, others during the feasibility study phase, while one project even failed after the first trial of operations. The fifth case is the light rail project in the French city of Strasbourg that proved to be very successful. Light rail (*le tramway*) has already been a proven concept in Strasbourg for more than twenty years. This case study was performed to have one ‘ideal’ case that could be used as a benchmark for the Dutch cases. The cases are described in detail in the following section.

Different methodologies were used for this research. For all projects, literature research on generic transport related papers and case specific (policy) documents was done. All Dutch cases also used structured interviews with involved stakeholders (being 6 (external) experts, 4 (assistant) project

managers, 2 former aldermen and 5 policy advisors). It must be noted that some of these interviews were rather delicate, due to the sensitive information about failures that were made in the process of the light rail project.

In both the interviews and literature research we applied the following structure to find answers to our questions in a consistent way. Afterwards, the authors derived the conclusions presented in this paper as an expert judgement, based on their experience. More insights into the detailed structure and the raw results may be found in *(13)*.

The main structure consists of four categories, being:

A. Description of the project;
B. Context;
C. Organization;
D. Decision making.

Category A consist of three parts, according to the project phases, being plan/project (A1), construction (A2) and operation (A3). Amongst others, the result of this category are insights in costs, transport, social and economical benefits, sustainability, technological factors and safety issues

Category B yields insights into the main issues that are beyond the project's influence, and that turned out to be important for one of the three phases: plan/project (B1), construction (B2) and operation (B3). Examples of this categories are: laws and legal rules and financial sources and constrains.

In category C, questions that are answered are:

- What are the efficiency and success of the internal and external communication?;
- Who is and who is not involved in the project organization?;
- How was the project tendered?

In Category D, all relevant agents who share or own a particular responsibility in the project are described. Who is, or who are the 'project owners'? Who is assigned major parts of the project? We compiled a time line containing major decision making regarding each phase and the transition (moments of 'green light') to the next phase.

In Section 4 the five projects are presented and in Section 5, the general findings of the five individual case studies are given. Subsequently, a general conclusion follows. Thereafter, an overview of success and failure factors of light rail projects follows.

4. INVESTIGATED PROJECTS

4.1 Introduction

To find the answer to our research objective, we investigated 5 actual light rail projects (4 in The Netherlands and one reference project in France). These projects are introduced in the following section. The projects are presented in Figure 3.

FIGURE 3 Investigated projects.

4.2 Uithoflijn Utrecht

The Uithoflijn is currently being built in Utrecht (see (*7*)). The construction started several years ago. The operation will start in 2018. The line connects the university area with the main station of Utrecht. In a later stage, the line will be linked to the current existing *sneltram* (fast tram) to Nieuwegein and IJsselstein.

4.3 Regiotram Groningen

The Groningen tram project was cancelled in 2012, after decades of decision making processes. Already in the 1980s, advanced plans existed for a tram link in Groningen. Just like the Utrecht case, the Groningen tram was meant to link the university and the station in the first stage (see (*14*)). The network was planned to expand over the next years into a regional tram-train project with tram links from Groningen to numerous surrounding towns.

4.4 RijnGouweLijn Leiden

This project is the most remarkable failing light rail project. Trial operations already started on a part of the route, when the project eventually collapsed. This project was revolutionary in the 1990s, because it would link tram and train for the first time. The line was planned to run from Gouda to Leiden via the main existing railway link and from Leiden towards the coast via new infrastructure.

4.5 RandstadRail The Hague/Rotterdam

This project is the largest light rail project in the Netherlands so far. RandstadRail operates on two former railway lines between The Hague and Zoetermeer and The Hague and Rotterdam (see (*9*)). The branch in the direction of Rotterdam is linked to the metro network, while the Zoetermeer-branch is linked to the tram network of The Hague. This results in a hybrid system on which both high floor metro style vehicles and low floor tram style vehicles operate. RandstadRail has operated since 2006.

4.6 Light rail Strasbourg

The first part of the Strasbourg light rail network was designed in 1991 and the first tram operated in 1995. The network consists of five lines. During the construction of this system, not only the physical infrastructure was being built, but the whole urban environment was revised as well. The Strasbourg *le tramway* is considered to be one of the first 'modern' tram systems with low floor vehicles and separated infrastructure.

5. FINDINGS

5.1 General findings per case

All four Dutch light rail projects were originally initiated to stimulate sustainable regional mobility and to guarantee good accessibility to dense urban environments like inner cities. Two light rail projects were also supposed to serve a university. The Uithoflijn will serve the University of Utrecht. The Regiotram in Groningen was meant to have the same purpose. The other projects, RandstadRail (success) and RijnGouwelijn (failure) were dedicated to guarantee a sustainable and fast connection in the area. In this section, the most remarkable findings from the case studies are summarized. At the end, the comparison with the existing and successful Strasbourg system is made.

5.1.1 Uithoflijn Utrecht

Although the Uithoflijn is not in operation yet, it is currently under construction and the first trials are expected within a few years. The Uithoflijn will solve a large congestion and capacity problem. At the moment, the main transportation modes from the station to the university are buses and bikes. The bus system is facing severe capacity problems, and increase of frequency is not realistic with departures every two or three minutes currently. Earlier research (7) illustrated the impacts of this on capacity and level of service.

The project faced difficult technical and design challenges. Due to the complex and dense urban environment, implementation of the line has been difficult. The tramway in the university district was expected to cause a lot of disturbance to sensitive electromagnetic industries and laboratories along the route. Another important threat to this project was the governmental complexity. The Uithoflijn faced three important governmental structures in one project, being the municipality, the regional government (BRU) and the province of Utrecht.

Key factor for the success of this project was the highly desired capacity improvement. The problem was and still is severe. Another important factor is the creation of one strong and powerful project organization in which all the governmental layers are integrated. The project organization has strong connections with both the involved governments and other stakeholders, like residents and companies along the track. Transparency in the decision making process curbed a lot of possible resistance.

5.1.2 Regiotram Groningen

In 2007, the Regiotram project started. The congested inner city and the poor accessibility of the suburbs were the key reasons for this project to start. The project was already in a quite advanced state of feasibility research. Studies showed the viability of the project (in a second phase the urban section was to be extended into the region, which justified the project's name 'Regiotram').

Nonetheless, in 2012 the plug was pulled, because the project continued to lose support in the municipality. Important factors for the failure are the very innovative form of public tendering. For the first time in The Netherlands, a project of this type was tendered as a DBFMO-contract (Design, Build, Finance, Maintenance and Operate). During the tendering stage, provision of information to other stakeholders (e.g. local politicians) was limited, which resulted in a negative image of the project. Another problem was caused by successive scope enlargements of the project. It initially started as a single urban tram line, but during the development of the project, the scope changed to a two-line tram system. At the same time the regional second phase represented a risk of scope too, since the implied link

to the existing heavy railway system was considered to be a large challenge and large risk. These 'scope matters' caused also a lot of distrust among the inhabitants and the municipality of Groningen. And most of all, the project organization underestimated the governmental decision making processes. The project organization had a technocratic attitude towards other stakeholders, and unintentionally they caused a lot of distrust, particularly due the use of complex type contract (DBFMO).

5.1.3 RijnGouwelijn Leiden

Already during the 1990s, the first plans of the RijnGouwelijn were made, inspired by the breakthrough of the dual-mode, 'tram-train'track sharing system of Karlsruhe, Germany. The advantages of light rail pleased the municipality of Leiden, who had already been searching some years for alternative transport modes for connections between the inner city and surrounding suburbs and the coast. The municipality and the province of Zuid-Holland were the initiators of the light rail line. Dutch Railways (NS) and the rail infrastructure provider (Prorail) never favored the project. Some think they considered the regional light rail project as a threat for their monopoly positions on the existing heavy rail infrastructure used by their national and regional train services. Despite their resistance a first trial operation started in 2003, using a section of the proposed track sharing route. Within a few years the trial proved that operation of light rail vehicles using the heavy rail network was possible in terms of reliability, inter-operability, safety and many technical issues.

From 2003, first expressions of resistance occurred among residents and some shopkeepers in Leiden that lived and worked in the areas around the proposed route. The perception was that a heavy train line was going to run through ´their´ living districts. Growing resistance forced the municipality of Leiden to organize a referendum in 2007. The referendum was not organized properly. No alternative was given and the voters only could chose *yes* or *no* for the newly proposed light rail system. A very small majority voted against the project. Based on this result, the municipality of Leiden also opposed the projects, while other actors like the Province, surrounding municipalities and even the NS who changed their views on light rail, were still in favor of the project. The province forced the municipality to cooperate further in the project and a definitive route was chosen. Despite the efforts of the municipality, the new town council of Leiden –elected in 2010- refused to cooperate again. In 2011, new elections also caused a shift in the province council. Eventually, this new council pulled the plug.

5.1.4 RandstadRail The Hague/Rotterdam

Like the previous project, RandstadRail aimed at combining seamless journeys between urban regions and main centers, particularly the inner cities, in this case, those of Rotterdam and The Hague. The project was initiated at different governmental levels, but every governmental organization made their own plans and kept their own agenda and program for the project. The municipalities of Rotterdam and The Hague could not agree with regard to system choice. The Hague wanted to extend its tram system towards Zoetermeer via the existing Zoetermeer railway line. Rotterdam, on the other hand, planned an extension of the metro system via the former heavy railway line (Hofpleinlijn) towards The Hague. The largest problem was the shared track of both systems (due to different platform heights, for instance).

Eventually, a hybrid system variant was developed in which both the low-floor light rail vehicles between the inner city of The Hague and Zoetermeer and the high-floor light rail vehicles between Rotterdam and The Hague CS could operate. Until 2006, the project seemed to proceed quite smoothly, but just during the very first weeks of operation, severe problems arose, leading to several derailments. The two project organizations of The Hague and Rotterdam that were established to build and assign operation of the system, hardly communicated during the construction stage. The operation was put to a hold after two severe accidents in which vehicles derailed resulting in tens of injuries. Only after months of investigating, restructuring and solving the infrastructure and the related problems, operations could start again.

As soon as the system came to a stable and reliable operational stage, passenger numbers started to increase and after physically connecting the networks of The Hague tram and Rotterdam metro, passenger usage levels grew way more than expected.

5.1.5 Light rail Strasbourg

While the Dutch light rail projects have goals like increasing numbers of passengers and increasing accessibility for city centers, foreign projects often have other goals to serve, besides these. Especially France, where the tram has made a comeback in the past decades, passenger numbers are often not the most important drivers for tram systems. Urban renewal, prevention of social exclusion and banning car traffic are only a few examples of such drivers. By comparing Dutch projects with a successful foreign project, differences in goals and the level of success per goal tell something about the project itself. In this paper, the Strasbourg tram project was chosen, because it does not only serve similar goals to the Dutch cases, but also other goals. This project can be seen as a success, since most of its initial goals were met.

The Strasbourg project started in the early 1980s. The project was initiated to not only solve congestion problems, but even more to enhance public realm, as well as the economic and social fabric of the city. The development of the system was expected to boost the quality of the urban environment.More space for cyclists and pedestrians, more public urban green, clean and fast transport modes and the exclusion of (polluting) motorized traffic from the inner urban center. These were the most important goals of the project. The project already seemed to succeed in fulfilling these goals only after a few years of operation. And although the system is not financially able to function on its own, the benefits that the city of Strasbourg gains with the light rail system are much higher than the costs. For example, the inner city real estate has become considerably more valuable due to the arrival of the tram.

5.2 Main reasons for failure and success

The most important factors for the success or failure of the project are summarized in this part. Almost all factors are applicable to each project and are rooted in several European projects (*15*). The failing reasons should mainly be linked to the failing projects and vice versa. Meanwhile, that does not mean that there weren't successful factors in failing projects and vice versa. Some of them are in line with the findings of *(10)*, many of them are additional.

<u>Success factors</u>

In this survey we found the following success factors:

Project conception

- ✓ Define the basic project as small as possible (scope minimization, proven technologies,etc.), but conceive project's long term and context as comprehensively as possible, hence, elaborate its economic, social and environmental value;
- ✓ Focus first of all on 'why' the project (short term and long term) is necessary;
- ✓ Elaborate and manage project 'rind' (context, future).

Project organization

- ✓ A strong project organization with an independent and visionary, though pragmatic, project director. Conflicts between different governmental layers can be solved more easily;
- ✓ Different organizations for different stages of the projects, including initial planning, construction, trials and test and operations;
- ✓ One part of the organization is continuously focusing on safeguarding the project as such.

Politics

- ✓ Enhance and safeguard political decision making by chopping the project (phasing, scoping, etc.) into smaller pieces as subjects of subsequent decisions to be taken;
- ✓ Accept and apply incremental planning when necessary;
- ✓ Transparency during all decision making processes. By supplying all information to all stakeholders, every actor involved is able to formulate a good and valid vision on the project;

- ✓ All decisions made should be supported by a major political support and coalitions for decision makers must be made with the right stakeholders at the right time;
- ✓ Every part of the project organization must be aware of their own responsibilities, as well as the responsibilities of existing hierarchy of common organization and administration;
- ✓ The timeframe of contracts for the project must be consistent with political timeframes;
- ✓ Every stage of the project (including new events and developments) must be accepted and if necessary approved. In the planning and decision process time must be reserved for this acceptance stage. New steps should only be made when previous steps are accepted by the majority of the stakeholders;
- ✓ But also aim at creating *faits accomplis*. Do not allow (new generation) politics to question again the value and progress of the project at stake;
- ✓ Sometimes an unconventional approach towards politics and administration is mandatory to continue the project successfully.

Communication

- ✓ Residents and citizens must be involved in the project. Open and clear communication on the design, progress and possible setbacks will contribute to bigger support. The value of the project must be shown to these groups comprehensively (i.e. beyond mere transport issues);
- ✓ If necessary every available form of communication must be used. Not only traditional media like newspapers and the internet must be used, but also social media like Twitter and Facebook. The exposure of the project is optimal if information is provided via every possible communication channel. Visitor centers are also proven to contribute to this goal;
- ✓ Stakeholders must be personally involved. By doing this, possible resistance is discovered in an early stage. Personal involvement also opens doors for stakeholders to have input in the processes;

Failure factors

In this survey we found the following failure factors:

Project conception

- × Changing the scope of the projects and thus the targets is very dangerous. The support of the project changes. Changing support may lead to decrease of support.
- × Interfaces with related projects or between components of the project itself represent a substantial hazard. Conception and project definition should be smart enough in this respect;
- × Too few project variants or alternatives may lead to a bad underpinned project. Solutions for a good project are often found in the combination of different alternatives. Optimal solutions will not be found when there is a lack of alternatives.

Project organization

- × Innovative public tendering (e.g. DBFMO and alike) comes with risks. Ambitious tendering is not proven to be successful in light rail projects. Classical tendering forms have proven to be successful instead;
- × Focus on costs is important, but costs are not the most important part of the project. The benefits are often bigger than what was initially expected. The total value of the project is often much higher than singly the construction costs; *(7)* showed, for instance, the benefits with regard to enhanced service reliability and decreased crowding, which are often neglected in cost benefit analyses.

Politics

- × Uncertainty in relations between different governmental layers increases the risk of failure. The responsibility of the project can shift between different governmental organizationsduring the

project. Distrust between those organizations potentially leads to risks in the progress of the project;
- Changing political climate can be disastrous for the project. To protect the project against the consequences of changing political vision on one layer, it is important that political decision making is consistent on different governmental levels (municipality, province, national government);
- Do not approach the project as a development on its own. The project must be placed in integral spatial developments and urban planning policies;
- Only focusing on the most desired alternative leads to the displacements of other feasible alternatives;

Communication
- A technocratic attitude jeopardizes the project, hence, avoid a purely 'engineering' approach and aim for a socially involved approach instead;
- Neglecting citizens' involvement is dangerous. Real support of society is necessary, and not only those citizens who directly live along the (planned) trajectory.

5.3 Proposed checklist

Traditionally risk management deals with the scope and the context of a project. Based on our survey, we created a checklist that reflects the issues at stake in many light rail projects (*16*). The checklist consists of the following items:

- Scope, content, interfaces, content, design/engineering;
- Technology, safety;
- Financing, funding, business case;
- Justification (transport value, economy, …, cost-benefits);
- Decision-making politics and administration;
- Stakeholder involvement;
- Citizens involvement;
- Planning and (project-)organization;
- Tendering, contracting;
- Construction, operations.

Managing these issues properly represents a basic condition for any successful project. However, that's not enough. Our survey revealed that, what we like to call a 'technocratic attitude' of decision makers and project agents implies a serious risk. Hiding behind management and engineering they fail to act emphatically regarding all stake holders and particularly citizens and opposing politicians. A second non-traditional risk is embedded in an attitude conceiving the planning process as a rational process. Such an attitude could to a large extent fail to understand, hence to handle social dynamics in and around a project. Irrational behavior of stakeholders and pressure groups is common practice. Actually this is a main risk in almost every urban tramway project. Finally, a too limited delineation of the project implies severe risks. It's true that the scope of a project should be precisely defined (see our checklist above), but on the other hand the developing focus and context of a project should be as open as necessary. While the project is progressing and at the same time not taking into account changing social, spatial and temporal characteristics can kill a project easily (and often suddenly).

6. GENERAL CONCLUSIONS AND RECOMMENDATIONS

Although light rail is successful in many cities, there is still much debate about the (societal) cost-benefit ratio of light rail systems. In addition to the success stories, several light rail projects were not that successful or even failed. In recent years, many light rail plans were cancelled in The Netherlands. This

paper describes our research aiming to answer the question: what are the success and failure factors of light rail planning based on the Dutch experiences? We investigated five actual light rail cases (one of them in France as a reference) and we learned that there is never only one factor that causes a project to fail. Combinations of different failure factors can be dangerous for the project. If a project lacks sufficient success factors, the project might eventually fail.

Both success and failure factors are grouped into main subjects. These main subjects give a general idea in which field of the project stage the failure or success factors belong. The success factors must be seen as factors for which the project organization should strive. The failure factors must be seen as factors that the project organization must avoid.

Success and failing factors should not be sought in just one section. Combinations of factors eventually cause the project to fail. It is naïve to suppose that only one factor like the arrangement of the project organization or financing can lead to a failed or successful project. On the other hand, having just a high potential ridership or political support is for instance not enough to guarantee a project to succeed.

We recommend expanding the presented survey to other countries, to increase the success and failure factors and get a grip on regional and cultural differences. In the end, it would be beneficial to create a joint handbook, based on experiences, that supports proper design and decision making with regard to light rail and public transport in general.

ACKNOWLEDGEMENTS

This research is performed in cooperation with Bestuur Regio Utrecht, Delft University of Technology, Department of Transport & Planning and RVDB Urban Planning. We also would like to acknowledge the students who were involved in this project, being Arthur Scheltes, Mahtab Sharifi, Célénie Piccot, Vincent den Hertog, Eka Hintaran, Björn Loenis, Niek Lemans, Daphne Kerpel, Mark Gorter, Menno Yap and Andele Swierstra.

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