

1 **LIGHT RAIL IMPLEMENTATION: SUCCESS AND FAILURE ASPECTS OF DUTCH LIGHT**  
2 **RAIL PROJECTS**

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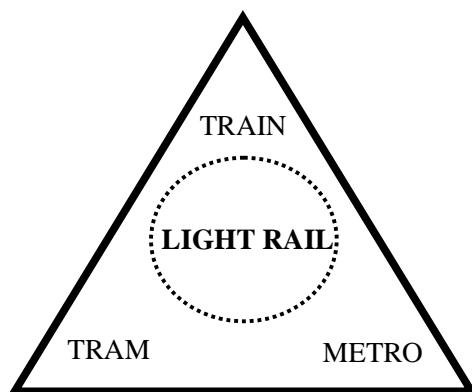
**1 ABSTRACT**

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

17  
18 *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.

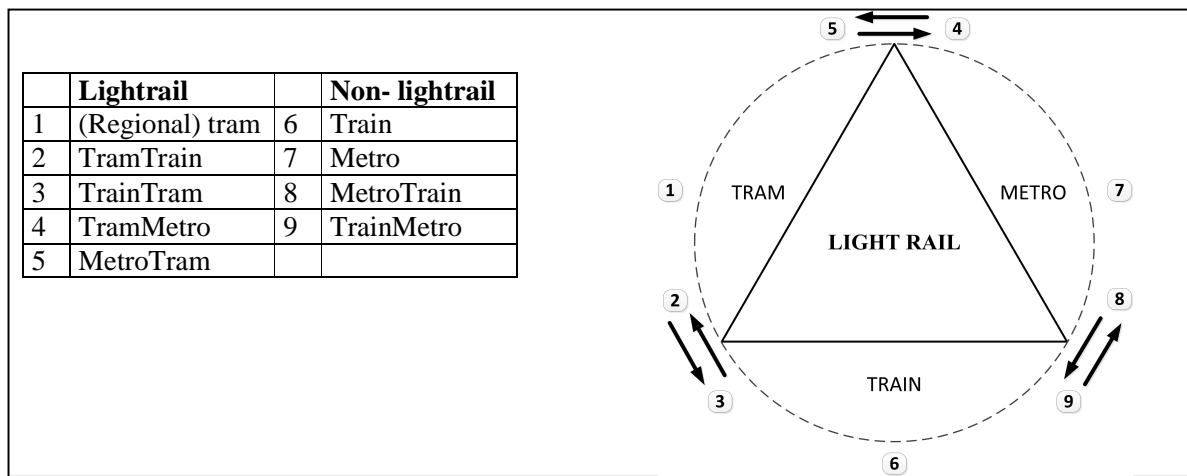
**2. LIGHT RAIL SYSTEMS**

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).



**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 extent) is able to share traffic space with other means of transportation (cars,

1 bikes, etc.; including pedestrians) at one part and may have own right of way on another part. Light rail  
 2 can be pragmatically integrated in different urban environments (4).  
 3

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

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

5  
 6 The attractive characteristics of light rail systems make them suitable to be implemented in urban  
 7 areas of all kinds. Light rail systems exist in many forms and disguises. Light rail is a container  
 8 expression, which makes it sometimes confusing to use. It represents many types of different systems like  
 9 metro style urban systems, regional tramways, enhanced streetcar circulators, or improved and  
 10 modernized classic tramways that can be found all over Europe and North America. The multiple  
 11 existences of different light rail systems that collectively form a very successful transport concept, forms  
 12 also the pitfall of light rail. The perplexity of different system layouts with the same names, sometimes  
 13 confuses those who decide on constructing light rail systems.  
 14

15 **3. RESEARCH OBJECTIVE AND METHODOLOGY**

16 Researchers (10) mention that in 1997 the Dutch government noted about 30 light rail initiatives. Fifteen  
 17 of them were acknowledged and gained support. At this moment, only one of them is actually in  
 18 operation, being the RandstadRail line in The Hague and Rotterdam (9).  
 19

20 In recent years, many light rail plans have been cancelled, some after many years of planning and  
 21 some even after the start of the tendering process. We want to know why this happened, so we could  
 22 support future design and decision making. This paper describes our research aiming at the answer to this  
 23 question: what are the success and failure factors of light rail planning based on the Dutch experiences?  
 24 We also investigated a French case to compare to the Dutch projects. More details may be found in (13).  
 25

26 This research has been performed as a survey, in which we investigated five selected actual  
 27 projects, being light rail projects in the Netherlands that either succeeded or failed in different project  
 28 stages. Some of these projects failed in the design stage, others during the feasibility study phase, while  
 29 one project even failed after the first trial of operations. The fifth case is the light rail project in the French  
 30 city of Strasbourg that proved to be very successful. Light rail (*le tramway*) has already been a proven  
 31 concept in Strasbourg for more than twenty years. This case study was performed to have one 'ideal' case  
 32 that could be used as a benchmark for the Dutch cases. The cases are described in detail in the following  
 33 section.  
 34

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

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

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

8 The main structure consists of four categories, being:

- 9 A. Description of the project;
- 10 B. Context;
- 11 C. Organization;
- 12 D. Decision making.

13  
14 Category A consist of three parts, according to the project phases, being plan/project (A1),  
15 construction (A2) and operation (A3). Amongst others, the result of this category are insights in costs,  
16 transport, social and economical benefits, sustainability, technological factors and safety issues

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

20 In category C, questions that are answered are:

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

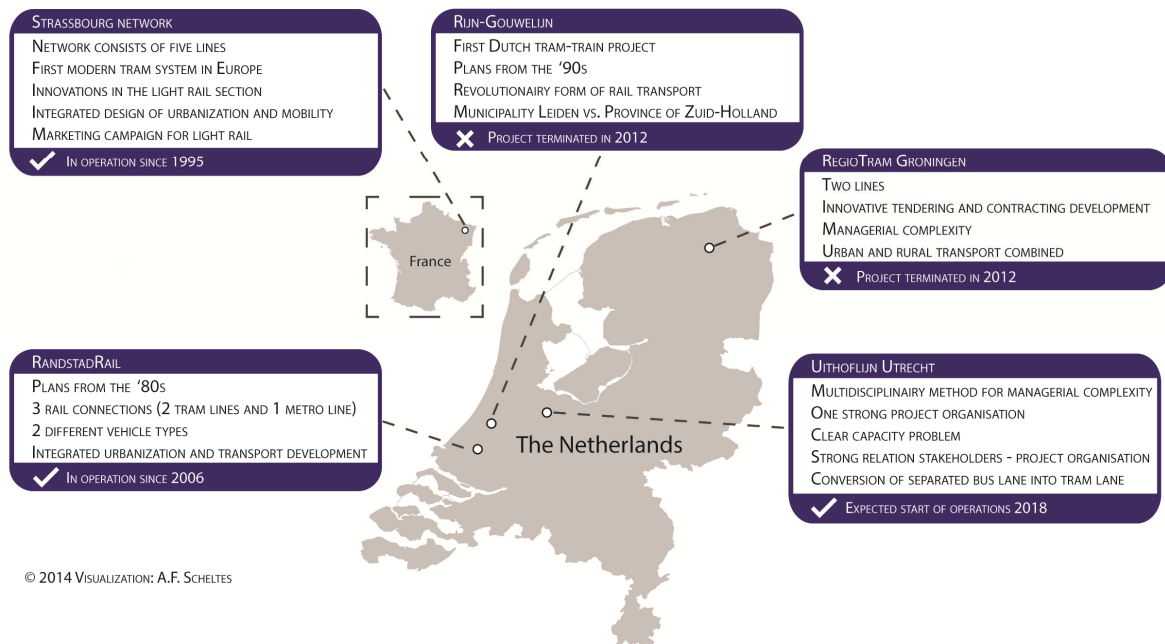
24 In Category D, all relevant agents who share or own a particular responsibility in the project are  
25 described. Who is, or who are the 'project owners'? Who is assigned major parts of the project? We  
26 compiled a time line containing major decision making regarding each phase and the transition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

28  
29 In Section 4 the five projects are presented and in Section 5, the general findings of the five  
30 individual case studies are given. Subsequently, a general conclusion follows. Thereafter, an overview of  
31 success and failure factors of light rail projects follows.

## 32 33 **4. INVESTIGATED PROJECTS**

### 34 35 **4.1 Introduction**

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



1  
2 **FIGURE 3 Investigated projects.**

3  
4 **4.2 Uithoflijn Utrecht**

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

9  
10 **4.3 Regiotram Groningen**

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

16  
17 **4.4 RijnGouweLijn Leiden**

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

22  
23 **4.5 RandstadRail The Hague/Rotterdam**

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

29  
30  
31

#### 1 **4.6 Light rail Strasbourg**

2 The first part of the Strasbourg light rail network was designed in 1991 and the first tram operated in  
3 1995. The network consists of five lines. During the construction of this system, not only the physical  
4 infrastructure was being built, but the whole urban environment was revised as well. The Strasbourg *le*  
5 *tramway* is considered to be one of the first ‘modern’ tram systems with low floor vehicles and separated  
6 infrastructure.

### 7 **5. FINDINGS**

#### 8 **5.1 General findings per case**

9  
10 All four Dutch light rail projects were originally initiated to stimulate sustainable regional mobility and to  
11 guarantee good accessibility to dense urban environments like inner cities. Two light rail projects were  
12 also supposed to serve a university. The Uithoflijn will serve the University of Utrecht. The Regiotram in  
13 Groningen was meant to have the same purpose. The other projects, RandstadRail (success) and  
14 RijnGouwelijn (failure) were dedicated to guarantee a sustainable and fast connection in the area. In this  
15 section, the most remarkable findings from the case studies are summarized. At the end, the comparison  
16 with the existing and successful Strasbourg system is made.

##### 17 *5.1.1 Uithoflijn Utrecht*

18  
19 Although the Uithoflijn is not in operation yet, it is currently under construction and the first trials are  
20 expected within a few years. The Uithoflijn will solve a large congestion and capacity problem. At the  
21 moment, the main transportation modes from the station to the university are buses and bikes. The bus  
22 system is facing severe capacity problems, and increase of frequency is not realistic with departures every  
23 two or three minutes currently. Earlier research (7) illustrated the impacts of this on capacity and level of  
24 service.

25  
26 The project faced difficult technical and design challenges. Due to the complex and dense urban  
27 environment, implementation of the line has been difficult. The tramway in the university district was  
28 expected to cause a lot of disturbance to sensitive electromagnetic industries and laboratories along the  
29 route. Another important threat to this project was the governmental complexity. The Uithoflijn faced  
30 three important governmental structures in one project, being the municipality, the regional government  
31 (BRU) and the province of Utrecht.

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

##### 38 *5.1.2 Regiotram Groningen*

39  
40 In 2007, the Regiotram project started. The congested inner city and the poor accessibility of the suburbs  
41 were the key reasons for this project to start. The project was already in a quite advanced state of  
42 feasibility research. Studies showed the viability of the project (in a second phase the urban section was to  
43 be extended into the region, which justified the project’s name ‘Regiotram’).

44  
45 Nonetheless, in 2012 the plug was pulled, because the project continued to lose support in the  
46 municipality. Important factors for the failure are the very innovative form of public tendering. For the  
47 first time in The Netherlands, a project of this type was tendered as a DBFMO-contract (Design, Build,  
48 Finance, Maintenance and Operate). During the tendering stage, provision of information to other  
49 stakeholders (e.g. local politicians) was limited, which resulted in a negative image of the project.  
50 Another problem was caused by successive scope enlargements of the project. It initially started as a  
51 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



1 to the existing heavy railway system was considered to be a large challenge and large risk. These ‘scope  
2 matters’ caused also a lot of distrust among the inhabitants and the municipality of Groningen. And most  
3 of all, the project organization underestimated the governmental decision making processes. The project  
4 organization had a technocratic attitude towards other stakeholders, and unintentionally they caused a lot  
5 of distrust, particularly due the use of complex type contract (DBFMO).  
6

### 7 *5.1.3 RijnGouwelijn Leiden*

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

19 From 2003, first expressions of resistance occurred among residents and some shopkeepers in  
20 Leiden that lived and worked in the areas around the proposed route. The perception was that a heavy  
21 train line was going to run through ‘their’ living districts. Growing resistance forced the municipality of  
22 Leiden to organize a referendum in 2007. The referendum was not organized properly. No alternative was  
23 given and the voters only could chose *yes* or *no* for the newly proposed light rail system. A very small  
24 majority voted against the project. Based on this result, the municipality of Leiden also opposed the  
25 projects, while other actors like the Province, surrounding municipalities and even the NS who changed  
26 their views on light rail, were still in favor of the project. The province forced the municipality to  
27 cooperate further in the project and a definitive route was chosen. Despite the efforts of the municipality,  
28 the new town council of Leiden –elected in 2010- refused to cooperate again. In 2011, new elections also  
29 caused a shift in the province council. Eventually, this new council pulled the plug.  
30

### 31 *5.1.4 RandstadRail The Hague/Rotterdam*

32 Like the previous project, RandstadRail aimed at combining seamless journeys between urban regions  
33 and main centers, particularly the inner cities, in this case, those of Rotterdam and The Hague. The  
34 project was initiated at different governmental levels, but every governmental organization made their  
35 own plans and kept their own agenda and program for the project. The municipalities of Rotterdam and  
36 The Hague could not agree with regard to system choice. The Hague wanted to extend its tram system  
37 towards Zoetermeer via the existing Zoetermeer railway line. Rotterdam, on the other hand, planned an  
38 extension of the metro system via the former heavy railway line (Hofpleinlijn) towards The Hague. The  
39 largest problem was the shared track of both systems (due to different platform heights, for instance).  
40

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

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

### 1 5.1.5 Light rail Strasbourg

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

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

### 20 5.2 Main reasons for failure and success

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

#### 27 Success factors

28 In this survey we found the following success factors:

#### 30 *Project conception*

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

#### 37 *Project organization*

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

#### 46 *Politics*

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

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

#### 15 *Communication*

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

#### 27 Failure factors

28 In this survey we found the following failure factors:

#### 30 *Project conception*

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

#### 39 *Project organization*

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

#### 49 *Politics*

- 50 ✗ Uncertainty in relations between different governmental layers increases the risk of failure. The
- 51 responsibility of the project can shift between different governmental organizations during the

1 project. Distrust between those organizations potentially leads to risks in the progress of the  
2 project;

3 \* Changing political climate can be disastrous for the project. To protect the project against the  
4 consequences of changing political vision on one layer, it is important that political decision  
5 making is consistent on different governmental levels (municipality, province, national  
6 government);

7 \* Do not approach the project as a development on its own. The project must be placed in integral  
8 spatial developments and urban planning policies;

9 \* Only focusing on the most desired alternative leads to the displacements of other feasible  
10 alternatives;

### 11 12 *Communication*

13 \* A technocratic attitude jeopardizes the project, hence, avoid a purely ‘engineering’ approach and  
14 aim for a socially involved approach instead;

15 \* Neglecting citizens’ involvement is dangerous. Real support of society is necessary, and not only  
16 those citizens who directly live along the (planned) trajectory.

### 17 18 **5.3 Proposed checklist**

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

- 22 • Scope, content, interfaces, content, design/engineering;
- 23 • Technology, safety;
- 24 • Financing, funding, business case;
- 25 • Justification (transport value, economy, ..., cost-benefits);
- 26 • Decision-making politics and administration;
- 27 • Stakeholder involvement;
- 28 • Citizens involvement;
- 29 • Planning and (project-)organization;
- 30 • Tendering, contracting;
- 31 • Construction, operations.

32  
33  
34 Managing these issues properly represents a basic condition for any successful project. However, that’s  
35 not enough. Our survey revealed that, what we like to call a ‘technocratic attitude’ of decision makers and  
36 project agents implies a serious risk. Hiding behind management and engineering they fail to act  
37 emphatically regarding all stake holders and particularly citizens and opposing politicians. A second non-  
38 traditional risk is embedded in an attitude conceiving the planning process as a rational process. Such an  
39 attitude could to a large extent fail to understand, hence to handle social dynamics in and around  
40 a project. Irrational behavior of stakeholders and pressure groups is common practice. Actually this is a  
41 main risk in almost every urban tramway project. Finally, a too limited delineation of the project implies  
42 severe risks. It’s true that the scope of a project should be precisely defined (see our checklist above), but  
43 on the other hand the developing focus and context of a project should be as open as necessary. While the  
44 project is progressing and at the same time not taking into account changing social, spatial and temporal  
45 characteristics can kill a project easily (and often suddenly).

### 46 47 **6. GENERAL CONCLUSIONS AND RECOMMENDATIONS**

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

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

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

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

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

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