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PROJECT PROFILE

Netherlands

RandstadRail

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A INTRODUCTION

Type of project

RandstadRail is an interregional light rail and bus project between Rotterdam and The Hague. It aims to provide an attractive form of public transport that is of high quality and high frequency, and that can provide an alternative to the car by directly connecting the most important locations and enabling competitive traveling times (Min V&W 2001).

The RandstadRail is part of the development of the Zuidvleugel. This is the southwestern part of the Randstad region and is positioned completely within the province of Zuid-Holland. The Zuidvleugel has 3.5 million inhabitants and is one of the most densely populated regions in Europe (Zuidvleugel, accessed August 2008). Its main cities are Rotterdam, with one of the largest harbours in the world, and The Hague, the political capital of the Netherlands. Platform Zuidvleugel was founded in 2000 and is a governmental consultation organisation with representatives of key governmental partners.

RandstadRail consists of four lines. Three are light rail and the fourth is a bus route with a dedicated road. Some parts have tram vehicles while other sections use metro vehicles. Eventually, it is expected that about 120,000 passengers will use these lines daily (RandstadRail, accessed August 2008).

Overview of RandstadRail

- Built: 2000-2008;
- Located: at the Zuidvleugel (the southwestern part of the Randstad) between Rotterdam and The Hague;
- Owner: Stadsgewest Haaglanden en Stadsregio Rotterdam;
- Contractors: HTM (Haagsche Tram Maatschappij), and RET (Rotterdamse Elektrische Tram);
- Mode Type: Light Rail System and dedicated Bus Route.

RandstadRail is a combination of three types of transport. The municipality of The Hague and its provider HTM wanted to use a type of tram for the system. The municipality of Rotterdam preferred a metro type of transport, to enable the linkage to its metro network. The route between Zoetermeer and Rotterdam is a high quality bus system with a dedicated lane. Concerning security standards, RandstadRail has to operate to the same standards as the trams when in The Hague. On the rest of the tracks it has to operate to the same security standards as the whole track system in the Netherlands. Systems on board the vehicles are doubled-up to prevent problems caused by malfunctioning. The track is also designed following the ‘safe haven’ principle. A train must be able to drive to the next station in case of an emergency and is not able to leave the station unless it can dock at the next one (RandstadRail accessed August 2008).

Figure 1 shows the lines of the RandstadRail. Lines 3 and 4, the red and blue lines, connect the city of The Hague with the growth town of Zoetermeer. The green line connects The Hague with the metro network of Rotterdam. The dotted line is the bus route that connects the rail lines of The Hague and Rotterdam. The lines have many stations and stops. However, there are a few prominent stations that deserve special attention. These stations and their related developments are discussed below - the RandstadRail is linked to many redevelopment projects.

Figure 1: Route of RandstadRail major associated developments

Source: http://www.railway-technology.com/projects/randstadrail/randstadrail5.html

Figure 2: Beatrixlaan Station and surrounding development

One of the most prominent architectural highlights of the projects is the station at the Beatrixlaan in The Hague. It has the nickname of *netkous*, which is Dutch for ''net stocking'. The station was designed by Zwarts & Jansma Architects. Figures 2 and 3 provide images of the station in its surroundings and by night respectively. The costs of the station and viaduct are approximately EUR 55m (RandstadRail 2002).

Figure 3: Beatrixlaan Station by night

Related to this station is the development of the Beatrixkwartier. This will become a new Central Business District of 18ha with about 400,000m^2 of office space, of which 180,000m^2 will be new development, including a four-star hotel with 200 rooms, over 500 apartments and 5,000 parking spaces. About 20,000 people will live and work there (Gemeente Den Haag, accessed August 2008). The area is being developed by the municipality of The Hague and six private partners.

Another prominent station is the Souterrain Tram Tunnel. It was designed by the famous architect Rem Koolhaas and his bureau OMA. Construction of the tunnel in the centre of The Hague proved to be a disaster, with the tunnel flooding many times. Construction started at the end of 1996. To reduce the inconvenience at street level, a wall-roof building method was chosen. In this method, the walls and roof are first built from ground level downwards. After this has been done, the tunnel is dug from under its roof. However, underground water proved to be a problem, and in 1998 a big rupture caused the water to fill the tunnel. The Kalvermarket above subsided and, to prevent further damage, the tunnel had to be flooded completely. The project became popularly known as the 'Swimming Tunnel', or 'the Tramtanic' (2004). In 1993, the prognosis (Havermans 1993) was that the project would cost NLG 248m (EUR 112m). Eventually the project cost doubled to EUR 235m (SWB 2004). Next to the tram tunnel, the project also includes underground parking spaces and links to the shops above.

The tunnel was important for the redevelopment of the city centre of The Hague. By putting the trams underground, space was made for pedestrian shoppers and new buildings such as a large cinema complex.

Figure 4: Souterrain Station

Source: http://www.archined. nl/oem/reportaaes/souterrain/tram8.ipa

Figure 5: Artist's impressions of the station

Source: Benthem Crouwel

<u>The Hague Central Station</u>

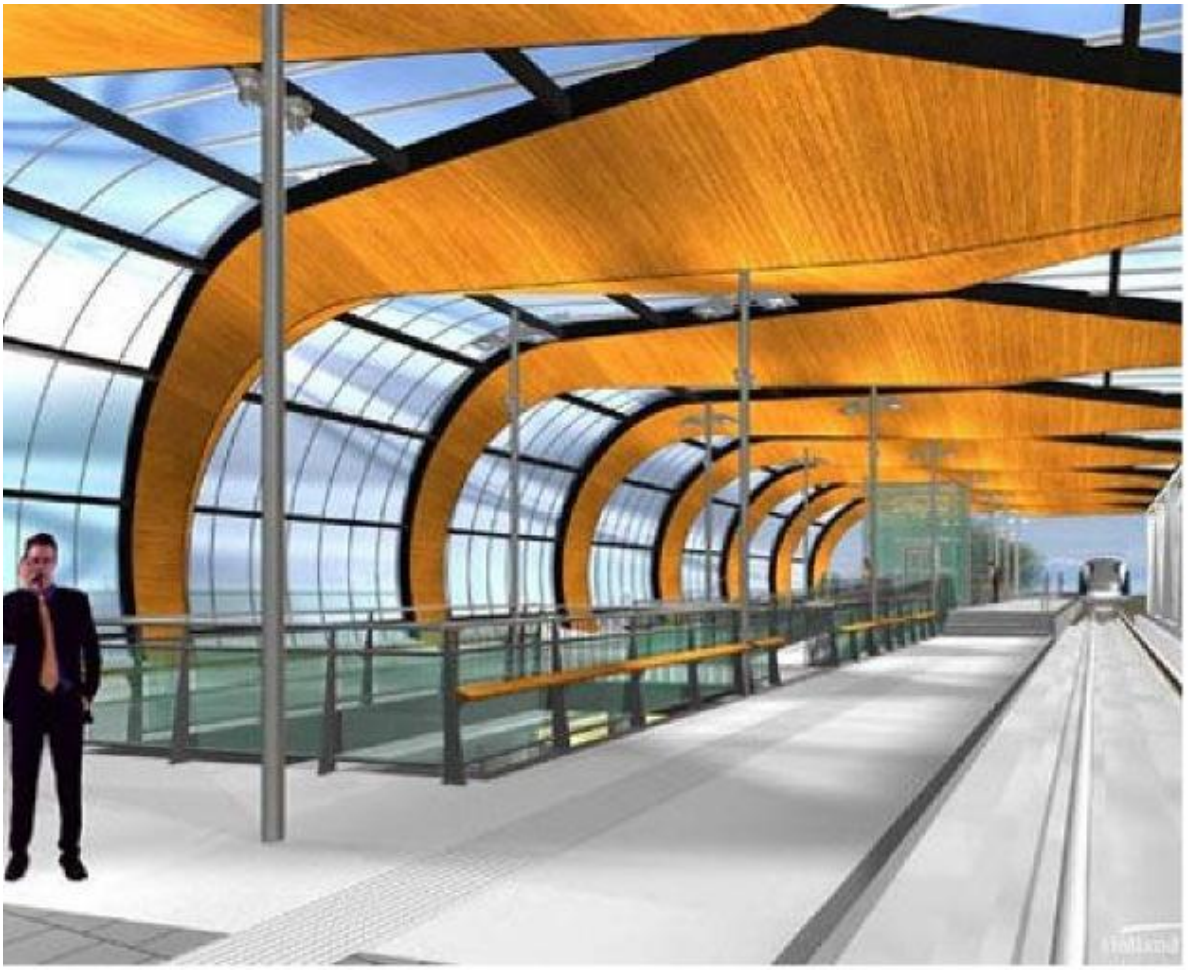
The Central Station is being redeveloped as a modern multi-modal transport centre. Important for the change is the shuttle connection with the High Speed Train and the RandstadRail connection. The station will be completely renewed including the surrounding area. Currently 190,000 passengers use the station. In 2020, it is expected that this number will have doubled to about 400,000. The new station will have 5,000m^2 of commercial space (currently 2,000m^2). The area will see an increase of 120,000m^2 of office space. There will be about 1,600 underground parking spaces for cars and 6,000 underground parking spaces

for bicycles. There will be about 500 new apartments, almost all in the upper segment of the market. The investment in the project amounts to approximately EUR 800m, of which EUR 500m has been invested by the private sector (Den Haag Nieuw Centraal, accessed August 2008).

The station itself is designed by Benthem Crouwel Architects. The design is very transparent with a lot of glass in the fronts and the top of the terminal. Work started in 2007 and will be finished in 2010. The new station will cost approximately EUR 130m (ProRail, June 2007). Transport will include local and regional buses, trams, RandstadRail, national trains and a shuttle connection with HSL.

Another station in the area of The Hague serves the growth centre of Leidschenveen. This station links The Hague, Zoetermeer and Rotterdam. The architect is Paul van der Ree. The station and the connection with the RandstadRail represent an important improvement in the accessibility of the area, and it it hoped that they will encourage a modal shift from car to public transport.

Figure 6: Leidschenveen Station



Source: Holland Railconsult

An important new station for the expansion plans of Rotterdam is the stop at the Meijersplein. It is located near the planned new neighbourhood of Polder Zestienhoven. Some 1,700 dwellings will be built in different shapes and sizes for different household incomes. The area consists of several small wards. The first to be built is the villa area

known as Mansion Parck, where prices range from EUR 750,000 to EUR 1,250,000 (ABB Ontwikkeling 2008).

Figure 7: Meijersplein Station

Another prominent station is Blijdorp Station. This station is built half-way in the rail tunnel. The station is constructed from glass, steel, and green natural stone. The station was part of the contract of the tunnel and the combined budget was approximately EUR 180m (Jongedijk 2008). The new station is expected to give a strong impulse to the Blijdorp Zoo. There are no large redevelopments planned in that area. It is already a relatively balanced and green neighbourhood.

Figure 8: Blijdorp Station

Source: RandstadRail

The most prominent station and redevelopment is Rotterdam Central Station and its surroundings. The old station, built between 1950 and 1957, was a monument of the post-war reconstruction. It was designed by the famous Rotterdam architect Sybold van Ravensteyn, who was inspired by the Italian train stations. However, because of the large increase in passenger numbers and the arrival of the High Speed Train and the RandstadRail, a new and larger station was needed. Figure 8 shows the old station and the new design.

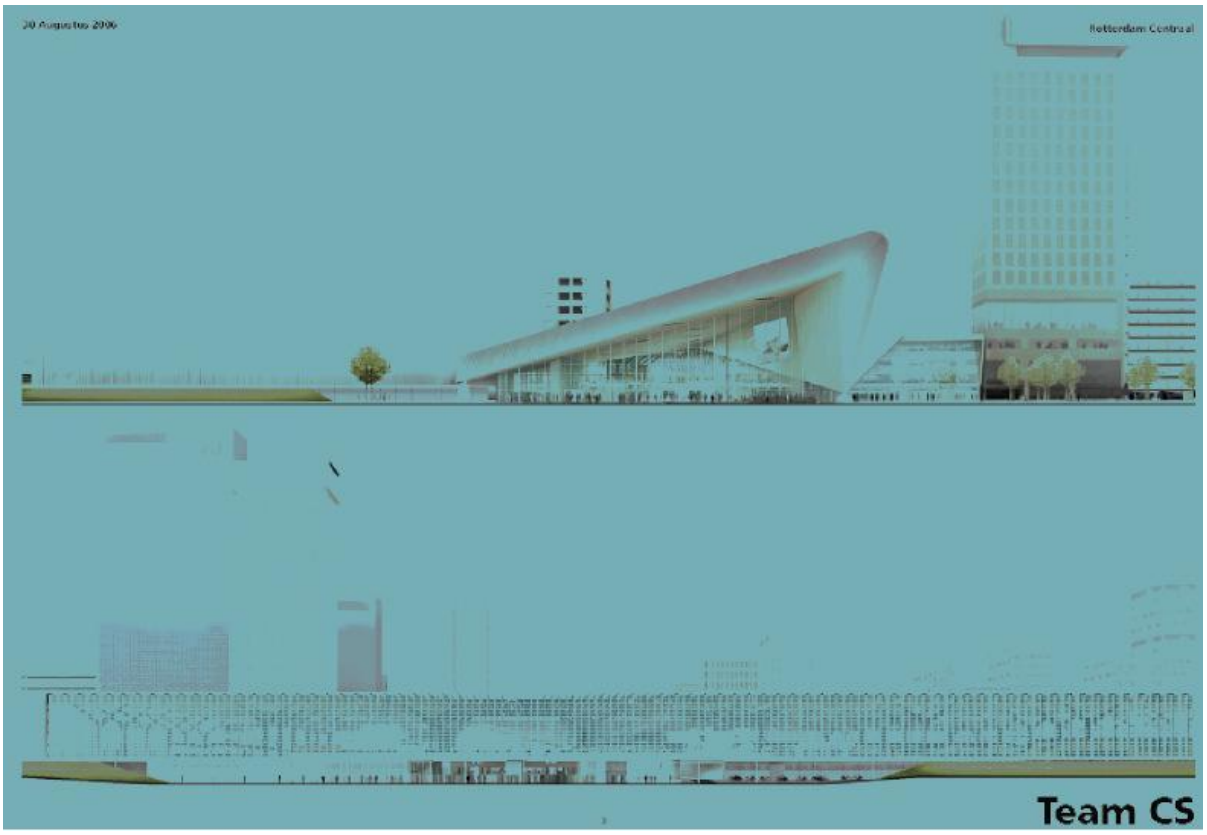
Figure 9: The old and new Rotterdam Central Station

Source: www.in10.nl

The new station was designed by a group of architect bureaus, united under the new Team CS. These include Benthem Crouwel (also responsible for The Hague CS), Meyer en Van Schooten and West 8 Urban design & landscape architecture. The underground structures surrounding the station have been designed by the architect of the municipality, Maarten Struijs, who was also responsible for Blijdorp Station . The estimated cost of the project is EUR 348m for the urban development and public transport terminal, and EUR 251m for the tracks and station (www.rotterdamcentraal.nl, accessed August 2008). The project is financed by the national government, NS (Dutch Railways), ProRail (the infrastructure provider), the city region of Rotterdam and the municipality of Rotterdam. The new underground metro stop for the RandstadRail is financed separately.

Many developments are related to the new station. The bus and tram stops will be positioned to the sides of the station. The Weena, a main road in front of the station, will be brought underground to create a nicer environment for pedestrians and more open entrance to the centre of the city. Under the Kruisplein, the main square leading into the city, a five-storey parking structure will be built, offering 760 parking places. Near the station there will also be parking spaces for about 7,000 cycles, of which 5,300 will be underground. The area around the station already has many skyscraper buildings housing the headquarters of large international and national companies such as ING and Unilever.

Figure 10: Definite Design Team CS



Source:Team CS 2006

Parent projects

RandstadRail is not part of any transnational parent projects, although some stations are also being redeveloped as a result of the introduction of High Speed Train services. It is, however, an interregional project aiming to enhance connectivity and mobility between cities in the southwestern part of the Randstad. As such, it is part of the program of the Zuidvleugel.

Figure 11: RandstadRail Souterrain

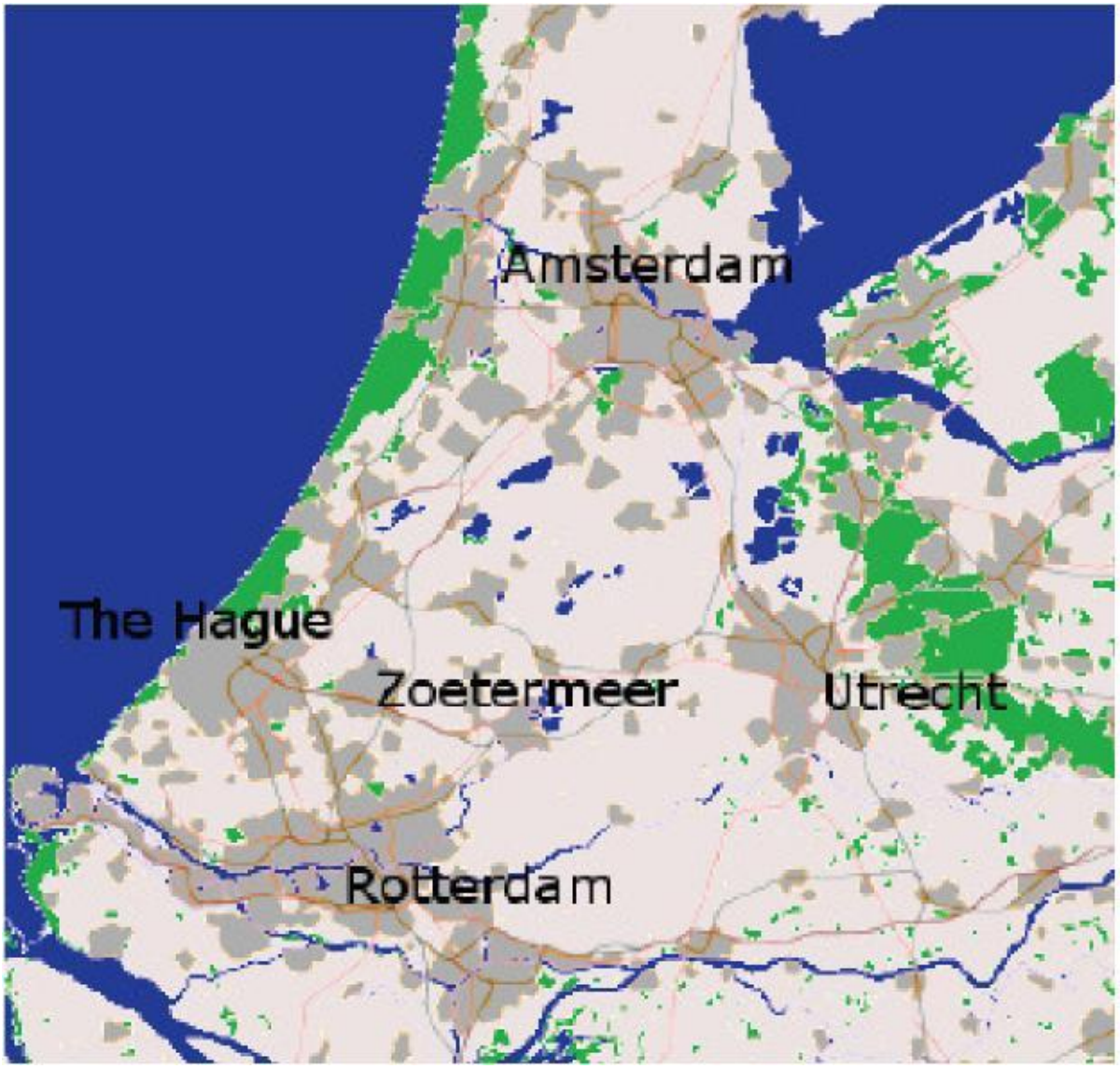
Source: http://www.cdadenhaag.nl/img/Image/RandstadRailfrankjansen.jpg

Location

The RandstadRail is located in the southwestern part of the Netherlands. The municipalities in this region have collectively organised themselves as the Zuidvleugel region. This region has a prominent position in at least three international economic sectors (Zuidvleugel, 2008). Firstly, Rotterdam has one of the largest harbours in the world. Consequently, many transport and other related companies are clustered in the region. The second sector is the Greenport Europe. The Zuidvleugel area is one of the largest flower and vegetable producers and markets in the world. The third sector is the legal sector in The Hague, which is host to the International Court of Justice and many other legal firms.

The Randstad as a whole has a population of about seven million people. Of that, 3.5 million live in the Zuidvleugel region. For the route within the region, see Figure 1 above.

Figure 12: Randstad current status



The RandstadRail has already commenced transportation of passengers on the line between Rotterdam and Zoetermeer and the Hague. In Figure 1 these are the blue and red lines, and the green line until the Boortunnel section. The line currently ends at Hofplein in the centre of Rotterdam. After the tunnel and related stations of Blijdorp and Central Station are finished it will continue through the tunnel and connect to the existing metro network of Rotterdam. This will extend the reach of the project to the whole city and that of some surrounding municipalities on the western side of the city. The tunnel has been completed and Blijdorp station is well on its way, and the full line is expected to be finished and ready for transport in the autumn of 2009. The stations will then be:

- Station Den Haag Centraal
- Laan van NOI
- Voorburg 't Loo
- Leidschendam-Voorburg
- Forepark
- Leidschenveen
- Nootdorp

- Pijnacker Centrum
- Pijnacker Zuid
- Berkel Westpolder (from 2008)
- Rodenrijs
- Wilgenplas (to 2009)/Meijersplein (from 2009)
- Melanchthonweg
- Blijdorp (from 2009)
- Rotterdam CS (from 2009)
- Stadhuis
- Beurs
- Leuvehaven
- Wilhelminaplein
- Rijnhaven
- Maashaven
- Zuidplein
- Slinge.

In the area of The Hague, the RandstadRail is fully functional. The dedicated bus route will commence in 2009. Approximate traveling times between The Hague and Rotterdam are as follows:

- Wilgenplas - Den Haag Centraal: 24 minutes;
- Rodenrijs - Rotterdam Centraal: 8 minutes;
- Rotterdam Centraal - Den Haag Centraal: 30 minutes;
- Pijnacker - Rotterdam Beurs: 18 minutes;
- Blijdorp - Forepark: 19 minutes.

(Source: RandstadRail)

RandstadRail has two types of vehicles. In the region of The Hague, tram type vehicles are used. In the Rotterdam region, transport is provided by metro technology based vehicles. Table 1 provides an overview of the main characteristics.

Table 1: Vehicle types RandstadRail

	HTM (The Hague)	**RET (Rotterdam)**
Number of vehicles	50	21
Company and type	Alstrom	Bombardier
Direction	Both Directions	Both Directions
Length	36.76m	30.16m
Width	2.65m	2.66m
Width of track	1.435mm	4.435mm
Turning radius	23m	150m
Voltage	600 en 750 Volt DC	750 DC
Maximum speed	80 km/h	100 km/h
Low floor area	75%	0%
Number of seats and folding chairs	72 + 14	72
Standing places	130 (4 per m^2)	153

Lines 3 and 4 between The Hague and Zoetermeer travel every five minutes during rush

hour, and every ten minutes outside of these hours. In the evening they depart approximately every 15 minutes. Until the new trains and stations become available in autumn 2009, the route between The Hague Central and Rotterdam will be serviced every 15 minutes during the day and every half an hour during the evening and on Sundays. Starting from the end of 2009, the trains will run every ten minutes during the day and every 20 minutes during the evening and on Sundays. The same frequency will be used for the bus service between Zoetermeer and Rotterdam.

At present 17,000 people travel on the Zoetermeerlijn between Zoetermeer and The Hague, and 7,000 on the line between The Hague and Rotterdam. This number is expected to rise to 42,000 and 28,000 respectively. Due to the linkage with the metro network of Rotterdam, about 47,000 travelers are expected on the trajectory The Hague Central to Rotterdam Slinge, as described above.

B PROJECT BACKGROUND

Principal project objectives

- Owners: the city regions of Haaglanden (Lines 3 and 4) and Rotterdam (Eurasmuslijn);
- Associated municipalities: The Hague, Rotterdam, Zoetermeer, Leidschendam-Voorburg, and Pijnacker-Nootdorp;
- Operators: HTM (Haaglanden) and RET (Rotterdam);

Because RandstadRail is an interregional project, a multitude of administrative bodies were involved in its planning and delivery. Projects of this type generally begin with an administrative agreement between these bodies (Min V&W 2001). In this case the agreement was between the national Ministry of Transport and the city regions of Haaglanden and Rotterdam. These regions are also the owners of the project. In this document several objectives were identified as motivation for the project:

- a need for a high quality public transport system that can provide an alternative to car usage in the area over distances between ten and 40 kilometres;
- public transport access to the new growth neighbourhoods (*VINEX-wijken*) in the region;
- RandstadRail is an attractive form of public transport because of its high quality and frequency, and direct connections between the urban cores of Rotterdam, The Hague, and Zoetermeer;
- traveling times which are competitive with car travel.

As the project was developed by the operators (in the beginning these were still government agencies) and the municipalities, there have not been many external communications of objectives. However, the scope of the project changed without changing the main objectives of the parties involved. This happened in a process of coordination between the municipalities, operators and the national government in the form of the Ministry of Transport.

An interesting stakeholder is the national railway company, NS. Two of its railway lines, the Hofpleinlijn and the Zoetermeerlijn, form the basis for the project. The lines were for heavy rail services, and were not attracting many passengers. Redeveloping the lines into light rail would increase the viability of the project. However, the operators of the project would be the municipal transport companies, RET and HTM. The principal objectives of the NS in transferring these lines are not available in the public domain.

Key enabling mechanisms and decision to proceed

<u>Transport operators</u>

MIT

As with all infrastructure projects, crucial to the RandstadRail project was the funding. Because the municipalities have very limited funds of their own, the largest share of the funding is usually provided by national government. The prime mechanism for funding infrastructure projects in the Netherlands is the MIT (Multi-year plan for Infrastructure, and Transport), or the MIRT as it has been called since spatial development projects (*Ruimte*) were added in 2007 (Min V&W, 2008). The MIT is controlled by the Ministry of Transport

and hence coordination and negotiation between the municipalities and the Ministry was crucial.

In July 2000, the parties involved were satisfied with the plans developed for RandstadRail and its scope. They, including the Ministry, made an agreement to apply to the MIT for subsidy. That the Ministry agreed was of course crucial, as it is the main controller of the MIT funds. However, the involved municipalities and regions were still required to produce a definite plan which would guide their application. This was finished in February 2001 (SGH 2001), and the concept application was finished a few months later. The final application was delivered in 2002, after an agreement between the regions, SGH and SRR, and the Ministry of Transport about the funding of the project (Min V&W, 2001). The funding was approved by the Minister the following year.

Parliament

However, the approval of funding also needs to be made irreversible, through approval by parliament. The role of parliament has been fairly limited. Discussions in parliament have been limited to concerns about delays and accidents, with little public debate about the scope and design of the project. Typical of the role of parliament is the letter by the Minister asking for silent approval of his proposal to transfer the control of the project to the regions, SGH and SRR (Tweede Kamer der Staten-Generaal, 2003). There has not truly been a 'go or no go' decision by parliament. This shows that the project is a regional project that has been almost fully funded by national funds. Its approval was needed and given.

Councils

Because the project was decentralised, the role of the council was key to enabling support for the project.

Table 2: Timeline - enabling mechanisms

1995	The public transport companies RET, HTM, ZWN (now Connexxion), and the NS took the initiative by publishing the report *RandstadRail, de file voorbij*.
November 1996	Exploration study. SRR, SGH, and the Province of Zuid Holland suggest a light rail system costing between NLG 3bn and NLG 6bn (EUR1.3bn to EUR 2.7bn (1996)). The national state asked for solutions requiring less investment.
December 1998	Plan Study Report suggesting a first phase of light rail, updating the existing Hofpleinline and Zoetermeerlijn, and providing a new line between Zoetermeer and Rotterdam without linking them to the urban transport networks for approximately NLG 1.28bn (EUR 0.58bn (1998)). The State reserves EUR 0.52bn in the infrastructure fund (MIT) 2000-2004.
December 1999	Additional advice by the RandstadRail Steering Group (State, PZH, SRR and SGH) to achieve a higher quality of transport. The suggestion is to link the lines to the urban rail networks and make the line between Rotterdam and Zoetermeer a high quality bus line. The foreseen investment is EUR 0.84bn.
July 2000	Agreement between State and the regions about preparing an application for subsidy from the MIT.
February 2001	Final Advisory Report by SGH defining the project.
July 2001	RandstadRail - Developed concept subsidy application by the regions.
December 2001	SGH and SRR - Administrative Agreement between the State and the Regions about the financial aspects pending the subsidy application.
March 2002	Subsidy Application to the Ministry of Transport including several scope changes in comparison to the concept.
December 2002	Approval of the application by the Minister of Transport.

Source: Information for this timeline is gathered from a multiplicity of sources, including TU Delft (1 006), Het RandstadRail-project: Lightrail, Zware Opgave, The Hague, Stadsgewest Haaglanden.

Principal decision-makers

The funding was mainly provided by the national government through the MIT. The key decision-maker on this project was the Minister of Transport. At the final approval, the minister was De Boer, but for the largest part of the project it was Jorritsma. The parliament has to give approval to the Minister, but its role was mostly limited throughout the decision-making process.

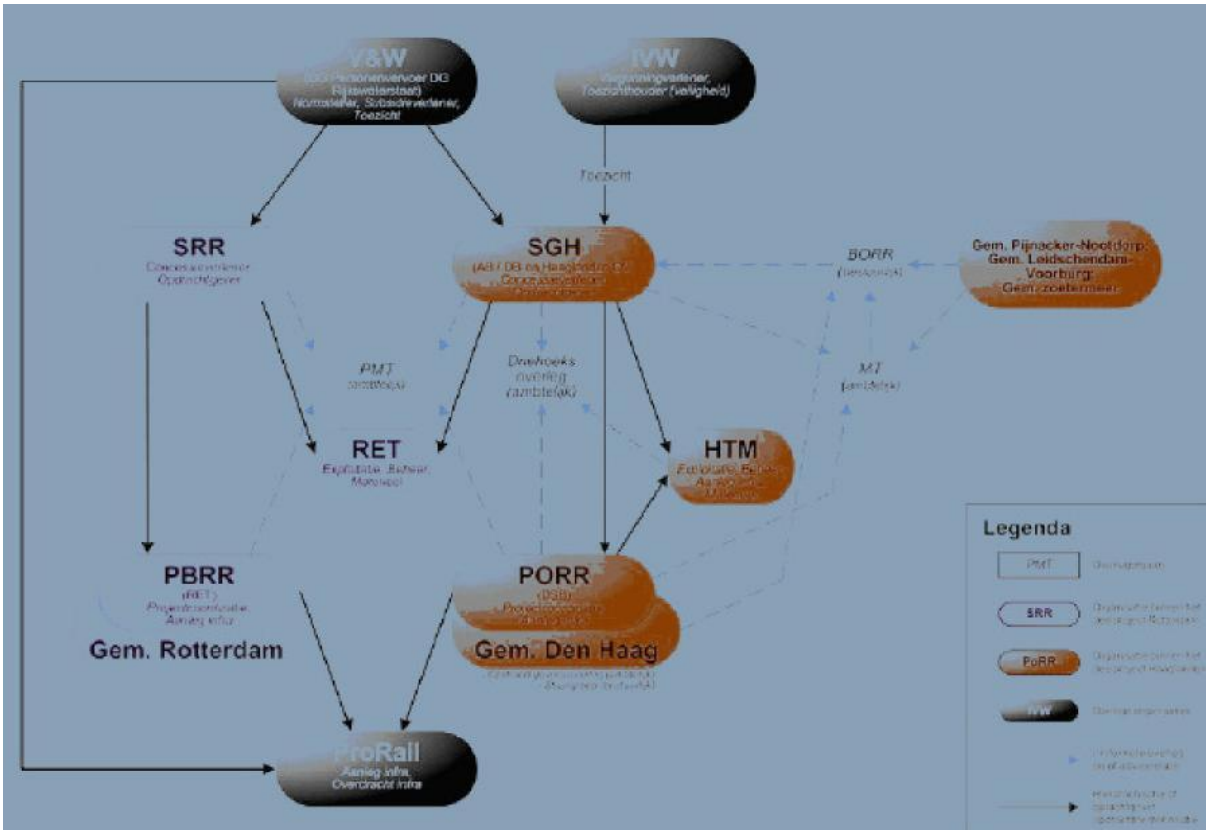
The rest of the funding and the permits were in the hands of the participating municipalities. Key ownership and responsibilities, however, were with the regions SGH and SRR. The project itself and the main funds for these regions came from the municipalities of The Hague and Rotterdam respectively. The aldermen of these municipalities were the main responsible actors within the territory of their municipalities. Of course the municipality's council controlled the aldermen. Permits are also a municipal responsibility, as are land use plans and zoning. This means that while the funding was mainly provided by the national government, the judicial procedures were dominated by the municipality.

Feasibility studies

Very few feasibility studies, at least publicly accessible or identifiable studies, were conducted by external companies. , although Twynstra & Gudde conducted an audit of the subsidy application. Studies were carried out mainly within the organisation in order to produce a proposal for submission to the Ministry of Transport. These are the exploration study and Plan Study Report mentioned in the timeline. These were proposal rather than feasibility studies, although including an element of feasibility calculation.

Main organisations involved

Figure 13: Organisation Chart



Source: TU Delft 2006

Figure 13 provides an organisation chart for the RandstadRail project. This is the situation from the moment that the subsidy application is approved by the State, when preparations for construction could begin. The organisations in purple are those within the territory of the Rotterdam region. The organisations in orange are those active within the Haaglanden boundaries. The black organisations operate at the national level.

Coordination between the different sections of Rotterdam and The Hague was undertaken by the Project Management Team (PMT). Participants were the project leaders within each of the project organisations and representatives of the regions. Not included in this team were the responsible aldermen of the municipalities, who only coordinated with each other on an ad-hoc basis.

The organisational structure of the section in The Hague is relatively complicated compared to that of the Rotterdam section. In the upper left corner is the SGH, which is the project owner. As it is a regional coordinative administrative layer, nine municipalities are involved. However, because only four municipalities had a direct stake in the project, these gathered in the BORR (Bestuurlijk Overleg RandstadRail). This board started functioning at the end of 2002. It was not a formal administrative body and thus it was not allowed to make decisions. However, its chairman was the alderman of The Hague and also the alderman of the SGH, and thus the main person responsible. So informally, this was an important place to make decisions that had to be formalised through the SGH.

Although the SGH was the owner of the project, it did not have the institutional capacity to

lead the project. So the main city, The Hague, took te full responsibility including for risks. In The Hague there is a separation between services concerning infrastructure projects. The Dienst Stedelijke Ontwikkeling (DSO) prepares the project until the Council has reached a definite decision. It then transfers responsibility to the Dienst Stadsbeheer (DS). This last organisation established the PORR (Projectorganisatie RandstadRail), which was responsible for construction of the infrastructure. This organisation divided the project into several parts and a number of sections, and HTM and ProRail (national heavy rail provider) were delegated principal constructors. Execution of the projects was mainly by external construction companies.

Coordination within the municipality of The Hague took place within the Stuurgroep RandstadRail. In this group participated the DSO, DS, PORR and the aldermen. The management team (MT) was the coordination group for the civil servants of the four municipalities within Haaglanden that had direct dealings with the RandstadRail and the PORR for preparing the BORR meetings.

Pre-construction phase

As shown by the timeline (above), the decision-making was given a definite impulse by the publication of the report, *RandstadRail: de file voorbij,* by the public transportation companies HTM, RET, ZWN, and NS. So the involvement of these companies was clear. They had ideas about solutions to the problem of accessibility in the Randstad region, and especially in the Zuidvleugel. This meant that throughout the process there was the continuous support of the transportation companies.

Of the governmental agencies, the regions SGH and SRR were of course very active. Also the municipalities that would participate in the RandstadRail were also involved (Rotterdam, The Hague, Zoetermeer, and Lansingerland) in the pre-construction phase. The Zuidvleugel organisation was a stakeholder but not a direct participant in the project. The Ministry of Transport was involved strongly in the process as the main provider of funding of the project and provided many suggestions.

Construction phase

The funding of the project was provided in a lump sum agreement by the Ministry of Transport. The regions, as owners, appointed the municipalities of Rotterdam and The Hague as principal constructors. At that time, the Rotterdam public transportation company (RET) was still a municipal organisation. This meant that they could be fully responsible without having to participate in a public tender procedure. The RET thus had responsibility for the design, construction, and maintenance of the infrastructure.

The situation in The Hague was less straightforward, because the transportation company was already privatised. Its *Dienst Stadsbeheer* became the principal constructor of the infrastructure. Its Project Organisation RandstadRail then divided the project into several sections. Some were still in principle constructed by them, while for other sections private companies were appointed as (sub-)principal constructor. Because some sections of the project were on national railway track, the national safety agency for infrastructure, *Inspectie voor Verkeer en Waterstaat* (IVW), had to supervise those sections of the project. This proved a valuable source of information on security measures.

Construction started in 2002 and sections were finished gradually in 2006 and 2007, leaving only the bus line and the underground connection with the Rotterdam metro network. The construction of the project in both The Hague and Rotterdam has been within budget (Rotterdam: EUR 580m (Rotterdam 2007), and The Hague: EUR 560m (RandstadRail 2007)). The construction included the usual Dutch building companies such as BAM,

Strukton, Dura Bouw, and BallastNedam. An important part was played by consultancy firm Movares (which was part of NS before privatisation). This company led some projects and was responsible for the design of several stations.

Although construction started in 2002, perhaps the most important phase in the construction was the TTT (Transformation, Testing, and Trial exploitation period, *OTP* in Dutch). Although the period was originally planned to last six weeks, the decision was made to extend it to thirteen weeks in 2005.

The goals of the TTT were to (TU Delft 2006):

- deconnect the RandstadRail track from the main railway network;
- do construction work on the tracks, track switches, security system, ground systems for traction voltage, stations and other sub-systems;
- test the transformed system;
- perform a trial exploitation period (driving the timetable without passengers).

It proved impossible to finish the security system during this period, so an early decision was made to drive on sight for a period of time. In relation to the organisations involved, one of the main problems during the TTT was that the period was so short that time pressures were very strong. This meant that many constructors had to be active at the same time and this caused some severe coordination problems (TU Delft 2006).

Operations phase

The organisations involved in the operation phase are clear. The exploitation is by RET for the Eurasmusline from Rotterdam to The Hague. The connections between The Hague and Zoetermeer, Line 3 and 4, are run by HTM. The owners of the project are still SRR and SGH.

Planning and environmental regime

Outline of planning regime

The legislation was relatively complicated because the RandstadRail made use of different types of track falling under different Acts. The original heavy rail, the tram and the metro are all subject to different legislation. Some of the legislation is old, for example the *Spoorwegwet* (Railway Act) from 1875. This Act has been revised many times. But the *locaalspoor en Tramwegwet* has had very few updates. This made the judicial context complex, with issues concerning safety, amongst others. Concerning exploitation, the *Wet Personenvervoer* (Public Transport Act) assured the institutions providing the concession, the owners SRR and SGH, of a single framework. This made it easy for them. However, the public transportation companies were and are responsible for synchronisation of materials and procedures with the different types of legislation. This also meant there were three supervisory organisations: IVW for RandstadRail, with the exception of the section of the tram in The Hague and the metro section in Rotterdam. This makes it impossible for IVW to integrally supervise the whole project (TNO 2007).

The main financing legislation of these types of projects is the MIT (*Meerjarenprogramma Infrastructuur en Transport*). Infrastructure projects in the Netherlands are still mainly funded by national government. The largest part of the budget for infrastructure is allocated in the Infrastructure Fund. The Infrastructure Fund Act was introduced in 1993 to make an integral approach to the financing of infrastructure possible. It provides the possibility of shifting finances between projects or in time to ensure that budgetary bottlenecks do not cause

unnecessary delay. The Fund is mainly financed from the budget of the Ministry of Transport and Water Management and the Fund for Economic Structure enhancement (FES), compiled from profits from the sale of natural gas and shares owned by the state. The Infrastructure Fund hads a planned budget in 2007 of about EUR 7bn.

(Source: www.rijksbegroting.nl)

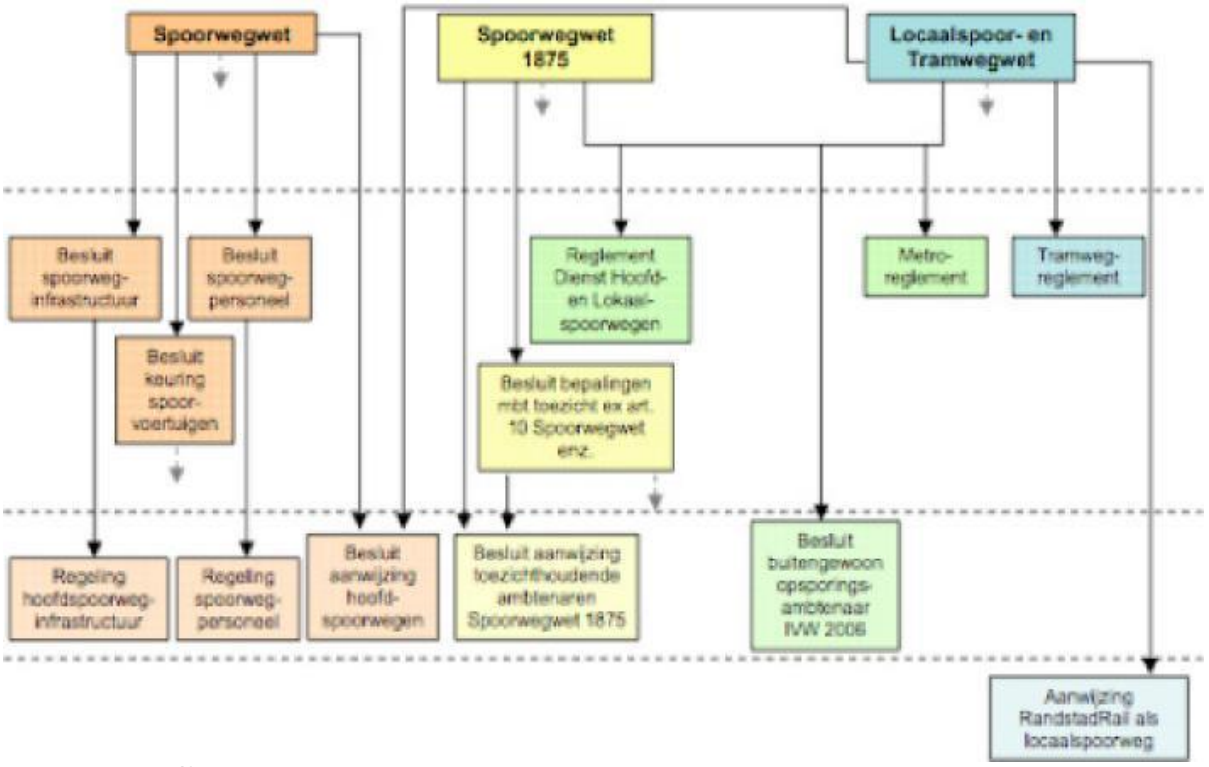
The government budget also includes a list of projects that are on the agenda or are already being built. It is essential for a project to get on this list in order to get funded. The MIT is updated annually as part of the State Budget and has a scope of four years. Since 2004, it has an outlook until 2020. Some developments can easily remain in the MIT for decades without ever being built. This is possible because the MIT categorises projects in three phases (Koenders and Noordsij 2004):

- exploratory phase: projects are placed on the agenda by political parties or ministries and are discussed for desirability;
- plan study phase: projects have proven their desirability and it can reasonably be expected that they will be developed. Plans are studied on the best approach to the technical, judicial and political dimensions of the project;
- execution phase: projects are ready to be carried out or are already being realised.

As already noted, projects can remain in the MIT for a very long time, never leaving the first two phases. This often happens because the consociational nature of Dutch politics (Lijphart, 1999) demands that many different parties are consulted and more or less agree on the importance and route of the project. Because of the many parties and the many possible projects, there are very narrow windows of opportunity for projects to get past the first two phases and into the third.

It is usually only after finishing the decision-making process that attempts are started to acquire external funding. However in the proposal budget te, assumptions will have been made about possible contributions from private sector third parties and from the EU.

Figure 14: Legal structure



Source: TU Delft, 2008

Environmental regime

There was no environmental impact assessment for the RandstadRail project as a whole, because it principally involves the transformation of heavy rail into light rail and linking these tracks to the existing tram and metro network. So the EIAs of the project were only carried out for individual elements such as the large stations. Rotterdam Central Station was subject to an environmental impact assessment because its original plans were expensive enough to be legally bound to an EIA in order to change the land allocation plans. Although the final plans were not as grand, the EIA was still undertaken. An EIA was also carried out for The Hague Central Station. However, overall the project was subject to very few environmental impact assessments.

Overview of public consultation

Public consultation is necessary for changes to land allocation plans. The municipalities are responsible for the land allocation plans. The Hague held a few public consultation meetings for Line 3 in 2002 (most of the public consultations were held between 2002 and 2004). These consultations concerned small route changes, crossings for bicycles, new stops and the expansion of existing ones. Records of public consultation in Rotterdam also limit themselves to smaller projects. But it seems no major impacts were caused by the public consultation rounds – such as large scale changes that severely changed the budget of the project.

Perhaps one of the most surprising public consultation rounds involved the public in deciding the colour of the RandstadRail vehicles within The Hague. Eventually the colour blue was chosen. Well over 3,000 people participated and about two thirds of them preferred the colour blue.

Regeneration, archaeology and heritage

Because the RandstadRail was built mainly on existing tracks, the need to consider archaeology and heritage was limited. However, an important archaeological find was made during the drilling of the tunnel connecting the Hofpleinlijn to Rotterdam Central Station, near Blijdorp station:

> "Since 14 October, archaeological research is being done into one of the oldest steam powered pumping station. The special thing about the station is that it is the first application in the Netherlands of the steam powered motor invented by James Watt; a revolutionary development for that time. The machine of Watt was a lot more efficient than other machines from that time. The Pumping Station worked excellent as was multiple times more effective than the usual wind powered stations. The pumping station was in use from 1987 to 1791. Remarkably, the station was named Keezending. This was a reference to the Keezen, which was an old name for the patriots"

(RandstadRail, 2004).

Project appraisal

Several risk appraisals were carried out during construction. However these are not available in the public domain.

Land acquisition

There is no publicly available information about the number of compulsory acquisitions. But because the RandstadRail was mainly developed on existing track, it can be expected that this was very limited.

C PRINCIPAL PROJECT CHARACTERISTICS

Description of route

The RandstadRail project has three lines running at present. The most important stations have been described above in Section A.

Line 3

This line is a combination of two former lines and runs from Loosduinen, southwestern part of The Hague and a former garden city, to Zoetermeer, an important growth town. The section Loosduinen to The Hague Central Station replaces the former tram line 3. On this section vehicles have a maximum velocity of 50km/hr because traffic is heavy and sections are shared with normal urban trams. From The Hague CS onwards, the line becomes separated from the rest of the traffic. The rest of the section is the former Zoetermeerlijn, which was a heavy rail train connection between The Hague and Zoetermeer. This was transformed to light rail. Because it is a dedicated line with no level crossings, vehicles are able to move at a speed of 80km/hr.

From the Loosduinen (Arnold Spoelplein), the line goes through the Laan van Meerdervoort, Koningin Emmakade, Lijnbaan, towards Central Station via Sousterrain station. It then goes onward to the Laan van Nieuw Oost Indië, an important station for commuters. It goes on to Voorburg, one of the prominent suburbs of The Hague. The following area is Leidschendam, which forms its own municipality with Voorburg. The train steadily continues towards Leidschenveen, an important VINEX-location (new growth town) within the municipality of The Hague. It continues to Zoetermeer, and finishes at the station Zoetermeer Centrum West, in the centre of the town. The line was taken into operation in two phases. In February 2007, the section Loosduinen-Central Station was taken over from the urban tramline. In October 2007 the rest of the line became operational.

Line 4

This line is also a combination of two lines. The train line runs from De Uithof, southwestern part of The Hague, to Zoetermeer Javalaan. The section from De Uithof to Central Station is a shortened adaptation from the former urban tramline 6. In the original plans Line 4 was indeed called line 6. The other section is for a large part shared with tram line 3, and is the old NS Zoetermeerlijn. As with Line 3, the section between De Uithof and The Hague Central Station is used at a maximum velocity of 50km/hr. The other section is used at a maximum of 80km/hr.

The line moves from De Uithof through the Meppelweg to Leyenburg station, a nodal point with several urban and regional bus lines and a tramline. It continues through the Escamplaan, the Apeldoornselaan, de Loosduinseweg, de Lijnbaan and the Prinsengracht. It then goes underground through Sousterrain Station towards The Hague Central Station. It continues to the Laan van Noord Oost Indië, and then on to Voorburg, Leidschendam, and Leidschenveen, terminating in Zoetermeer. This section from Central Station to Zoetermeer is similar to Line 3. Within Zoetermeer it serves some additional stops in order to finish at Zoetermeer Javalaan.

Four phases are identifiable in the exploitation of this line. In October 2006, the section The Hague Central Station to Zoetermeer Oosterheem was taken into operation. The exploitation was stopped a month later due to a derailment and consequent investigation by the IVW. In May 2008, exploitation was started on the other section of the line, on the urban network between De Uithof and Central Station. It was not until October 2007 that the full

line was operational.

Erasmuslijn

This line is a light rail conversion of a former NS heavy rail line known as the Hofpleinlijn. It runs from The Hague Central Station to Rotterdam Hofplein. It is expected that this section will be linked with the Erasmus metro line in 2010 after the Statenwegtrace tunnel connection is finished with its station Blijdorp and the new Rotterdam Central Station.

The route starts from The Hague Central Station and runs along with Lines 3 and 4 to the Laan van Noord Oost Indië. They all continue through Voorburg and Leidschendam to the growth town Leidschenveen. Here the Erasmuslijn leaves the other lines and continues on its own path in the direction of the growth towns of Nootdorp and Pijnacker. It then continues to the Berkel en Rodenrijs suburb to enter Rotterdam from the north, terminating at Hofplein Station, in the centre of Rotterdam near the Central Station. However, when the Statenwegtrace is finished the line will continue beyond Hofplein to Blijdorp station, near the Zoo, and to Central Station. Here it will be linked to the metro network of Rotterdam and will continue in the direction of the southern boroughs of Rotterdam. The taking into operation of the line has occurred in several phases. In September 2006, the section Rotterdam Hofplein – Nootdorp was taken into use. In November 2006, the line became fully operational from The Hague Central Station to Rotterdam Hofplein. At the end of that month, two derailments caused exploitation to stop on the orders of the IVW. Only the Hoofplein – Nootdorp section was allowed to remain in use. In September 2007, the entire Erasmuslijn became fully operational again.

Project costs

Predicted costs

At the time of approval, the estimated cost of investment was estimated to be NLG 1.674bn (Min V&W, 2001), or EUR 761m (in 2001 prices). The RandstadRail is a one billion dollar project. The section developed by Rotterdam cost EUR 580m (Rotterdam, 2007), and the Hague section cost EUR 560m (RandstadRail, 2007)). The difference is mainly because of related projects that RandstadRail has taken aboard.

Timeline of cost estimates

Figure 15 provides an overview of the need for liquidity in the project per year within The Hague region. Figure 16 provides a comparison between the different estimates of income and expenses on a cumulative basis within The Hague part of the project.

Figure 15: Liquidity prognosis

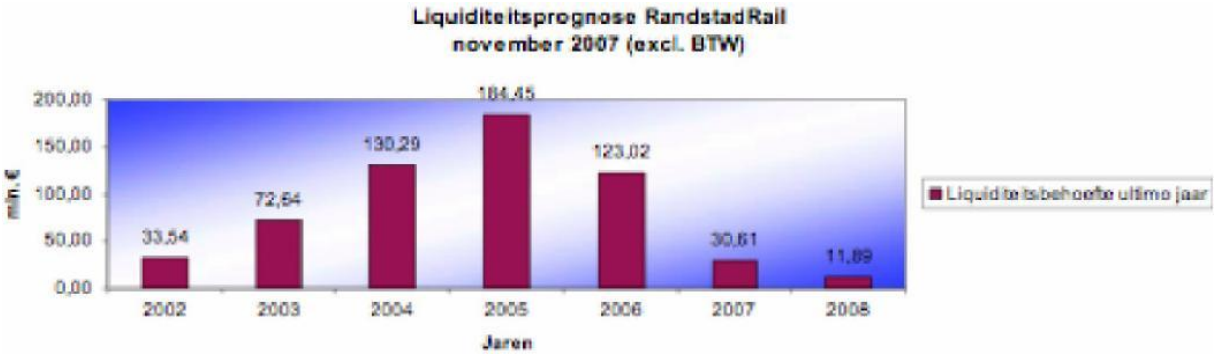
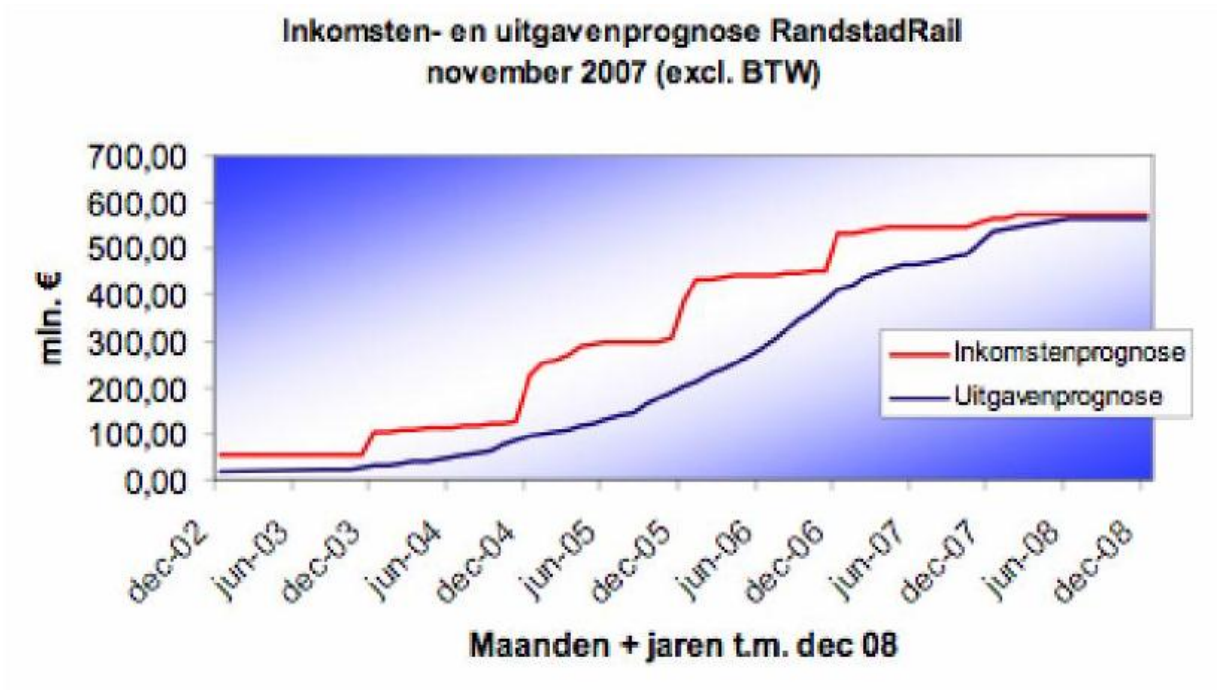


Figure 16: Income and expenses, The Hague section



There are no similar statistics for the Rotterdam section in the public domain. However, Figure 17 provides an overview of the cost of different sections of the project.

Figure 17: Financing and investment Rotterdam

Investeringsraming oktober 2007, prijspeil januari 2007
bedragen mln €

Onderdeel	bedrag	Toename	opmerkingen
	€	€	
Metrostation CS	119,1	-7,4	Toename (+) of afname (-) t.o.v. raming maart 2006
Stationwegtrace	339,8	+39,8	
Buitenruimte	13,2	-2,2	
Gezamenlijke kosten	51,0	-0,7	
Bovengrondse haltes en ZORO bus	54,4	-2,7	
Totaal investeringsraming	**577,5 + PM**	28,8	€ 577,5 is inclusief € 43 mln aan onvoorzien en aanbestedingsrisico. Geen rekening is gehouden met de (gedoeltelijke) toewijzing van claims aannemers betreffende kosten vertragingen (PM post). Zie toelichting onder onzekerheden.

Projectfinanciering oktober 2007

Bijdragen van		
V&W/SRR	536,5	Totaal gefactureerd naar financiers € 348 mln inclusief 7 mln aan scope wijzigingen
Nanteopbrengst	56,0	
Reservering voor index	-12,5	Totaal aan verplichtingen € 455 mln dit is inclusief scope wijzigingen
Totaal aan financiering	**580,0**	Totaal betaald aan facturen € 348 mln dit is inclusief scope wijzigingen

Scope wijzigingen	
Scope wijzigingen	35,1
Financiering	35,1

Contracts/Contractors

As previously mentioned, there are two main contractors. The city of The Hague was the main contractor for the section under the ownership of the SGH – Lines 3 and 4. The RET was the main contractor for the section that fell under the ownership of the SRR. This is the Erasmuslijn. Both were financed by lump sum.

In regard to the number and types of major civil engineering contracts and contractors working on each contract, there is no information available in the public domain.

D PROJECT TIMELINE

1989	First plans surfaced for a regional public transport network linking The Hague with Rotterdam.
1995	The public transport companies RET, HTM, ZWN (now Connexxion), and the NS took the initiative by publishing the report *RandstadRail, de file voorbij*.
November 1996	Exploration study. SRR, SGH, and the Province of Zuid Holland suggest a light rail system that would cost NLG 3-6bn (EUR 1.3-2.7bn, (1996)). The national state asked for solutions requiring less investment.
December 1998	Plan Study Report suggesting a first phase of light rail updating the existing Hofpleinline, Zoetermeerlijn, and a new line between Zoetermeer and Rotterdam without linking them to the urban transport networks for about NLG 1.28bn (EUR 0.58bn (1998)). The State reserves EUR 0.52bn in the infrastructure fund (MIT) 2000-2004.
December 1999	Additional advice by the RandstadRail Steering Group (State, PZH, SRR and SGH) to achieve higher quality of transport. Suggested is to link the lines to the urban rail networks and make the line between Rotterdam and Zoetermeer a high quality bus line. The foreseen investment is EUR 0.84bn.
July 2000	Agreement between State and the regions about preparing an application for subsidy from the MIT.
February 2001	Final Advisory Report by SGH defining the RandstadRail project.
July 2001	Concept subsidy application developed by the regions SGH and SRR.
December 2001	Administrative Agreement between the State and the Regions about the financial aspects pending the subsidy application.
March 2002	Subsidy Application to the Ministry of Transport including several scope changes in comparison with the concept.
December 2002	Approval of the application by Minister of Transport. This enabled the regions to continue with preparations for construction.
2002-2004	Public consultation for specific parts of the project. The project as a whole was not subject to public consultation because it was built on existing track. This also meant that an environmental impact assessment was not necessary. However for many parts of the project, public consultation wasundertaken, in the sense that the public could react to proposals by the project organizations. Key proposals for consultation were the plans for the area around the Prinses Beatrixlaan (see 'Introduction') and the trajectory choice for Line 4.
February 2003	Council agrees with the alderman's proposal to let the municipality of The Hague act as the principal constructor of the section owned by SGH. All associated risks are for the municipality of The Hague.
June 2003	Start of construction in Rotterdam.
April 2004	Alstom is chosen as the provider for the vehicles of the The Hague section.
June 2004	A decision is made to have Alstom put tram wheels on the vehicles and to replace the track changes to make them suitable for light rail material.
September 2004	A decision is made to secure the track with the ATB system that is also used for the metro.
December 2004	A decision is made to use 750 Volts instead of 1500 Volts as originally planned.
May 2005	The Zoetermeerlijn appears to be in a bad state of maintenance.
August 2005	The Transformation, Testing and Trial Exploitation Period (TTT) is extended from six weeks to thirteen weeks (from June 3 to September 3 2006).
September 2005	The concession for transport and maintenance of the infrastructure in the region Haaglanden and the RandstadRail line 3 and 4 is given to HTM.
February 2006	The concession for transport and maintenance of the Hofpleinlijn section (the Erasmuslijn) is given to the RET.

June 2006	Start of TTT. Replacement track Zoetermeerlijn.
August 2006	Start of exploitation is postponed.
September 2006	Exploitation of the Erasmusline begins between Rotterdam Hofplein and Nootdorp.
October 2006	Exploitation of Line 4 begins.
November 2006	Derailments of line 4 in the proximity of The Hague Central Station. Full exploitation of the Erasmuslijn between Rotterdam Central Station and The Hague Central Station. Derailments of line 4 near Ternoot Station and of the Erasmusline near Forepark station. The last derailment caused 17 lightly wounded victims. Exploitation is fully stopped by the IVW except for the section between Rotterdam Hofplein and Nootdorp.
February 2007	Exploitation begins on line 3 on the section between Loosduinen and The Hague Central Station, effectively replacing tramline 3 with RandstadRail 3. An alderman of The Hague and of the SGH, Van Woensel, resign and gives as a reason a budget overrun of EUR 12m on the underground connection of RandstadRail to Central Station. He had only been in office for several months.
March 2007	Start of the test runs on the Erasmuslijn.
May 2007	The IVW produces a report on the derailments. Exploitation begins on the tram section of line 4 between De Uithof and The Hague Central. A human error caused a derailment of a vehicle on line 4.
September 2007	Exploitation begins on the Erasmuslijn between Nootdorp and The Hague Central station. It is now fully operational.
October 2007	Line 3 and 4 are fully operational between de Uithof and Zoetermeer Oosterheem. This means that RandstadRail is now fully operational.

Key timeline issues

There are several key issues that have had specific influence on the project.

The first is the fact that definite support for the project was given by the public transportation companies. This was very important because a dominant aspect of the project is the transformation of heavy rail trajectories into light rail. The heavy rail was owned by the state but exploited by the NS. By publishing the report, the NS and the other companies committed themselves to the project. The fact that a new route did not have to be developed meant a reduction in the need for public consultation and environmental impact assessments.

Another crucial aspect was the willingness of the municipality of The Hague to take full responsibility for construction of the RandstadRail within the region of SGH. This meant that there was one party responsible for the risk management and planning of the project. In Rotterdam it also fell under the responsibility of the RET, which was an agency of the municipality at the time of construction.

A key decision in the successful management of the cost was perhaps the fact that the metro system ATB was chosen as the security system. It was a proven system and one of the main partners, RET, had extensive experience with this system through the construction and

exploitation of the Rotterdam metro network. Choosing a proven system reduced the risk.

Defining in the image of the RandstadRail were the many derailments. This was a definite setback in exploitation and in the image of RandstadRail as a safe and fast mode of transport. The project was even being called Rampstadrail, which means 'disaster rail' (AD 2006). The derailments caused delays in starting exploitation, costing an estimated EUR 150,000 to EUR 200,000 per week.

E PROJECT FUNDING/FINANCING

Overview of project funding

RandstadRail, as most infrastructure projects in the Netherlands, is almost fully funded from public funds. The national government, through its MIT, is the main financier of RandstadRail. Furthermore the participating municipalities contributed, to both the construction of the project infrastructure and its exploitation. HTM and RET as transporters on the RandstadRail each get a certain amount per year for the exploitation of the infrastructure, irrespective of revenues. So it is a fully public sector financed project.

Revenue – actual and forecast

There are no data available in the public domain. Revenue is difficult to operationalise for the RandstadRail, or for any other section of the public transport network. This is because a national system operates, whereby people buy cards anywhere that they can use for any public transport system in the Netherlands. Operators get a calculated share from the national revenue.

Because the funding of the project is not dependent on actual revenue from ridership, traffic forecasts were not required to secure funding during the decision-making process.

Table 3: Overview of key stages in funding approach

Exploration study	Exploration Study – SRR, SGH, and the Province of Zuid Holland suggest a light rail system that would cost between NLG 3bn and NLG 6bn (EUR 1.3bn to EUR 2.7bn (1996)). The national state asked for solutions requiring less investment.
December 1998	Plan Study Report suggesting a first phase of light rail updating the existing Hofpleinline, Zoetermeerlijn, and a new line between Zoetermeer and Rotterdam without linking them to the urban transport networks for about NLG 1.28bn (EUR 0.58bn (1998)). The State reserves EUR 0.52bn in the infrastructure fund (MIT) 2000-2004.
December 1999	Additional advice by the RandstadRail Steering Group (State, PZH, SRR and SGH) to achieve a higher quality of transport. Suggested is to link the lines to the urban rail networks and make the line between Rotterdam and Zoetermeer a high quality bus line. The foreseen investment is EUR 0.84bn.
July 2000	Agreement between State and the regions about preparing an application for subsidy from the MIT.
December 2001	Developed concept subsidy application by the regions SGH and SRR - Administrative Agreement between the State and the Regions about the financial aspects pending the subsidy application.
March 2002	Subsidy Application to the Ministry of Transport including several scope changes in comparison to the concept.
December 2002	Approval of the application by the Minister of Transport. This enabled the regions to continue with the preparations for construction.

Funding sources

The section within the SGH section was financed by a subsidy of EUR 428m from the Ministry of Transport, EUR 29m of own resources, and EUR 102m from taking on other related projects. (RandstadRail, 2007).

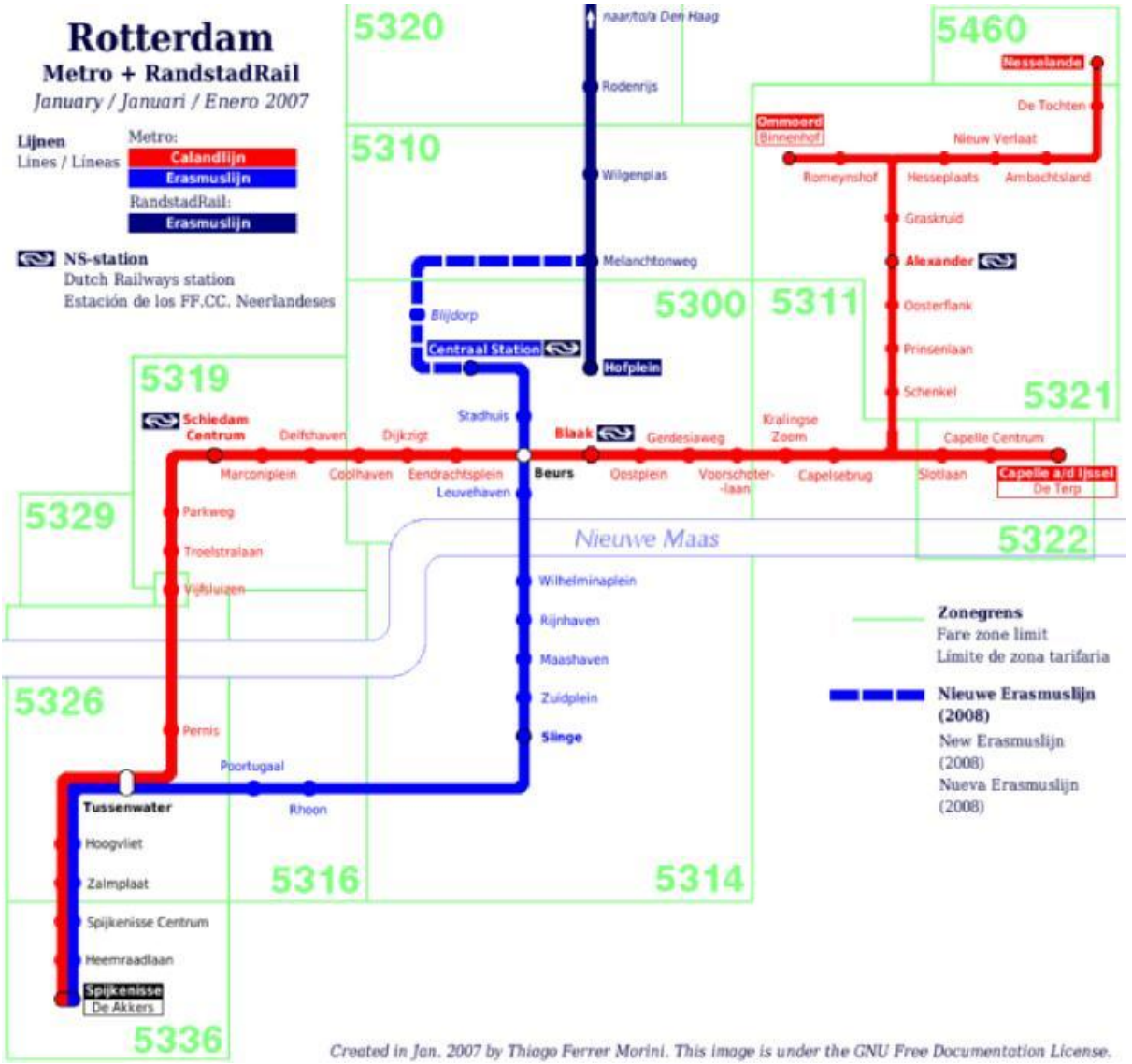
The Rotterdam section was financed by a V&W and SRR for EUR 536m, and EUR 56m is derived from interest from reservations.

F OPERATIONS

Traffic volume

Approximately 75,000 passengers travelled on Lines 3 and 4 in 2008. Of these, approximately 48,000 were within the borders of The Hague and about 27,000 traveled outside of the municipality (htmfoto.net, accessed in September 2008). The number of current travelers on the Erasmuslijn is unknown.

The predicted number of passengers was 42,000 on lines 3 and 4 and 28,000 between The Hague and Rotterdam (RandstadRail, accessed August 2008).



G BIBLIOGRAPHY

(2004). De tramtanic is eindelijk open. Trouw. Den Haag.

ABB Ontwikkeling (2008). VON-prijzen per bouwnummer Mansion Parck 1 6-hoven Rotterdam. AD (2006). Irritatie groeit over 'Rampstadrail' 02 November 2006.

Den Haag Nieuw Centraal (accessed August 2008). Factsheet Den Haag Nieuw Centraal. Gemeente Den Haag. (accessed August 2008). "Beatrixkwartier." from http://www.denhaag.nl/smartsite.html?id=6028.

Havermans, A. J. E. (1993). Ontwerp-bestemmingsplan Grote Marktstraat e.o.

htmfoto.net. (accessed in September 2008). "HTM: dagelijks 75.000 reizigers in RandstadRail." from http://www.htmfoto.net/nieuws/tonen. php?datum=20080522&item=250.

Jongedijk, T. (2008). Bouwers RandstadRail claimen negen miljoen; Gemeente heeft forse eis aan de broek. De Telegraaf. Rotterdam.

Min V&W (2001). Bestuurlijke overeenkomst inzake de aanleg en wijze van financiering van RandstadRail.

Min V&W (2008). MIRT Projectenboek 2008. The Hague, Sdu. ProRail (June 2007). Nieuw Station Den Haag Centraal.

"Ran" College ds zetta in dop Rabijzonilder (20 vormgegeven 02) vviaduct oor RandstadRail in Prinses Beatrixlaan

RandstadRail (2004). "Persbericht 25-10-2004" RandstadRail (2007). "Voortgangsrapportage 11." RandstadRail (2007). Voortgangsrapportage 11. RandstadRail. (accessed august 2008). from http://www.RandstadRail.nl/.

Rotterdam, B. W. (2007). Voortgangsrapportage aan de gemeenteraad: 4 December 2005: 07BSD.

SGH (2001). Eindadvies projectdefinitie RandstadRail.

SWB, C. (2004). Financi‘le analyse 21 Tunnels Centrum: November 2004.

Team CS (2006). Rotterdam Centraal. Definitief Ontwerp OV-Terminal. www.rotterdamcentraal.nl. TNO (2007). Onderzoek naar handelswijze IVW inzake RandstadRail.

TU Delft (2006). Het RandstadRail-project: Lightrail, Zware Opgave. . The Hague, Stadsgewest Haaglanden.

Tweede Kamer der Staten-Generaal (2003). Vaststelling van de begrotingsstaat van het Infrastructuurfonds voor het jaar 2003: 28600 A, nr. 48

www.rotterdamcentraal.nl. (accessed august 2008). "Financiering | Rotterdam Centraal."

Zuidvleugel (2008). Ontwikkelingsperspectief Zuidvleugel - bijdrage aan Randstad 2040 www.zuidvleugel.nl.

Zuidvleugel. (accessed august 2008). from http://www.zuidvleugel.nl/page/De Zuidvleugel.