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Report PMZ market consultation

Developing Mainportcorridor Zuid

-A study of viable alternatives for PMZ-

First STEP Partnership

-October 2007-

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First STEP
Partnership

First STEP Partnership

First STEP is a partnership of:

Strukton Integrale Projecten

TNO Built Environment and Geosciences

Egis Projects

Strukton Integrale Projecten

TNO

egis projects Developer of Infrastructure & Services

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Preamble

The PMZ Project Board submitted a call for Expression of Interest for a market consultation for definition of scope and type of contract for operating the A4 Corridor.

The goal of the project has been finding the optimal scope (geographical, functional and institutional) for PMZ and defining what preconditions can and must be met, focusing on improving the accessibility on and around the A4 free-flow route and the quality of life and living environment related to this.

Three well-known partners have joined forces for this market consultation and together we form a unique combination: the First STEP Partnership. Both research and business organisations are involved here, as well as Dutch and non-Dutch parties. The partners are

- Strukton Integrale Projecten: a major Dutch building & construction company as well as PPS/PPP developer;
- TNO Built Environment and Geosciences: a recognized Dutch research organisation focusing on innovative aspects of building and transportation;
- Egis Projects: a reputed French company acting as long-term developer, systems integrator, and operator of transport infrastructures.

Our team combines skills regarding traffic management and road pricing strategies, PPS/PPP project structuring capabilities, innovative infrastructure (Design & Build), operation and maintenance (O&M) of transport infrastructure, and project management in complex environments.

The results presented in this report reflect the comprehensive yet preliminary work which has been carried out by First STEP members in the time frame set up by the PMZ Project Board, and therefore are supported by a certain number of key assumptions which are clearly stated in the report.

Those assumptions are based either on the comprehensive PMZ Project documentation's primary data or on the own experience and capabilities of First STEP members as well as on their internal preliminary calculations (traffic and revenue aspects, construction aspects, operation and maintenance aspects, financial engineering aspects).

We are aware of the sometimes innovative nature of our final advice, but we feel this is in line with the clear ambitions of the PMZ Project Board and the presented facts and figures.

First STEP supports the way in which the market has been consulted, and is proud to present its final conclusions in this report to the Project Board.

Paris, October 2007

First STEP Partnership

Glossary

A different way of paying for road use	Anders Betalen voor Mobiliteit (ABvM)
A4 Corridor	Highway between junction Benelux and Belgian boarder
A4 South	Missing link between junction Benelux and Klaaswaal
Capital expenditures (capex)	Investeringskosten
Central government	Rijksoverheid
Corporate social responsibility (CSR)	Maatschappelijk verantwoord ondernemen (MVO)
Draft route decree	Ontwerp tracébesluit (OTB)
DSRC Technology	Dedicated Short Range Communication. Used for communication between on-board equipment and road side equipment
Environmental impact study	Milieu effect rapportage (m.e.r.)
Environmental utilisation space	Milieugebruiksruimte
First STEP	The partnership of Strukton, TNO and Egis Projects
Governments memorandum on environmental planning, (2005)	Nota Ruimte
Governments memorandum on transport of dangerous goods	Nota Vervoer Gevaarlijke stoffen
Grantor	Opdrachtgever
Guidelines	Richtlijnen (van m.e.r.)
Heavy goods vehicles (HGV)	Zwaar transport
Highest court for administrative law	Raad van State
Interweaving	vervlechting
Law on noise pollution	Wet Geluidhinder
Light vehicles (LV)	Licht transport
Ministry of housing, planning and environment	Ministerie van VROM
Ministry of Transport, Public Works and Water Management	Ministerie van Verkeer en Waterstaat
National ecological network	Ecologische hoofdstructuur
Natura 2000	An ecological network in the territory of the EU
Operate and maintain (O&M)	Beheer en onderhoud
Operational expenditures (opex)	Lopende kosten
Origin Destination Matrix (OD-matrix)	Herkomst bestemming Matrix (HB-matrix)
Particulate matter	Fijnstof
Pcu	Passenger car unit
PMZ	Dit project
PMZ Board	De PMZ Project Board
Protected townscape	Beschermd dorps- en stadsgezicht.
Spatial plan	Bestemmingsplan
Starting document	Startnotitie
Trajectory	Tracé
Urgency Plan Randstad	Urgentieprogramma Randstad (UPR)

Advice (executive summary)

To come to a short, transparent overview and a comprehensive integral advice we summarize and asses the analysis of the following subjects:

- Feasibility of the project scope alternatives
- PPS organisational structure
- Traffic and environmental targets
- Preconditions and Follow Up Process

In the analysis of the three developed Project Alternatives we will see that all Alternatives are (more or less) feasible from an economical point of view, of course with carefully made assumptions and (traffic) modelling.

The solution to be chosen by the government should preferably meet the following 4 goals to be politically and financially feasible:

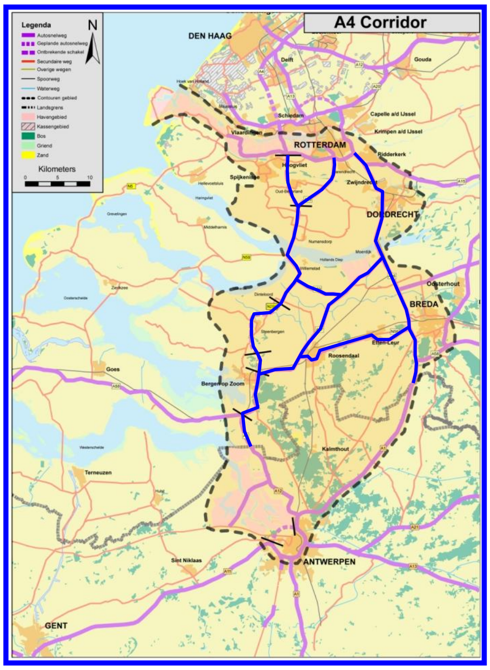
1. Covering costs of construction of the A4 South and if possible also its maintenance and operational costs;
2. Influencing traffic flows within the corridor;
3. Satisfying environmental requirements;
4. Satisfying political requirements.

Performance within full scope of alternatives

First STEP developed the following Alternatives:

- Project Alternative 1: design, build, finance, maintain, operate and toll the A4 South
- Project Alternative 2: as Alternative 1 and extended with maintenance, operation and tolling of A29/A4 Vaanplein to Belgian Border
- Project Alternative 3: as Alternative 1 with an extension of the maintenance operation and tolling of the whole PMZ Corridor (thus with A16, A17 etc.). Also land acquisition of the National ecological network can be part of this Alternative.

Alternative 1 is feasible, but it is a relatively vulnerable business case because the internal rate of return is too low. As the competing infrastructure (A29) is not tolled, drivers can decide to take the free route although it is not cheaper (perception of tolling). The risk of people diverting from the A4 South is high. Another downside of this alternative is the relative modest geographical scope. For the plans in creating a green route including free flow targets and environmental targets to be effective on a national level, the route should be implemented over a longer route than only the 11km A4 South.



Project Alternative 2 is a feasible project as the report shows it can be realized and financed. It is very close to the base case as described by the PMZ-Board, what is expected to help in the political feasibility. As both the A4 and the A29 are included in its scope, the income is expected to be far more solid than alternative 1.

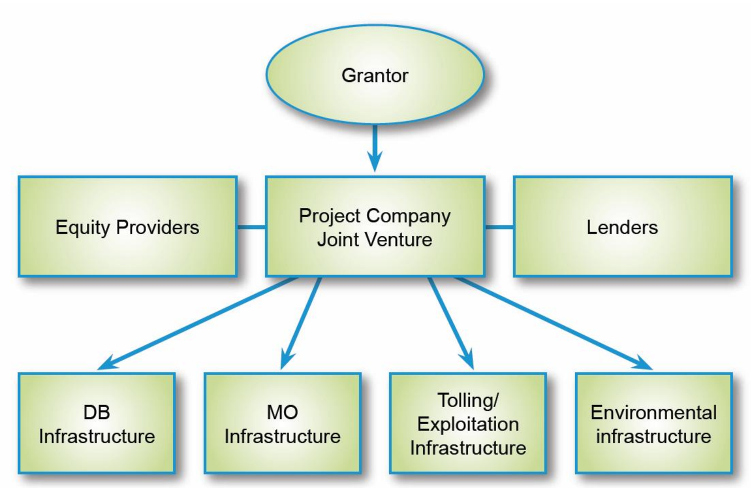
Alternative 3 (see figure) is the most interesting and is innovative from the perspective of Dutch infrastructure development.

The solution meets the goals best. It has a robust and significant impact on the traffic flows on both axes A4/A29 and A16. It reduces congestion and improves the overall environmental condition of the area. Additional toll levels are congruent with the planned tariffs of “Anders Betalen voor Mobiliteit” and the income generated covers construction costs of the A4 South as well as operations and maintenance costs in the whole PMZ Corridor. Finally the objectives in the A16 corridor and Dordrecht area are also better served with this alternative, which leads to higher general societal revenues. A further improvement in the performance of this alternative can be obtained by separation of passenger car and freight traffic infrastructure on sections of the corridor and by applying noise reducing asphalt.

Organisation

We elaborated on several possible PPP Structures. Based on the presented information and perceived risks we structured the organisation with the following characteristics:

- Design, Build, Finance, Maintenance and Operation (including tolling) of A4 South and
- Finance, Maintenance and Operation (including tolling) of the whole PMZ Corridor. This includes the A29, A4 and the A16 up to the Belgian boarder, and the highways A17, A58 and A59
- DBFMO Contract to a 10-50% public and 90%-50% private SPV (Joint venture; JV) to underline the joint strength and cooperation in an innovative project



- The Joint Venture (JV) is responsible and paid for the availability of the network out of the Infrastructure Fund. Also an incentive based system is established for free flow and environmental targets
- Toll is collected on behalf of the Central Government
- Contract for 40 years, updated with 5 year plans as in France
- When the project starts, the risk regarding toll income is carried by government (100%) permitting diminishing traffic at the A4 Corridor for the sake of the free flow and environmental targets. We suggest to reassess this risk allocation in the 5 yearly revisions of the Contract
- Infrastructure Fund is fed by the income from tolling the (PMZ) Corridor
- Possible subproject: buying areas belonging to the national ecological network (so called EHS areas) in the PMZ Corridor allowing green development of this Corridor instead of only developing a road. For this option the Province Noord Brabant can be allowed to join the JV

A further support for a Joint Venture between public and private partners can be found in the response of the Dutch Minister of Transport on the Dutch Rekenkamer Research of the HSL PPP project (June 2007). This response stated that in innovative projects an alliance of public and private partners joining risks and working together to avoid and mitigate risks is a good approach.
The JV also makes it easier to integrate the Traffic Controllers at Rhoon and the Road Inspectors in the JV.

Targets

As targets to be set for this Joint Venture one could think of:

- Free flow targets based on time needed to pass the A4 Corridor between either Vaanplein or Beneluxplein and A16 Corridor. These targets could be formulated in travel time, for instance:
  - For LV: 45 minutes, with penalties if travel time increases (under condition one travels with 100 km/h)
  - For HGV: 60 minutes, with penalties if travel time increases (75 km/h)
- Information on actual travel time should be available on a real time basis in the corridor for users, so they can choose their route efficiently.
- Availability targets to avoid (long) maintenance periods during busy hours and to stimulate quick incident management (see experiences from the PPP projects A59 and HSL/Infraspeed)
- Furthermore the Environmental Utilisation Space can be limited to certain values (to be decided; see chapter 2.6.2) regarding noise and NOx and “fijn stof” (particulate matter). We advise to calculate these values back to the number of cars maximum allowed during a month. This allowed number of LV’s and HGV’s should be reassessed every 12 months, based on the average pollution LV’s and HGV’s in the EU (of course the limits for noise and air quality in the law will still apply).

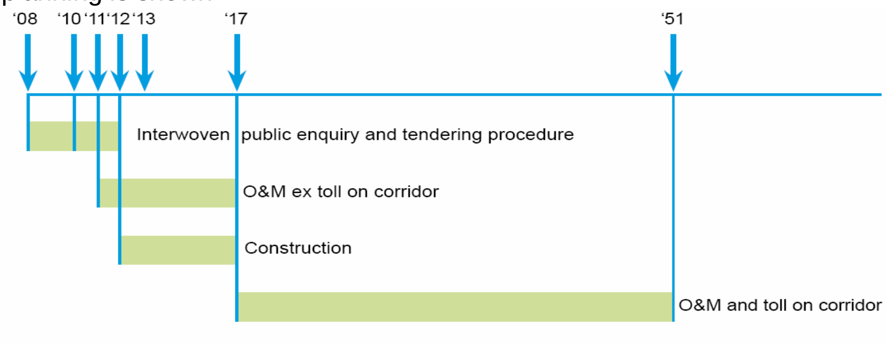
This environmental information could be made available to the inhabitants and politicians in the region.

Preconditions and follow up

The tender regulations allow a selection of the private partner in the SPV for this Project (with several subprojects starting in different periods).

Furthermore an agreement between all involved public parties and the establishment of one mandated public Project Organisation is necessary to lead the Tender and Start the Tracé/m.e.r. procedure at the same time.
We advise to run Tender and Tracé/m.e.r. procedures parallel (“vervlechting”) where the private partner in the SPV is selected just after the Starting Document is published. The SPV (JV) will become then the Initiator (“Initiatiefnemer”).

The maintenance and operation of the Corridor can start before the construction of A4 South has started, comparable to the planning of the 2nd Coentunnel project. In the following figure an ambitious planning is shown.



Start interweaving process	2008
Choice preferred partner	2010
Start O&M excl toll Corridor	2011
Route decree (TB) ready	2012/13
Start construction A4 South	2012/13
Construction finished	2017
O&M total scope incl. tolling	2017
End concession	2051

First STEP Partnership

1 Re-assessing the A4 South

This section presents an analysis of several aspects of the Basic Variant and various issues associated with the project in general. This analysis provides guidelines to identify possible improvements to the Basic Variant with the purpose of deriving a feasible business case. It also aims at identifying constraints and requirements that need to be taken into account in setting up ‘project alternatives’, these are alternative solutions to the two main goals formulated by the PMZ Board (the basic variant primarily focuses on (1) the free flow of traffic and also addresses (2) the related quality of life and area development along the corridor. The set up of the different project alternatives and more specific details regarding the exact business case that First STEP has found more or less viable are explained in the following chapters.

1.1 Geographical Scope

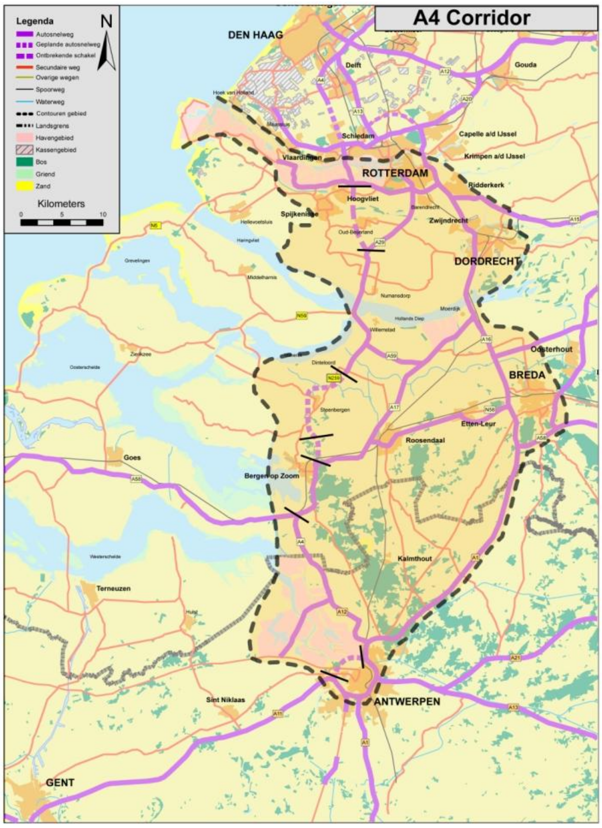


Figure 1-1: PMZ Corridor

The corridor considered (referred to as the corridor) lies between the ports of Rotterdam and Antwerp. All main roads between those two cities are part of the corridor:

- A4 between Rotterdam and Belgian border
- A15 between Maasvlakte and Dordrecht
- A16 between Rotterdam Maas and Belgian border
- A17
- A29
- A58 between Breda and border of Zeeland province
- A59 between A16 and A4.

Since the ultimate goal is to favour free-flow traffic in the corridor, all alternatives that are considered in this report include motorway stretches forming part of the PMZ corridor.

The A4 South is part of the corridor (in Figure 1-1 shown as a dashed line near Oud Beijerland), and is a link in the new main route between Amsterdam and Antwerp. It is part of the geographical scope of the Basic Variant. The A4 South can be considered as a critical stretch of road in the PMZ corridor, considering the high capital expenditures associated with its construction. Construction of the A4 South is included in all three project alternatives that are described in this report.

We choose to focus on the realization of the A4 South according to PMZ Board's first solution direction 'A' of the quick scan (see Verkeerskundige analyze PMZ). Here, the new A4 South connects with the ring south of Rotterdam at Benelux interchange and joins the A29 near Klaaswaal (see Figure 1-2).

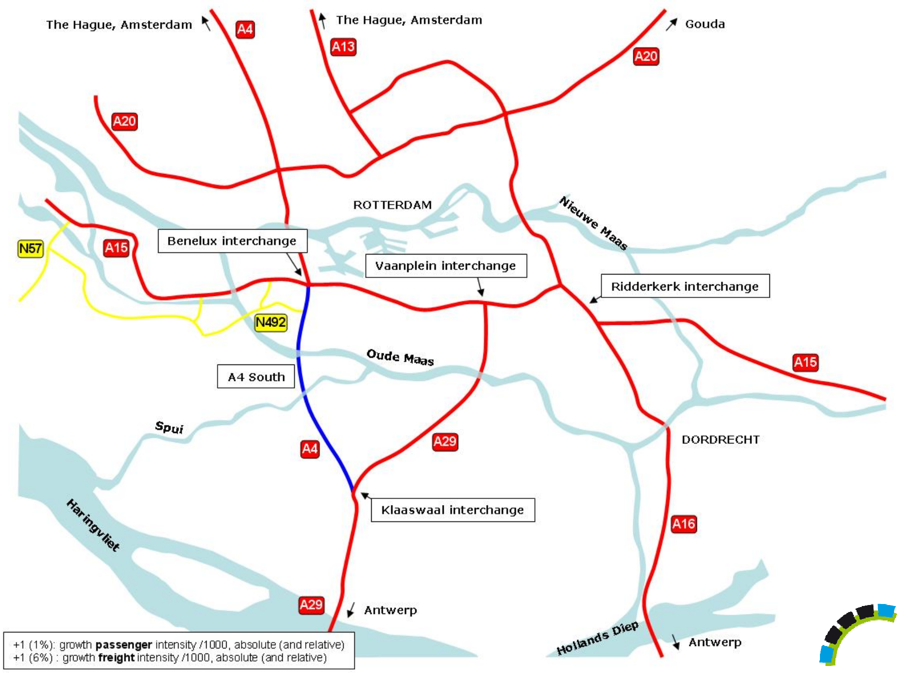


Figure 1-2 road configuration Rotterdam

The route lies in line with the A4 (ring west of Rotterdam), hence it can be part of a seamless connection between Amsterdam and Antwerp in case the stretch between Delft and Amsterdam is constructed.

Besides the A4 South, two other parts of the A4 have to be constructed: A4 Delft – Schiedam and A4 Dinteloord – Bergen op Zoom. The latter is under construction now.

The new main route from Amsterdam to Antwerp is considered economically important: the shortest route between those two cities nowadays goes through Utrecht and Breda, and suffers from heavy congestion in peak hours. Next to that, the route makes the network in the western Randstad more robust. It provides fall back options for road users between Amsterdam and Rotterdam, The Hague and Rotterdam and Rotterdam and Antwerp.

The numerous waterways in the South-western Randstad and Zeeland, the Rhine and Meuse Delta, make construction of new infrastructures complex and expensive. Most waterways in the corridor are used by tall seaworthy ships, making them difficult to cross by bridge. In most cases, important highways cross waterways via tunnels: there are 5 highway tunnels in the corridor (Botlektunnel, Beneluxtunnel, Drechttunnel, Noordtunnel and Heinenoordtunnel), whereas the bridge option was chosen in three occasions (Van Brienenoordbrug, Haringvlietbrug and Moerdijkbrug). Except for the Moerdijkbrug, these bridges are able to be opened to allow the crossing of ships.

1.2 *Traffic and Revenue*

The PMZ Board performed a traffic analysis (PMZ traffic analysis) to offer the different consortia an overview of the current traffic situation in the corridor as well as an unambiguous view on anticipated future traffic developments in 2020. With this elaborate analysis and a quick scan of some solutions for the A4 South, PMZ Board aimed at satisfying the common need of insights into:

- (potential) traffic flows in the corridor;
- the traffic situation and bottlenecks in 2020.

Prior to the identification of possible alternatives we first take a closer look at the relevant aspects of the PMZ traffic analysis. The reaction of both passenger and freight traffic on toll is therefore of our special interest, because revenues generated by a stretch of road are directly related to the amount of traffic that chooses to use the road.

In this section a brief overview is given of the relevant scenarios of the PMZ traffic analysis. In the next paragraphs, the changes in intensities are presented between different scenarios and striking aspects are discussed.

The shifts of traffic flows on the roads are estimated in the PMZ traffic analysis using the following 4 sets of assumptions:

- doing nothing (see paragraph 1.2.1);
- constructing the A4 South, no tolling (see paragraph 1.2.1);
- tolling the A4 South (see paragraph 1.2.1 and 1.2.1);
- tolling main motorway sections in the corridor (see paragraph 1.2.3)

1.2.1 A4 South without toll vs. no A4 South

According the PMZ traffic analysis, constructing the A4 South will attract around 20,000 heavy good vehicles (HGV) and 64,000 light vehicles (LV) daily to the northern part, and respectively 48,000 LV and 20,000 HGV to the southern part of the A4 South, as shown in this figure.

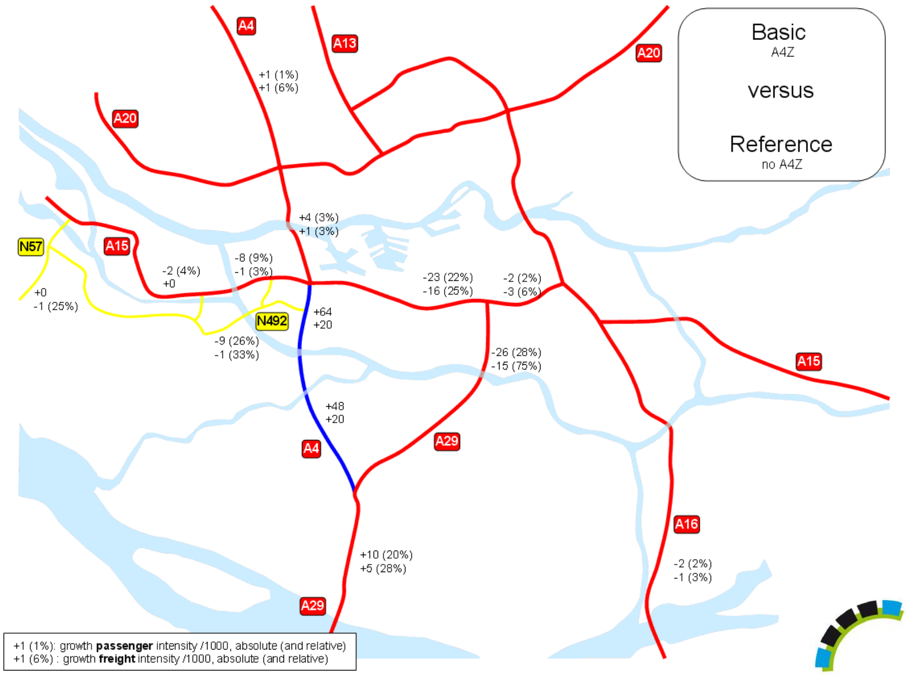


Figure 1-3 Resulting intensities basic versus reference alternative

The road has a through going function for 95% of the HGVs and 65% of the LVs.

Most traffic is attracted from the north of the A29, where a decrease of 37% (sum passenger and freight) is anticipated. However, the intensities south of the connection with the A4 near Klaaswaal increase by 22%.

The PMZ traffic analysis therefore anticipates that location and magnitude of bottlenecks are changed by the A4 South. It is worth noting in particular the conclusion that congestion chances reduce at the northern part of the A29, but increase at the southern part between Klaaswaal and Hellegatsplein.

To conclude, the A4 South appears not to be an alternative for the A16, since A16 traffic is only affected by 2% of passenger traffic and 1% of freight traffic as A4 South is open to traffic.

1.2.2 Toll on A4 South vs. A4 South without toll

If a toll is raised at a level of € 1.00 for passenger, and € 3.00 for freight traffic (respectively € 0.09 /km and € 0.27 /km) in accordance with 'Anders Betalen voor Mobiliteit' (ABvM), some remarkable traffic flow changes are predicted by the PMZ traffic study (see Figure 1-4).
Depending on destinations, part of the traffic is predicted to divert to other route alternatives like the A15/A29, A16, and N57. Short distance trips of local traffic are predicted to be most likely performed on the underlying road network, no longer on motorways. However, the observed flow reductions due to raising toll, as anticipated by the PMZ traffic forecast, appear to be surprisingly large.

First STEP believes that it is worth undertaking a rough cost check to compare the costs incurred by through going vehicles using the A4 South, on one side, and A15/A29 on the other side. Variable costs are determined based on the route lengths and costs per kilometre (toll and other distance related costs). Time related costs can be derived by means of vehicle speeds, route length and value of time. Together they give a rough estimate of total costs incurred by vehicles, both on the A4 South and the parallel route A15/A29.

It is questionable whether 45% of the heavy good vehicles, mostly through going traffic, are really willing to choose the longer route alternative A15/A29. Based on values of time and variable costs per kilometre, we believe that this is not likely, since trips using the A4 South (including € 3.00 toll) would approximately cost € 14, and detours over the A15/A29 about € 22. Moreover, freight traffic is hardly affected by the negative perception of paying toll, since most drivers do not pay the toll themselves.

According to the PMZ traffic study, passenger cars also appear to easily choose another route, as 28% avoid the A4 South in case a modest toll of € 1.00 is raised. This is also surprisingly large amount given the fact that based on the values of time and costs per kilometre, the A4 South route costs about € 4 (incl. € 1.00 toll) and the A15/A29 about € 7. The perception of paying more for a tolled route plays a larger role here then with freight traffic.

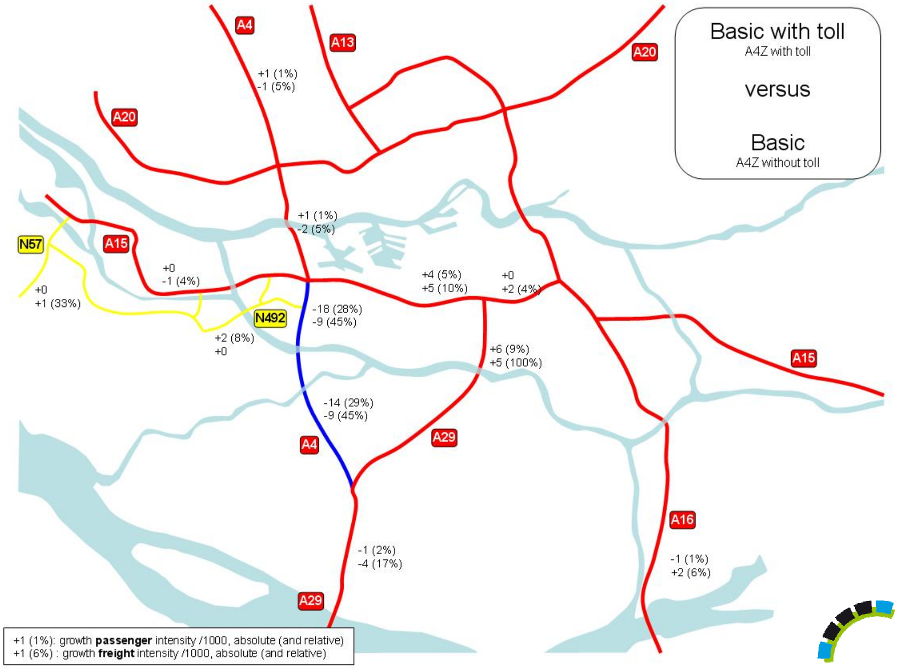


Figure 1-4: Resulting intensities toll on A4 South versus basic alternative

1.2.3 Toll on A4 South and alternative routes vs. Toll on A4 South

If additional tolls for freight traffic are raised on all parallel routes (A16 € 9.00, A29 € 3.00, N57 € 14.00), a large freight share shifts to the A4 South (16,000 vehicles per day), as shown in Figure 1-5. However, a significant part of freight traffic seems to disappear: all parallel routes lose vehicles, but only a part is found back at the A4 South. In total over 27,000 vehicles will make use of the A4 South daily, 7,000 more than in the situation in which no toll is raised. The share of freight trucks will be approximately 50% of the total traffic flow.

Moreover, according to the model, passenger traffic starts avoiding the A4 South because of the large amount of through going freight vehicles. They mostly divert to the A16, which is understandable because only little freight traffic remains there.

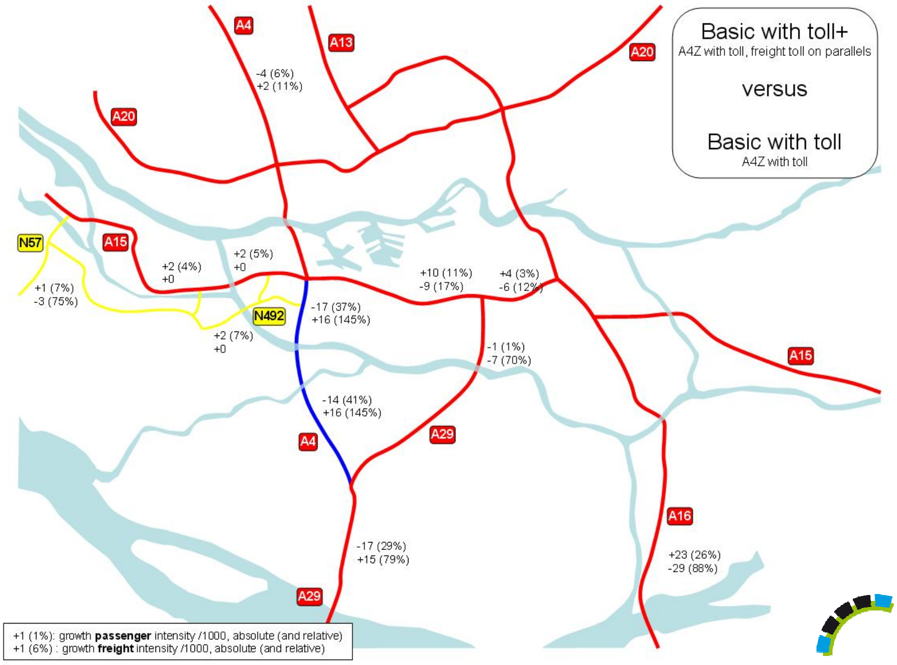


Figure 1-5: resulting intensities toll on A4 South and alternative routes versus toll on A4 South only

1.2.4 Information needed for a tolling business case

The PMZ traffic analysis definitely provides an elaborate overview of the current and future traffic situation in the corridor, and fits to its purpose very well. In the economic evaluation of a road scheme, it is vital that an accurate estimate of travel on the road is produced. When a new road is built the estimation of traffic is not a simple matter because of the complexities of interaction between different parts of the network.

When tolling is to be considered on part of the network to create a feasible business case, forecasting is even more complex and it has not often been successfully achieved.

It is important to understand however that the forecasts are required in order to:

- estimate an economic benefits from the road;
- estimate the net revenue maximizing toll (i.e., net of costs of revenue collection).

We believe that it would be worthwhile updating, completing or refining the traffic forecast in relation to the following aspects:

Toll Revenues

The given local intensities are, for instance, not sufficient to make an accurate prediction of toll revenues. Instead of local intensities, traffic performance on a link could have given an unambiguous estimate, because then the problem of possible double counting is prevented.

For an extensive evaluation of tolling revenues, a precise description of traffic flow intensities is very important. Besides, a good description of flows between origins and destinations that make use of roads in the corridor is mandatory. However, such precise definition of traffic flows is not given in the PMZ traffic analyses. Therefore, we decided to make additional analyses based on the available data, accepting its limitations.

Road User Segmentation

Tolling policies need to be adapted to the type of user (e.g. commuters, other frequent users, occasional users, commercial vehicles). Additional information in this respect would also assist in establishing more accurate revenue forecasts.

Horizon of Traffic

The time horizon in this project is set to 2020, which is only 13 years from now and very soon after opening the A4 South to traffic. Generally for this type of projects, predictions over 30 years are common to get better insights into possible future developments and in this case the feasibility of the base case.

Elasticity with Toll

The tolling rates on both the A4 South and parallel routes are estimated by making use of the traffic forecast model. In other words, the rate is determined at which modelled vehicles choose alternative routes. As the PMZ Board has indicated, the PMZ traffic analysis predicts strong reactions on relatively modest toll fees, therefore these values will be recalculated. Finally, only one toll level for heavy good vehicles and passenger cars is initially analyzed by the PMZ Board. To get better insight into how traffic reacts on different toll rates (toll elasticity), additional analyses are needed. Another option is to come up with alternative estimates by developing a quick scan model for toll rates.

Base Data

Results which are presented are derived from countings and raw data which were gathered in 2002 for most of them. Since there can be significant evolutions from one year to the other, the use of updated countings figures is advisable.

1.3 Design and Construction

Design and construction aspects of the A4 South are critical in the evaluation of any project alternative. These aspects are discussed below with the aim of identifying a preferred option which can be seen as an optimized solution of the A4 South design and construction from a whole-of-life perspective, based on a qualitative multi-criteria analysis. An analysis of the design of the Basic Variant is performed automatically.

1.3.1 General

The construction costs associated with the A4 South are an essential part of the business case. The input given by the RWS organisation can be summarized as follows:

	Length (km)	Unit Costs	Total Costs
Capital expenditures (capex)	11	€ 118,000,000	€ 1,300,000,000
Operational Expenditures (opex) 1 (road)	9	€ 300,000 / km / year	€ 2,700,000 /year
Opex 2 (tunnel)	2	€ 800,000 / tunnel / year	€ 1,600,000 / year

These numbers are to be used in the reference calculations for the business case. This is the starting point of the calculations.

First STEP believes the capex and opex values can be challenged and costs can be reduced by making innovative decisions in designing, building and maintaining the infrastructure. The most important aspect in reducing these costs is freedom of design, because small changes in design can lead to a significant cost reduction. The involvement of private companies in the design is important in an early phase.

When there is room to make (changes to) the design, this leads to reductions in the capex and opex. A very simple example can be given for a river crossing. If a route is designed to cross a river, the angle between the route and the river influences the tunnel's length and therefore the costs (see Figure 1-6).

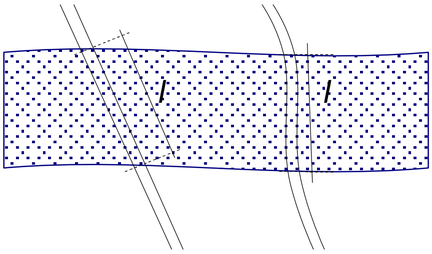


Figure 1-6: freedom of design leads to optimization

In general a few constraints can be named such as regulations (noise, health and safety) or possible interaction with existing structures, communities or ecosystems. The constraints that are inventoried need to be taken into account to make appropriate design, construction, operation and maintenance decisions. Not acknowledging these constraints can lead to higher costs, a longer construction period, and issues during operation and maintenance phase.

The second overall topic is land ownership. In many infrastructural projects the expropriation of current owners is a time consuming process. Here however, the government owns the largest parts of the necessary land. This reduces the risks of delay, and is expected to make the procurement process less complex.

Design decisions in this project are made to make the project financially viable. This means that decisions regarding capex, risk mitigation, operation and maintenance costs need to be taken with a life cycle approach. The option that is the most viable over a certain period is chosen.

1.3.2 Construction Options

Route Description

Between Beneluxplein and Klaaswaal the A4 is incomplete. An 11 kilometre stretch which has to cross two waterways is missing as is shown in Figure 1-7 below.

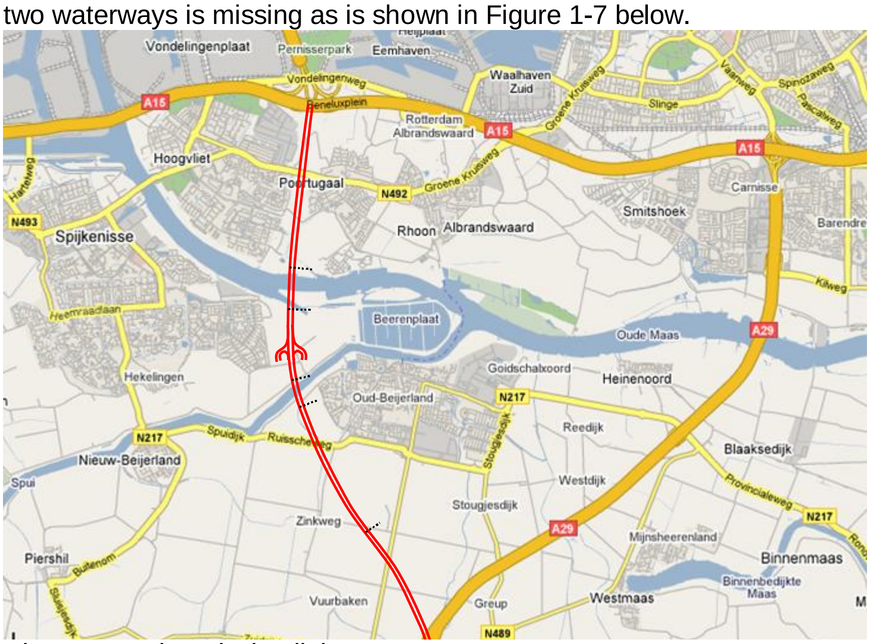


Figure 1-7: The missing link

The route will be divided in the following parts from North to South:

	Name	From	To
Part 1	Hoogvliet	Junction Benelux	North Oude Maas
Part 2	Oude Maas	North Oude Maas	South Oude Maas
Part 3	Spijkenisse	South Oude Maas	North Spui
Part 4	Spui	North Spui	South Spui
Part 5	Oud Beijerland	South Spui	South Oud Beijerland
Part 6	Klaaswaal	South Oud Beijerland	Junction Klaaswaal

Constraints associated with each stretch are described below.

Part 1

A connection has to be realized between the A4 South and the A15 at the Beneluxplein. There is room for a connection, but the existing junction needs to be restyled to connect to the A4 South. 4 fly overs are to be created with a significant height, which makes it a challenging assignment.

Because the existing roads on the A15 are used intensively, good engineering and smart phasing is essential to reduce possible loss of value for the (urban) environment and the users of the existing infrastructure. Although it costs a lot of time and money to handle this traffic in a good order and the societal benefits of a good handling are very valuable, it does not generate income.

The route between Hoogvliet and Poortugaal runs through an urban area, which affects the way the infrastructure can be designed and realised. Noise, safety, urban fit and pollution are relevant topics for this route.

Measures have to be taken to reduce this environmental impact. Noise screens or complete roofing can be realistic options to minimise the downsides of the new highway through a populated area. An overpass of the Groene Kruisweg has to be realised, as well as an overpass of the Aveling/Slaperskade.

These are two intersections that are difficult to create, because of the slopes needed to make the roads cross. No exits are to be created, but the Groene Kruisweg is a crucial road in the secondary network that should not be obstructed with the A4 South construction.

The cooperation between the local habitants and the construction company has to be good and constructive, in order not to provoke actions or petitions which can lead to delay.

Part 2

The Oude Maas is a main transportation route for ships and therefore part of the non stop route between Rotterdam and Germany, which makes it a relatively busy waterway. The Oude Maas is also part of the route for dangerous substances (Rotterdam-Germany).

In the Dutch vision on recreational navigation the ‘Oude Maas’ is given the status of ‘connecting water’ for ships with masts as high as 30m.

The required sail through height is 30m. The maximum sail trough height is +45m NAP for vertical lift bridges. The riversides are part of Natura 2000, and should be respected accordingly.

Part 3

Near Spijkenisse an exit and access route are to be created in so-called “half klaverblad” implementation. This is essential because of the problems Spijkenisse has regarding traffic entering and exiting the island, local politicians have been striving for a new bridge or tunnel on their island for a long time. Because of the need for an exit and access route the people of Spijkenisse will welcome the A4 South.

On Voorne Putten, of which Spijkenisse is part, live around 74.000 inhabitants and the traffic flow these people are expected to generate is significant for the business case.

Part 4

The Spui is not a main waterway, but the required sail through height of the solid part of the bridge is 9,1m. For the moveable part a height of +28m NAP has to be preserved. Like the Oude Maas the riversides are part of Natura 2000, and should be respected accordingly.

Part 5

The A4 South of the Spui runs through the island of Hoeksche Waard, which is part of the National ecological network and the river banks are part of Natura 2000. Because of this the fit in the environment is crucial in this section.

The projection of the A4 South is through a relative green field. Because the government has got the most important land positions, the construction can start quickly after the design is finished.

Good and constructive cooperation with the local authorities and environmental organisations is essential to fit the route in the green surroundings.

Part 6

The connection with the A29 is realized near Klaaswaal. Because the A29 is an existing highway that is being used, connecting to the A4 South has to be phased in such a manner, that the inconvenience can be minimized. The interchange is prepared, though, as can be seen on aerial photographs.

Linking route to solution

For every part of the route a different option can fit best. To choose a specific construction option to the different parts of the route, some criteria have been formulated. These criteria are:

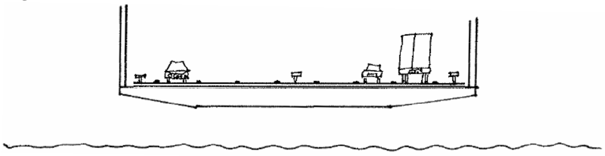
Optimized life cycle costs	Not only construction costs matter. Costs of maintenance and operations are to be considered when choosing a construction option. It is important to also calculate the societal costs of the maintenance because of delay, inconvenience and damage to the environment.
Fit with local environment	A highway through a crowded urban area is different than one that leads through nature. Therefore the fit with local environment is an important factor.
Fit with local politics	A difficult topic in realizing infrastructure is the political will to support a project, and the opinion of the local inhabitants. No proper fit in this regard can lead to major delays, and cost overruns. Local politics and inhabitants should be respected.
Short time of construction	Shorter construction time leads to earlier completion and lower time based construction costs. Toll revenues can be expected earlier. Disturbance time is limited as well
No obstruction to other traffic	The A4 South interferes with the main transport routes A15, A 29, and Oude Maas which are used intensively. Some construction options can be engineered or phased in a smart way to reduce possible loss of value for the (urban) environment and the users of the existing infrastructure.

The score of a construction option has been ranked from a very positive effect to a very negative effect. This is to compare the different options on the different criteria. Because the criteria are approximate and are not equally important, the ranking only gives a rough indication.

The construction types that have been considered are stated in the table hereunder. For every construction type, advantages and disadvantages are given below:

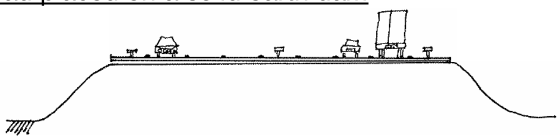
Above ground level

Bridge



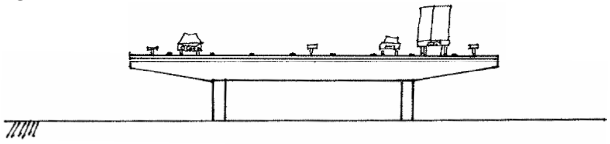
Advantages	Less expensive than a tunnel in building and maintenance Building time is shorter Little obstruction for ships during construction Landmark
Drawbacks	Limited height for ships Traffic crossing the bridge is influenced because of side wind Opening obstructs traffic flow (in case of bridge with moveable part)

Road placed on a solid earth dam



Advantages	Possibility for roads to cross on ground level Particulate matter air pollution is reduced a little Connection to a bridge relatively easy
Drawbacks	Large volume of earth moving Large ground area requirement Noise pollution is worsened Visual barrier in environment

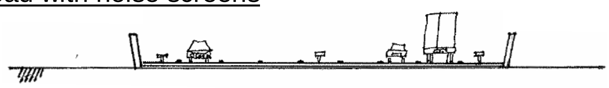
Long viaduct



Advantages	Possibility for roads to cross on ground level Particulate matter air pollution is reduced Ground level can be used for other purposes Connects to a bridge easily
Drawbacks	More expensive than a road placed on a solid earth dam Very noticeable

Ground Level

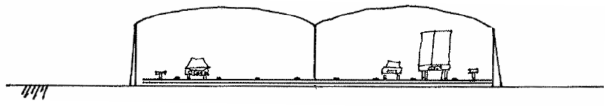
Road with noise screens



Advantages
- Cheapest solution
- Little earth to be moved
- Building time is short
- Exits and entrances are easy to realize
- Noise pollution is reduced significantly

Drawbacks
- Visual barrier in environment
- Crossing roads only with tunnel or viaduct
- No solution for particulate matter air pollution

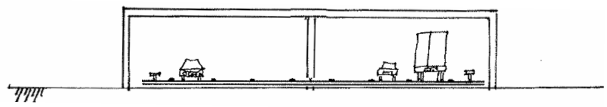
Road with light roofing



Advantages
- Cheaper than a real tunnel
- Noise pollution is contained
- Particulate matter air pollution is contained

Drawbacks
- Under development. No proven technology
- Visual barrier in environment
- Crossing roads only with tunnel or viaduct

Land tunnel



Advantages
- Cheaper than a tunnel under ground water level
- Noise pollution is contained
- Particulate matter air pollution is contained
- Crossing roads can run over the roof
- Grounds on top of roof can be used (park, playing fields etc.)

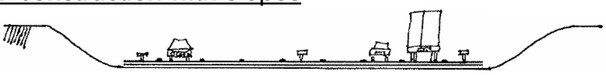
Drawbacks
- Visual barrier in environment
- Large ground area requirement
- Extra attention necessary in case of emergency (accidents, fire, explosion)

Partially immerged, partially below ground water level

Polder construction

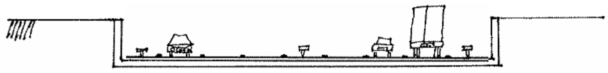
Advantages	No need for a concrete construction ⇒ less expensive Open structure ⇒ safer for traffic Noise pollution is reduced Less noticeable in the environment Crossings can be realized with half height
Drawbacks	Water stopping soil has to be present Water stopping walls have to be realized (retaining wall) Continuous water pumping Large ground area requirement No solution for particulate matter air pollution

Foil construction with slopes



Advantages	No need for water stopping walls The same advantages as polder construction
Drawbacks	Vulnerable, especially during construction Large volume of earth moving Need for construction site and water stopping soil to place the foil in dry surrounding Continuous water pumping Foundation for crossings difficult Need for large (construction) site No solution for particulate matter air pollution

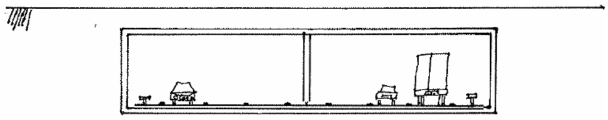
Concrete U-channel



Advantages	Durable waterproof construction Crossing viaducts can be founded easily on the concrete U-channel Can be roofed completely when necessary
Drawbacks	Expensive because of the use of concrete Perhaps need for foundation on poles Need for construction site and water stopping soil or underwater concrete

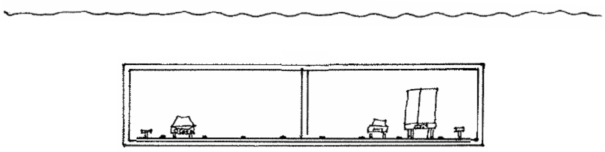
Under ground water level

Cut & cover-tunnel



Advantages	Durable waterproof construction ‘Invisible’ for the surrounding Particulate matter air pollution is solved Crossing roads can run over the roof
Drawbacks	Expensive solution Longer than bridge (with exits) Extra attention necessary in case of emergency (accidents, fire, explosion) Lot of obstruction for passing ships (when realized under a river)

Immerged tunnel



Advantage	Little obstruction for passing ships during construction The same advantages as cut & cover tunnel
Disadvantage	Need for a dock to build the tunnel parts The same disadvantages as cut & cover tunnel

Drilled tunnel

Thought	Direct connection from Benelux to Klaaswaal for ongoing A4 traffic. This option does not fit the scope because Spijkenisse needs an exit, this is hard to realize. The costs of a drilled tunnel are expected to be significantly higher than a ‘conventional’ option. This is mainly because of the technical expertise and machinery needed.

+ + very positive effect	+ positive effect;	0 neutral	- negative effect	- - very negative effect

Part 1 Hoogvliet	Above ground level			Ground Level			Partially immerged, partially below ground water level			Under ground water level		
	Bridge	Road placed on a solid earth dam	Long viaduct	Road with noise screens	Road with light roofing	Land tunnel	Polder construction	Foil construction with slopes	Concrete U-channel	Cut & cover-tunnel	Immer-ged tunnel	Drilled tunnel
Low life cycle costs	No option; there is no water to cross.	0	-	+ +	-	-	0	No option; there is no room to build this construction	-	- -	No option; there is no existing water to sink the tunnel in	No option; costs are expected to be significantly higher than a conventional tunnel
Fit with local environment		- -	- -	0	+	+	0		0	+		
Fit with local politics		- -	- -	0	0	+	+		+	-		
Short time of construction		0	0	+	0	0	0		0	-		
No obstruction to other traffic		+	+	-	-	-	0		0	+		

Part 2 Oude Maas	Above ground level			Ground Level			Partially immerged, partially below ground water level			Under ground water level		
	Bridge	Road placed on a solid earth dam	Long viaduct	Road with noise screens	Road with light roofing	Land tunnel	Polder construction	Foil construction with slopes	Concrete U-channel	Cut & cover-tunnel	Immer-ged tunnel	Drilled tunnel
Low life cycle costs	No option; too much height needed.	No option; a river to cross	No option; span is limited	No option; a river to cross	No option; a river to cross	No option; a river to cross	No option; a river to cross	No option; a river to cross	No option; a river to cross	- -	- -	No option; costs are expected to be significantly higher than a conventional tunnel
Fit with local environment										0	+	
Fit with local politics										0	0	
Short time of construction										-	-	
No obstruction to other traffic										- -	+	

Part 3 Spijkenisse	Above ground level			Ground Level			Partially immerged, partially below ground water level			Under ground water level		
	Bridge	Road placed on a solid earth dam	Long viaduct	Road with noise screens	Road with light roofing	Land tunnel	Polder construction	Foil construction with slopes	Concrete U-channel	Cut & cover-tunnel	Immer-ged tunnel	Drilled tunnel
Low life cycle costs	No option; there is no water to cross	No option; to high coming from tunnel	No option; to high coming from tunnel	+ +	-	No option	0	0	-	- -	No option; there is no existing water to sink the tunnel in	No option; costs are expected to be significantly higher than a conventional tunnel
Fit with local environment				0	+		0	0	0	+		
Fit with local politics				+	+		+	+	+	0		
Short time of construction				0	-		0	0	0	-		
No obstruction to other traffic				0	0		0	0	0	+		

Part 4 Spui	Above ground level			Ground Level			Partially immerged, partially below ground water level			Under ground water level		
	Bridge	Road placed on a solid earth dam	Long viaduct	Road with noise screens	Road with light roofing	Land tunnel	Polder construction	Foil construction with slopes	Concrete U-channel	Cut & cover-tunnel	Immer-ged tunnel	Drilled tunnel
Low life cycle costs	-	No option; a river to cross	No option; span is limited	No option; a river to cross	No option; a river to cross	No option; a river to cross	No option; a river to cross	No option; a river to cross	No option; a river to cross	- -	- -	No option; costs are expected to be significantly higher than a conventional tunnel
Fit with local environment	0									+	+ +	
Fit with local politics	-									+	+	
Short time of construction	+									-	-	
No obstruction to other traffic	++									- -	0	

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Part 5 Oud Beijerland	Above ground level			Ground Level			Partially immerged, partially below ground water level			Under ground water level		
	Bridge	Road placed on a solid earth dam	Long viaduct	Road with noise screens	Road with light roofing	Land tunnel	Polder construction	Foil construction with slopes	Concrete U-channel	Cut & cover-tunnel	Immer-ged tunnel	Drilled tunnel
Low life cycle costs	No option; there is no water to cross	0	-	+ +	-	-	0	0	-	- -	No option; there is no existing water to sink the tunnel in	No option; costs are expected to be significantly higher than a conventional tunnel
Fit with local environment		- -	- -	-	-	0	+	-	+	+		
Fit with local politics		- -	- -	-	-	0	+	-	+	+		
Short time of construction		0	0	+	0	0	0	0	0	-		
No obstruction to other traffic		+	+	0	0	0	+	+	+	+		

1.3.3 Proposed Solution

Based on the qualitative analysis above, a proposed solution can be derived which reflects a first level of optimization.

Construction

From the matrices can be concluded that a road on ground level with noise screens is the best option for part 1. There is no need for any tunnel, or a partially immerged solution. The above ground level solutions are expensive and do not fit in the urban environment.

For the crossing Oude Maas a tunnel is the only realistic option, because of the fact that tall ships have to be able to navigate through the Oude Maas. A high solid bridge (about 45 meters) is no realistic option because of the costs involved and the insufficient space on ground kevel to realize the necessary slopes. A bridge that can be opened is not acceptable because of the impact on the traffic flow and the negative influence on reliable travel times on the A4 South.
This tunnel can be drilled, immerged or cut & covered. This particular situation needs an immerged tunnel as can be concluded from the matrix. The tunnel length, and limited construction site size makes the crossing ideal for an immerged tunnel. A drilled tunnel is no option, considering the tunnel length (short), and the possible construction site size. The impact a cut & covered tunnel has on the ships sailing the Oude Maas, and the impact this has on the river sides makes a cut & cover tunnel not a valid option.

In order to realise the exit and access route, and to connect to the tunnel under the Oude Maas the solution for Spijkenisse is preferably a road on ground level with noise screens. There has to be an overpass to the eastern side of the A4 as well.

When crossing the river Spui a bridge and a tunnel are both viable options. Although the height of a bridge is limited, it does not have to be higher than 9.1 meters, a bridge can not be constructed easily. This is because the crossing has a length of around 200 meters. When a bridge is realised noise pollution will be a problem because of the closeness of the traffic on the slopes to Oud Beijerland.
A tunnel is an option as well, but is expected to be more expensive (capex and opex). A standard tunnel option rules out the dangerous freight option, measures have to be taken to keep the dangerous freight route possible. However, connections are easier to realize; in the north coming from ground level as well as in the south where the route is partially immerged. Therefore a tunnel is chosen.

The solution developed by RWS describes a bridge for local traffic to be realized east of the A4 South, connecting to the Randweg. First STEP recommends this bridge is moved to the western side of the A4 and is connected to the Droge Dijk in the north, and the Ruisscheweg in the south. This is expected to improve the traffic flow in the city of Oud Beijerland, and simplifies the construction of the slopes needed for this bridge.

South of the Spui, the A4 is realised partially immerged over a length of 3800 meter to reduce environmental pollution and not to disrupt the calm and quit character of the Hoeksche Waard area.
This partially immerged solution can be realised with a foil-construction, a concrete U-channel or in a polder construction. The first option cannot be used in this situation because of the environmental impact and the amounts of ground needed to create and maintain the road.
It is not sure whether or not a polder construction can be realised in this area, therefore a concrete U-channel is chosen. If additional probing shows a polder construction is possible, this can lead to a 40mio optimisation.

The solution presented by the PMZ Board is the same as First STEP advices for the A4 South. Therefore the route choice and design choice is supported.

Asphalt

For the asphalt it is important to choose safe, durable and silent asphalt. We intent to use the type of asphalt that is considered best. For now this is ZOAB (very open asphalt concrete) and in the future it might be DGD (thin noise reducing top layer). This is a type of asphalt that is researched now, and can lower capex with € 20 million, and opex is expected to be lower as well. This is still being researched though, so we do not use this in our business case.
Because of the maintenance costs we do not use double layer ZOAB. DAB (closed asphalt concrete) is no option either because it is considered uncomfortable (spray, sound, etc).

1.3.4 Costs

In the following table the costs are stated for the structural works, and the asphalting. The costs for road and facilities include demolition, ground works, draining, asphalting, stripes, crash barriers, traffic signs, lighting, signalling, traffic management measures, preparation, design etc.
All costs are the direct costs, plus unforeseen costs, design and construction costs, profit, risk and general costs, insurances, management costs and procedural costs. All costs include 19% VAT.

Part 1 Hoogvliet	€ 210 million
Part 2 Oude Maas	€ 270 million
Part 3 Spijkenisse	€ 10 million
Part 4 Spui	€ 240 million
Part 5 Oud Beijerland	€ 190 million
Part 6 Klaaswaal	€ 10 million
Road and facilities	€ 120 million
Total incl. VAT	€ 1050 million

This assessment shows the costs can be reduced by 250 million relative to the Basic Variant. This cost reduction is based on different key numbers, because the design has not changed. The calculations have been done on a detailed level, but are presented more general here.

Costs for re-asphalting are approximately 12 /m2 (including all costs and VAT) and re-asphalting takes place every 12 years.

The budget for operation and maintenance is € 300,000 per kilometre per year for a road and € 800.000 per kilometre per year for a tunnel (both 2 x 3 lanes).

Detailed O&M cost analysis could be performed based on more detailed design assumptions and precise scope. First STEP decided not to challenge these numbers.

2 General aspects of the corridor

This chapter describes general aspects that are to be dealt with in this project. Environment, toll rates, traffic management, life cycle optimization and added value to society in general are discussed.

2.1 Environmental Management

A major limiting condition for development of infrastructure in the Netherlands is, apart from funding, environmental impact. Once a basic funding is secured and the project starts with the planning phase, environmental impact becomes a leading aspect. It is in that stage that stakeholders step in and get involved and their interests often lie in the quality of the environment. Such stakeholders are local and regional governments, groups of neighbouring citizens, environmental organizations and pressure groups, etc.

For PMZ, a range of stakeholders has already been invited to give their views. Delegates from the Hoeksche Waard, the southern stretch of the A4 South where no exits are planned, put it like this:
“The A4 South is OK with us as long as we don’t hear it, we don’t see it and we don’t smell it”

A possible approach is to not merely see the environment as a limiting force, but to see it as an aspect of the business that has to be managed: in the exploitation phase as well as in the planning phase. Stakeholders should gain trust that the environment will actively be monitored and appropriate actions are taken if necessary.

The issues addressed in this chapter are:

- Noise
- Air pollution (NOx, PM10)
- Landscape
- Safety
- Nature reserve / habitat

The impact of these issues on the environment of the A4 South is investigated. In the future planning stage, like the m.e.r., any A4 South variant will in our view demand the assessment of the impact on the whole corridor, including non-highway roads. As the addition of the A4Z is meant to have effect on traffic on the whole corridor, it will consequentially also have effects on the environment of the whole corridor. This broadening of the environmental scope has become a standard approach.

These issues are treated in the context of laws & regulations and their impact (2.1.12.1.22.1.4), political risks (1.3.2), opportunities (2.1.3) and controlling the environmental impact (2.1.4).

2.1.1 Laws & regulations and their impact

Noise

For noise, of primary importance is the Wet Geluidhinder (law on noise pollution), a national law. It sets a limit on the average sound level (“Lden”) on the façade of surrounding dwellings. That limit is 55 dB. If necessary, for new roads noise barriers and/or special road surfaces have to be implemented to ensure this. Sound levels, for existing and future roads, are calculated, not measured (although the law does permit that).

Of importance also is the EU guideline on environmental noise. It forces the government to map out the noise impact per dwelling. Right now, its application is limited to large cities / conurbations and infrastructure (like highways). The objective is to find problematic situations, instigate action plans and to inform the public. Noise impact should consider all sources: although different laws may apply for

industrial noise, highway noise and railway noise, the maps should present the summing total of these.
The range of influence of traffic noise around 2x3 highways is about 1000 meters, beyond that distance Lden will be lower than the limit. The application of quiet road surfaces will reduce that distance roughly by half. Obstacles such as noise barriers and a first line of buildings reduce the distance even much more.
Some thousand dwellings in west of Hoogvliet and east of Poortugaal will lie within the 1 km contour. Sound barriers are probably needed: 1 km on the east side and 2 km on the west side.
A couple of hundred dwellings in Spijkenisse en Oud-Beijerland will lie within the contour. Application of a quiet road surface might be enough to deal with this.

Air pollution

The EU has set a guideline on the amount of PM10 and NOx in the air. Any new development (whether it will involve housing or infrastructure) has to meet these guidelines. However, the way these amounts are determined is still in development. The introduction of the guideline a couple of years ago has put many Dutch projects, especially infrastructural projects, to a hold. It still is a major obstacle, as the recent ruling of the Raad van State (highest court for administrative law) on the broadening of a section of the A4 showed. Determination methods, dispersion models and scope of influence: nothing is fixed yet.
The range of influence of air pollution around highways is at most about 100 meters, given the current regulations.
Within the projected trajectory of the A4 South no urban areas lie within the 100 meter contour. In the Hoeksche Waard a couple of isolated farms might fall within that range.

Landscape

There are no hard regulations on the preservation of landscape. There exists, however, the 'protected townscape (beschermd dorps- of stadsgezicht), a label issued by the secretary of culture, forcing local government to implement environmental planning to ensure this protection. And there is the 'national landscape', a label issued by the Nota Ruimte (government's memorandum on environmental planning, 2005). This compels all levels of government to preserve a large (mostly rural) area. The Hoeksche Waard is such a national landscape, which should protect it against the development of large scale urban or industrial areas. There are no guidelines on how new infrastructure can be implemented in national landscapes: this must be judged in each individual case.
A key aspect of national landscape the Hoeksche Waard is its flatness, emptiness and openness. There are little obstacles blocking the view. That means that it is probably needed to make the A4 South nearly invisible from a certain distance (say: 1 km and further).
An option is to lower the highway by a couple of meters.
Another option is the build a surface highway without any superstructures, or only very low superstructures. Lighting, information panels and such would have to be implemented on ground level. The amount of road signs can be minimized given that there are no exits.

External safety

Of primary interest is the Nota Vervoer Gevaarlijke Stoffen (government memorandum on transport of hazardous goods, 2005). It introduces the Basisnet (basic network) for the transport of hazardous goods. There is going to be a Basisnet for water, rail and road. Basisnet has not been mapped out yet: proposals are expected in the fall 2007, for stakeholders such as local governments to reflect on.
Basisnet will make a distinction between three categories:

- routes with no restrictions for road use (and limitations on spatial development)
- routes with restrictions for both road use and spatial development
- routes with stronger restrictions on road use and no limitations on spatial development

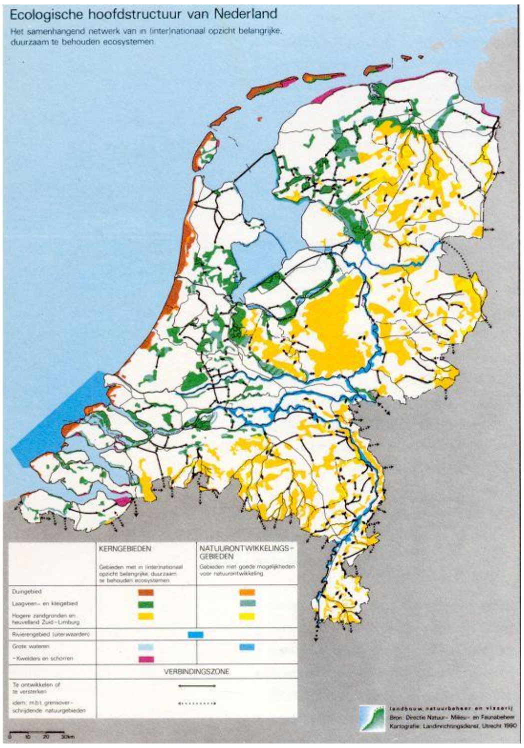
It is therefore unsure what the status of a future A4 South will be. However, the Nota makes a link to the Nota Ruimte (environmental planning) and the hierarchy of transport connections herein. This could imply that the A4 South, which is labelled by the Nota Ruimte as a missing link in a maincorridor, will probably be part of Basisnet, in the highest category.

For the two highest categories the Nota stipulates three zones: next to the road is a safety zone (in general 30 meters wide). Beyond the safety zone the risks should be assessed and limited. 200 meters away from the road this is no longer needed.

Internal safety and external safety: Dordrecht

In general no explosive goods are allowed in water crossing tunnels. This limits the use of such tunnels (which are labelled category 1). Category 0 tunnels, which allow any cargo, are only found among land tunnels. The tunnel under the river Roer, in the A73, is the first exception to this rule. It proves that with appropriate technical measures also water crossing tunnels can get upgraded to category 0. This is of interest for the city of Dordrecht.
Part of the Mainportcorridor Zuid is the network through Dordrecht: A16, A15 and N3. As both southbound highways in the corridor (A29 and A16) contain a category 1 tunnel, explosive goods are forced to bypass them via the N3, right through a very urban environment. It would therefore greatly enhance the external safety of the corridor if it would be enriched with a category 0 tunnel. This could be the new A4 South tunnel or a refurbishment of the A29 tunnel (Heinenoordtunnel) if possible.

Nature Reserve / Habitat



The Birds Directive and Habitat Directive of the EU lists 187 species of birds, 200 other animals and 500 species of plants that need special protection. The directives also oblige national governments to allocate Special Protection Areas (SPA). The directives have become part of the national laws on nature reserve (Natuurbeschermingswet) and on flora and fauna (Flora- en faunawet). The government has assigned SPA's, which formed the basis of the national Ecologische Hoofdstructuur (national ecological network).
In the vicinity of the A4 South, there are two SPA's: the Haringvliet (south of the trajectory) and the Oude Maas. The Haringvliet is probably too far away to be influenced directly by the A4 South. Indirect influence is traffic growth on the Haringvliet Bridge. More important is the Oude Maas, which the A4 South crosses. A tunnel crossing will probably take away most of any influence on this habitat, but the need to assess the influence of the tunnel openings remains.
The Ecologische Hoofdstructuur also includes a connection zone between the mentioned areas. This zone is the channel Het Spui. Connection zones have a lower status than an SPA, and are designated to be developed or enhanced. It might imply that the crossing of the A4 South should not impede such developments. A tunnel crossing will mostly certainly be sufficient, and a bridge crossing should avoid any structures right on the banks.

2.1.2 Political risks

Current noise regulations are the result of decades of development in that area. Though the development has not stopped, and traditionally national policy making tends to make way to European and local policies, there seem to be no risks in the foreseeable future like stricter limits or agitated citizens.
However, given the relatively quiet backyards of Hoogvliet, Poortugaal and Oud-Beijerland the A4 South will be passing, it is possible that local action groups demand stricter standards than the law offers, an perhaps rejecting noise barriers because of the view.

Another aspect is the general dismissal of noise barriers, which might lead to the requirement that a highway is built below ground level.

At this stage it is hard to predict how air pollution will be treated in the 2010's. Laws and jurisprudence are still in development. The background level of PM10 en NOx in the Netherlands is high. It is possible that the A4 South will be judged on its impact on a larger zone than only the 100 meter contour. As there are hardly any mitigating measures, this issue might be hard to control.

The Hoeksche Waard is a preserved landscape. From the lawmaker's point of view that should not block any development of the area. Pressure groups, and local governments in their wake, might think differently. The main risk is not cancellation but delays because of juridical procedures.

The Habitat guideline might cause planning delays. The Oude Maas and Spui should be treated thoroughly. Again pressure groups might object. An aspect that is harder to predict and control is whether one or more of the protected species is found somewhere along the trajectory.

2.1.3 Opportunities

The addition of the A4 South to the corridor will also provide environmental opportunities. In the planning phase this should be an important aspect.
The main feature of the A4 South is that the 11 km itself mostly stays clear of existing urban areas. It also unlocks the rest of the A4 which mainly goes through rural areas. In other words: the A4 South will take away traffic and its adverse environmental impact from the 'urban' A16 to the 'rural' A4. Overall the number of citizens suffering from noise and air pollution will be reduced (given a fair comparison between corridor variants).
An important opportunity to grasp is to improve the safety of Dordrecht by creating a category 0 tunnel (either as part of the A4 South or as part of the A29).

2.1.4 Controlling the environmental impact

A very special opportunity is to develop a Environmental Contract with certain stakeholders (such as local governments) to actively control the environmental impact. That means that the PPP goes beyond what is strictly required by law, does not limit itself to preliminary predictions and the implementation of technical measures, but monitors the impact during the exploitation phase and takes action when needed. This has several advantages:

- it reduces the costs for technical measures as the predictions in the planning phase can be less conservative, for example on future developments in car technology
- it shows commitment to the issue and builds trust among the stakeholders, which should lead to less delays and less cost increase in the planning phase
- it leads to a more cost-effective control of the environment

For this to be successful, the control should be transparent from the start: no false expectations should be raised, the limits should be realistic from the PPP's point of view, and monitoring results should be readily available to the public, foreseen actions should be realistic.
Lessons can be learned from the Schiphol case, where the noise pollution is a big problem. Innovative points of view to the regulations have been developed here. Similar is also the way industrial noise is regulated in the Netherlands: which can be called relatively successful.

The main part of the contract concerns the limits that are set on a contour all along all affected highways on noise & air pollution and the passage of hazardous goods. Continuous measurements on numerous points along the contour will monitor the levels. It is also possible to connect the environmental utilisation space to the maximum allowed amount of vehicles. Measured or calculated levels are published, for example on internet.
If limits are exceeded actions are taken such as the lowering of the speed limit, the change of tolling along the corridor, or the activation of acute (technical) measures (too costly for continuous use) alongside the road. These actions are published also.

For air pollution, present levels are important. Acute transgressions should lead to acute actions.
For noise, the legal timescale of assessment is one year, averaging out weather changes, season effects, etc. The contract might very well provide for more ambitious timescales, on the basis of months, weeks, days, or even hours.
For safety, an appropriate timescale should be agreed upon.

2.2 Toll rate levels variations

This paragraph presents background information about toll rates levels and toll rates variations. It also analyses the toll issues regarding this specific project.

2.2.1 Tolling goals

Different types of objectives can be followed in raising tolls on a road infrastructure. They include:

- covering construction or rehabilitation costs which requires a long period of tolling if it is possible at all (depending on financial structure, the construction costs, and the amount of traffic);
- covering maintenance and operations costs which requires continued tolling;
- ensuring that road users directly support the full cost of their travel by including all external impacts of the travel in the toll rate; this also requires continued tolling;
- creating a stream of revenues which can be used to develop the road network and which are not under control of the annual Government funding process. This requires tolling to continue until the required network is complete and requires the earlier roads to generate surplus revenues for investment in new ones;
- using the toll as a tool to manage traffic (influence on traffic demand), in order to achieve traffic fluidity.

The objectives that are followed for a given road network will affect both the level of toll and the period of tolling. Where tolls are simply required to cover construction costs, and if traffic levels are high, then tolls may only be required for a relatively short period. The Japanese Government has made 61 roads toll free following recovery of the total project cost.
Where Governments seek to cover maintenance and operations costs, tolls required are low and need to be levied continuously. Where tolls are levied to allow extensions to the road network, the tolls would be required only as long as further developments of the network are required.

In the case of PMZ, tolling objectives need to be clearly defined, in particular in respect of covering project costs on one hand and being used as a traffic management tool on the other hand.

2.2.2 Project and Toll Acceptance

Toll acceptance issues need to be considered from an early stage as an integral aspect of a toll infrastructure project. If not handled properly, they can lead to a patronage on the tolled infrastructure that is significantly lower than expected, boycott/rejection of a new infrastructure, political reactions, even in extreme cases civil disobedience and violent demonstrations. It should also be noted that specific issues are associated with open road tolling technologies (massive fraud) where no physical facility forces drivers to stop to pay tolls.

The following aspects which are key to ensure acceptance of a toll infrastructure project:

- the project must serve a clear transport policy and be consistent with it;
- the decision-making process must be designed so as to guarantee the transparency and to facilitate interaction with the various actors;

- implementation of an appropriate communication and marketing policy make it possible to better work out and promote the project;
- Ownership of the Project Company must be very clear;
- project objectives must correspond to main expectations of the public and road users;
- project revenues must be used within the transport sector;
- a step by step strategy allows to adapt the project and raise awareness of the population;
- it is necessary to convince there is no better solution;
- the project must remain as simple as possible;
- the rates charged when opening the road must be attractive, and may be increased at a later stage once acceptability and patronage are well established, and the benefit of the infrastructure is recognized;
- a broad and stable political adhesion must be required;
- the various institutional levels must establish a good capacity of negotiation.
- unless specific schemes are put in place, toll will represent significant charges for residents along the infrastructure, local firms, commuters: in the PMZ context, it is First STEP's opinion that specific schemes such as subscriptions are essential to ensure the acceptance of toll by categories of users that will be most affected by it.

2.2.3 Toll Levels

Netherlands

2 toll infrastructures are currently in operation in the Netherlands.

- Kiltunnel:
  - Total length 901 m
  - Length closed part 406 m
  - Toll Fare for Car: € 2.00 (€ 2.22/km)
  - Toll Fare for Freight truck: € 5.00 (€ 5.55/km)

- Westerschelde tunnel:
  - Length: 6,600 m
  - Motorcycles, cars: € 4.50 (€ 0.68/km)
  - Cars with caravan: € 6.70 (€ 1.01/km)
  - Small trucks, campers, busses: € 16.50 (€ 2.50/km)
  - Freight trucks: € 22.50 (€ 3.41/km)

France

The A14 is a 15.6 km toll motorway in France, between Orgeval and La Défense (business district in the outskirts of Paris city). It crosses a large portion of Paris outer western suburbs. It opened in November 1996 as the first urban toll motorway in France.

Another route links Orgeval and Paris: A13 motorway, which is free and works as a competing route to the A 14. A 13 is an old motorway that suffers from heavy congestion.

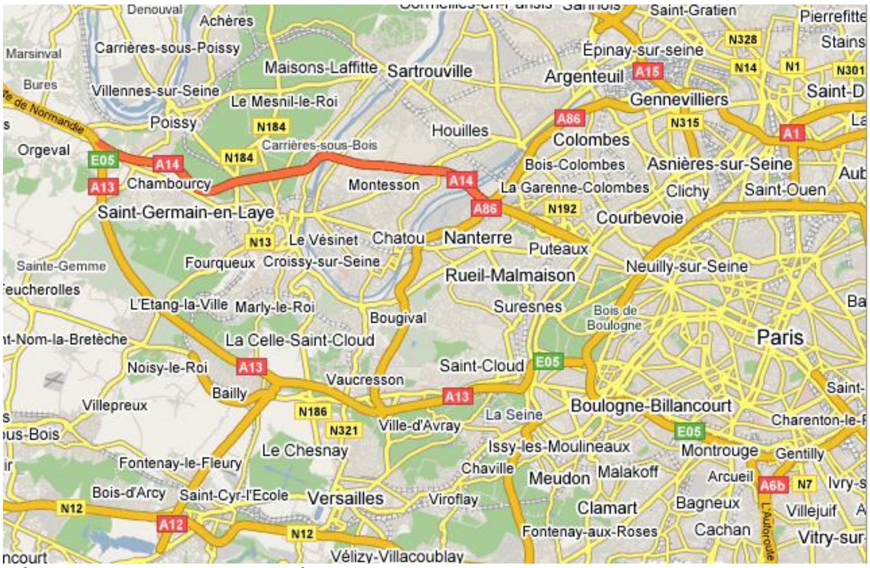


Figure 2-1: A14 near Paris

The A14 includes:

- 2 viaducts over the Seine River (total length of 1.3 km);
- 1 twin tubes tunnel 4.6 km long and 6 covers totalling a length of 1.3 km.

Total project costs were € 686 mio. That is around € 42 mio per km.

A14 carries an annual average daily traffic in order of 30,000 vehicles per day, quasi exclusively light vehicles (commuter traffic). Over 50% of traffic is electronic toll collection.

A number of subscription schemes have been put in place on the A14. A car sharing scheme is in place with a free tolls for vehicles carrying more than 3 people on a week day.

Toll rate modulation according to time of the day.

A14 Toll Fares (as of Dec 2006)	Light Vehicles	Heavy Goods Vehicles
Base Fare (peak periods)	€ 6.90 (€ 0.44/km)	€ 32.70 (€ 2.10/km)
Reduced Fare (off-peak periods)	€ 4.80 (€ 0.31/km)	€ 22.80 (€ 1.46/km)

The A14 example is interesting since a number of its characteristics are comparable to the A4 South:

- similar length with major infrastructure work (tunnel);
- peri-urban motorway;
- paying section;
- newly constructed section of road with highly congested existing alternative free route (A 13).

It is worth mentioning that the A14 was opened successfully despite strong rejection of toll on urban motorways in France.

The French authorities regularly increase the toll fares for all vehicles, with a wider variation for HGVs. The table below illustrates this increase in France since the last 4 years:

In € cents per km	**2003**	**2004**	**2005**	**2006**
Light vehicles	6.87	6.97	7.12	7.26
Heavy vehicles	19.64	20.0	20.6	21.07

Germany

Vehicles in Germany are classified by their number of axles and by pollution category.
In Germany, a nationwide kilometre charging system for Heavy Goods Vehicles (HGV), named TollCollect, is in place. Toll fares charged to the vehicles are depending on the number of axles and the pollution category of each HGV.
There are currently 3 pollution categories (A, B, C), and two categories for axle number (up to 3 axles, and 4 axles and beyond).
As an illustration, for up to 3 axles trucks, the toll per km amounts to € 0.09 for pollution category A, € 0.11 for category B and € 0.13 for category C. For vehicles with 4 axles and more, the toll per km then amounts to € 0.10 for pollution category A, € 0.12 for category B and € 0.14 for category C.
The German authorities have also introduced incentives in the system with a phased tariff grid encouraging truck owners to invest in less polluting vehicles.

2.2.4 Conclusions tolling levels

The toll levels that have been used on the A4 South to run simulations as part of the PMZ traffic forecast were € 1.00 for Light Vehicles and € 3.00 for Heavy Goods Vehicles. For a 11 km stretch, this represents a rate of € 0.09/km for LVs and € 0.27/km for HGVs.

Compared to other sections of toll road currently in operation in the Netherlands and in other similar environments, we believe that the toll levels that have been used in the PMZ traffic forecasts (€ 1.00 for LVs and € 3.00 for HGVs) are relatively modest.

A4 South is a new infrastructure including major civil engineering structures (viaduct/tunnel) in a constrained environment. Given that there is a real benefit in using it, it should be possible to apply significant toll rates – from a political/social acceptance perspective - and we believe that rates significantly higher than the ones that have been used in the PMZ traffic study could be considered, provided that the toll scheme to be implemented includes specific features such as subscription schemes for specific categories of users (e.g. commuters).

The rate between LV and HGV rates could also be increased. This is further analyzed as part of a refined traffic and revenue forecast.

2.3 Possible Toll Schemes and Associated Issues

Our understanding is that the revenue for the Project entity could theoretically come from various possible sources:

- taxpayers (Ministry of Transport, Public works and Water Management budget);
- users, (toll/acceleration charge or a kilometre charge which is to be implemented in the future)

However, in our view user charge should be the only source of income for the project. When evaluating any of the alternatives, the assessment is performed without subsidy.

In respect of user charges, we have made the following assumptions:

A. if the kilometre charge scheme (ABvM) is in place at the time the PMZ project is implemented (Option A), this scheme would be used to generate income for the PMZ Project. In that case, any specific tolling charge to be applied on the geographical scope of the PMZ project (such scope depends on the alternative which is considered) would be combined with the kilometre charge. This means that when a toll rate is mentioned in the assessment of the alternative, it would be charged 100% by means of the kilometre charge scheme both for LVs and for HGVs. We also understand that the total charge rate (incorporating kilometre charge and any relevant toll rate) could be different for different categories of users, from one section of road to the other or depending on the period of travel.
B. if the kilometre charge scheme is not in place at the time the PMZ project is implemented (Option B), a specific tolling scheme needs to be put in place on the stretches of road that form part of the PMZ project. Whether this specific tolling scheme is kilometre based or based

on charging vehicles at a given point (e.g. crossing), we assume that it would generate the total revenues that are indicated for each alternative, both for LVs and HGVs.

Depending on the contractual scheme which is adopted, the revenue stream would be different:

- if the Project Company bears traffic risk in a concession type scheme, the revenue would be allocated to the Project Company as follows:
  - under a kilometre charge scheme (Option A above), the total road charge would be collected by the (private) entity in charge of managing the kilometre charge scheme; it would be paid to the Infrastructure Fund prior to its transfer to the Project Company;
  - under a specific tolling scheme (Option B above), the road charge would be collected by the Project Company itself (or an operator working on its behalf).
- if the Project Company does not bear the traffic risk, revenue generated by user charging on the network would not be directly allocated to the Project Company. Revenue from user charge would be allocated to an Infrastructure fund (or equivalent). In turn, the Project Company would receive an on-going fee during the operating period; this fee would reflect the estimate of the whole of life project costs, adjusted based on the Project Company's performance in meeting pre-defined performance criteria (e.g. infrastructure availability). The user charge would then be collected (and turned to the infrastructure fund) as follows:
  - under a kilometre charge scheme (Option A above), by the body (probably a private entity) in charge of managing the kilometre charge scheme;
  - under a specific tolling scheme (Option B above), by a collecting body, which could be the Project Company itself (or an operator working on its behalf).

First STEP would like to emphasize the following aspects in relation to toll collection:

- the scheme which is considered must ensure that the entity which is entitled to receive the tolls must get assurance that toll evasion remains within acceptable limits;
- when considering open road tolling (free flow), enforcement is of the utmost importance. Whereas technical aspects are well mastered (image capture, licence plate recognition), it is important to ensure that the legal framework is in place to allow for efficient enforcement:
  - the toll operator must be allowed to capture, analyze and store licence plate numbers of violators;
  - the legal framework shall consider open road toll violation as an offence that can be enforced to the same extent as over speeding or other offences to traffic regulations;
  - access shall be made available to a central database to identify vehicle owners; this applies to vehicles registered in the Netherlands as well as vehicles registered in other EC countries (it is reasonable to assume that the number of vehicles registered in countries outside the EC travelling the PMZ road sections would be extremely limited and that violation by these vehicles would be virtually impossible to enforce).
- in selecting a tolling scheme, careful consideration must be given to the feasibility/costs associated with the processing of toll transactions and enforcement actions; in this respect, First STEP strongly recommends to avoid, if not completely disregard a tolling scheme that relies on the processing of non-registered transactions; in other words, this means avoiding non-registered video tolling as a regular means of payment.

The approach regarding toll collection could be significantly different whether we are talking about a national tolling scheme or a toll system limited to specific portions of the road network (PMZ geographical scope depending on the alternative considered). In the case of the PMZ corridor, the variety of traffic that is likely to use the road sections forming part of the project (e.g. commuters, long distance traffic, and foreign vehicles) is a very crucial constraint to be taken into account. Contrary to other countries or regions of the world, the Netherlands receives a very diverse traffic, including a large portion of foreign drivers. Whereas a systematic registration can be realistically envisaged in a nationwide scheme, this may be unrealistic if only a small portion of the Dutch road network is tolled (situation of the PMZ project, with a limited geographical scope).

In the case where the road sections forming part of the PMZ project were to be tolled without a national tolling scheme being in place (Option B above), First STEP would place the following recommendations:

- a pure open tolling scheme may not be practical to implement (high risk of fraud with non registered users on one hand – excessive costs and constraints of registering all vehicles using the road sections part of the PMZ scope);
- a distance based toll system may therefore not be relevant;
- the setting up of toll barriers for all vehicles does not appear in line with the goal of ensuring “free-flow” travel on the tolled roads it also increases travel times and thus revenues;
- a hybrid scheme whereby registered vehicles (i.e. frequent users) are allowed to use open road tolling scheme whereas non-registered vehicles are forced to use controlled toll lanes could be envisaged.

If a gradual implantation of tolling is envisaged (e.g. tolling of the PMZ area in the first instance, to be later integrated in a national tolling scheme), attention should be paid to the adaptability of the system put in place in the first instance. In this respect, DSRC technology (Dedicated Short Range Communication) is very much favoured for small scale applications, bearing in mind that it can be integrated into a nationwide scheme in the second place.

If toll or acceleration charge is to be implemented on the project without any national tolling scheme in place (ABvM), careful consideration will need to be paid to the Eurovignette scheme (ABvM is designed to replace the Eurovignette). Prior to that, vehicles in excess of 3.5 t cannot be charged with any extra payment mechanism such as toll or ABvM to travel on a given section of the road network if they are already subject to the payment of the Eurovignette on that section. We are therefore assuming here that Eurovignette will not / no longer be applied on sections where toll is in place, in particular the PMZ geographical scope.

In any case, setting-up workable tolling schemes requires:

- a clear assessment of regulatory constraints that need to be taken into account;
- the drafting of “business rules” detailing all aspects of the relation with the toll road users;
- the evaluation of associated costs and technical constraints to be taken into account;
- the early involvement of an experienced toll operator to validate the feasibility of the proposal.

For the purpose of financial modelling in this study, bearing in mind that the toll scheme is not precisely defined, the assumption was made that toll collection costs would amount to 5% of the toll revenue amounts.

2.4 Traffic and Congestion Management

Traffic and congestion management is at the heart of the PMZ project.
We have identified several options to manage traffic. These approaches are complementary and can be combined to a certain extent. An outline of such options is provided below:

2.4.1 Free-flow requirement versus Traffic Risk

It is our understanding that the current PMZ Board approach is based on the assumption that the commercial operator must:

- have at his demand (steering) instruments for the purpose of realising the free-flow objectives which will be set (as opposed to purely making available capacity in the infrastructure);
- have sufficient earning capacity to finance the provision of infrastructure from financial means outside of the budget of the central government.

It is worth analyzing these statements.

Free-flow on a given infrastructure is the combination of:

- sufficient availability of the infrastructure;
- demand management so that it does not exceed the optimal availability of the road.

Infrastructure availability risks can be allocated to a private operator, provided that availability requirements are made clear and are compatible with the characteristics of the asset (e.g. requirements to perform heavy repairs, replacements, improvements, expansions, particularly if an existing asset has to be taken over). This scheme is now commonly implemented and known as "availability scheme".

In First STEP's opinion, the demand for road capacity is associated with different issues:

- only a road charging scheme can significantly impact demand;
- road charging must be well adapted to the characteristics of traffic, specific user categories (e.g. commuters, local commercial vehicles) so that it remains socially and politically acceptable. The freedom for the private operator to set toll rates needs to be restricted: it is no option to allow a private Operator to set excessive toll rates on a section infrastructure for the only purpose of limiting demand without offering a real alternative route free of charge;
- in certain circumstances, the level of charge that would lead a significant portion of the traffic not to use a given infrastructure would be well above socially and politically acceptable levels.

In the view of First STEP, a number of issues are associated with a scheme where a Project Company is given the responsibility to achieve global free-flow objectives while bearing traffic/revenue risk on the infrastructure; this may indeed result in a number of side effects:

- the free-flow objective on a specific section of the network may be achieved in a situation where there is not an optimal usage of the infrastructure network (high level of congestion on other parts of the road network which are outside the scope of the Project Company);and/or
- high constraints being imposed on the private Operator (in terms of toll rates setting for instance) may not allow enough flexibility to perform an efficient demand management; and/or
- bankability of such a project may be difficult to achieve, which results in delays for its implementation and increased financial costs.

To combine efficient demand management and the guarantee that toll will remain within politically and socially acceptable limits, First STEP recommends that:

- the Grantor and the Project Company have to cooperate closely on the definition of the toll rate and traffic management strategy with a common objective of achieving maximum free-flow on the corridor: the Project Company has financial incentives to achieve this goal;
- the Grantor however remains in charge of making final decisions regarding toll rates level (including variable rates) with the purpose of optimizing traffic flow;
- traffic and revenue risk remain with the Grantor at first. This can be reassessed every 5 years;
- the Project Company is contractually required to achieve road availability objectives on the network that it has in charge (principle of a performance based contract).

These principles are followed under Alternatives 2 and 3, which we describe in our report in chapter 3.

2.4.2 Toll Charging

Toll charging on the various alternative routes can be a very efficient tool in managing traffic, with the purpose of reducing congestion. In this scheme, toll rate variation can be used with different rates at different times of the day or days of the week.

First STEP believes that appropriate fare policy can be very effective in managing traffic, reducing congestion and associated inconvenience; such effect can lead to improved travel times, reduced pollution level with significant environmental and socio-economic benefits. Provided that the political and social acceptance risk of toll is properly managed, such a strategy also bears the advantage of generating revenues from the road users, therefore relieving taxpayers from the burden of paying for infrastructures.

Such schemes have been tested in France (see A14 motorway example above, and A1 motorway example below) and it appears to have a significant impact on driver's behaviours. In specific cases, it has encouraged 10 percent of travellers to reschedule their journey when tolls were increased 50 percent in the peak periods. These figures will vary depending on the value of time and the decision making criteria of travellers and therefore is very much country and project specific.

Example of the A1 Motorway near Paris - France

The toll is implemented in an interurban section between the Chamant toll barrier and Paris to solve the week-end returns of passenger cars to Paris and returns from the Asterix entertainment park that occur at the same time (map in annex 1). But parts of congestion problems have to be solved in the Paris suburbs.

The objective of the time differentiated toll operation is to spread the demand on Sunday afternoon (week-end returns to Paris) in order to decrease congestion and thus increase the network efficiency. Every Sunday afternoon since April 1992, there is toll tariff variation in time for light vehicles return in to Paris. In red period (16:30 to 2030) : +25% ; In green period (14h30:16h30 and 20h30 :23h30) : -25%. The operation has succeeded to smooth the peak hours: the traffic during the red period has decreased (-4.4%) and was progressively transferred toward the green periods. The peak hour is now later (21:00 to 22 :00).
The user acceptance and awareness was high thanks to the clearness and fairness of the pricing scheme and the information campaign.

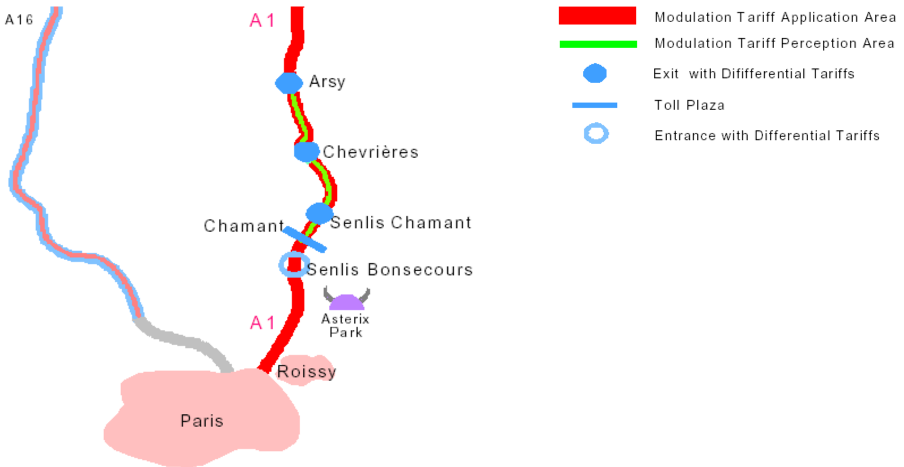


Figure 2-2: A1 near Paris

In the southbound direction, toll rate modulation is applied for users who:

- leave the A1 motorway (and pay toll in exit) at Arsy, Chevrières and Senlis Chamant interchanges (interchanges immediately north of Chamant mainline toll barrier)
- drive through (and pay toll at) the Chamant mainline toll barrier
- enter the A1 motorway (and pay toll in entry) at Senlis Bonsecours interchange (interchange immediately south of Chamant mainline toll barrier)

Congestion Related Tolling
Recently, in California, congestion related tolling has been introduced on major roads. The tolls are levied on new facilities (whether full new roads or specific additional lanes), and may be waived for high occupancy vehicles.

2.4.3 Vehicle Discrimination

Vehicle discrimination refers to the scheme consisting of prohibiting the use of certain parts of the infrastructure to certain categories of vehicles. This can be seen as a solution to solve the issue of HGVs crossing Dordrecht on the A16.

In implementing such schemes, First STEP recommends to carefully consider the following aspects:

- this approach is less expensive to implement than toll; it assists in road usage optimization with direct consequences for measures taken but can only be envisaged to solve specific – well identified – issues;
- vehicle discrimination schemes will lead certain categories of vehicles to have to make inefficient detours – this will not reduce travel times and costs for these categories;
- associated political acceptance risk appears to be significant and needs to be taken into account;
- this approach can be seen as way to make construction and maintenance of infrastructure more efficient.

2.4.4 Information to drivers

Information to drivers includes information on specific incidents on the road network, congestion issues, and travel time predictions. It can be made available by the means of radio broadcasting, variable message signs, internet and on-board units.

First STEP views in this respect are as follows:

- impact on congestion is likely to be minimal, unless associated with monetary incentives or constraints (see tolling above);
- driver information however brings significant benefit to road users as it reduces unreliable travel times for road users;
- driver information bears a significant cost (depending on required level of service and information means selected) – however, this is now seen as a must on highly trafficked networks
- in summary, it cannot be seen as a solution to traffic congestion unless combined with other approaches.

2.4.5 Access Restrictions

First STEP views on access restrictions are as follows:

- we note that the Dutch national traffic and transport policy supports this kind of restrictions;
- it indeed reduces congestion, but at expense of commuters;
- such scheme may lead to frustration due to unexpected rejection;
- it may have a negative effect on other sections of the network (local roads)
- it keeps the main road flowing, but it will become less easy to enter the main road in busy periods;
- it fits perfectly with a long distance travel goal, but will require additional measures for the accessibility of Spijkenisse.

2.4.6 Splitting freight and passenger traffic

Introducing dedicated lanes or routes for specific types of traffic can be an interesting option:

- It may contribute to driving freight away from urban areas;
- It allows to homogenize traffic flows, leading to a better throughput;
- It may reduce building and maintenance costs.

One possibility, to lower the construction costs of the new stretch of the A4, is to only allow light vehicles on the A4 South. Heavy vehicles have to take the A15/A29 route in that case. The advantage of this solution is a lighter construction of the A4 South, less maintenance and possibly tunnels with a reduced height. In addition, the total capacity would increase due to the homogeneity of traffic and environmental burden around the light-vehicle road would be reduced. Construction costs would decrease, but toll revenues will be lower as well, since the toll revenues of freight vehicles will not be there. In chapter 3 we assess this solution further.

Although the complete banning of trucks from some routes may introduce savings in capital and operations costs, it may be difficult to gain acceptance among the industrial stakeholders. An alternative is promoting some alternatives for trucks and making other itineraries more attractive for LVs. More specifically, one could consider promoting the A4/A29 itinerary for heavy vehicles and making the A16 route friendlier for light vehicles. This option is analyzed in more details for Alternative 3 in chapter 3.5.5

This would offer a number of advantages:

- reduce truck traffic crossing highly populated areas of Dordrecht and Breda;
- keeping to the minimum the distance for trucks driving between Rotterdam port and the south

This could be achieved via:

- fare policy for trucks to reflect an incentive to use the A4/A29 corridor rather than the A16: in particular, discounts (within the limits authorized by current regulations) could be granted on the A4/A29 so as to make it a more attractive option than A16 for trucks (see 2.6.3)
- development of facilities associated with the road, in a way that is consistent with traffic to be attracted (LV drivers and truck drivers do not have the same expectations). In particular, service areas for trucks could be envisaged on the A4/A29 corridor:
    - o petrol station
    - o secured parking area
    - o all facilities for truck drivers (restaurant, showers, laundry, internet access)

2.5 Life Cycle Optimization

2.5.1 Life Cycle Approach

The First STEP life cycle approach is based on the vision that a PPP Project is not the result of a simple addition of a “Design and Build Project” and a “Maintenance Project”. Indeed, one of the key success factors in developing PPP Projects is to take maintenance requirements into account right from the beginning of the Project (i.e. during the bid preparation). This early involvement of the Operator in the Project and the relevant specific concurrent engineering process is very advantageous for the whole Project, as it enables:

- the integration of maintenance expertise (especially for pavement, structures and mechanical and electrical equipment) to allow review and optimisation (from a maintenance point of view) of the design at a very early stage of the Project;
- the successful combination of maintenance requirements and design and construction possibilities;
- the securing of the long term interests of all project stakeholders;
- a lifecycle approach for the assets handback conditions at the end of the Concession Period.

This early integration of maintenance in the Design & Build implementation and planning activities will also result in cost-effective achievement of goals of reaching a high level of safety, reliability and availability for the project.

Proactive preventive maintenance is also considered to be in the best interests of all stakeholders. Timely and effective measures focused on minimizing consequential damage, traffic disruption, road unavailability and future costs, are strongly encouraged.

Since a significant portion of maintenance costs is affected by design, whole of life assessment needs to be done early in the process.

2.5.2 Operator's Involvement

First STEP believes that the early involvement of the Operator is a key to the success of a complex road infrastructure project. The word "Operator" refers here to the operating entity that will provide operation and maintenance services to the Project Company under a scheme which is commonly adopted in road infrastructure projects.

The Operator is usually required to:

- provide the services in accordance with performance criteria which are fully compliant with those imposed by the Grantor to the Project Company;
- operate for a fixed fee, including a variable part linked to traffic and linked to a panel of indices reflecting cost evolutions.

The Operating contract is usually a long term contract, covering all on-going activities on the road (operation and routine maintenance). Decision and cost for non-routine activities as well as major capital investments or decisions likely to affect project revenue (e.g. commercial policy) usually remain at Project Company level. The Operator is however responsible to provide advice and assistance in this respect.

Since the Operator is requested to commit on performance and cost, it is crucial to involve the Operator from the early stages of the project:

- involvement in all strategic decisions that can affect operation and maintenance
- functional specifications for O&M Facilities and Fixed Operating Equipment
- design review
- involvement in the commissioning and testing of relevant facilities and equipment,

so as to ensure that:

- the infrastructure is fit for its purpose
- operation and maintenance constraints are fully taken into account
- whole of life approach is followed, leading to whole of life cost optimisation.

We favour a high involvement of the private operator on sections that would be managed by the Project Company; the corresponding scope should include:

- management of a Traffic Control Room, especially since a significant tunnel is part of the scope (workplaces at 'Rhoon', the RWS control room)
- safety on the road including patrol, on-site incident response, management of works on the project roads
- routine maintenance, both for infrastructure and associated equipment
- whole of life maintenance, including inspections and tests, heavy repairs and replacements
- if relevant (depending on the tolling scheme which is chosen), toll operation.

Since the Operator is usually set-up as a separate company (with associated fixed costs), First STEPs recommendation is to ensure the project has significant size and scope of operation and maintenance for the private sector.

2.5.3 Regulating Mechanisms for a balanced relationship

In a concession scheme where the Project Company would bear traffic risk we recommend that regulating mechanisms be introduced as part of a true public-private partnership, to ensure that the contract balance is maintained at all times:

- a long term contract should be favoured, used as an incentive to incorporate whole of life approach from the design and construction phase
- mid-term plans, to be agreed between the Grantor and the Project Company, covering the following aspects:
    - Reassess the allocation of traffic risk. When data regarding traffic flows and environmental issues is available it is easier to asses the risks then at the start of the

   project of course. The issues regarding toll politics, acceptance and tariffs are expected to be more predictable;
   - specific performance objectives assigned to the Project Company during the coming 5 year-period;
   - investments that are considered necessary to improve safety, due to capacity constraints (e.g. widening, removal of bottlenecks);
   - the need to take into account road user expectations (e.g. traffic information, new services to road users) or social/political expectations (e.g. creation of new interchanges, implementation of new tolling schemes for local users);
   - a frame for the increase/adjustment of toll rates during the coming 5 year period to ensure the reasonable profitability of the concession (together with acceptability of toll) taking into account the existing financial situation and the expected traffic growth.

First STEP believes that such a 5 year approach for such a scheme would be very beneficial to both parties since:

- it allows a regulated increase in toll fares, with a strong control from the Grantor;
- it allows to take into account constraints and needs that arise throughout the duration of the (long-term) contract, even though these aspects are not covered in a detailed manner in the initial agreement;
- it mitigates the risk of unbalanced situations where the Project Company makes excessive profits with limited obligations in return or situations which can lead to the bankruptcy of the Project Company.

This scheme can of course easily be adapted to alternative schemes with a larger scope, for instance with a regular review of the free-flow objectives for the management of the corridor and the review of the corresponding financial incentive mechanism.

2.6 Extra added value to the society

One of the most important aspects of an integral public-private process, even before the m.e.r. (Environmental Impact Assessment) and the Route Decree have been issued, is the mitigation of the risks concerning the possible delays in aforementioned procedures and concerning permits. All to be investigated solutions should serve this purpose. The challenge is to get a broad societal acceptance through win-win situations for as much stakeholders as possible. This is especially the case for the missing link in the Hoeksche Waard.
In this paragraph we want to broaden upon three possible solution directions, of which we think they may contribute to a broader societal acceptance. These are:

- Corporate Social Responsibility
- Environmental utilisation space and Ecological Footprint
- Influencing the route-choice through “pull measures”

The Environmental Contract (see 2.1.4) is an example of this, focussing on noise, air pollution and safety.

2.6.1 Corporate Social Responsibility

The public-private consortium may use a Corporate Social Responsibility policy to be more transparent to the public and organisations, and in that way show:

- which goals have been agreed upon;
- to what extent these goals actually have been met;
- that the company strives for improvement.

This transparent approach will lead to more trust in the consortium and their actions. This extends the traditional annual (environmental) reports. A broad range of indicators should be presented, which demonstrate that the performance on economic, social and ecological aspects, meets the goals agreed upon.

Defining and realising the sustainability goals can in our opinion best be managed in a communal domain. Only then will all parties involved have a shared sense of responsibility and can economic, social and ecological demands really be weighed up integrally. This will also prevent that contractual agreements must be written down in detail, uncertainties will raise the pricing level and later optimisations will be hindered.
Within the communal domain several stakeholders can put forward their demands, wishes and ideas. This should lead to an integral design with maximal win-win situations for all parties involved. Through the management of luck and bad luck there can be worked within the budget, but also agreed upon a higher budget, when this allows for a higher value of the project and the surroundings.

Examples of sustainability goals are (Kwaliteit en Toekomst, MNP en RIVM, 2004):

- competitiveness – traffic jams
- collective burden of taxation (project costs, tolling or pricing)
- energy consumption – stock depletion
- Global warming (CO2 emissions due to energy and mobility)
- Water quality (Wvo)
- Biodiversity (land use, EHS, natural recourses, waste)
- Quality of the living surroundings – health issues (contamination, hinder, external safety)
- Quality of the landscape

2.6.2 Environmental utilisation space and Ecological Footprint

The environmental utilisation space is defined as: “The allowed use of the environment by societal activities whereby the sustainable environmental quality is not affected.” This comes down to the causal relationships between the degree of pollution, the natural regeneration capacity and the use of natural recourses, which define sustainable development.

When comparing the environmental utilisation space to Corporate Social Responsibility, the incorporation of the economic aspects forms the most important difference. From the view of a social responsible business conduct, profitability remains an essential starting point. Even when this leads to exceeding the environmental utilisation space. On the long term however, a business can not remain profitable when the environmental utilisation space keeps being exceeded on a large scale.

The question must be how the environmental utilisation space can contribute to a broader societal acceptance for this project. What will civilians and organisations think of the possibility of the acceptance of additional pollution levels, in the form of for example noise and air quality, somewhere in the projected area, when this additional pollution will be compensated for elsewhere? We are all familiar with the NIMBY principal (not in my backyard). Even when in this context we are not speaking of pollution in terms of decibels and concentrations, but of amounts of people hindered. Schiphol is a well known example.
The environmental utilisation space could in our opinion be extended to an “Ecological Footprint” for the project. By incorporating spatial development issues around the motorway, a much broader improvement of the environmental quality can be achieved. The desired improvements can be part of the sustainability goals, which we suggest to manage in a communal domain.

With regard to energy, the goal can be set for a CO2 neutral project (by making use of compensation of emissions of construction and material use). For this the principles of the Trias Energetica can be used. The Projectbureau Energiebesparing GWW and the innovation programs have a lot of knowledge on energy efficiency.
With regard to waste, the cradle-to-cradle concept of McDonough and Braungart can be used. Following these principles during the total life cycle of the project only the first three steps of the “ladder of Lansink” are taken. When we can realise an ecological motorway in the Hoeksche Waard, by using as much natural materials as possible and optimising the fit-in in the natural environment. This will have a better chance of acceptance. There are sufficient innovative, but proven, techniques at hand to make this possible. During maintenance and replacement of existing infrastructure within the concession, the Ecological Footprint of the project can be decreased gradually.

With regard to the quality of the landscape, the design concepts from “Bloeiende bermen". Verstedelijking langs de snelweg. Ruimtelijk Planbureau, 2006” can be used as a guideline.

By broadening the definition of the environmental utilisation space, the negative impact of the motorway can be minimized on the one hand, and compensated for on the other. This by incorporating the development of the “Ecologische Hoofdstructuur”. And by attuning the use of the road to the spatial and functional arrangement of the surroundings. Defining broad sustainability goals for the project make this possible. By defining indicators, the goals become transparent and testable. The fulfilment of stakeholders wishes in this way, will lead to a broader acceptance of the project.

2.6.3 Area development: pull factors

Bergen op Zoom has the following ambition: “a central position on the crossing of logistics and the process industry”. Recently a number of knowledge intensive companies have settled in the area, with still a serious growth potential. Bergen op Zoom wants to be attractive for industrial investments and wants to have a container terminal in their harbour.

The idea to make the A4 South, the shortest link between the harbours of Rotterdam and Antwerp, an industrial route sounds logical. Especially taking into account the wish for a container terminal in the harbour of Bergen op zoom. The A4 South is however located in a recreational and ecological environment, with Willemstad, the Volkerak locks, the Ecologische Hoofdstructuur around Bergen op Zoom and the access to the Zeeuwse islands. From the viewpoint of external safety, this route has advantages, because of the natural environment.
This industrial view on the route does not only affect the use of the motorway, but also the future spatial development of the area. This is an important starting point for the integral approach of the relationship between the motorway and its surroundings.

In the mobility analyses a lot of attention has been given to the effects of tolling and pricing on the choice of routes of the road users. Freight traffic has a higher value-of-time, in other words they are prepared to pay more than passenger traffic for a faster connection. When the amount of freight traffic increases, it will affect the passenger traffic in a way that the latter will choose an alternative route if available. This is the case for the A4 and the A16.
Apart from possible pricing and tolling, the choice of routes will be influenced by the experience of the road. We will sum up some ideas which can be taken to influence the experience of the road. We will call these pull measures, because they will invite the road users to take a certain route.

<u>Announcements above the road</u>

- When the maximum levels for air quality or noise have almost been met, an announcement above the road can be given to stimulate road users to take the other route;
- During breeding season announcements can be given to stimulate road users to take the A16.

<u>Providing in functionalities</u>

- by designing “pick nick places” which are especially accessible for trucks (or not), they will be more (or less) attractive to this group;
- by providing for and advertising (signs) recreational places along the A4, this route will be more attractive to recreational (passenger) road users;
- by providing for Business Points (as with the Mercure concept), the route will be more attractive to business travellers, providing them with high quality meeting facilities outside city centres;
- by providing for transferia (combined with e.g. a supermarket, day care centre, fitness) the route will be more attractive for commuters.
- Development of EHS (broadening the scope) will be more attractive for users and residents.

<u>Road layout</u>

- Using designated lanes for freight traffic and/or (carpool)busses;
- Having 24h overtaking restrictions for freight traffic;
- Setting the speed limit to 90 km/h for the right lane or for all lanes, permanently or during rush hour.

3 Project alternatives

This section describes the various Alternatives that were selected by First STEP for in-depth analysis.

3.1 Process and Criteria to Identify Alternatives

3.1.1 Approach followed by First STEP in the Selection of Alternatives

The following criteria were used to select project alternatives to be further analysed by First STEP:

- in line with PMZ Board requirements: “PMZ Board requests that you first look to making changes to the functional and institutional scope before dealing with changes to the geographical scope”;
- focus on road infrastructure type projects, which are in line with the core business of First STEP members. Alternatives outside this frame (such as real estate/industrial development, other modes of transport by sea or rail) could be mentioned in the report to be issued by First STEP but with no quantitative analysis;
- solutions based on proven approaches and technologies (after all the purpose of the consultation is to find solutions that work and bring benefit to the community, not to find the most innovative solution to break new ground);
- the project should be based on a financing structure, without public subsidy;

In the process of selecting workable alternatives, First STEP realized that the thorough analysis of the feasibility of the A4 South as a stand alone project was absolutely critical. A4 South is indeed a section of the road network that remains to be built with significant constraints associated with river crossings.

3.1.2 Outline Description of Alternatives

Alternative 1; optimising the A4 South
Philosophy
Alternative 1 is designed as a real toll concession for the A4 South only: the toll revenue being collected by the concessionaire for the financing of the construction and operation and maintenance of the facility for a period of 40 years.

Under Alternative 1, First STEP focussed on the challenge of revenue forecast and optimisation of the construction cost which appear to be the main drivers to the financial feasibility in that case.

In order to assess financial feasibility, First STEP used a significant number of assumptions based either on PMZ Project documentation primary data or on their own experience and capabilities of its members as well as our own preliminary calculations (traffic and revenues, construction costs, operation and maintenance costs, financial engineering).

figure 3-1; Alternative 1

Alternative 2; embracing A4 South, A4 and A29 till Belgian border
Philosophy

Alternative 2 is designed with the aim of improving the financial feasibility compared to Alternative 1 by extending the geographical scope, while managing a complete link (A4 South + A4 + A29) from Rotterdam to the Belgian border.

This alternative is therefore designed as a project in which toll, be it project specific or part of the nationwide road kilometre charging scheme (Anders Betalen voor Mobiliteit), would be collected on behalf of the Public Authority, and the private operator would earn highway availability fees to build the A4 South and operate and maintain the whole A4 and A29.

This alternative offers the advantage of providing earlier earnings to the private operator, since it would receive availability fees from operation and maintenance of the existing sections before opening the A4 South.

Therefore, the financial feasibility of Alternative 2 would be improved as compared to Alternative 1, while the possibility to manage traffic on both A4 and A29 would avoid traffic diversion from A4 South to A29 as it could occur in Alternative 1.

figure 3-2; Alternative 2

Alternative 3; managing the whole corridor
Philosophy

Alternative 3 is a geographically expanded version of Alternative 2, which serves the purpose of managing traffic globally on the whole PMZ corridor, this includes the A29, A4 and the A16 up to the Belgian boarder, and the highways A17, A58 and A59. Therefore minimizing overall congestion and environmental impact on the corridor. Toll rates are designed to achieve this goal to the largest possible extent (toll rates have to remain within politically and socially acceptable limits) while ensuring that no taxpayer money is used to manage the corridor.

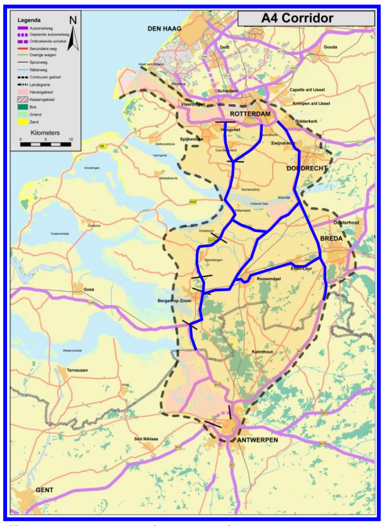


figure 3-3; Alternative 3

3.2 Traffic Forecast for the various Alternatives

In section 1.2.2 it is noticed that the sensitivity of route choice behaviour in the preliminary traffic analysis with NRM is quite high. Even with modest toll levels on the A4South, almost all traffic skirts around to the A29 (see frame below). When comparing the total costs for vehicles, including time and distance based costs, the sensitivity can be proven to be too high. In First STEP view, it is necessary to improve the model results to make a realistic business case.

The goal of the traffic calculations is to obtain resulting traffic flows by varying toll rates on the different routes in the area. Thus optimal toll rates and daily toll revenues can be calculated as well.

To be able to assess the effects of different toll levels on parts of the network, First STEP developed a quick scan model, based on simple and flexible assumptions. The quick scan model estimates the division of traffic over the route alternatives, based on travel times, toll rates, travel distances and estimated congestion loss times. The principles of this quick scan model are explained below.

For alternative 1, a different approach is chosen than in alternatives 2 and 3. The route alternative in 1 is quite easy to model, whereas in 2 and 3 there are many routes possible in the whole corridor.

Why the toll sensitivity is too high in the preliminary analysis (NRM)
Comparing two routes from Benelux interchange to Klaaswaal, for freight traffic.

	via A4 South	via A15-A29
Route length [km]	11.6	21.6
Travel time with 80 km/h [min]	8.7	16.2
Time cost passenger cars [€][1]	6.77	12.60
Distance cost passenger cars [€][2]	2.70	5.03
Total cost passenger cars [€]	**9.47**	**17.63**

The cost difference between the two routes is € 8.16, which correspondents with € 0.70/km. Which means that if the toll rate on the A4 South is € 0.70 /km, both routes are exactly equally expensive to freight vehicles. Freight truck drivers will only consider taking the A15-A29 route is the toll rate is about 0.70 €/km, or higher. In the preliminary NRM calculations, most trucks were skirting around to the A15-A29 at a toll rate of about 0.30 €/km, which seems far too low: the toll sensitivity is too high in the NRM. It is therefore not possible to calculate a sensible business with NRM when toll is involved.

3.2.1 Route properties

Traffic making a choice between two or more routes, do that on the basis of some perceived indicators. These indicators can be added up to an overall benefit of choosing one of the options.

The influencing indicators, which are used in the quick scan model, are:

- free flow travel time
- loss time, due to congestion
- travel distance
- toll cost

The times and distance can be multiplied with respectively a value of time (vot) and a value of distance (vod) to convert them to cost units. This is a standard way of dealing with times and distances, and the values are in most cases estimated by stated preference research. The calculations of First STEP use the same vot and vod as the preliminary traffic analysis.

In the different variants, we used the following values for the values of time[3] and distance (all at price level 2020, corrected for inflation):

- value of time passenger work related traffic: € 10.76 / hour
- value of time passenger business related traffic: € 36.53 / hour
- value of time passenger other traffic: € 9.23 / hour
- value of time freight traffic: € 46.66 /hour
- value of distance passenger traffic: € 0.138 / km
- value of distance freight traffic: € 0.44 / km

The number of car kilometres between the three trip motives work related, business related and otherwise are respectively 26%, 8% en 89%[4], so a weighted average value of time of € 13.93 has been used for passenger traffic.

[1] Using the value of time from the preliminary analysis: € 46.66/ hour.
[2] Using the value of distance from the preliminary analysis: € 0.233 / km.
[3] Source: PMZ traffic analysis
[4] CBS Statline, statistics for 2005. http://statline.cbs.nl.

The values of time and distance are used to calculate the generalized total cost of choosing a particular route. If a route is 20 km long, and a passenger car drives with an average speed of 100 km/hr on that route (which takes 12 minutes), the total cost is 20 km * 0.138 + 12 min / 60 * 13.93 = € 5.55. Together with the toll costs, it is possible to calculate a generalized total cost for each route alternative, on which we can base the route choice process.

3.2.2 Route choice

The modelling approach adopted until now by PMZ was limited in its effectiveness due to three constraints:

- it assumes that transport cost attributes are the same for all users of the same alternatives
- it assumes that all users will shift from one alternative to the other even if differences are marginal (all-or-nothing)
- it assumes that all traffic is of the same class, namely passenger cars

First STEP chose to use a route choice function, which is more realistic. Instead of an all-or-nothing assignment of cars to routing alternatives, the model provides a sloping function (Figure 3-4) which allows gradual changes and a 50-50 split if the costs are similar. All these assignments are based on generalized costs, weighing time with the value of time as described above.

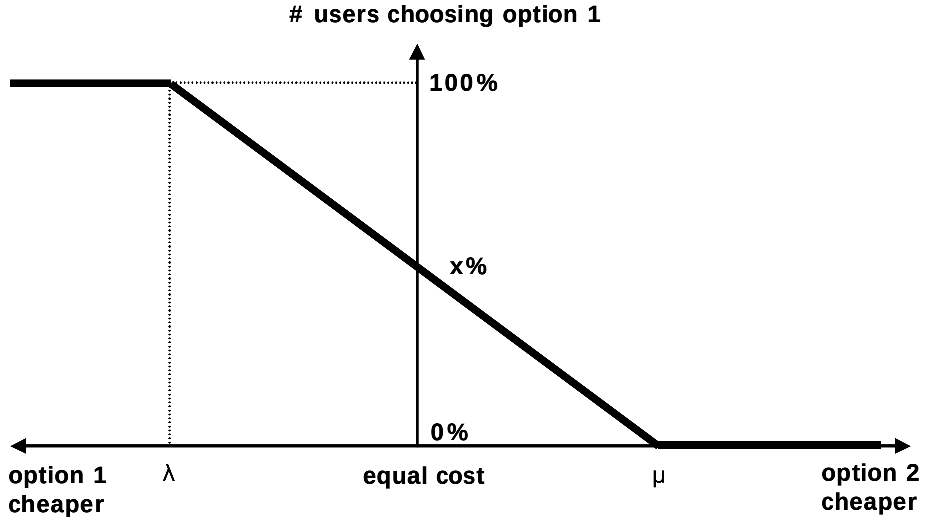


Figure 3-4: route choice function

On the horizontal axis the relative difference of costs between the two route options are indicated. The vertical axis indicates the share of users of route option 1. If option 1 is the relatively cheaper than λ, all users choose option 1. On the other hand, if option 2 is relatively cheaper than μ, all users choose option 2. Between λ and μ the choice is mixed, and gradually evolves from all to option 1 to all to option 2. We have implemented this as a multinomial logit choice model, so that it can be used for several independent routing alternatives relevant for PMZ and that freight and passengers can be treated separately in their responses.

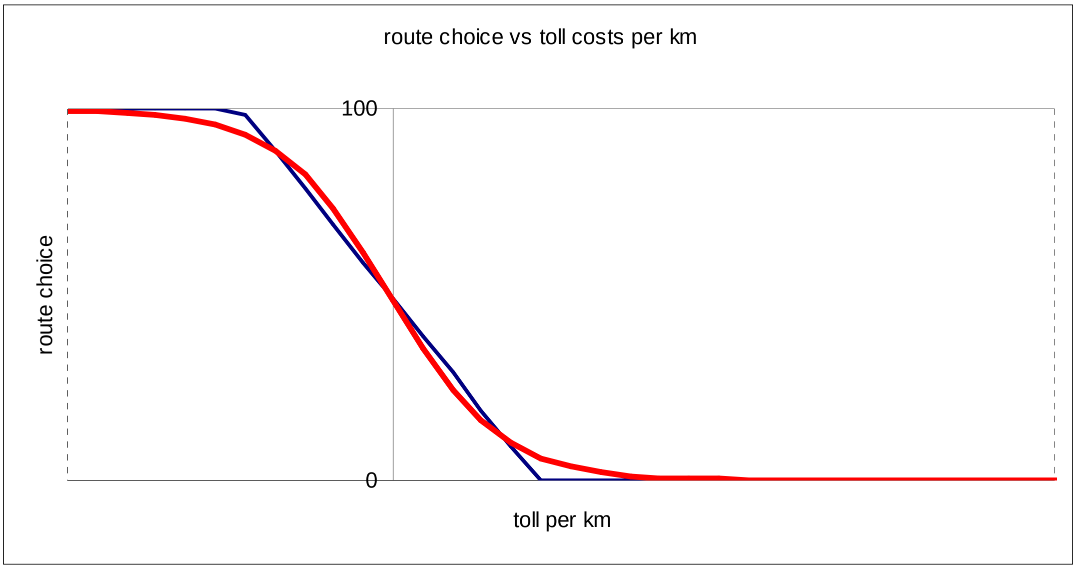


Figure 3-5: Model shape for route choice behaviour (red, curved line)

The model was implemented as a sketch planning model in a spreadsheet and calibrated upon the known flows with satisfactory results. Subsequently we applied the model on the alternatives for PMZ to re-assess the sensitivity of the traffic for various toll scenarios and optimise the level of tolling in the business case.

Route choice for alternatives 2 and 3

In alternatives 2 and 3, the whole corridor between Rotterdam and Antwerp is considered for tolling. The number of alternative routes per road is too complex to derive directly from the network. A car driving on the A4 from Rotterdam to Antwerp has other route alternatives than a car driving from Rotterdam to Zeeland.

Therefore, the basis of the route choice in the corridor situation is the aggregated origin-destination matrix (OD matrix), as provided by PMZ. The OD-matrix contains the number of car and freight vehicle trips between 14 areas in the Netherlands and abroad (see Figure 3-6), summed for working days.

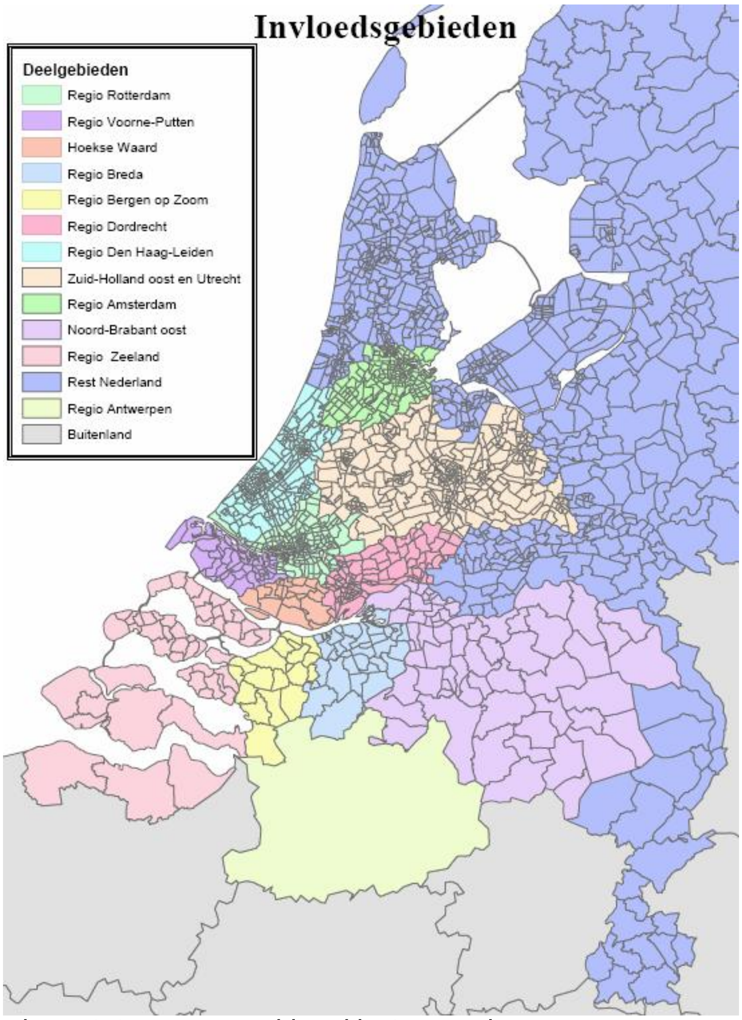


Figure 3-6: Areas considered in OD-matrix.

For each OD-pair three routes are chosen:

- one via the A4/A29
- one via the A16
- one alternative, with as less as possible use of tolled roads.

Figure 3-7 shows, as an example, the three chosen routes between Rotterdam and Hoeksche Waard. In total, since there are 14 different areas, for 91 situations[5] three route alternatives are chosen.

[5] In total there are 14*14 OD-pairs (= 196). In 14 cases the origin is also the destination, these are left out. For the remaining 182 OD-pairs routes are chosen, but since each pair has two occurrences (to and fro), considering 91 pairs is sufficient.

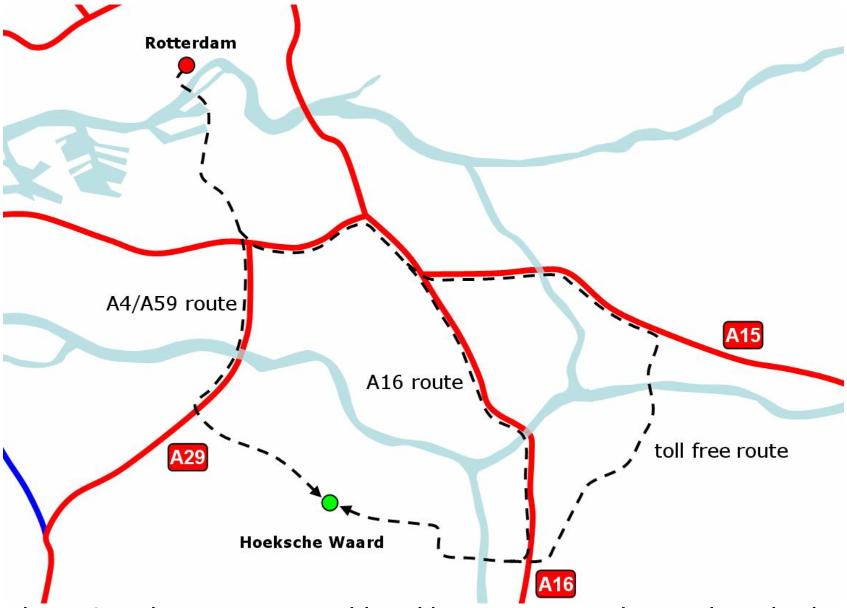


Figure 3-7: three routes considered between Rotterdam and Hoeksche Waard.

For each route, the length and the travel time (for light and heavy vehicles) are calculated. The traffic on an OD-pair chooses the routes based on total costs (that is the sum of time costs, distance costs and toll costs), equally to the procedure of alternative 1. The logit approach makes it possible to assess three alternatives. The OD-pairs that use a stretch of route can be added up to a total intensity on that stretch.
What happens is that when toll is introduced on one or more routes, the costs of the different alternatives for each OD-pairs change. This may influence the route choice for an OD-pair, depending on the size of the cost change. The intensities on the different road stretches are influenced as a result of that, and thus the revenues as well.

Calibration
The route choice model for these alternatives is calibrated, to make a traffic forecast of sufficient quality. Due to the simple route alternative approach (three routes per OD-pair) and the quite large areas considered (Woerden – Goeree Overflakkee is in the same OD-pair as Amersfoort – Hulst, for which a totally different route should be considered), the first assignment of traffic can be too bad to use. By estimating calibration factors, the weight of the different OD-pairs can be influenced, with as result that the traffic flows are as they are expected to be. In this case, we used the PMZ traffic analysis basic alternative (without toll anywhere) as the situation the quick scan model should represent. After calibration, the traffic flows on the major river crossings are more or less equal to those reported in the PMZ traffic analysis report.

3.3 Alternative 1: Tolling the A4 South

3.3.1 Description

In alternative 1, toll is collected on the A4 South between Benelux interchange and Klaaswaal. The choices from the Benelux interchange to the Haringvlietbrug (vice versa!) are either using the A4 or using the A15/A29. From the Vaanplein to the Haringvlietbrug there are also two options: either A15/A4 or A29. However, since the goal of the calculation is to obtain an optimal toll level and expected revenues, and in this alternative toll schemes are only applied to the A4, it is not feasible to expect users on this relation to use the partly tolled A15/A4 alternative (which is the longer one and users need to pay toll), unless there is heavy congestion on the A29, for which there are no indications in recent studies.

So, we consider all trips from Benelux interchange to Klaaswaal, and assign them to either the A4 South, or to the A15/A29 route. For trips to Spijkenisse, another approach is necessary, since they use only part of the A4 South (there is an exit planned between Oude Maas and Spui). An alternative route, not using the A4 South, is necessary: from the south that is A29-A15-exit Spijkenisse.

Figure 3-8 indicates the only two route options considered in this exercise:

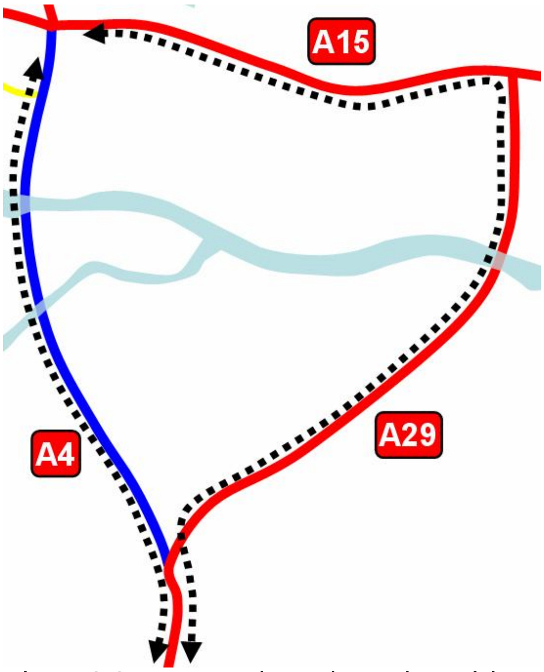


Figure 3-8: Route options alternative 1 (vice versa)

3.3.2 Alternative 1: expected traffic and revenues

Properties

The PMZ traffic analysis estimated in the Basic Variant (which an A4 South without toll) the following intensities on the A4 South.

	passenger cars	freight trucks	passing cars	passing trucks
A4 Benelux – Spijkenisse	64000	20000	65%	95%
A4 Spijkenisse – Klaaswaal	48000	20000		

These intensities are the sum of two directions, and 24 hours.

Since we are only varying the toll levels on the A4 South, just these intensities can be influenced. However, there is an exit situated near Spijkenisse, and some cars are leaving or entering the A4 at this exit, as indicated in the last two columns in the table.

	Number of passenger cars	Number of freight trucks
A4 Benelux – Klaaswaal	41600	19000
A4 Benelux – Spijkenisse	22400	1000
A4 Spijkenisse - Klaaswaal	6400	1000

For the cars entering and leaving at the Spijkenisse exit, the route alternative mentioned above is considered, next to the A4 South route alternative. When the toll rates on the A4 South become too high, a gradually larger number of Spijkenisse destined cars will not use the A4 South.

The route alternatives (Benelux interchange – Klaaswaal) have the following properties:

Property	A4	A15/A29
Length [km]	11.5	21.5
Speed passenger cars [kph]	100	100
Speed freight trucks [kph]	80	80
Congestion loss time [min]	0	0
Toll rate [€/km]	vary	0.00

The extra distance and time for the route alternative for Spijkenisse are:

Property	**From the south**	**From the north**
Extra length [km]	19.3	1.7
Extra time passenger cars [min]	12.1	2.6
Extra time freight trucks [min]	15.1	2.6

Basic alternative

In Figure 3-9 the route choice function for alternative 1 is drawn, based on the properties above. When the toll rate on the A4 is below € 0.17/km (which corresponds to an overall rate of € 1.96) 95% of the cars use the A4 South. When the toll rate is above € 0.48/km (overall € 5.52) 95% of the cars choose the A15/A29 route.

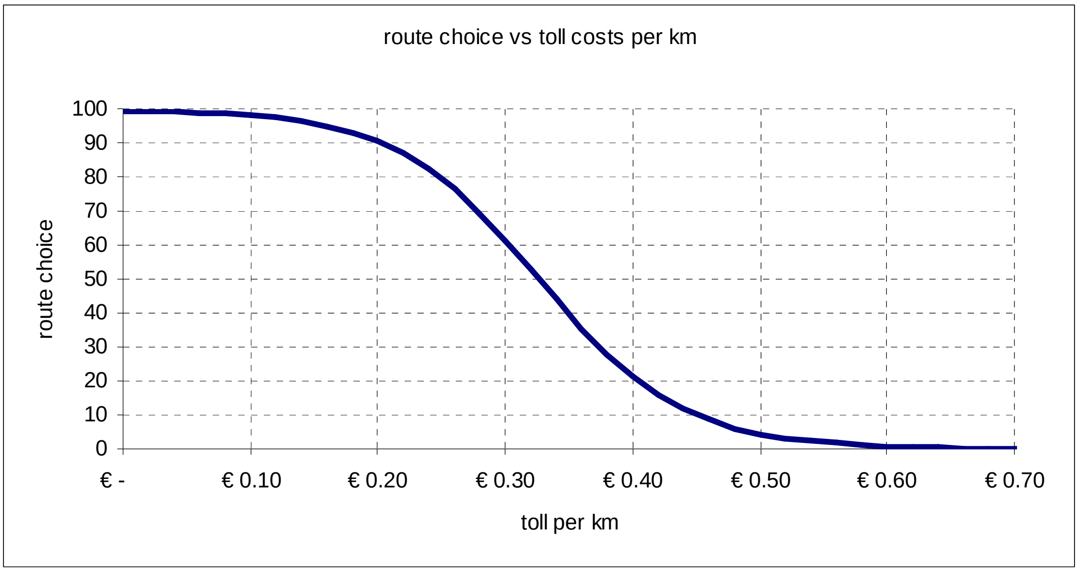


Figure 3-9: route choice depending on toll rate in alternative 1, passenger cars

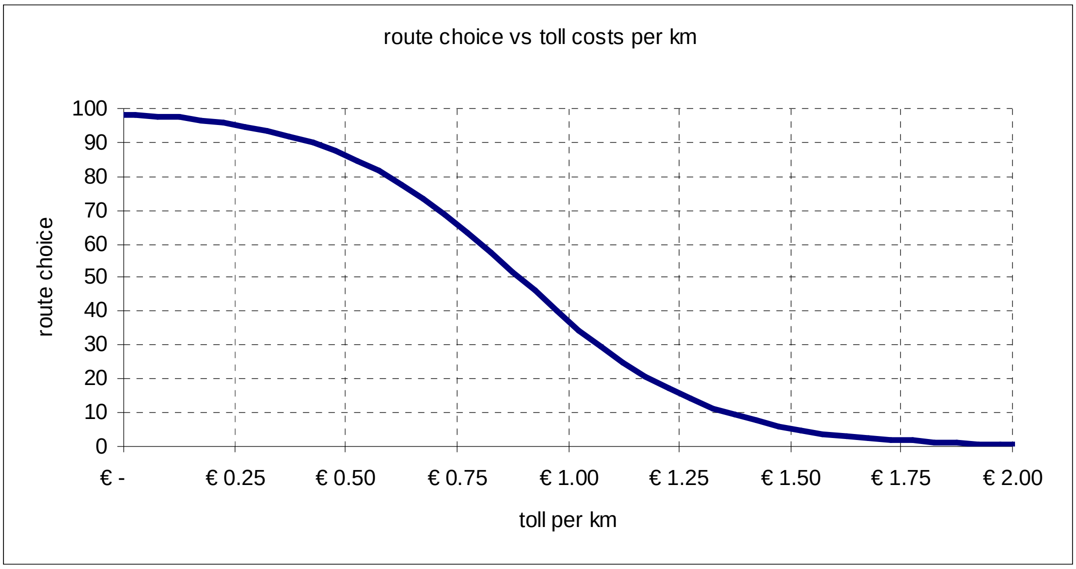


Figure 3-10: route choice depending on toll rate in alternative 1, freight traffic

Figure 3-10 contains the same information for freight traffic route choice. When the toll rate on the A4 is below € 0.28/km (which corresponds to an overall rate of € 3.16) 95% of the trucks use the A4 South. When the toll rate is above € 1.53/km (overall € 18.11) 95% of the trucks choose the A15/A29 route.

Now the optimal toll rate for passenger and freight traffic can be calculated. The optimal toll rate is the rate that generates the most revenues.

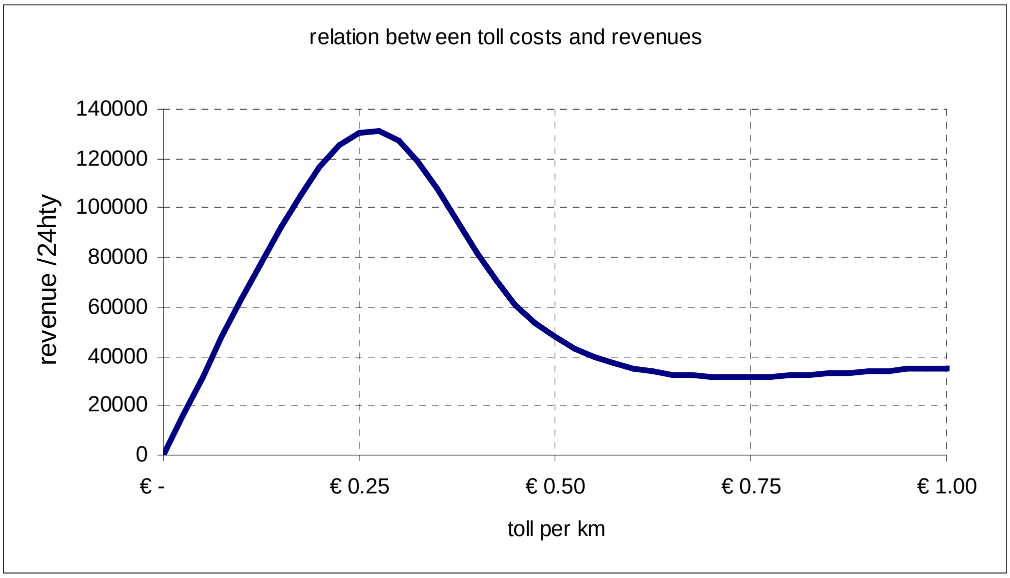


Figure 3-11: revenues at different toll levels, passenger cars

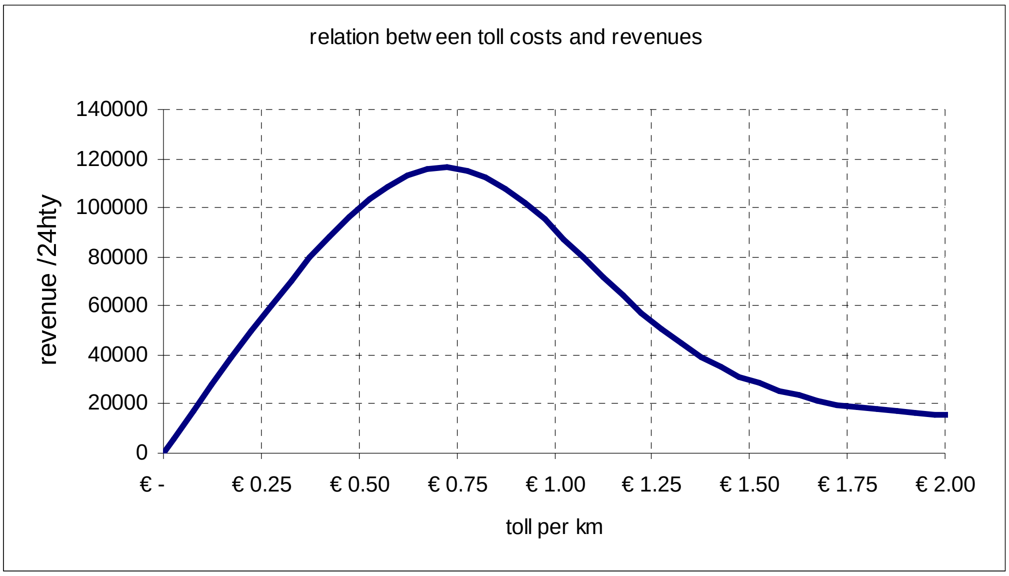


Figure 3-12: revenues at different toll levels, freight traffic

In Figure 3-11 and Figure 3-12, the revenues by the varying toll levels are drawn, for respectively passenger and freight traffic. The results of the calculations are:

	Passenger traffic	**Freight traffic**
Toll rate with maximum revenues [€/km]	0.27	0.73
Overall toll rate with maximum revenues [€]	3.11	8.34
Intensity A4S North [/24h]	47340	13854
Intensity A4S South [/24h]	36484	14015
Daily revenues [€]	130871	116153
Yearly revenues [mio €]	39	35

The yearly revenue is obtained by multiplying the daily revenue with 300 days. The A4 South is expected to yearly generate approximately 75 million euros.

Based on a peak hour factor of 10%[6], it can be expected that the intensities in peak hours reach approximately 3750 passenger car units[7] per hour per direction. A road of two lanes wide will be enough in 2020, but only 6% overcapacity remains.

Alternative with congestion on A15/A29

What are the optimal toll rates if there is some congestion considered on the not tolled alternative via A15 and A29? Assume that approximately 40% of traffic passes in peak hours, and that in peak hours the speed reduces to approximately 60 km/h. In that case, the extra travel time via the A15/A29 will be 8.6 minutes. Only 40% of total traffic experiences this loss time, so the average loss time will be 3.5 minutes.

[6] On the A29 Heinenoordtunnel, peak hour factors reach up to 12% in 2006, source RWS-MTR+ internet application, which can be considered high in comparison with other roads in the Rotterdam area. In this report everywhere a peak factor of 10% is used. In reality however, the peak hour factor tends to decrease when roads become more heavily loaded, and the traffic spreads out more over the day.

[7] Passenger car unit (pcu): in traffic models, the capacity of a road is in most cases expressed in pcu. Passenger cars are 1 pcu, for freight vehicles 2 pcu is used. That means that when road capacity is the subject, freight vehicle intensities should be multiplied by 2.

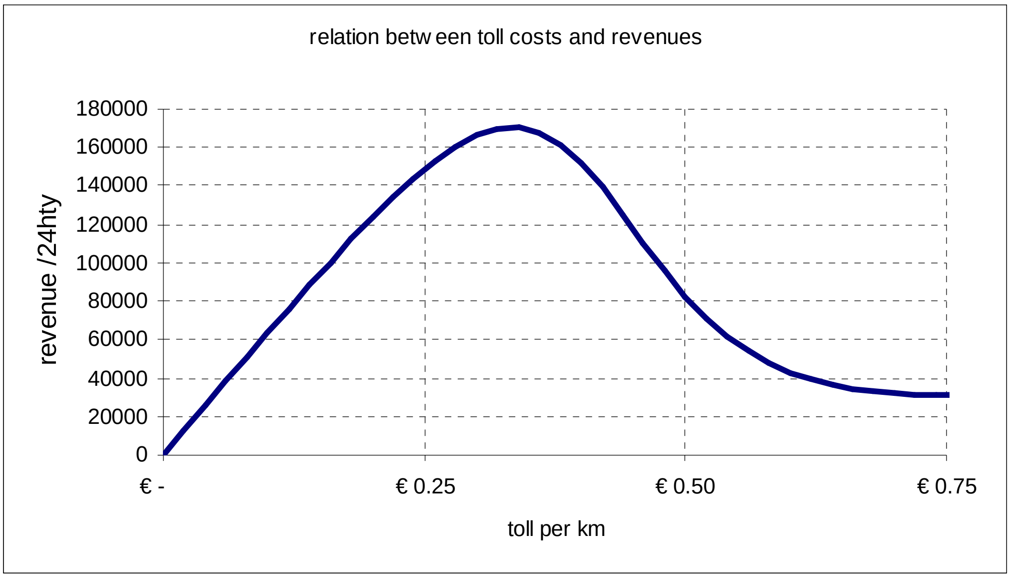


Figure 3-13: revenues at different toll levels in a situation with congestion loss time on A29, passenger cars

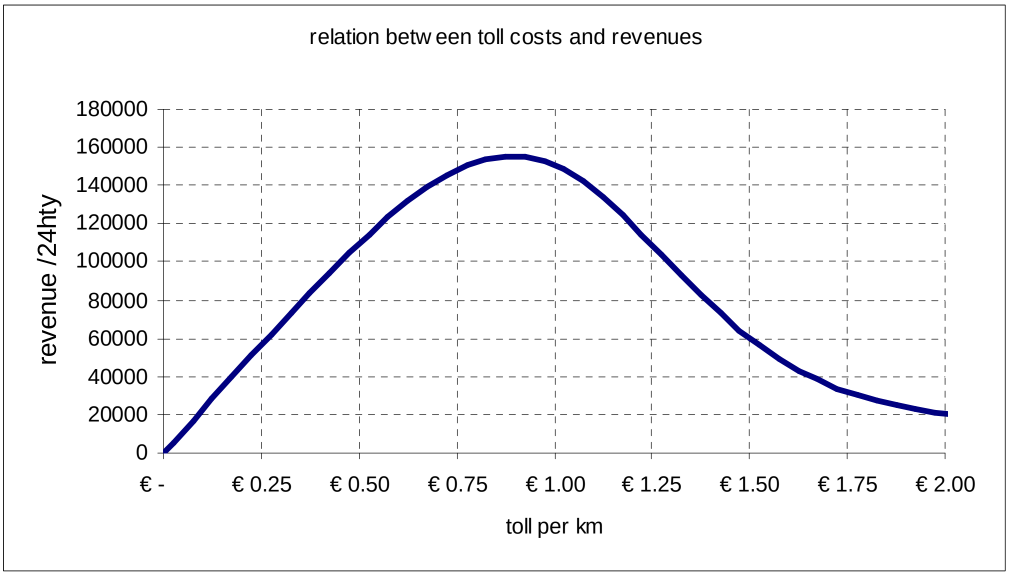


Figure 3-14: revenues at different toll levels in a situation with congestion loss time on A29, freight transport

The results of the calculations, with a reduced speed on the A15/A29 due to congestion are:

	Passenger traffic	**Freight traffic**
Toll rate with maximum revenues[€/km]	0.34	0.89
Overall toll rate with maximum revenues[€]	3.91	10.18
Intensity A4S North [/24h]	47292	15170
Intensity A4S South [/24h]	39561	15391
Daily revenues [€]	170456	155463
Yearly revenues [mio €]	51	47

The yearly revenue is obtained by multiplying the daily revenue with 300 days. The A4 South is expected to yearly generate approximately 100 million euros, if the traffic in peak hours has a reduced average speed of 60 km/h on the A15/A29 route.

In this case, in the peak hours almost 3900 passenger car units (pcu) can be expected, in which a 2x2 road is just suitable. The remaining capacity is 3%.

Sensitivity analysis

The parameters of the route choice function (called α) have been tested in a sensitivity analysis. In Figure 3-15 and Figure 3-16 the effects of varying of these α for passenger and freight traffic drawn. The values on the horizontal axis are chosen so that the resulting logit functions remain within boundaries that resemble more or less the basic route choice function as presented in Figure 3-4

The figures indicate that the revenues can change approximately 15% (freight 30%) when varying the α parameter. The choice of the used values clearly can be seen as an average one.

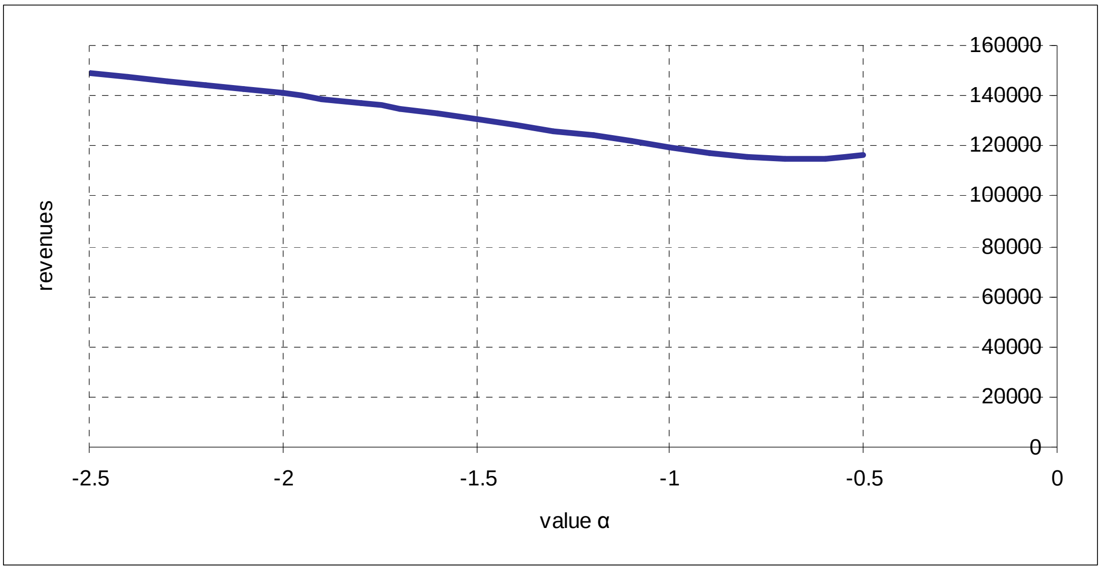


Figure 3-15: sensitivity analysis passenger traffic (used value = -1.54)

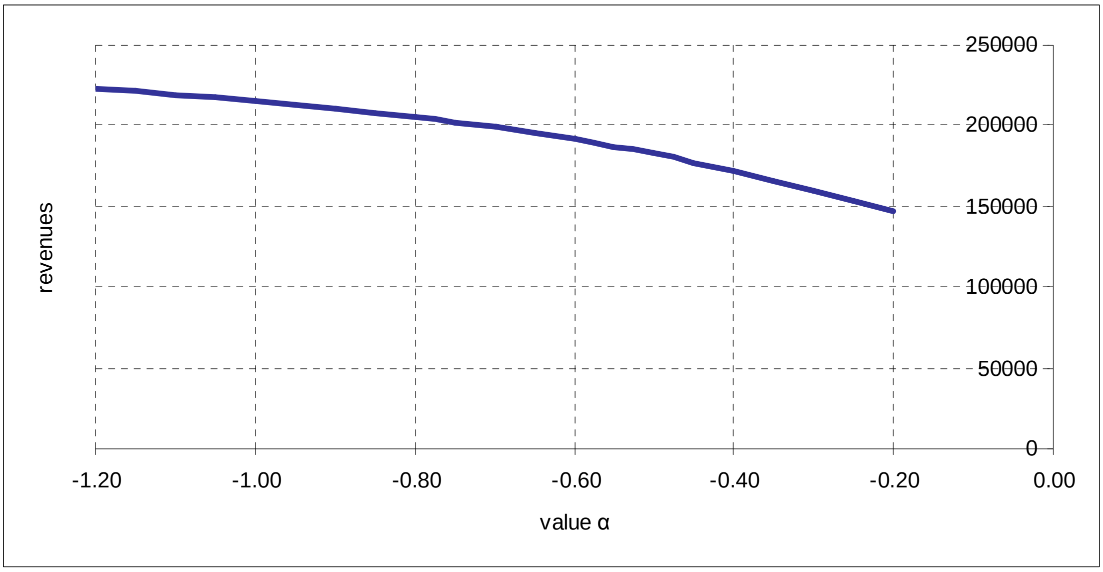


Figure 3-16: sensitivity analysis freight traffic (used value = -0.41)

3.3.3 Financial feasibility of Alternative 1 from a private developer's perspective

The table below describes the main assumptions we used for the preliminarily assessment of the feasibility of the project Alternative 1 from a financial point of view, as well as the results of our financial model. The dates used in this model are the dates mentioned by the PMZ Board.

Assumption and results book Alternative 1 : real toll concession	
Indexes	
Year of reference (1st January)	2007
Inflation rate	2%
Construction Index	3%
Timing Indexes	
Start of Concession	2015
Start of Construction	01/01/2015
Concession Period	**40**
Operation Period	01/01/2020
End of Concession	01/01/2054
Technical characteristics	
Project's length (km)	**11,5**
Traffic Assumptions	
Traffic/day	
Number of vehicles (horizon 2020) AADT *(in thousands)*	**58,90**
(% of Light Vehicles)	74,02%
Number of LVs (horizon 2020)	**43,60**
(% of Heavy Goods Vehicles)	25,98%
Number of HGVs (horizon 2020)	**15,30**
Tolling Horizon 2020	
HGVs Coefficient	2,6
Overall Toll LVs (incl. VAT) in €	**3,91**
Overall Toll HGVs (incl. VAT) in €	**10,18**
Annual traffic Growth	
2020 2025	2%
2026 2030	1,50%
2031 2040	1%
2041 2054	0,50%
Revenues value 2020 (Incl. VAT) in € million	
LVs Revenues	**51**
HGVs Revenues	**47**
Total revenues	**98**
%LVs revenue	52,26%
%HGVs revenue	47,74%

Construction	
Start of construction (year)	2015
Period of construction (year)	5
Construction cost (value 2007 excl. VAT) in € million	**900**
Ramp Up Reserve Account	0,50%
Concession Company cost *per annum*	7,00
Construction schedule	
2015	15%
2016	15%
2017	30%
2018	25%
2019	15%
Maintenance (in € million value 2007)	
Resurfacing (life cycle) excl. VAT	5,75
Number of resurfacing during operation period	3
Resurfacing Frequency (in years)	12
Operation (in € million value 2007 excl. VAT)	
Year of reference (January)	2007
Start of Operation	2020
Operation Cost (tolling) per year (in % of the yearly turnover)	**5%**
Opex excl. tolling (2*3 lanes @ € 300 K/km ; 2*2 lanes @ € 200 K/km)	**2,85**
Opex. Tunnel (excl. tolling) @ € 800 K/km	**1,6**
Concession Company Cost *p.a*	2
Tax assumptions	
VAT rate	19%
Income tax rate	25%
Period of tax reserve account	3
Remuneration of the reserve account	2%
Other Taxes (% of Turn over)	5%

Financing	
Public Financing	
Rate of Subsidy (% Construction cost)	**0%**
Discount rate of public financing	**6%**
Private financing	
Gearing concessionaire (Debt/Equity)	**78%**
Project debt	
Senior Debt Drawdown date	2015
Max Amount of senior Debt	**1098**
Maturity (years)	**39**
Arrangement fee	1%
Commitment fee *p.a.*	0,5%
Swap interest rate	5%
Buffer	0,5%
All-in	**5,50%**
Senior debt margin	1%
DSCR profile	1,8%
Grace period (Post financial closing)	**7**
DSRA amount *(million euros)*	20
Equity	
Shareholders IRR Post income tax (nominal/concession period)	**4,00%**
DSCR (average)	1,2
DSCR Lock up	1,15

TABLE OF USES AND SOURCES FOR ALTERNATIVE 1			
USES		SOURCES	
Construction cost	1232	Equity	310
Concession cost	36	Senior Debt	1098
Capitalized financial interests	110	Subsidy	0
Ramp Up Reserve Account	10		
DSRA	20		
TOTAL	1408	TOTAL	1408

Result and outcomes for Alternative 1

The re-assessment of the PMZ basic variant carried out by First STEP in the Alternative 1 tends to demonstrate the feasibility of the project from a financial point of view, with a sole target of a “zero” public subsidy. However two points need to be highlighted:

- The project might not be attractive enough for private parties in terms of Internal Rate of Return (IRR), especially as the concession company would bear the traffic (and revenue) risk. Indeed the preliminary IRR of 4% resulting from our assumption book could probably be optimized, but it would definitely not reach the usually observed benchmark for similar projects around the world.
- Besides, the Alternative 1 does not solve the problem of congestion and global traffic management of the corridor, which is an equally important issue of the PMZ market consultation.

In order to overcome those two issues, i.e. improving the financial feasibility and managing traffic from a broader and “free-flow” perspective, First STEP imagined and investigated two other possibilities which are developed in our report as Alternatives 2 and 3 and described hereafter.

3.4 Alternative 2: Embracing A4 South, A29 and A4 down to the Belgian border

3.4.1 Description

In alternative 2, toll is collected on the complete A4 South, and the present A29 and A4 up to the Belgian boarder (see figure 3-2). The complete A4 route must become an alternative for the A16 which suffers from congestion. The relatively large share of trucks put extra pressure on the environment, and confronts inhabitants of near cities with high emission levels. Making the A4 a serious alternative for the A16 might help giving the environment around the A16 some slack.

3.4.2 Alternative 2: expected traffic and revenues

The A4 corridor (A4 South, A4, A29) is of course not always completely used; most route alternatives only make use of part of the A4 corridor. As explained before, the alternatives for trips between the OD pairs are worked out in the model. By varying the toll on specific stretches of road the costs of alternatives will change and different alternatives are chosen.

For the first analysis of Alternative 2 the toll rate is gradually increased to € 1.00/km and € 2.50/km for respectively passenger cars and freight vehicles. Passenger cars react stronger on increased toll levels, because their lower values of time and costs per km make the absolute cost differences between alternatives smaller.

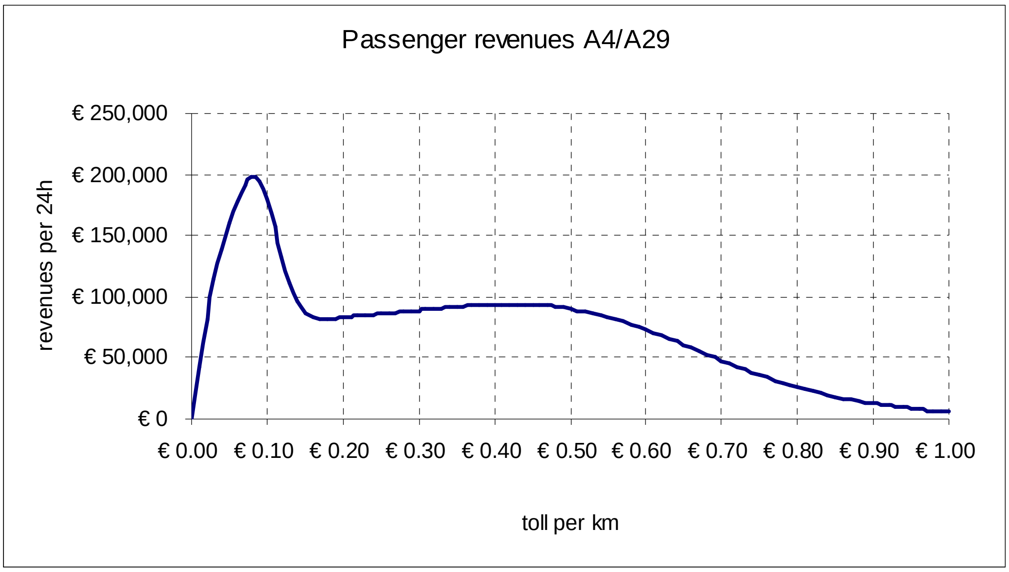


Figure 3-17: revenues at different toll rates, passenger cars

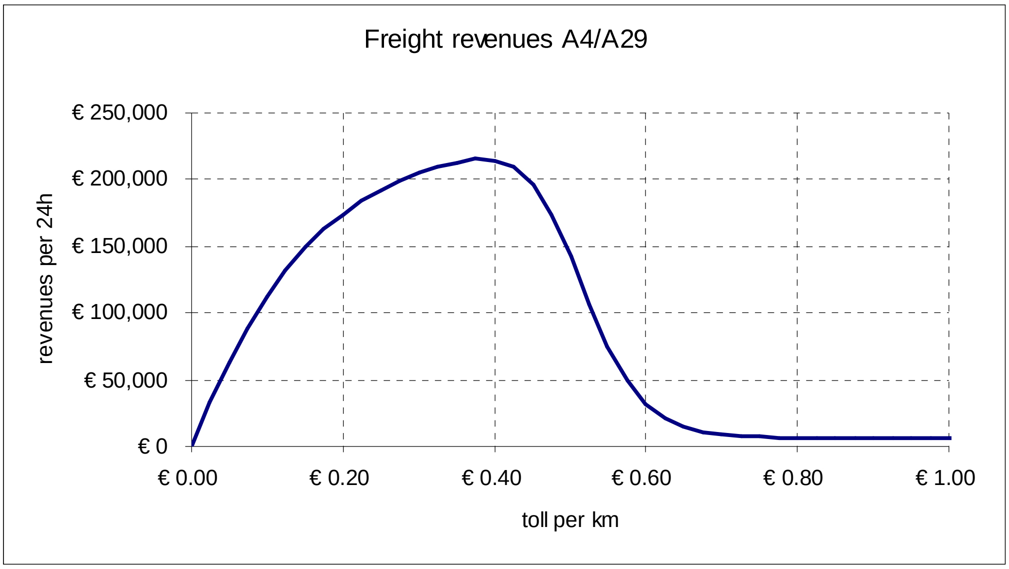


Figure 3-18: revenues at different toll rates, freight vehicles

For both passenger cars and freight vehicles which generate the maximum revenues tolling levels can be defined of respectively € 0.08/km and € 0.38/km. The toll costs for using the complete A4 corridor would then become approximately € 5 for passenger cars and € 23 for freight vehicles. This might look like enormous tolling rates, but apparently the seemingly high total toll for freight vehicles are in many cases acceptable. It is also important to consider that different origins and destinations are taken into account, so most passenger and freight trips only use parts of the tolled A4 corridor. Most road users will therefore not pay the full amount.

Looking at the revenue graphs, increasing the toll rates too far would lead to strong decreases in revenues. It seems therefore important to carefully choose a toll rate. To conclude, the yearly revenues are obtained by multiplying the daily revenues with 300 days; 120 mio per year.

		Passenger traffic	**Freight traffic**
Toll rate with maximum revenues	[€/km]	0.08	0.38
Overall toll rate with maximum revenues	[€]	4.88	23.18
Intensity A4S Oude Maas	[/24h]	35806	8673
Intensity A4S Spui	[/24h]	35806	8673
Intensity A29 Oude Maas	[/24h]	54481	1401
Intensity A4 Haringvliet	[/24h]	40664	8869
Intensity A16 Hollands Diep	[/24h]	121.136	38834
Daily revenues	[€]	197946	214253
Yearly revenues	[mio €]	64	59

Using a peak hour factor of 10%, at the A4 South intensities in peak hours can be expected of 2650 passenger car units (pcu) per direction. A 2x2 road is therefore enough to provide the users with a high level-of-service. According to the calculations, also the rest of the A4 will need 2 lanes each side, because peak hour intensities at the Haringvliet Bridge are around 2900 veh/h per direction. The intensities of 9950 pcu per direction at the Moerdijkbridge are rather high. This means that the road is loaded up to its capacity during peak hours, when implemented as a 2x5 road (the Moerdijkbridge is 2x3 nowadays)! It might therefore be considered to decrease toll rates on the A4 South to attract more traffic. However, in the basic variant from PMZ, with no toll on any road, 152000 pcu cross the Moerdijkbridge per 24h, leading to a peak hour intensity of just over 7500. In this situation a 2x4 road is already necessary.

In the table below the needed infrastructure width in 2020 is presented for each river crossing, together with the remaining, unused capacity during peak hours.

River crossing	*Needed road width*	*Remaining capacity*
A4S Oude Maas	2x2	34%
A4S Spui	2x2	34%
A29 Oude Maas	2x2	28%
A4 Haringvliet	2x2	27%
A16 Hollands Diep	2x5	1%

Justifying a 2x3 A4 South

To attract enough traffic to justify constructing the A4 South as a 2x3 road, toll rates should be decreased by 50% to € 0.04/km for passenger cars, and € 0.19/km for freight vehicles. Of course, revenues will be lower in that case, as can be seen in the table below: 93 mio per year.

	Passenger traffic	*Freight traffic*
Toll rate [€/km]	0.04	0.19
Overall toll rate [€]	2.44	11.59
Intensity A4S Oude Maas [/24h]	51145	14540
Intensity A4S Spui [/24h]	51145	14540
Intensity A29 Oude Maas [/24h]	59587	2741
Intensity A4 Haringvliet [/24h]	60171	16024
Intensity A16 Hollands Diep [/24h][8]	105591	35125
Daily revenues [€]	139132	169823
Yearly revenues [mio €]	42	51

The A16 at the Moerdijkbridge still needs 5 lanes for each direction, but the remaining capacity in peak hours increases to 12%.

River crossing	*Needed road width*	*Remaining capacity*
A4S Oude Maas	2x3	33%
A4S Spui	2x3	33%
A29 Oude Maas	2x2	19%
A4 Haringvliet	2x3	23%
A16 Hollands Diep	2x5	12%

3.4.3 Sensitivity of revenues

Figure 3-19 shows the decrease of revenues as a result of decreasing toll rates. As can be clearly seen, if the toll rate is reduced by 50%, the revenue from passenger cars reduces by 30%. The freight sensitivity is less high. The table below contains more or less the same information.

	passenger cars			**freight vehicles**		
	toll	revenues	decrease	toll	revenues	decrease
0%	€ 0.080	€ 197946	0.0%	€ 0.380	€ 214861	0.0%
-10%	€ 0.072	€ 193465	-2.3%	€ 0.342	€ 211949	-1.4%
-20%	€ 0.064	€ 183809	-7.1%	€ 0.306	€ 206021	-4.1%
-30%	€ 0.056	€ 170812	-13.7%	€ 0.267	€ 196996	-8.3%
-40%	€ 0.048	€ 155884	-21.2%	€ 0.228	€ 184988	-13.9%
-50%	€ 0.040	€ 139132	-29.7%	€ 0.190	€ 169823	-21.0%

[8] No toll levied in this alternative.

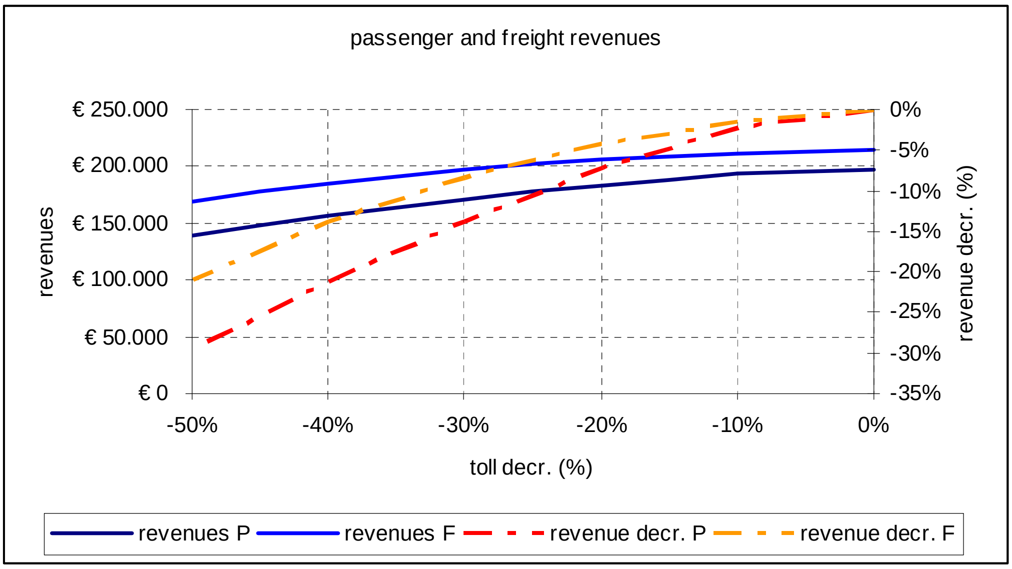


Figure 3-19: decrease of revenues by decreasing toll rates

3.4.4 Financial feasibility of Alternative 2 from a private developer's perspective

The table below describes the main assumptions First STEP used in order to preliminarily assess the feasibility of the project Alternative 2 from a financial point of view. The dates used in this model are the dates mentioned by the PMZ Board:

Assumption and results book Alternative 2 : availability based concession	
Indexes	
Year of reference (1st of January)	2007
Inflation rate	2%
Construction Index	3%
Timing Index	
- Start of Concession	2015
- Start of Construction	01/01/2015
- **Concession Period**	**40**
- Operation Period	01/01/2015
End of Concession	01/01/2054
Technical characteristic	
Project's length (A4South + A4 + A29)	**73**
Traffic Assumptions	
- **Traffic/day**	
number of vehicles (horizon 2020) AADT *(in thousands)*	**49,70**
(% of LVs)	81,49%
Number of LVs (horizon 2020)	**40,50**
(% of HGVs)	18,51%
Number of HGVs (horizon 2020)	**9,20**

Tolling Horizon 2020		
HGVs Coefficient		4,8
Overall Toll LVs (incl. VAT) in €		**4,88**
Overall Toll HGVs (incl. VAT) in €		**23,18**
Annual traffic Growth		
	2015 2025	2%
	2026 2030	1,5%
	2031 2040	1%
	2041 2054	0,5%
Revenues value 2020 (Incl. VAT) in € million		
LVs Revenues		**59**
HGVs Revenues		**64**
Total revenues		**123**
%LVs revenue		48,10%
%HGVs revenue		51,90%
Construction		
Start of construction (year)		2015
Period of Construction (year)		5
Construction cost (value 2007 excl. VAT) in € million		**900**
RURA		0,50%
Concession Company cost *p.a.*		7
Construction schedule		
2015		20%
2016		15%
2017		25%
2018		25%
2019		15%
Maintenance (in € million value 2007)		
Resurfacing (life cycle) excl.VAT		36,5
Number of resurfacing in operation period		3
Resurfacing frequency		12
Operation (in € million value 2007 excl. VAT)		
Year of reference (January)		2007
Start of Operation		2015
Operation Cost (tolling) / year		**5%**
Opex (excl. tolling)		**15,2**
Opex. Tunnel (excl. tolling)		**1,6**
Concession Company Cost p.a		2
Tax assumptions		
VAT rate		19%
Income tax rate		25%
Period of tax reserve account (in years)		3
Remuneration of the reserve account		2%
Other Taxes (% of Turn over)		5%

Financing	
Public Financing	
Rate of Subsidy (% Construction cost)	**0%**
Discount rate of public financing	**6%**
Private financing	
Gearing concessionaire	**85%**
Project debt	
Senior DebtDrawdown date	2015
Max Amount of senior Debt	**966**
Maturity (years)	**35**
Arrangement fee	1%
Commitment fee p.a.	0,5%
Swap interest rate	5%
Buffer	0,5%
All-in	**5,50%**
Senior debt margin	1%
DSCR profile	1,8%
Grace period (Post financial closing)	**3**
DSRA amount *(million euros)*	20
Equity	
Shareholders IRR Post income tax (nominal/concession period)	**6,70%**
DSCR (average)	1,2
DSCR Lock up	1,15

TABLE OF USES AND SOURCES FOR ALTERNATIVE 2 during construction period			
USES		**SOURCES**	
Construction cost	1228	Equity	170
Concession cost	36	Senior Debt	966
Capitalized financial interests	98	Subsidy	0
Ramp Up Reserve Account	6	Availability payment	395
DSRA	20		
OPEX	142		
TOTAL	1531	**TOTAL**	1531

Result and outcomes for Alternative 2

The assessment of the feasibility of the Alternative 2 conducted by First STEP demonstrates an improved result from a financial point of view, with a IRR preliminary estimated around 6,7% which could probably be optimised through fine-tuned financial engineering.
However two points need to be highlighted:

- This Alternative still might not be attractive enough for private parties from a financial point of view as it does not have sufficient prospect of earning capacity;
- Besides, the Alternative 2 might not tackle with congestion and global traffic management as much as expected for the reason that it might bring strong side effects on the A16, the competing alternative route from Rotterdam to the Belgian border.

These outcomes are precisely the reason for First STEP to building a third alternative, as described below.

3.5 Alternative 3: Managing the whole Corridor

3.5.1 Description

In alternative 3, toll is collected on all main roads in the Mainportcorridor. This includes the A29, A4 and the A16 up to the Belgian boarder, and the highways A17, A58 and A59 (in the figures in this section indicated as A17) that lie in between.

3.5.2 Expected traffic and revenues

The toll rates are gradually increased to €1.00 for passenger cars and €2.50 for freight vehicles. The total revenues of tolling the complete corridor are subsequently calculated. These revenues are built up out of the revenues of the mentioned roads together. Note that, for example, the A16 revenues while tolling the whole corridor differ from the revenues that are gathered in case only the A16 is tolled (see Figure 3-20 and Figure 3-21).

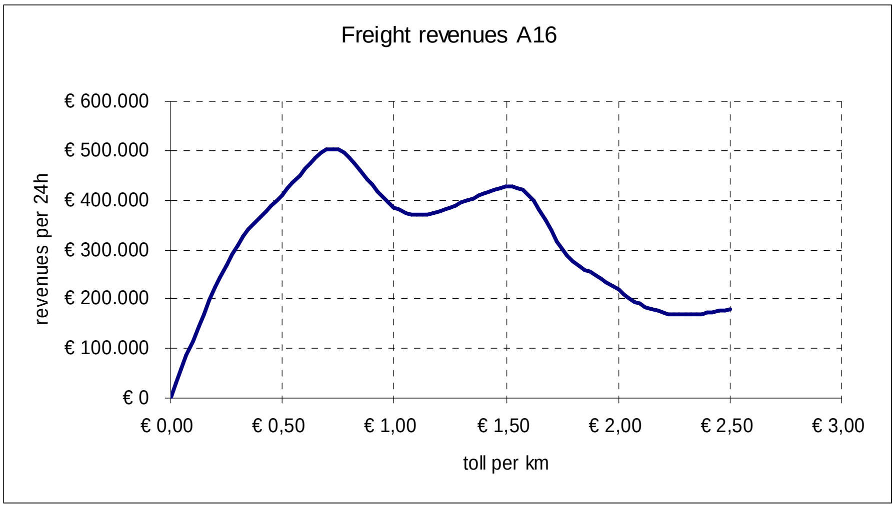


Figure 3-20: revenues from the A16 while tolling all roads in the corridor

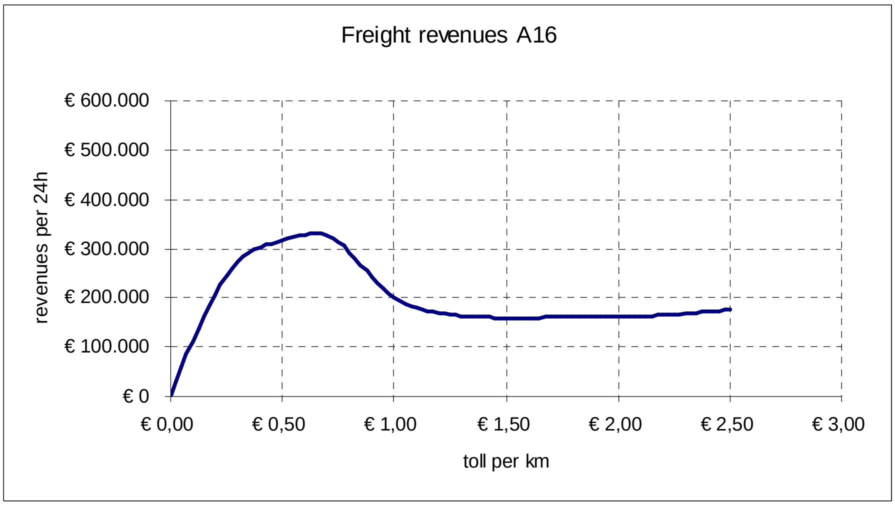


Figure 3-21: revenues from the A16 while only the A16 is tolled

In Figure 3-22 and Figure 3-23 the tolling revenues are given in case the whole corridor is tolled for both freight vehicles and passenger cars. The optimum toll levels are € 0.26/km for passenger cars, and € 0.68 for freight vehicles, generating revenues of respectively 1.2 million and 1.1 million euros per 24 hours.

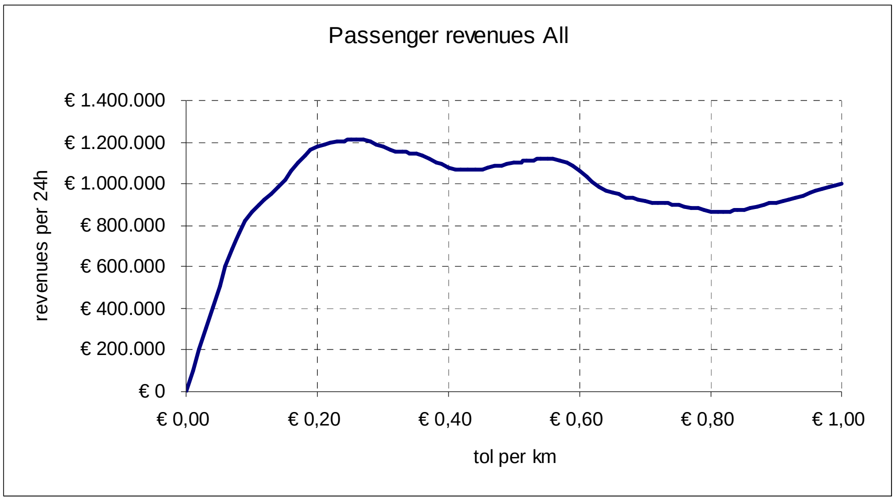


Figure 3-22: Revenues at different toll rates for the complete corridor, passenger cars

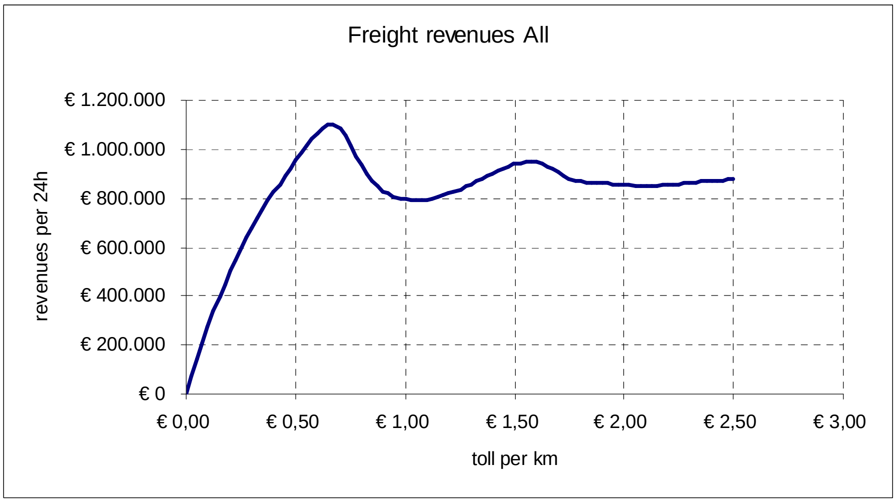


Figure 3-23: Revenues at different toll rates for the complete corridor, freight vehicles

In the table below the intensities are given of the different roads in the corridor at the optimal toll level that generates maximum revenues.

		Passenger traffic	**Freight traffic**
Toll rate with maximum revenues	[€/km]	0.26	0.68
Toll complete corridor	[€]	15.86	41.48
Intensity A4 South Oude Maas	[/24h]	14080	9584
Intensity A4 South Spui	[/24h]	14080	9584
Intensity A29 Oude Maas	[/24h]	54618	2605
Intensity A4 Haringvliet	[/24h]	28445	14087
Intensity A16 Hollands Diep	[/24h]	48960	17409
Daily revenues	[€]	1214978	1095609
Daily revenues A4	[€]	364054	474673
Daily revenues A17, A58, and A59	[€]	190660	123514
Daily revenues A16	[€]	660264	497422
Yearly revenues	[mio €]	365	329

The expected yearly revenues for the whole corridor are about 700 million euros. The intensities determine the required dimensions (number of lanes per direction) of the roads. The dimensions of the A4 South and the A29 can be 2 lanes in each direction, because the intensities in the peak hour are respectively 1700 and 3000 passenger car units (pcu) per direction. The congestion problems at the A16 appear to be solved, since only 4200 vehicles per direction remain left in the peak hour.

River crossing	*Needed road width*	*Remaining capacity*
A4S Oude Maas	2x2	58%
A4S Spui	2x2	58%
A29 Oude Maas	2x2	25%
A4 Haringvliet	2x2	29%
A16 Hollands Diep	2x3	30%

The quite high level of toll rates has a vast influence on the traffic: 54% of passenger cars and 42% of freight vehicles choose to use a route outside the corridor. In most cases that will be a route via the A27 or N57. These roads are not able to handle these large increases of traffic, and will become congested. As a result, these routes will become less attractive, and some traffic will return to the A4 Corridor. The amount of this effect cannot be calculated with the quick scan model; neither are demand effects (destination and mode choice).

Further maximizing the revenues

The revenues can be increased by tuning the toll rates on the A4, the A16, and the A17, A58 and A59 based on the found rates with maximum revenues in the previous section. It is obvious that the optimal toll rates for both the A4 and A16 are closely approached by the overall optimum toll rate. On the other hand, the optimal toll rate at the A17, A58, and A59 can be put much higher. With a toll of approximately € 1.60/km for freight on the above mentioned roads, the revenues increase from € 122835 to € 203920 per day.

The same can be done for passenger cars. The overall toll optimum lies again close to that of the A4 and the A16. The toll level for the A17, A58, and A59 can be increased to optimize the toll revenues. Thus, the A4 toll will remain € 0.26/km, the A16 will be slightly decreased to € 0.20/km, and the A17, A58, and A59 toll rates will be increased to € 0.50/km.

The total revenues increase from € 1214978 to € 1361645 per 24 hours. Those gained on the A4 remain more or less the same, the A16 revenues increase from € 660264 to € 707354, and the A17, A58, and A59 revenues increase from € 190660 to € 292371 per 24 hours.

To conclude, in the next table the results are presented of the optimized tolling rates in case the whole corridor is tolled.

		Passenger	**Freight**
Toll rate with maximum revenues A4	[€/km]	0.26	0.65
Toll rate with maximum revenues A16	[€/km]	0.20	0.75
Toll rate with maximum revenues A17, A58, and A59	[€/km]	0.50	1.60
Daily revenues	[€]	1361645	1208496
Daily revenues A4	[€]	361920	535287
Daily revenues A17, A58, and A59	[€]	292371	202260
Daily revenues A16	[€]	707354	470950
Yearly revenues	[mio €]	409	363

The expected yearly revenues for the whole corridor with optimised toll rates are about 770 million euros.

3.5.3 Lowering the toll rates to equal the needed revenues

A yearly revenue of 193 million euros is enough for financing construction of the A4 South, and maintenance of all roads in the corridor. The in section 3.5.2 calculated yearly revenues are much higher: from 620 to 770 million euros. First STEP thinks it would be better in that situation to decrease the toll levels, because otherwise road users would be forced to pay more than the costs of the infrastructure.

Lowering the revenues by decreasing the toll rates can be done in more than one way. Both light and heavy vehicles toll rates can be decreased by a certain, not necessarily equal, percentage. To keep it simple, at first the toll rates are proportionally decreased. Optimization, with for instance, a larger decrease on the rate of heavy vehicles, can always be done later.

Using Figure 3-22 and Figure 3-23, targeting at a daily revenue of 645000 euros, it appears that toll rates can drop with 86% to € 0.04 for light vehicles (which is almost the same amount as envisaged in ABvM), and € 0.10 for heavy vehicles.

In the table below the intensities are given of the different roads in the corridor for these toll levels.

	Passenger traffic	*Freight traffic*
Toll rate [€/km]	0.04	0.10
Toll complete corridor [€]	2.44	6.10
Intensity A4S Oude Maas [/24h]	63039	18209
Intensity A4S Spui [/24h]	63039	18209
Intensity A29 Oude Maas [/24h]	63323	4806
Intensity A4 Haringvliet [/24h]	74734	22209
Intensity A16 Hollands Diep [/24h]	89182	30278
Daily revenues [€]	407438	273451
Daily revenues A4 [€]	171486	122975
Daily revenues A17, A58, and A59 [€]	56539	34914
Daily revenues A16 [€]	179413	115562
Yearly revenues [mio €]	122	82

The expected yearly revenues with these decreased toll rates are about 205 million euros. Because of the lower toll rates, the intensities in the corridor are higher. The needed dimensions of the river crossing are in the table below.

River crossing	*Needed road width*	*Remaining capacity*
A4S Oude Maas	2x3	17%
A4S Spui	2x3	17%
A29 Oude Maas	2x2	9%
A4 Haringvliet	2x3	1%
A16 Hollands Diep	2x4	6%

What can be clearly seen is that the roads are much better used than in the situations described before. The A4 Haringvliet and the Moerdijkbrug are in fact too heavily loaded. They both need 4 lanes per direction, while the current and planned capacity is less. Building these extra lanes is not included of the scope of this Alternative.

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3.5.4 Financial feasibility of Alternative 3 from a private developer's perspective

The table below describes the main assumptions First STEP used in order to preliminarily assess the feasibility of the project Alternative 2 from a financial point of view. The dates used in this model are the dates mentioned by the PMZ Board:

Assumption and results book Alternative 3 : availability based concession	
Indexes	
Year of reference (1st of January)	2007
Inflation rate	2%
Construction Index	3%
Timing Index	
- Start of Concession	2015
- Start of Construction	01/01/2015
- **Concession Period**	**40**
- Operation Period	01/01/2015
End of Concession	01/01/2054
Technical characteristic	
Project's length (km) **(A4 + A29 + A16 + A17 + A58 + A59)**	**181**
Traffic Assumptions	
- **Traffic/day**	
number of vehicles (horizon 2020) AADT *(in thousands)*	**103,00**
(% of LVs)	74,37%
Number of LV (horizon 2020)	**76,60**
(% of HGVs)	25,63%
Number of HGVs (horizon 2020)	**26,40**
Tolling Horizon 2020	
HGVs Coefficient	**2.5**
Overall Toll LVs (incl. VAT) in €	**2,44**
Overall Toll HGVs (incl. VAT) in €	**6,10**
Annual traffic Growth	
2015 2025	2%
2026 2030	1,5%
2031 2040	1%
2041 2054	0,5%
Revenues value 2020 (Incl. VAT) in € million	
LVs Revenues	**101,5**
HGVs Revenues	**91,5**
Total revenues	**193**
%LVs revenue	52,59%
%HGVs revenue	47,41%

Construction	
Start of construction (year)	2015
Period of construction (year)	5
Construction cost (value 2007 excl. VAT) in € million	**900**
RURA	0,5%
Concession Company cost p.a.	7
Construction schedule	
2015	20%
2016	15%
2017	25%
2018	25%
2019	15%
Maintenance (in € million value 2007)	
Resurfacing (life cycle) excl. VAT	91
Number of resurfacing in operation period	3
Resurfacing frequency	12
Operation (in € million value 2007 excl. VAT)	
Year of reference (January)	2007
Start of Operation	2015
Operation Cost (tolling) / year	**5%**
Opex (excl. tolling)	**42,1**
Opex Tunnel (excl. tolling)	**1,6**
Concession Company Cost p.a	4
Tax assumptions	
VAT rate	19%
Income tax rate	25%
Period of tax reserve account (in years)	3
Remuneration of the reserve account	2%
Other Taxes (% of Turn over)	5%
Financing	
Public Financing	
Rate of Subsidy (% Construction cost)	**0%**
Discount rate of public financing	**6%**
Private financing	
Gearing concessionaire	**90%**
Project debt	
Senior DebtDrawdown date	2015
Max Amount of senior Debt	**919**
Maturity (years)	**43**
Arrangement fee	1%
Commitment fee p.a.	0,5%
Swap interest rate	6%

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Buffer	0,5%
All-in	**6,50%**
Senior debt margin	1%
DSCR profile	1,8%
Grace period (Post financial closing)	**5**
DSRA amount *(million euros)*	20
Equity	
Shareholders IRR Post income tax (nominal/concession period)	**13,43%**
DSCR (average)	1,2
DSCR Lock up	1,15

TABLE OF USES AND SOURCES FOR ALTERNATIVE 3 during construction period			
USES		**SOURCES**	
Construction cost	1228	Equity	102
Concession cost	36	Senior Debt	919
Capitalized financial interests	100	Subsidy	0
Ramp Up Reserve Account	6	Availability payment	695
DSRA	20		
OPEX	326		
TOTAL	1717	**TOTAL**	1717

Outcomes for Alternative 3

The assessment of the feasibility of the Alternative 3 conducted by First STEP demonstrates a satisfactory result from a financial point of view, with an IRR preliminary estimated around 13-14%. This rate of return being usually observed on similar projects.

From a traffic and congestion management point of view this alternative appears to be also the most efficient as the private operator is given responsibility of the full network of the PMZ corridor, while the Public Authority would remain in charge of setting appropriate toll fares in order to adjust demand to capacity on every part of the network (in accordance with Anders Betalen voor Mobiliteit).

3.5.5 Building the A4 South as a light road

Implementing the new to be built road as a light road, only to be used by light vehicles, brings some important cost reductions. Examples of 'light' highways are the A86 West Tunnel in Paris (partially opening this year) and the proposed tunnel A6-A9 in the Netherlands.

The light A4 South, due to the low axle loads involved, might be constructed as a continuously poured, reinforced slab of concrete, without further foundation, topped with a layer of asphalt. The main benefit is the fast, relatively simple building process, saving labour costs (the major part of the total costs). Material costs, however, would increase. Setting is an interesting aspect of this type of road. The road is free to set, which saves the effort of fighting setting during construction and maintenance. However, the road should be stiff enough to resist bending and torsion to a certain extent. All in all, significant cost reductions would be expected.

In our preferred alternative all heavy vehicles have to use the A15-A29 route. This has a number of benefits:

- the construction and maintenance costs of the A4 South can be lowered
- the negative effects on the local residents (sound, air quality) in Hoogvliet and Poortugaal will be less
- the separation of traffic types increases capacity of the corridor

Another impact which has to be recognized is that the heavy vehicles have to make a detour, travelling from the Benelux interchange to Klaaswaal. However, they have to make this detour also in the situation without an A4 South, like now. Furthermore, for this variant it makes sense to retrofit the tunnel in the A29 (Heinenoordtunnel) for category 0 hazardous goods, changing the A29 into a dedicated cargo route. This again has the benefit of concentrating flows on one route.

Although these benefits are of significant importance to the physical planning and negotiation process, at this stage we have not attempted to assess their economic value. Instead we have focused on the expected construction cost and revenue impacts, the key inputs to the business case.

Expected cost reductions

Dedication of the A4Z to light vehicles has the following design consequences:

- tunnel (Oude Maas) with a lower cross section, which means less excavations and shorter ramps
- bridge with a lower load capacity, which can be capitalized especially when short spans are chosen
- increased acceptable inclination, shortening the ramps of the tunnel and the bridge
- lowering of the road in the Hoeksche Waard: less or no longer needed
- substructure/foundation with a lower load capacity, which means less setting issues (considering the soft soil conditions along the whole stretch of the route)

In general, the height of no obstruction can be lowered from 4.2 m to 3 m. The maximum axle load can be lowered to, for example, 2000 kg.

No detailed calculations of the resulting cost reduction due to these design consequences have been made yet. A first rough estimate of expected reductions in construction costs is given in the table below, presenting a comparison between the ‘standard’ A4Z and the light variant. On some sections the expected cost reduction would be limited to 10%. On others, a reduction of 75% is achieved.

	standard A4 South	light A4 South
Part 1 Hoogvliet	€ 180 million	€ 162 million
Part 2 Oude Maas	€ 230 million	€ 207 million
Part 3 Spijkenisse	€ 10 million	€ 9 million
Part 4 Spui	€ 200 million	€ 180 million
Part 5 Oud Beijerland	€ 160 million	€ 36 million
Part 6 Klaaswaal	€ 10 million	€ 9 million
Road and facilities	€ 110 million	€ 110 million
Total (ex VAT)	€ 900 million	€ 713 million

Heavy vehicles are the main source of tear and wear of roads. Removing them from the A4Z should lead to a significant cut in maintenance costs (by at least, say, 50%). However, the A29 will likewise suffer from an increase in maintenance costs. At this stage it is difficult to say how the balance will strike.

Expected traffic and revenue

The main effect of this light implementation is that heavy vehicles cannot use the A4 South. They are forced to use the A15/A29 or A16 as an alternative. It can be assumed that most heavy vehicles that want to use the A4 South will choose the A29 instead. On the A29 that means an increase from 3380 to nearly 18000 heavy vehicles a day. As a result, part of the light vehicles that use the A29 in the ‘regular’ alternative 3, will flee to the A4 South, because of the quite large numbers of trucks on the A29. In peak hours, 900 heavy vehicles will pass per direction on the A29, which corresponds to almost the capacity of a highway lane.

The revenues will hardly be influenced, because the length of the A29 between Vaanplein and Klaaswaal is equal to the length of the A4 South.

3.6 Conclusions

The sections in which the different results are described finished with an estimation of yearly total revenue.

Alternative		*Estimated yearly revenue [million euros]*
1	A4 South A4 South, congestion on A29	75 100
2	A4/A29 Complete Optimized use of A4 South	120 93
3	Corridor Maximized revenues Optimized use of A4 South Corridor with light A4 South Revenues collected equal revenues needed	700 770 620 700 Ca. 193

Alternative 3 is very interesting and is innovative in Dutch infrastructure development.
We prefer this solution because of the robust and significant impact it has on the traffic flows on both axes A4/A29 and A16. Therefore it can avoid congestion and improve the overall environmental condition of the area. The tariffs are congruent with the planned tariffs of "Anders Betalen voor Mobiliteit" and the income generated covers construction costs as well as operations and maintenance costs in the whole PMZ Corridor. Environmental benefits in the A16 corridor and Dordrecht area are also better served with this alternative, which leads to higher general societal revenues.

The table below facilitates financial comparison between the three alternatives:

Summary table of the 3 Alternatives

	Alternative 1	**Alternative 2**	**Alternative 3**
Contract period (in years)	**40**	**40**	**40**
Capex (€ M value 2020)	**1 228**	**1 228**	**1 228**
Equity (€ M value 2020)	310	170	102
Debt (€ M value 2020)	1098	966	919
Gearing	78%	85%	90%
NPV of Revenues (€ M value 2020)	1 369 (real toll)	2 038 (availability fee)	3 258 (availability fee)
Subsidy	**0**	**0**	**0**
Return (IRR)	4,00%	6, 70%	13,43%

4 Project Structuring

In this chapter First STEP's approach to risk management and project structuring and the link with the preferred alternative is described. In the first paragraph the risk profile and risk allocation is presented. Paragraph 4.2 sets out the relationship between project tangibility, land ownership, possible project structures and the advantages and disadvantages per possible structure. In this paragraph the rights and duties of both public and private party are described at a high level. After that an overview is given of the match between the preferred alternative with the feasible structures. The conclusion combines the risk profiles with the matching project structure to come with First STEP's preferable and feasible alternative and project structure.

4.1 Risk management: Allocation from a value for money perspective

4.1.1 Risk analysis and inventory

For the risk inventory First STEP makes a distinction between: Completion risks; Performance risks; Revenue risks and Development risks.

The Completion risk profile consists of risks resulting in the design and building activities not being completed in time and for the budgeted costs with the following four possible financial consequences:

- Higher design and construction costs than budgeted to comply with the requirements of the Grantor as stated in the Output Specifications.
- Acceleration costs to prevent delays
- Contractual fines for delay reflecting the actual liquidated damages for the Grantor (value for money)
- Extra financing costs due to postponement of revenue (e.g. toll) and if the End date is fixed, the shortening of the revenue period. With regard to the shortening of the income period, it should be recommended from a value for money point of view to extend the End date simultaneously with the extension of the completion date.

The Performance risks are the risks during the operate & maintenance phase that operation & maintenance cost turn out higher than budgeted to comply with the requirements of the Grantor as stated in the Output Specifications and/or deductions on the availability payments due to non compliance with the performance requirements.

The Revenue risks are the risk during the operate & maintenance phase that the number of vehicles (volume risk) and the prices of the toll (price risk) do not correspond with the assumptions in the business case that results in more or less revenue.

Development risks concern the land and real estate development results or residual value of assets which do not correspond with the assumptions in the business case that results in more or less revenue.

4.1.2 Ranking of risks

To get a feel for the magnitude of the risks for the PMZ project the method of risk mapping is used. Therefore the probability of occurrence is described in a number of categories from “highly likely” to “extremely unlikely”. Also the consequences of risk occurrence are categorized from a bankruptcy situation for the project to a situation with a trivial effect on the project result whereby the leading principles are the possible loss of investments for the equity providers and lenders and a possible loss of profit for the equity providers, lenders and (sub)contractors. Using this information, the weight factors of the assessed probability of occurrence and consequence are multiplied which results in four possible outcomes regarding the risk value:

1. A negligible risk that can be subject to risk surcharge and simple mitigation measures.

2. An acceptable risk which should be budgeted or retained, mitigated and managed by the Project Company by taking (organisational) measures in the design construct, operate and maintenance activities.

3. An undesirable risk can be a serious threat for project investment and/or profit and must be reduced through technical measures, risk transfer, risk sharing with the Grantor or by insuring the risk

4. An intolerable risk that leads to non-bankability must be prevented or reduced by risk transfer to the Grantor or by insuring the risk.

A factor to consider in this respect is the insurability of risks.

4.1.3 Risk mapping

Starting point for risk allocation is that risk should be mitigated by considering which party is most capable to manage the risk in a most cost effective manner. From a contractual point of view risks can be owned by the Grantor, the Project Company or risks can be shared. The allocation of risks should be based on the consideration which party influences the causes of risks and which party influences the consequences of risks. Risk sharing is an interesting alternative for risks that (1) have multiple causes and consequences which can be influenced by both the Grantor as well as the Project Company and (2) risks of which the cause can be best influenced by one party and the mitigation of the consequences by another party. This principle can be best explained by the following figure:

	Project Company can control the cause of a risk	Project Company cannot control the cause of a risk
Project Company can control the consequence of a risk	Project Company’s risk	Risk sharing
Project Company cannot control the consequence of a risk	Risk sharing	Grantor’s risk

An important aspect of risk allocation is the insurance of risks which are considered to be undesirable or intolerable for the private sector and as a result can jeopardize the bankability of the project. Risks that are interesting to insure from a value for money perspective are those risks which can be characterized by a small likelihood but severe consequences. In outline a consortium should be able to deliver an insurance program for the PMZ project for example as indicated below, but final conclusions on this are very dependent on the size of the project and remain obviously subject to further study when the real project scope and its financial size is precisely known:

Construction period:

- Construction All Risks, including if necessary a marine cargo insurance to cover material damages to the civil works
- Liability insurance to cover liability for damage towards the Grantor (not being contractual fines) and third parties and to cover Grantor's liability.
- Delay and Start Up insurance to cover consequential losses of late completion caused by an insured event, for example extra finance costs.
- A professional indemnity insurance to cover design risks

Operation period:

- Liability insurance to cover liability for damage towards the Grantor (not being contractual fines) and third parties
- Business Interruption insurance to cover consequential losses of non-availability caused by an insured event.

4.1.4 Top Ranking Risks

The conclusions from the risk inventory by First STEP for the PMZ at this moment (consultation stage) are summarized below by indicating First STEP perception of the most important risks. These risks can be considered undesirable or even intolerable (see 4.1.2)

Risk description	Type of risk
Protestor action	Completion
Completion delay because of technical problems (tunnel/bridge)	Completion
Toll issues risks (including toll limitations by law etc.)	Revenue, performance and completion
Traffic diverting to alternatives	Revenue
Unbalanced Financial situation for SPV (mismatch between traffic & revenue forecasts and real situation)	Revenue
Environmental requirements higher then expected (e.g. air quality and research obligations)	Completion and revenue
Non Cooperation by local and regional politicians (incl necessary authorizations)	Completion and revenue
Condition of existing assets/roads (worse then expected)	Performance and revenue
Free flow and environmental targets not met due to non effective toll tariffs and/or traffic management (congestion, too much traffic)	Performance and revenue
Risk of flooding in this area (Hoeksche Waard Ringdike) 8 times higher then "standard"	Revenue and performance

First STEP reckons that sharing of completion risk and revenue and/or performance risk can deliver value for money when combined with a project specific and fit for purpose risk sharing mechanism.

Value for money can be maximised by transferring in part the completion and performance risks to the party that can manage the risks and its consequents best.

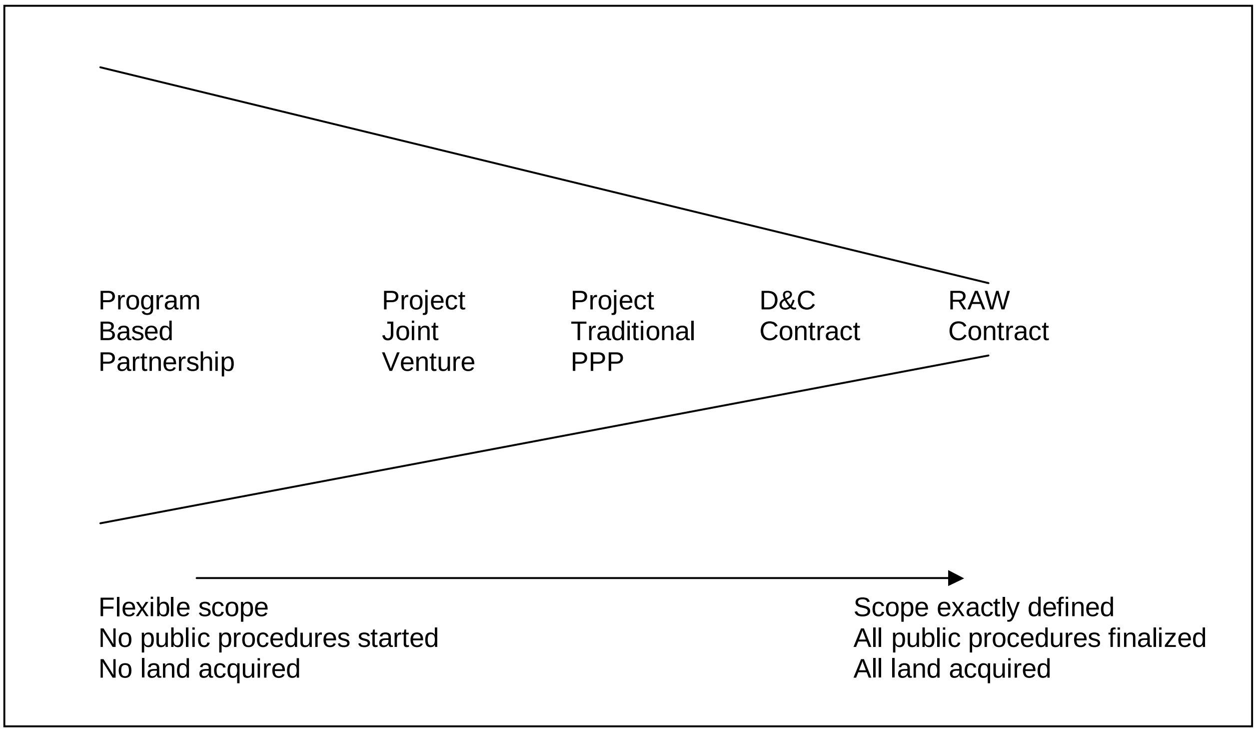
4.2 *Contractual structure*

4.2.1 Introduction

In the previous paragraph the issue concerning risks has been addressed in a general way and without assuming what contractual structure would in effect be the most favourable from the perspective of a consortium. However, we take a closer look at feasible contractual arrangements and elaborate upon the preferred.

4.2.2 Feasible contractual structures

The figure below indicates in general which situation fits best for what type of contractual structure. This will also be taken into account when choosing the most suitable contract structure.



(RAW Contract=traditional construction contract with detailed technical specs)

Given the characteristics of the preferred Alternative First STEP has narrowed the feasible contractual structures to the following three:

- Project based traditional PPP
- Project based Joint Venture
- Program based PPP Partnership

Project based traditional PPP

The project based traditional PPP is a cooperation form in which the Grantor and private partners, with preservation of their own identity and responsibility realize a project together based on clear scope and risk allocation. The goal of a PPP is realizing added value: more quality for the same price or the same quality for a lower price. This goal is achievable if both the Grantor and the private partners do what they can do best. By doing so a win-win situation is achieved. More and more the Grantor and private partners cooperate in this type of relationship to realize large public investment projects in an effective and efficient way. Typically, a private sector consortium forms a special company called a SPV to build, operate and maintain the asset. The consortium is usually made up of a construction

Company, an operation and maintenance company and a bank/ lender. It is the SPV that signs the contract with the Grantor and with subcontractors to build the facility and then maintain it. The advantages and disadvantages of a Project based traditional PPP can be summarized as follows:

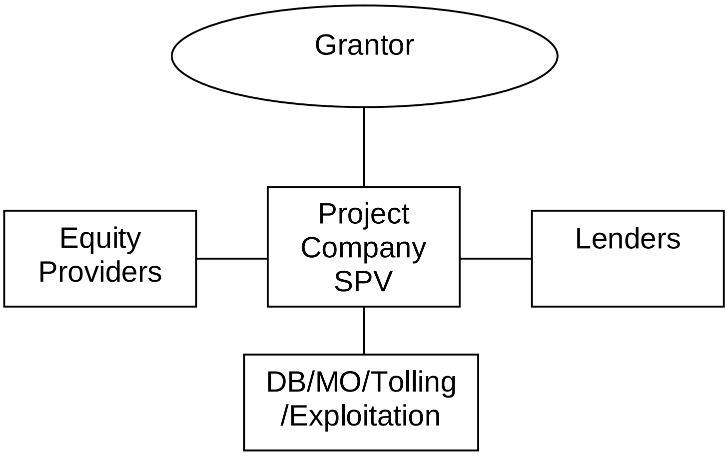
Advantages:

- Build on different parties strengths
- Clear understanding of division of risks
- Improving access to financial resources
- Economies of scale and advantages of size
- Access to new technologies and customers
- Access to innovative managerial practices
- Experience with contract form

Disadvantages:

- Later start-up of the project (preparation by Grantor first)
- No optimisations between preparation works and the design, construction and exploitation
- Limited possibility of risk sharing
- Possible conflicts between parties due to shorter term relationship
- High transaction cost

A schematic representation of the contractual structure of a Project based traditional PPP is presented below.



This type of contractual structure has the following basic conditions/characteristics:

- Prepatory works to be carried out by the Grantor (e.g. Tracé/m.e.r. procedure, land acquisition, etc.)
- Project scope based on output specifications to be determined by the Grantor
- Contract period of a fixed period of years (e.g. 20-30 years)
- Income by means of availability payments and/or tolling
- Completion, Performance and Revenue risks

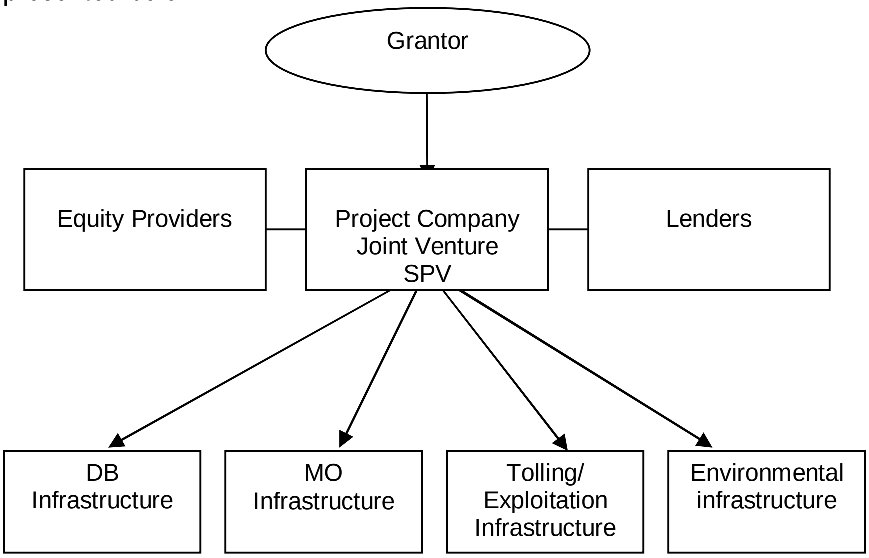
Project based PPP Joint Venture

A joint venture (JV) is an entity formed between two or more parties to undertake economic activity together. The parties agree to create a new entity by both contributing equity, and they then share in the revenues, expenses, and control of the enterprise. The venture can be for one specific project only, or a continuing business relationship. The phrase generally refers to the purpose of the entity and not to a type of entity. Therefore, a joint venture may be a corporation, limited liability company, partnership or other legal structure, depending on a number of considerations such as tax and tort liability. In this case the JV will consist of a Private Party (Consortium) and the Grantor. This JV will enter into an agreement with the Grantor. From this JV several subprojects can be carried out. A joint venture has in this case the following advantages and disadvantages:

Advantages:
- Build on different parties strengths
- Sharing costs and risks
- Improving access to financial resources
- Access to new technologies and customers
- Access to innovative managerial practices
- Early start of project (preparation jointly)

Disadvantages:
- Possible conflicts between parties due to shorter term relationship
- High transaction cost when used for one project
- Basic experience in this type of contract form

A schematic representation of the contractual structure of a Project based PPP Joint Venture is presented below.



This type of contractual structure has the following basic conditions/characteristics:

- Prepatory works to be carried out by the Project Company and Grantor (e.g. Tracé/m.e.r./habitat, land acquisition, etc.)
- Project scope fixed and to be determined by the Grantor and private party
- Constraints further development defined (feasibility assessment and fall back / termination scenario)
- Completion, Performance and Revenue risks

Program based PPP

The Program based PPP contractual structure is based on the same principles as the Building Schools for the Future program (BSF program) in the UK. Within this program so-called Local Educational Partnerships (LEP) are formed to ensure that BSF money is used efficiently and effectively to improve local authorities' secondary school estates. This same principle could be used in the PMZ corridor in which the role of the various authorities in the PMZ corridor can be compared to the BSF organization (the Public Alliance). The Infrastructure Planning Partnership has the same role as the LEP, i.e. to ensure that the money from the Public Alliance is used efficiently and effectively to improve the mobility in the PMZ corridor. An initial sample project can be tendered and realized by the private market after which similar follow-up projects are awarded to the private party winning the tender of the initial project. The follow-up projects will be subject to benchmarking to ascertain that these follow-up projects are awarded to that private party on a market-conform basis. The following advantages and disadvantages can be drawn for this type of contractual relationship:

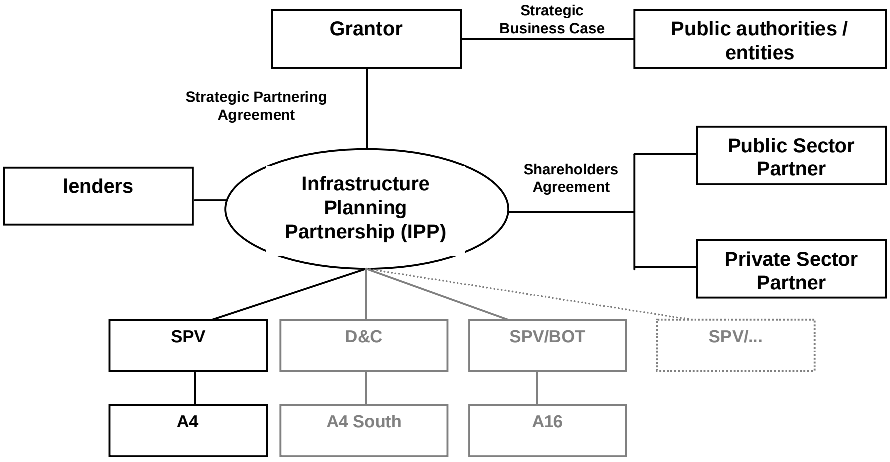
Advantages:

- Build on different parties strengths
- Access to new techniques/ innovative practices
- Sharing costs and risks
- Improving access to financial resources
- Economies of scale and advantages of size
- Early start of project (preparation jointly)
- Less chance of conflicts between parties due to longer term relationship
- Lower transaction cost (transaction cost are spread over more projects)

Disadvantages:

- No experience of this type of structure in the Netherlands
- Possible difficulties in tendering other type of projects (e.g. area development)

A schematic representation of the contractual structure of a program based PPP Partnership is presented below.



This type of contractual structure has the following basic conditions/characteristics:

- Preparatory works to be determined and carried out jointly (e.g. Tracé/m.e.r./habitat, land acquisition, etc.)
- Realisation initial “pilot” project
- IPP has a role as strategic investor for the road corridor and performance monitoring of the road infrastructure corridor
- Project scope to be determined by the Grantor and/or private party
- Constraints further development investment projects defined (feasibility assessment and fall back / termination scenario)
- Completion, Performance and Revenue risks

4.2.3 Feasible contractual structures for alternative PA3

In this paragraph the contract structures as described in the above paragraph are analysed for fit for purpose with respect to the preferred PA3.

Traditional PPP

For Project Alternative 3 the exact scope of the project is not clearly defined. A lot of the necessary public procedures have not been started and depending on the scope it is still uncertain whether extra land needs to be acquired. Based on that a traditional PPP structure for PA3 has the following positive and negative results:

Positive:

- Known contract structure
- Guaranteed not conflicting with European tender law

Negative:

- Limited optimisations possible between conditioning and design, construction and availability/toll requirements
- Less optimisations possible in terms of risk sharing
- Ambition of PMZ not in line with contract structure
- High transaction cost

The extra scope of PA3 compared to PA1 and PA2 is of such a magnitude that it will be almost impossible to get clarity on the full scope, public procedures and possible land acquisition at the start of the project. Also taking the top risks into account one can see that using the method and table described in 4.1.3 (Risk Mapping) "Risk Sharing" is for most identified risks the best strategy. Therefore matching PA3 with a traditional PPP structure seems not feasible.

Joint Venture

Whether PA3 is handled best by means of a Joint Venture or a Program Partnership is not easy to establish. Matching PA3 and the Joint Venture structure has the following positive and negative results:

Positive:

- Known contract structure
- Optimisations possible between conditioning and design, construction and availability/toll requirements
- Optimisations possible in terms of risk sharing

Negative:

- Starting additional projects not possible, because scope is defined at the start
- High transaction cost

Program Partnership

Since the possible scope of PA3 is limited to infrastructural sub projects there is a strong similarity with the BSF program. Matching PA3 and the Program Partnership structure has the following positive and negative results:

Positive:

- Optimisations possible between conditioning and design, construction and availability/toll requirements
- Optimisations possible in terms of risk sharing
- Ambition of project in line with contract structure
- Low transaction costs
- New projects and ideas can be started/implemented in time during concession/contract period

Negative:

- Inexperience with contract structure in the Netherlands and in infrastructure
- Complex due to establishing new projects every time

Unambiguously it is an attractive and ambitious structure, the program based structure is (at this moment) a step too far in the Netherlands thus causing delays in the process.
Also the structure is more complex then the project based joint venture because of the establishment of several projects which can also be time consuming with more focus on legal aspects then necessary.

4.3 Advise and risk allocation PPP Structure

Taking into account all aspects and the identified risks we, in the end, advise to structure the PMZ project as a Project based Joint venture SPV with a DBFMO Contract between Grantor/Government and Joint Venture.

In the joint venture the whole defined project (not open ended) will be implemented via D, B, M, O and F (sub)contracts between the SPV and technical and financial partners.
The joint venture structure also makes it easier to integrate the traffic controllers at Rhoon ('work places' for A4 Corridor partly reserved in this control centre of Rijkswaterstaat) and the road inspectors in this area in the consortium.

The sub-projects being:

- Delivering Tracé/m.e.r. studies and advises, land acquisition (most of the A4 South land already bought by Government) (see also the chapter about follow up procedures)
- Tolling
- Design and building A4 South
- Incident management and small functional inspections in the Corridor (maintenance)
- (heavy) Maintenance of Corridor
- Traffic management of Corridor
- (optional) Buying and developing green area's (ecological important areas in the Corridor)
- (optional) Maintaining the green area's

Looking to the risks we advise to place the risks related to tolling at the level of the government, argued in the first chapters (Alternative 3).

5 Public Pre-conditions

The previous chapters have given an analysis upon which First STEP has based a preferred alternative. In this chapter an outline of the necessary involvement and commitment of the various governmental agencies with (different) responsibilities in the scope of the Corridor is given to make this alternative work.

Some areas of governmental influence are essential to start a successful public private partnership and to make our preferred alternative work. Therefore we need clear statements about the following topics:

- Scope of the Project;
- Agreement and commitment between involved public authorities regarding this project
- The government's role;
- Legal issues and governmental support for levying toll for this specific project
- Financial involvement of the various governmental agencies
- The use and interpretation of the European laws on tendering.

In the following paragraphs we describe and analyse the most important policy and legal issues that affect the preferred solution.

In describing these issues we presume that the decisions on the missing links in the A4 Corridor (near Steenbergen) are taken and committed.

5.1 Scope of the Project

Of course the government has to define the geographical and functional scope of the project PMZ before starting tendering and infrastructural, environmental and spatial procedures. In the previous chapters we showed and discussed several possibilities and alternatives. We advised Alternative 3 (PA3).

5.2 Cooperation between all Public Authorities

Since the project has not started official procedures yet and therefore all infrastructural, spatial and environmental decisions have to be taken, cooperation between all public authorities is crucial.

The following policy developments and plans can help to speed up this mutual agreement between the several governments.
The PMZ has become part of the so called Urgency Plan Randstad of the new Dutch government with the minister of Transport, Public Works and Water Management as project minister (published June 22, 2007). An important part of this plan is to deal with the hesitations and fuzziness with regard to important economical projects in the Randstad (the urban area Rotterdam-The Hague-Amsterdam-Utrecht). To overcome these hesitations the central government will take a leading role in the process. Every project, including PMZ, will be guided by a duo: a minister and a regional governor (of a province or municipality). Also legal instruments to overrule blockades will be used more often then is considered as "normal" in Dutch public culture.

We foresee the following steps and measures are to be taken:

- Install duo: a minister and a regional governor. They should point out the importance of the project and that “non decisions” are not fruitful.
- A public agreement signed by all relevant public authorities should be ready by the end of 2007. In this agreement the government as a whole describes the scope, ambition, procedures and deadlines they agree on.
- A joint project organisation (governmental) should be installed with sufficient mandates to work effectively and efficiently towards the end result: a green free flow area between Rotterdam and Antwerp. This means this project organisation can start and guide the tender for this project and can start the formal procedures such as infrastructural and environmental procedures (Tracé/m.e.r. procedure). As an example the Maastricht/A2 Project organisation can be used, where several governmental authorities succeeded to sign a common agreement and to organise one project bureau. The participating public authorities guide this project bureau via a steering committee.
- Align the tender procedure with the Tracé/m.e.r. procedure. The guideline developed by the ministry of Transport, Public Works and Water Management called “Nieuwe Marktbenadering (New Market approach)” and the guideline “Werkwijze vervlechting Tracé/m.e.r. procedure en aanbestedingsprocedure bij infrastructurele projecten” (“Aligning Infrastructural and Tender procedures”) offers support in aligning these procedures. See also chapter 6.

5.3 The three roles to be played by Government

The government has to serve the public interest. This is a very broad and wide description which can take shape in different ways. For the preferred alternative, three main roles can be defined, in which the Dutch government can influence the public interest in an optimal manner. It is important these roles are clearly divided and transparent so they can be understood by the general public and politicians (parliament, local councils etc.).

First role

The first role of the government is to provide and to execute the laws and regulations. This is implemented by the formal and legal public instruments the governments have to deliver: Tracé/m.e.r. procedures, new spatial plans and procedural and legal aspects concerning the Tender procedure.
Here the ministries of Transport, Public Works and Water Management and VROM (housing, planning and environment) act as responsible public decision maker (“bevoegd gezag”) (a real “first role”). The government also serves the public interest by controlling the consents for the works. Laws and regulations help the government to control the interests of the general public on many fields.

Because of the projects complexity this role can be made more explicit by an agreement between the several public authorities on how they want to cooperate regarding their public duties and procedures.

Second role

The second role that is advised for government in the preferred alternative is to participate in the joint venture. Risk sharing in this JV is the best strategy to deal with this “project from scratch”. There is a need to share the strengths of public authorities and the market together within a flexible framework avoiding shifting risk (and costs) from one party to another. Joined efforts and creativity in tackling unexpected problems that certainly will occur should be the leading focus.

This second role makes the public commitment and necessary public agreement more explicit and less informal and aligns the interests of the public and private companies. It speeds up the process of building the missing link, and it lowers the general costs. This is good for the general interest and leads to an optimal societal benefit.

This public-private company can be set up after the tender. Much can be learned from the development companies set up by municipalities and private consortia with the goal to develop housing and redevelop inner cities. Experience from these and other projects in Holland and from abroad provides enough knowledge and experience to form such a company and to work out the legal status (constructions of NV, BV or CV/BV are possible).

Part of the strength of this public-private company is that it can play an important role just after the tender when the planning phase starts. The chosen private partner to join in this public-private company (the one who won the tender) will swiftly take initiative for developing the reports for the Tracé/m.e.r. procedure.

In the chapter 6 (follow up process) we will use this approach to develop the necessary steps in the right sequence.

Third role
The third role is in fact very much related to the first role. It concerns the role the government has as contract partner (Grantor) in closing the DBFMO Contract. Here the necessary public interests should be translated into contractual targets and contractual provisions for the JV.

In line with the four goals the project will have to meet and the information given in the first chapters of this report we suggest the following contractual targets:

- Free flow targets based on time needed to pass the A4 Corridor between either Vaanplein or Beneluxplein and A16 Corridor. These targets could be formulated in travel time, for instance:
    - For LV: 45 minutes, with penalties if travel time increases (under condition one travels with 100 km/h)
    - For HGV: 60 minutes, with penalties if travel time increases (75 km/h)
- Information on actual travel time should be available on a real time basis in the corridor for users, so they can choose their route efficiently.
- Availability targets to avoid (long) maintenance periods during busy hours and to stimulate quick incident management (see experiences from the PPP projects A59 and HSL/Infraspeed)
- Furthermore the Environmental Utilisation Space can be limited to certain values (to be decided; see chapter 2.6.2) regarding noise and NOx and “fijn stof” (particulate matter). We advise to calculate these values back to the number of cars maximum allowed during a month. This allowed number of LV’s and HGV’s should be reassessed every 12 months, based on the average pollution LV’s and HGV’s in the EU cause (of course the limits for noise etc in the law will still apply).

This environmental information should be made available to the inhabitants and politicians in the region, and is (presented this way) transparent for them.

5.4 Possibilities and scope for Tolling

Because the minister wrote that no subsidy should be expected to finance the building and maintenance of the “missing link” A4 South through Hoeksche Waard, it is essential for private companies to have the possibilities to levy toll. If ABvM will not be implemented it is still (juridical, technical and organisational) possible to toll under WBM 2006
We argued and showed that Alternative 3 (including tolling the whole PMZ Corridor including A16) can cover all these costs while steering the traffic flows in the “right direction”. This makes the possibility and necessary public preconditions for tolling even more important.

First STEP is of the opinion that tolling the whole Corridor will be possible after the following decisions have been made:

- Decision (to be expected end of 2007) by the Dutch parliament with regard to the new Law on Accessibility and Mobility (WBM 2006) which replaces WBM 2002, this WBM 2006 possibly changed slightly to introduce big toll projects like PMZ and to be more clear about the definition of “free alternative routes”.
- A policy statement by the minister and subsequent follow up in all necessary procedures regarding tolling this Corridor [starting (app.) 2017/2020] by the end of 2007

- A policy statement that also heavy vehicles will and can be tolled and consequently decide on the participation in or withdrawal of the Netherlands from the Eurovignette
- Start Up (parallel to the Tracé/m.e.r. procedure) of the necessary procedure called “Betaalpunt besluit” (Pay location decision) to be taken by the ministries of Transport, Public Works and Water Management, Finance and VROM (Housing, Planning and Environment) together.
- The relationship with Anders Betalen voor Mobiliteit (ABvM, new tax system for mobility in the Netherlands) should be made clear: if ABvM will be implemented then their technical system of collecting money will be used, PMZ paying the marginal costs associated with the PMZ scope.
- Setting boundaries in differentiating tariffs on basis of time and pollution is possible ánd necessary to give the authority instruments to steer the joint venture in regard to the free flow and environmental pollution in the Corridor.
- Aim at the advised tariffs in this report, in order to have a positive business case and to meet free flow and environmental targets in this Corridor.

Explanation:

Tolling with the goal to finance specific new infrastructure has to be separated from the discussion on ABvM because this system will be introduced as a new tax system on the basis of car kilometres in stead of ownership of a car. This tax system has different and other goals than tolling. Tolling will exist as a separate instrument besides ABvM.

In the Netherlands already the possibility exists to toll for new infrastructure. This is arranged in the Law on Accessibility and Mobility 2002 (WBM 2002). In this law toll is only possible to finance new infrastructure and the connected costs for maintenance. Differentiating of tariffs is possible, but only regarding time.

A new law (WBM 2006) is now underway:

- This law opens the possibility to toll on not only new infrastructure but also on existing infrastructure that “makes the same connection as the new infrastructure or is an extension of the new connection”. This is possible when the effect for the total project can be proven resulting in lowering travel time, a higher reliability and better economic structure of the area. That’s what we are trying to prove with our preferred solution Alternative 3 in this study.
- Condition is that still a “free of charge route” must be available for the users regarding the same connection. One could argue that the secondary roads should be considered as this “free of charge route” but better is to make big toll projects in corridors like PMZ explicitly possible in WBM 2006 before it is adopted by parliament.
- The costs that can be covered by tolling should be project specific, so also costs on existing infrastructure necessary because of tolling can be part of these costs
- The costs of collecting the toll may not exceed 20% of the income.
- Furthermore this law makes differentiating of tariffs possible on environmental criteria.

The existing Eurovignette rules (in which the Netherlands participate) forbid charging vehicles above 3.5 tons more then once unless to cover costs for (new) bridges or tunnels. Maybe the Netherlands will opt out of this system in the future.

In the Betaalpuntenbesluit (Pay location decision) the following aspects should be dealt with representing criteria to be developed:

- Accessibility: what value will be gained from tolling: free flow, travel time, reliability, short cuts etc.
- Environment: air pollution, noise, landscape etc.
- Traffic safety: victims, risk development etc.
- Social: free-of-charge alternative available?
- Economic: income, collecting costs, profit rates, tariff structure, way of collecting (system), Pay locations etc.

5.5 Financial involvement of government

Joint venture
In the preferred solution, advised by First STEP, Government and Private Consortium will establish a joint venture. Two variants within this preferred solution are possible, depending on the scope the government wants to choose:

- In case of a "green area development including the infrastructural connection Rotterdam-Antwerp: A Joint venture of the Ministry of Transport, Province of Noord-Brabant and Private Consortium.
- In case of an "infrastructural connection Rotterdam-Antwerp": A joint venture of Ministry of Transport and Private Consortium

The most important decision to be taken by the participating government(s) is the share they want to have in the equity. We advise in first instance to consider a public participation of 10-50% and a 90-50% private participation in the equity of the joint venture.

This should not be seen as a cost since our advice delivers a positive business case meaning that the government will have a yearly return on investment which makes this project also financial profitable for the government (and province Noord-Brabant). This profit could be invested in this area between Rotterdam and Antwerp.

Financial involvement
Because of the identified risks (chapter4) and because of legal reasons (Law on WBM) the following preconditions have to be met when looking to the financial involvement of the Government:

- Toll collected on behalf of the central government by the Joint venture;
- When the project starts, the risk regarding toll income in carried by the government (100%; so not at the level of the joint venture) allowing diminishing traffic (by changing toll tariffs and traffic measurements) at the (PMZ) Corridor because of the free flow and environmental targets. We suggest to reassess this risk allocation in the 5 yearly revisions of the Contract;
- Infrastructure Fund is fed by this income from tolling the Corridor;
- The joint venture is responsible and paid for the availability of the network out of the Infrastructure Fund;
- The joint venture can not be responsible (in this structure) for free flow and environmental targets because she can not steer independently the toll tariffs and building extra infrastructure (broadening roads, bridges etc.). An Incentive Based System however can just as effectively be established for free flow and environmental targets for the joint venture since she advises and implements the government's (authority) decision to change the toll tariffs or take traffic management or infrastructural decisions.

5.6 European law on tendering

In the Netherlands opportunities the European tender laws offer, are often not taken into account. In this respect we can learn a lot of the PPP contracts and organisational constructions in the United Kingdom (UK) where the laws are applied less rigorous and degrees of freedom within the laws are utilized

A good example for interpreting the laws less rigorously, but acceptable under EU rules, is the program Building School for the Future, a public private investment program initiated by the UK's central government. Crucial in this program is that it organises so-called LEPs: Local Education Partnership which is a public private joint venture of national governments (20%) and private partner (80%). The Private Partner is selected through a tender based on European law (via publication in OJEU using the also in the Netherlands known Competitive Dialogue). The LEP has exclusive rights for 10 years to develop secondary schools with the potential for this to be extended for a further 5 years.

For every new project or wave of projects the private consortium will be selected not via a new European tender but on the basis of market conformity, the tender results and negotiation, without having to go through an expensive full competitive procurement process. More can be found in chapter 4.2.2.

We did research on the legal aspects of this construction and found evidence that it is possible, so with European practice and legal theory the Ministry has a good basis to move away from the traditional project based Tender to a “series based tender” (reeksaanbesteding).
It also offers the possibilities of lowering transaction costs, a big hurdle with regard to PPP in the Netherlands. Also: our preferred solution is not as innovative as the UK example, so we do not see any legal problems for the DBFMO contract we advise.

The European Law (Guideline 2004/18/EG) mentions the possibility for “series based tender”. For these repeated orders one is allowed to enter negotiations procedures without announcement.
Some aspects should be kept in mind:

- This possibility should be mentioned in the publication in OJEU
- The total costs should be taken into account by the Client/Granter
- The period of exclusivity should be not to long (UK example uses 10 years which could be considered as very long; again this reflects the approach of the UK when dealing with this EU Tender guidelines)

It is also possible (art. 3.2) to use “Frame Contracts” (raamcontracten) where the different subprojects fit into this contract. In the Netherlands these European Guidelines are implemented in national rules via art. 31 lid 4 sub b Bao en art. 32 lid 7 en 8 Bao (besluit aanbestedingsregels overheidsopdrachten)

6 Follow-up Process

6.1 Introduction

The chapter regarding the public preconditions already gives the first ideas how to proceed with this project after the market consultation. It is important for the incorporation of added value that the follow up process should not obstruct the common goals for the chosen alternative. The chosen tendering procedure should leave room for mutual optimisations and mutual improvement.

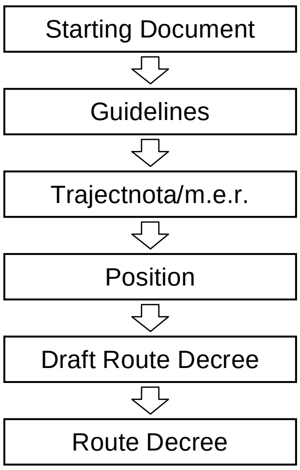
As is described in the previous chapter a joint venture is the preferred organizational structure. This JV is set up to fulfil three and possibly four ‘projects’, these are the construction of the A4 South, the maintenance and operation and tolling of the rest of the corridor. The fourth project could be the buying, development and maintenance of the green areas with special natural characteristics around the whole corridor (the so called EHS areas). These parts have to be developed in one hand, to make a optimal and balanced project where design depends on construction, maintenance, tolling options and vice versa. This means it should be combined into one single tender in order to reduce the total costs of the project.

For the construction of the A4 South, complicated spatial en environmental procedures are applicable, where laws and regulations play an important role. Different and less complicated laws and regulations are applicable for the operation and maintenance of the rest of the corridor and the tolling part.
Apart from this procedure a suitable tendering procedure has to be initiated. These two procedures (tendering procedure and Tracé/m.e.r. procedure) can be run in parallel (Vervlochten). In this chapter we present possible acceleration of the PMZ planning, although this might be difficult to achieve.

6.2 Interwoven procedures

For the realization of the A4 South, a tracé/m.e.r. procedure is to be used. This is a combined procedure for the routing and the design of the route on one hand, and the environmental impact of this routing and design on the other. For the existing roads in the scope of the preferred alternative, there is no need to perform a Tracé/m.e.r. procedure since only maintenance is performed.

The tracé/m.e.r. procedure consists of the following steps:

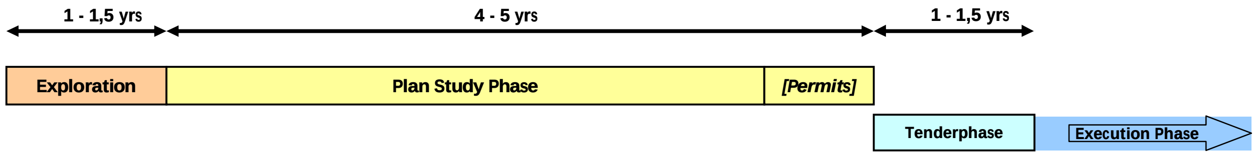


The tendering procedure that fits best to the situation and the procedures that are to be matched is the competitive dialog. This is a tendering procedure that is used for complicated projects, where tuning between the client and the company is reached through dialogs. This procedure should aim at the selection of the right private partner or consortium for the joint venture.

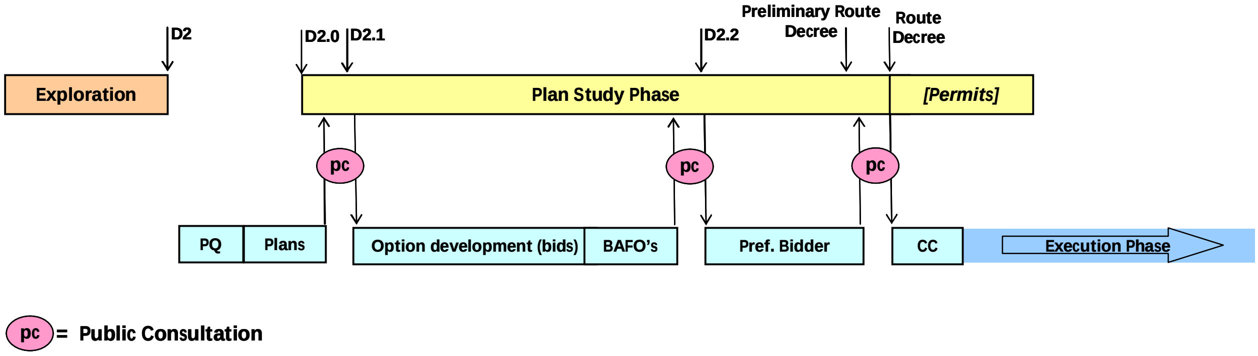
For some projects in Holland the tendering and the tracé/m.e.r. procedure have run in parallel. For the A4 South, this Interweaving is a serious option to execute the environmental procedure and the tendering procedure in one single integrated process.
This opens the possibility for private companies to produce input for the procedures. Private companies can have more influence in the beginning of the procedure, which should lead to more innovation and freedom in the design process. Because of this increased freedom in the design process time can be saved, financial security is reached sooner, and better and mutually agreed solutions in relation to the available budget can be reached.

The following picture shows the traditional situation where the tendering is not started until the Tracé/m.e.r. procedure is finished, and the 'new' situation where these two procedures are placed parallel (this can be done on different moments).

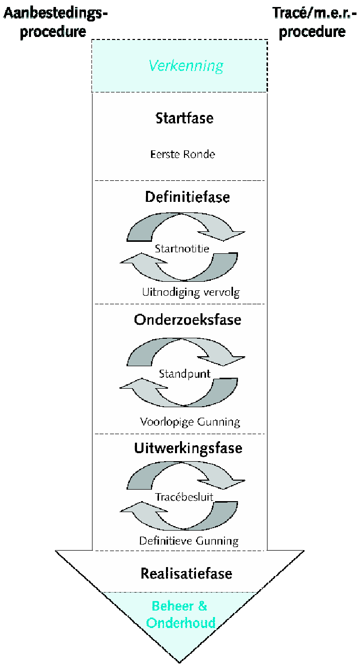
- Sequential processes (traditional approach)



- Parallel processes (possible through EU Competitive Dialogue procedure)



The different stages from this tendering procedure are interwoven with the spatial and environmental procedures as is shown in the following figure:



The moment the two procedures start interfering can be chosen depending on the situation. Three models are defined:

Model 1 Interweaving starts before Starting Documents
Model 2 Interweaving starts after Starting Documents, but before Position
Model 3 Interweaving starts after Position

First STEP believes model 1 is best suited for this particular project. The tender procedure and the tracé/m.e.r. procedure can start at the same time (2008). Notice that we advise that the interweaving in fact will be a partnering (in the Joint Venture) just after the choice of the private partner and the publication of the Starting Documents.

6.3 Points of attention

Points of attention that can help the public and private companies to come to a successful tender:

- **Full commitment**. To join these procedures successfully and to capture its potential value the full commitment from the private companies and of the public parties is essential.
- **The sooner, the better**. Regulations demand more detailed plans as the procedure rolls. The freedom in design diminishes as the process is continuing; therefore the tender procedure should be started at the same time as the environmental procedures.
- **Transparency of process**. It is important for private parties to know how the process is organized and how decisions are made.
- **Trust**. Public parties have to trust on the quality and trustworthiness of the input the private companies give in the procedures.
- **Set (only) important conditions**. Before the start of the tendering process the scope, program and some important conditions are to be agreed on by the public organisations involved. These shouldn't be too detailed.

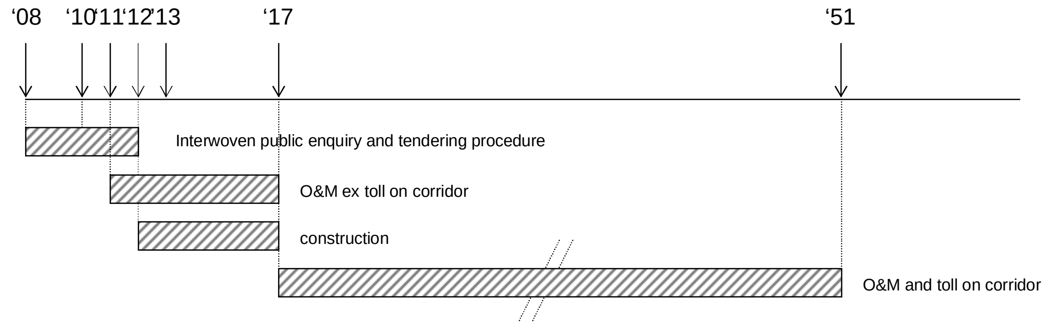
6.4 Process recommendations

Summarized we advise the following steps after the necessary decisions regarding the preconditions (as stated in chapter 5) are met. Note that it is important as stated in the preconditions chapter to make a distinction between the roles of initiator (initiatiefnemer) and formal public decision maker (bevoegd gezag)

Step 1	Tender procedure and starting document tracé/m.e.r. procedure
By	Project organisation of the public authorities (see chapter preconditions) and the formal decision maker (ministers of Transport and VROM)
Result	Selected private partner Starting document and Guidelines determined.
Step 2	Research phase tracé/m.e.r. procedure
By	Joint venture SPV as initiator
Result	Trajectnota m.e.r. report.
Step 3	Position preferred alternative
By	Formal public decision maker (ministers of Transport and VROM)
Result	Decision preferred alternative
Step 4	Detailing the preferred alternative in a Draft Route Decree (OTB)
By	Joined venture SPV as initiator
Result	Detailed design tracé (including mitigation measures to protect environment)
Step 5	Decision Route Decree
By	Formal public decision maker (ministers of Transport and VROM)
Result	Final design of the route determined including ‘Betaalpunt besluit (tol/WBM)’
Step 6	Possibly : Decision judge (1, 1.5 years)

Step 1-5 will take approximately 3-4 years. If people want to make use of asking the court to check the decision of the ministers the whole process will take 1 tot 1.5 years longer.

In the following figure an ambitious planning is shown.



Start interweaving process	2008
Choice preferred partner	2010
Start O&M excl toll Corridor	2011
Route decree (TB) ready	2012/13
Start construction A4 South	2012/13
Construction finished	2017
O&M total scope incl. tolling	2017
End concession	2051