

Rijnmond Regional Air Quality Action Programme

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Summery

Despite considerable improvements in recent years, the air quality in Rijnmond is still giving cause for concern. According to the available figures, limit values are being exceeded on a large scale. Air quality can adversely affect public health. The exceeding of the limit values produces a real risk that spatial and economic developments will be unable to take place. This issue is high on the agenda of the various administrative bodies in the Rijnmond region. This is why the ROM-Rijnmond Executive Council (BOR) has taken the initiative to achieve a package of measures for the region to tackle the problem. These must tie in with the existing plans drawn up by parties from the BOR, in particular Rotterdam's Approach to Air Quality (published 1 November 2005), the Air Quality Master Plan developed by the BOR (7 December 2004), the Air Quality Plan of Approach by the Rotterdam Metropolitan Region (12 October 2005) and the Plan of Approach to Air by the Rotterdam Port Authority (8 November 2005). On behalf of the BOR, the ROM-Rijnmond staff team has commissioned the DCMR Rijnmond Environmental Agency to draw up the package of regional measures.

Five task groups have contributed to creating the package of measures: road traffic (chaired by Rotterdam Metropolitan Region), shipping (chaired by Rotterdam Port Authority), railways (ditto), industry (chaired by DCMR) and households (ditto). Within the task groups a large number of parties have made an active contribution. This applies both to government (local and regional, provincial and central) [the Ministry of Housing, Spatial Planning and the Environment and the Ministry of Transport, Public Works and Water Management], and to representatives from the business community. Considering the breadth and the great involvement of the participating parties, it may be assumed that the package of measures gives a fairly complete picture of the possible measures which could be implemented through the cooperation of partners in the region. The measures from the plans listed above have been fully incorporated in the package. Furthermore, every effort has been made to achieve close coordination with other municipalities and regions in the Province of Zuid-Holland under the umbrella of the Zuidvleugel.

The efforts of the task groups resulted in 100 possible measures. Based on five criteria [impact on air quality, costs, feasibility, side-effects and timeframe], a qualitative assessment was made. From this, 34 measures emerged as 'promising'.

As far as possible the measures have been assessed according to their impact on air quality. There is no single local or regional measure which might be called an absolute 'corker'. Nevertheless, it has been found that local measures such as the introduction of shore-side electricity for ships in the port and low-emission zones do have a positive effect on the local air quality. Measures which are primarily undertaken at national or EU level and lead to source-based measures, such as the subsidising of filters, road-pricing and a stepped up introduction of the EURO-V norms have more impact on the regional air quality. These measures can lead (in the long term) to substantial improvements in regional air quality. Moreover, regional measures can provide an important stimulus to the national policy. For example, a measure such as low-emission zones (banning highly-polluting lorries from city centres) will prompt transport companies to accelerate their introduction of 'clean' lorries. This will also lead to a reduction in environmental pressure outside the region. The same applies to an additional, stimulating policy in the region with regard to sectors such as shipping and railways.

Of the 34 'promising' measures there are:

- 6 measures which can be implemented immediately;
- 19 measures which can be elaborated into measures in 2006 after which (if the result is positive) they will be ready to be implemented in 2006/2007;
- 6 measures which are aimed at the long term (lobbying, research).

It is advisable that:

- the 'leaders' (the parties who form the main contact in the BOR for the measure concerned) should, in the short term, draw up a rough budget for their package of measures, including a proposal for the division of costs. These proposals can be used in agreements with central government about financing.

- parties should implement measures in cooperation with partners in the region. Cooperation leads to measures being taken over a larger area (with a broader impact on air quality), so that they can be elaborated and implemented more efficiently and can be regarded as a clear and consistent package to the market parties involved. Whenever useful, also work on cooperation with other municipalities and regions under the umbrella of the Zuidvleugel. Cooperation and coordination can considerably reinforce the spin-off effect from local and regional measures.
- Efforts should be made to achieve the synergy of measures at local/regional level with those at supraregional and central government level. Examples include: environmental zoning, 'clean' public transport, 'clean' shipping and national support for the communication campaign.

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1 Introduction

1.1 problem outline

The air quality in Rijnmond, just as elsewhere in the Netherlands, has improved over the last 30 years. Nevertheless, the air quality in the region at present gives cause for concern.

Air pollution has an adverse impact on public health. Among other things, it can lead to respiratory complaints and premature death. In order to prevent such hazardous effects, European air quality standards have been drawn up¹. For particulate matter these took effect from January 2005, those for nitrogen dioxide (NO₂) will come into force on 1 January 2010. The limit for particulate matter is breached on a large scale across the region and in spite of anticipated improvement, it is expected that in 2010 the limit values for NO₂ will still be exceeded. In order to combat the extensive consequences to public health caused by air pollution, it is particularly important to implement measures at source.

If insufficient progress is made in tackling air pollution, parts of the Rijnmond region are in danger of becoming 'closed off'. Air quality regulations pose a threat to plans and projects. Examples include the second Maasvlakte and the North section of the A 4, as well as smaller-scale building plans.

This issue is high on the agenda of the various administrative bodies in the Rijnmond region. The ROM-Rijnmond Executive Council² in which the various parties are represented has set up a Top management steering committee on Air, chaired by the Director of the ROM-Rijnmond staff team. This staff team subsequently commissioned DCMR to devise a package of measures for the region with which to tackle the problem. This project is carried out in close cooperation with the other parties in the region and other involved parties (including the business community). The appended report gives the results of this project.

1.2 The air quality in Rijnmond at present

Particulate matter

The concentrations of particulate matter in the region fluctuate around 40 µg/m³. The exclusion of 'sea salt' (an adjustment to the Air Quality Decree in August 2005) means that the limit is only exceeded at a limited number of locations. However, large-scale breaches of the 24 hour /daily limit value do occur. According to the available models, the daily limit value for particulate matter is exceeded across a significant part of Rijnmond.³

¹ The Air Quality Decree lays down the limit values which the air quality must meet based on the European legislation and regulations:

Particles	Type	Value	To be achieved by	Exceedances
NO ₂	yearly average	40 µg/m ³	2010	-
Particulate matter (PM ₁₀)	yearly average	40 µg/m ³	2005	-
	daily average	50 µg/m ³	2005	35 days per year

The limit values apply anywhere in the open air, with the exception of workplaces.

² Includes representatives from: the Ministries of Housing, Spatial Planning and the Environment; Transport, Public Works and Water Management; Economic Affairs; Agriculture; Nature and Food Quality; the Province of Zuid-Holland, the City of Rotterdam, Rotterdam Metropolitan Region, Rotterdam Port Authority, DCMR Rijnmond Environmental Agency and the Chamber of Commerce

³ A discussion is taking place on the relationship between the results of model calculations and measurements in the Rijnmond region. Those involved include the National Institute of Public Health and Environmental Protection (RIVM), Netherlands Environmental Assessment Agency (MNP), DCMR, the Ministry of Housing, Spatial Planning and the Environment, and local parties.

Nitrogen dioxide

In the present situation, the limit value for nitrogen dioxide (which comes into force on 1 January 2010) is exceeded primarily along major arterial roads, in parts of the urban centres and in the Botlek and Pernis industrial areas. The concentrations show a slight downward trend but it is expected that - if no additional measures are taken - exceedances will still occur at a large number of locations in 2010, particularly along major arterial roads.

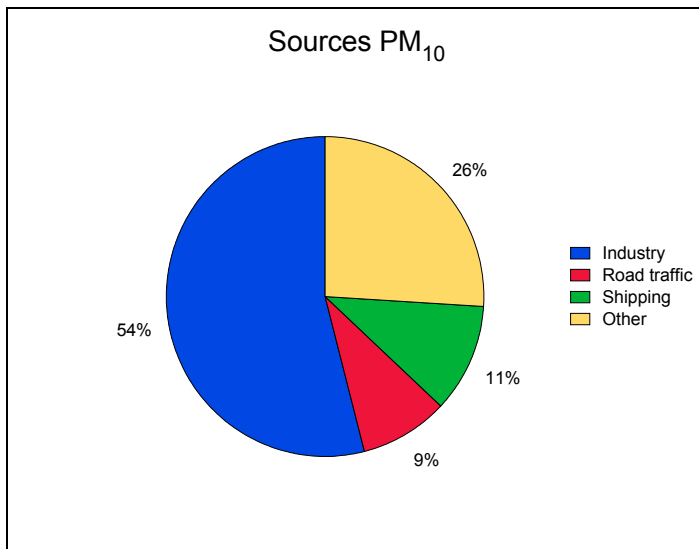
1.3 Sources

Air pollution is a problem that also has a trans-boundary component. The air quality in Rijnmond is thus only partly determined by sources within the region. By the same token, emissions in Rijnmond also have an impact outside the region.

Particulate matter

The diagrams below show the emissions (fig.1) and the concentrations (fig.2) of particulate matter in Rijnmond. The emissions are the amounts of air pollution which are released into the air in Rijnmond. The contribution per source is shown in fig. 1.

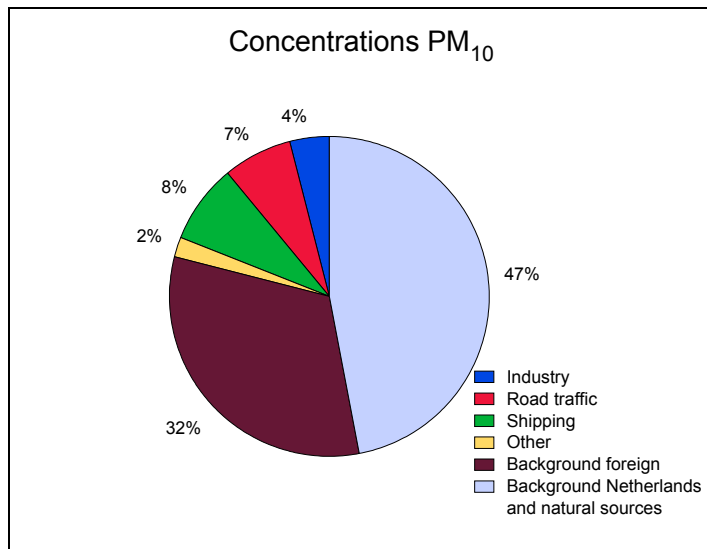
fig.1. Contributions from sources to **emissions (releases) of particulate matter** in the region



If we look at the air quality in Rijnmond (what are the residents of Rijnmond breathing in?) it appears that a large part of the emissions originates from outside the region. Only about 20% of the particulate matter in Rijnmond is the direct result of emissions in the region. The remaining 80% is 'background' levels. Within the 20% contribution from the region, road traffic and shipping form the most important sources. This is shown in fig.2.

The main difference between the contributions to the emissions and to the ambient concentrations at residential level is the result of the height at which emissions are released. For example, industrial sources are a major contributor to the emissions, but due to the high chimney-stacks, the effect on the regional ambient air quality is limited. Conversely, road traffic has a major impact on ambient air quality because the emissions are released at a low level.

fig.2. Contributions from sources to **ambient concentrations of particulate matter** in the region.



As a result of the small regional contributions, measures in the region will only be able to have a limited effect on the air quality. Nevertheless, local / regional measures can be worthwhile. In the first place, that little 'local / regional' bit may be what is causing the concentrations to exceed the limits values. A limited decrease may be all that is needed to bring concentrations below the limit value.⁴ Furthermore, local and regional measures will in many cases be aimed at reducing the emissions from incineration processes ('soot'), and 'soot' is the component of particulate matter which is most hazardous to public health. Finally, in places, local measures can have a much greater impact.⁵

Nitrogen dioxide (NO₂)

Sources in the region contribute largely towards air pollution from nitrogen dioxide (NO₂). The regional contribution is about 80%. The most important sources are road traffic and shipping. These two sources together contribute around two thirds of the concentrations of NO₂ in the Rijnmond region. Other sources are industry and households.

The diagrams below show the contributions from sources in Rijnmond to the emissions (fig.3) and concentrations (fig.4) in Rijnmond:

⁴ Broadly speaking, an average yearly reduction in particulate matter of 0.18 µg/m³ (i.e. approx. 0.5%) in the model calculations corresponds to the daily average limit value for particulate matter being exceeded one day less p.a.

⁵ For example, in Amsterdam the introduction of low-emission zones (the banning of old, highly polluting lorries from the city centre) has led in places to 20 - 30 % reductions in concentrations of particulate matter.

fig.3. Contributions from sources to **emissions (releases) of NO_x** in the region.

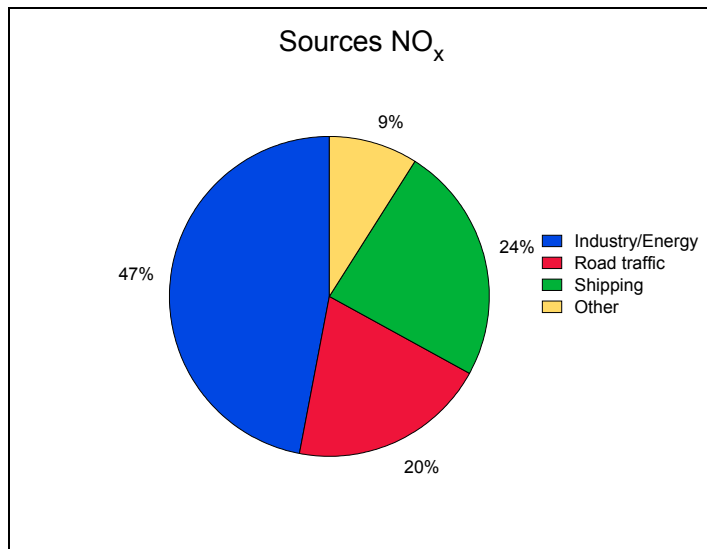
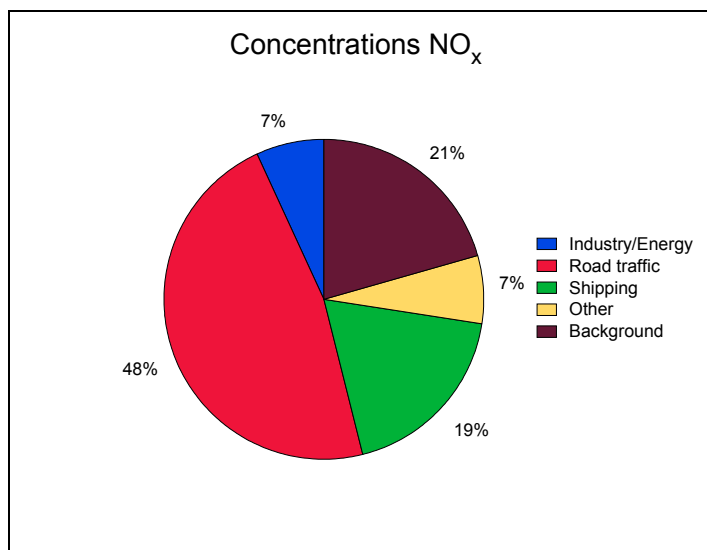


fig.4. Contributions from sources to the **ambient concentrations of NO₂** in the region.



Spatial sections have been constructed for the Rijnmond region showing the various sources of NO₂ concentrations in Rijnmond. These give a picture of the contributions made by each of the sources at various locations in the region. Road traffic is a particularly large contributor along the main arterial roads; shipping is a major contributor along the waterways and harbour basins, and industry makes a substantial contribution in the industrial port area.

1.4 Rotterdam's Approach to Air Quality

On 1 November 2005 the City of Rotterdam published its 'Approach to Air Quality'. This approach comprises a considerable number of measures aimed at improving the air quality in the City of Rotterdam. These measures have all been incorporated into this project. Moreover, coordination with the Rotterdam approach is assured since the project manager of Rotterdam's Approach to Air Quality participated in the Rijnmond Regional Air Quality Action Programme project group.

1.5 Regional Air Quality Master Plan; Rotterdam Metropolitan Region and Rotterdam Port Authority Plans of Approach

In December 2004 the ROM-Rijnmond Executive Council decided on the Air Quality Master Plan for the Rijnmond region. This includes fourteen measures for the improvement of air quality. In view of the overlap it was decided to incorporate the elaboration of this in the Air Quality Regional Action Programme.

Moreover, integration is assured since DCMR's project manager on the Master Plan also participates in the Regional Action Programme project group.

The project also incorporates the results of the Air Quality Plan of Approach, established 12 Oct. 2005 by the Rotterdam Metropolitan Region. The same goes for the Plan of Approach to Air that the Rotterdam Port Authority established on 8 November 2005. Again, the project managers for these two plans participated in the Regional Action Programme project group.

1.6 Zuidvleugel Randstad

At the Zuidvleugel level, the Province of Zuid-Holland centralizes local and regional authorities' initiatives.

The ambition is to achieve a cohesive, coordinated package for the Zuidvleugel. In view of the importance to the regional programme of effective coordination with other regions and municipalities as well as integration at Zuidvleugel level, during the timeframe of the project the project manager participated in the provincial air quality core team. In addition, the province has been represented in the project group.

1.7 Status and consequences

The package of measures in the present report has the status of the most complete overview possible of measures which could be taken in the Rijnmond region with, where possible, an analysis of costs, feasibility, implementation and impact on air quality. Based on the expertise of the participants in the project, a suggestion for a prioritization (which measures do the project participants consider to be most promising?) has been added to the overview.

The package of measures from the Regional Action Programme provides the administrators in the region with a basis for reaching agreements through regional cooperation about the measures which are to be implemented or further elaborated by the various parties.

2. IMPLEMENTATION

2.1 Organisation

ROM-Rijnmond Executive Council and Top management steering committee on Air

Due to the problems posed by poor air quality, the ROM-Rijnmond Executive Council has commissioned DCMR via the regional Top management steering committee on Air to draw up a regional package of measures. In this project a very active contribution has been made by the other regional parties from the Top management steering committee on Air, notably the Rotterdam Metropolitan Region, the Rotterdam Port Authority, the Province of Zuid-Holland and the City of Rotterdam's Town Planning and Housing department. The commission requires the plan to be so ambitious that it will make a serious contribution to resolving the problem of regional air quality.

The regional Top management steering committee on Air has also developed other initiatives in the context of the issue of regional air quality. Specifically, steps have been taken to achieve greater uniformity in measuring and calculating via a 'process and information' task group.

Task groups

The package of measures in the regional action programme has been drawn up primarily by five task groups chaired by Rotterdam Metropolitan Region, Rotterdam Port Authority and DCMR Rijnmond Environmental Agency.

Task group	Chair
Road traffic	Rotterdam Metropolitan Region (H.P. de Bruijn)
Shipping	Rotterdam Port Authority (M. Prinssen)
Rail traffic	Rotterdam Port Authority (T. Hempenius)
Industry	DCMR Rijnmond Environmental Agency (H. Knippels)
Households	DCMR Rijnmond Environmental Agency (A. de Buck)

The task group chairs have themselves borne the responsibility for putting together the task groups and have organised the group meetings. A large number of parties have participated in the task groups, including central government departments (the Ministry of Housing, Spatial Planning and the Environment and the Ministry of Transport, Public Works and Water Management) and the business community (CBRB, KNRV, TLN, EVO, Railion, etc.). This applies particularly to the road transport and shipping task groups. Appendix 1 gives an overview of the participants in the various task groups.

The brief of the task groups is to chart every possible measure for their particular 'source', including a breakdown of costs, impact, feasibility and timeframes.

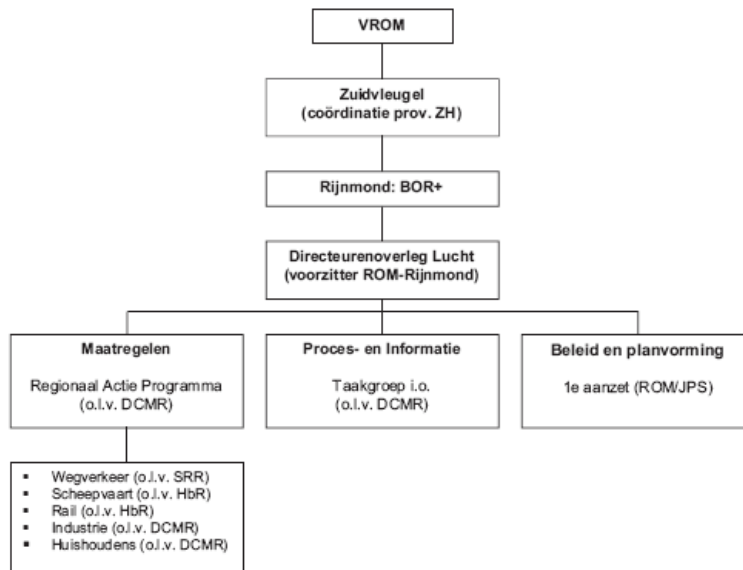
The five task groups cover the most important sources of particulate matter and NO_x in the region. There are other sources, however, such as the building sector and agriculture. These have not been included in the project. Air traffic has also been omitted because it does not make a contribution to the ambient levels of NO₂ and fine particulate concentrations. On the basis of the available know-how on emissions (see also figs. 1 to 4), however, the sources distinguished by the task groups account for more than 90% of the emissions in the region.

Project group

The project group receives regular feedback on the activities and results of the task groups. In addition to the chairs of the task groups, the project group includes representatives from: Rotterdam's Town Planning and Housing department (project manager Administrative task Rotterdam), Province of Zuid-Holland (in connection with its relationship with the Zuidvleugel conference and integration between the regions) and the ROM- Rijnmond staff team. DCMR (A. de Buck) chaired the project group. Appendix 1 shows a list of the members of the project group. During the period /timeframe of the project the project group convened four times.

The diagram below shows the organisation structure:

fig.5. Organisation structure



[text from figure: Ministry of Housing, Spatial Planning and the Environment; Zuidvleugel (coordination Province Z-H), Rijnmond: ROM-Rijnmond Executive Council+; Top management steering committee on Air (chair ROM-Rijnmond); Measures Regional Action Programme (led by DCMR); Process and Information (Task group (proposed) (led by DCMR); Policy and planning (1st draft ROM/JPS); Road traffic (led by SRR); Shipping (led by HbR); Industry (led by DCMR); Households (led by DCMR)]

2.2 Possible measures

A large number of parties have made a contribution to the five task groups. This applies in particular to the shipping and road traffic task groups. In addition to the regional authorities, these task groups have had active input from central government parties (the Ministry of Housing, Spatial Planning and the Environment and the Ministry of Transport, Public Works and Water Management) and the business community (in the shipping task group in the form of CBRB (inland shipping) and KNVR (seagoing shipping), in the road traffic task group in the form of TLN and EVO (the hauliers and the shippers respectively (responsible for road traffic's contribution). In the industry task group, the business community was represented by the trade association Deltalinqs and in the rail traffic task group the business community was also well represented. In total around 60 people from about 20 organisations provided input in the five task groups. Appendix 1 gives an overview of this. The task groups convened on a number of occasions between August and November.

The substantial input by parties (public authorities and market parties) in the task groups has made it possible to gain a broad insight into the various measures that might be taken and their consequences. Moreover, the consultation in the task groups has contributed to creating support among the parties involved. Consultation between the parties has also contributed to a better mutual understanding and provided tools for reaching joint agreements more quickly.

2.3 Effect calculations

As far as possible, the measures mapped (or combinations of them) have been assessed according to their impact on air quality. A condition for this was that a sufficient concretization of the measure had to be possible (e.g. only vehicles allowed in area xx which comply with emission standard yy).

The assessment according to impact was conducted by DCMR. Further details of this can be found in appendix 2. Broadly speaking, the filling in of the models is based on currently available knowledge and data. This has come from a number of different sources. DCMR was not able to verify all the data during the limited period /timeframe of the project. Furthermore, the figures used are often fairly rough. For these reasons the assessment results may contain considerable inaccuracies. The uncertainties are greatest in the case of particulate matter while assessments for NO₂ are generally more accurate. In the assessments for particulate matter the uncertainty is relatively great for the shipping sector. For this sector, use was made of emission studies which were conducted between 1994 and 1999. In the Rijnmond region a further study into the extent of these emissions is in progress. It is anticipated that this will lead in the first half of 2006 to a better insight into the actual emissions.

2.4 Elaboration of communication measures

Some measures focus particularly on using 'communication' as an instrument directed towards the residents of Rijnmond, with a view to raising awareness and influencing behaviour. This chiefly concerns measures in the 'households' and 'road traffic' sectors. For these two sectors further details in brief have been worked out: which communication instruments can best be used? and how promising are they envisaged to be? The result of this exercise can be found in appendix 4.

2.5 Prioritization

In the project a proposal has been made for the prioritization of measures. This was devised by the project group on the basis of insights from the task groups. The aim of the prioritization was to attain a preselection of 'promising measures' and serves as a preliminary 'proposal' to the administrators for further elaboration and decision making.

3. RESULTS

3.1. Inventory of possible measures

In total approx. 100 measures have been mapped for the five target groups. These are based on the know-how of the participants in the task groups. The overviews and measures drawn up per target group can be found in appendix 5a to 5e.

Broadly speaking, only a limited number of new proposals have emerged. The measures mainly comprise already existing ideas and initiatives. These have been combined in the project, tightened up and further worked out. In view of the large-scale participation of parties involved in the task groups and the active input which has been provided there, it may be assumed that the package of measures provides a fairly complete picture of the activities that can be set in motion in the Rotterdam region to improve air quality.

The measures may be distinguished into:

- technical measures (for example, to be achieved through regulations, financial instruments or demonstration projects);
- logistical and organisational measures;
- measures aimed at the exemplary function of government;
- communication/information.

In the measures an attempt has been made to give an indication of the available instruments, costs, effects, responsible parties and the period needed for achieving the goals. In most cases it has not been possible to estimate the costs of the measures to be taken. Impact on air quality was more frequently able to be estimated. Owing to the limited insight into the costs, it has not proved possible to work out the cost-effectiveness (costs per amount of reduction of air pollution) quantitatively.

3.2 Assessing the impact on air quality

Approx. 20 measures were sufficiently detailed to be able to assess them in terms of their effects. The overview in appendix 3 shows the particular measures concerned.

In addition to the measures, a number of scenarios have also been assessed. These scenarios show what the improvement in the air quality could ultimately be if certain more extensive techniques were to be used in a particular sector. These involve:

Lorry traffic:

- all lorry traffic meets EURO V standards [appendix 2B]

Emission reducing techniques particulate matter inland shipping (soot filters):

- all inland shipping fitted with a filter [appendix 2O]

Catalytic converters inland shipping:

- 100% Dutch fleet fitted with catalytic converters [appendix 2P, variant c]
- all inland shipping fitted with catalytic converters [appendix 2P, variant d]

Catalytic converters seagoing shipping:

- 50% foreign ships fitted with catalytic converter [appendix 2S]

Within the timeframe of the project it was not possible to estimate the effects of a combined package of measures (what is the total yield if the following package is implemented?).

3.3. General findings of the task groups

In view of the differences between the various task groups (composition, problems), and the nature and size of the potential package of measures, each task group followed its own line of action. A brief description of the most important findings is given below.

3.3.1 Road traffic

In the 'road traffic' sector no "comprehensive" measures presented themselves. The main benefit must come from relatively small projects (a lot of small contributions add up to one big gain). A number of actors (problem owners) may (in pairs or as a group) be held responsible in this matter. In addition, the measures cannot be seen in isolation. This is why a threefold cohesive approach was opted for: City measures, Ring road measures and Road haulage measures.

1. City measures package:

- Actors: city / region / central government / vehicle fleet management organisations.
- Methods: prevent traffic, make traffic less polluting and improve traffic flow
- Package of measures: Small-scale / quick-acting measures (chiefly traffic management) beat large-scale / long-term measures (tunnels, etc) hands down. Moreover, the small/quick method is a “no regrets” approach. This leads to five groups of interconnected measures:
 - *Low emission zones:*
First outline in February ready for the urban area of the Metropolitan Region, aimed at road haulage (dS+V commissioned by SRR). An important link-up with the routing of road haulage and the problems associated with loading and unloading in the inner cities (specified times for loading/unloading etc.).
 - *‘Cleaner’ municipal vehicle fleet:*
By the end of 2005, data on composition of municipal vehicle fleets and replacement investments including those from DCMR, ENECO and HbR (IGWR commissioned by SRR). Link-up with transport plans of municipal services.
 - *‘Clean’ Public Transport:*
Important exemplary function of the region. First effect in RET/Connexxion permits (2006).
 - *‘Clean’ vehicle fleet Metropolitan Region area:*
This is the ultimate goal: a ‘clean’ vehicle fleet in the Rijnmond region. Across the region and within the R3 framework, agreements with lease companies about upgrading vehicle fleets are already being worked on.
 - *Communication and Additional Policy*

2. Ring road measures package:

- Actors: chiefly Directorate-General for Public Works and Water Management / Ministry of Transport, Public Works and Water Management. Plus various other road maintenance bodies and other authorities.
- Methods: prevent congestion and promote constant-speed driving.
- Package of measures:
 - *Dynamic speed regulation on the Rotterdam diamond arterial route*
 - *(Lobby for) road-pricing:* Probably not achievable before 2010 (Nouwen advisory committee), but effective in the long term.
 - *P+R transferia:* This also includes the introduction of customised parking rates (parking policy), linked to ‘clean’ vehicles.

3. Road haulage measures package:

- Actors: hauliers, distributors, shippers, major “consumers”.
- Methods: (partially) prevent empty transport, promote ‘clean’ transport, modal shift.
- Packages of measures:
 - *Intelligent loading + distribution centres*
 - *‘Clean’ vehicle technology:* This includes campaigns on soot emissions (included in communication/peak days).
 - *Modal shift*
 - *Requirements with regard to ‘clean’ vehicles as part of the contracting out of public works*

3.3.2 Shipping

The measures for shipping have been subdivided into seagoing shipping and inland shipping. Both sectors operate internationally. When measures are taken these should first of all be adopted in regulations and/or supported by subsidy instruments. The subsidy instruments may be of a local, national or European character. For example, the ratifying of international treaties on seagoing shipping (IMO/MARPOL) and, in addition, EU policy/legislation on inland shipping. Various measures shown in the matrix point to this. A second consideration is the timeframe for achieving effective measures. Most measures cannot be implemented in the short term and will therefore not bring about less emissions from shipping in the short term. Furthermore, just as in the other sectors, measures have the greatest impact on NO_x emissions and less on the emissions of particulate matter.

It is not possible to give an unequivocal picture of which measures (based on our current knowledge of effects) are the most promising for improving air quality. The following list may be used as a rough guide:

1. existing and future policy and legislation
2. shore-side electricity for specific categories of ships in the port with high cost-effectiveness (€/prevented kg NO_x of particulate matter)
3. develop (end of pipe) techniques
4. apply existing (end of pipe) techniques

In points 2, 3 and 4 the combination with financial instruments (incentives and subsidies) has a stimulating effect on the sector. The scope of impact and the environmental effect of measures are important factors in making choices, in addition to the cost effectiveness of the various measures. Moreover, it is of major importance that there should be a good fit between incentives from the region and those from central government.

The budget provided by the Ministry of Housing, Spatial Planning and the Environment for the installation of NO_x catalytic converters and soot filters in inland ships is of vital importance to reducing emissions from inland shipping. However, the budget provided will only be sufficient to take the necessary emission-reducing measures in a part of the Dutch fleet. In order to achieve an adequate improvement in air quality it is essential that the scheme should provide sufficient financial scope to equip the entire Dutch fleet.

3.3.3 Railways

In the railways task group, parties from the public sector (regional and central government) and the business community convened for the first time to discuss the issue of air pollution from rail traffic. Bottlenecks, possible solutions and preconditions were discussed.

The railways are important in bringing about the 'modal shift' so desirable for achieving improved air quality. Moreover, as a result of international source policy the railways will also have to become 'cleaner'. Standardization of emissions from the EU forms the first point of action in this: up to now, in contrast to goods transport by road, there have been no emissions standards applying to rail traffic for releases of air polluting substances.

Once the Betuwe Railway Line is fully in operation, there will be opportunities for shifting to electric transport in the long term. This would eliminate emissions of NO_x and particulate matter. An important element is that the game rules (for entry, use, timeframes and preconditions, etc.) on the railways ultimately have a positive outcome for the 'modal shift' towards rail transport. For the secondary railway lines there are (in the short term) possibilities for cleaner diesel locomotives.

It is only recently that the impact of the railways on local air quality has been focused on. In this study, the effect of the Rotterdam Port Railway on air quality has been calculated, based on the present situation. These show that it is not an obvious move to invest heavily in measures to improve the railways in the short term.

It is desirable that when the anticipated 'modal shift' takes place once the Betuwe Railway Line is fully functional that a further calculation should be made. This should highlight its differences from road traffic and concretise the impact of measures on the railways, particularly in the longer term when the other modes of transport have become cleaner.

3.3.4 Industry

Since the seventies, industry has attained considerable reductions in its emissions to air. The majority of point sources (chimney-stacks) are now fitted with emission reducing facilities. In the near future a number of major measures will be taken such as the conversion of the refineries to gas combustion (this results in both a reduction in particulate matter emissions and NO_x emissions) and the implementation of NO_x limiting measures in the framework of the NO_x emission trade. In this region, the latter will lead among other things to the placing of an NO_x installation on the E.ON-Maasvlakte power station. Broadly speaking, after taking the above measures industry will satisfy the present criteria for the 'current level of technology'.

The NO_x emissions from industry are released via chimney-stacks. The impact of a source on the concentration at ambient level is thus determined to a great extent by the height of the chimney. The higher the chimney, the less can be perceived at ambient level. In the NO_x emission trade system, it is left to the market to determine where emission reducing measures should be taken. Each installation has to meet a reference value, the so-called performance standard rate. If a company releases too much NO_x then it can choose to either buy extra rights or to take measures. Since this is a national system, the regional imposition of extra requirements will be seen as an undermining of the trade system. This means that it will only be possible to take more far-reaching measures if the government makes available additional funds. The costs of more far-reaching measures come to around 5-6 €/prevented kg emission.

Major particulate matter emitters are the refineries and the storage and transshipment of dry bulk goods. The conversion of the refineries to gas combustion will result in a significant reduction in the emissions of particulate matter (approx. 90%). In the recent past, in the storage and transshipment of dry bulk goods good results (emission reductions on the order of 50%) have been achieved through adopting crust enhancers and control measures (monitoring). These have not yet been adopted by all the storage and transshipment companies in the region. Enforcement is being tightened up with a view to ensuring all companies implement these measures. The costs of other further-reaching measures, such as roofing-in, are disproportionate. Moreover, the greater part of the particulate matter from the dry bulk sector is relatively coarse and therefore probably has a limited impact on public health.

In addition to the storage and transshipment companies, in isolated cases particle filters could also be applied to a point source. It needs to be checked whether this fits into the criteria of the 'current level of technology'.

3.3.5 Households

Households contain two principal sources: central-heating boilers and fireplaces. As far as *central-heating boilers* are concerned, only emissions of NO_x are involved. Measures are closely linked with the energy policy: if households use less heating NO_x emissions automatically decrease. The most important measure is to connect up dwellings to residual heat from industry. The first phase in this (connection of 50.000 housing units to residual heat from industry) actually went ahead in November 2005. A second phase in which 500.000 housing units will ultimately be connected up is in the pipeline. Although major investments are involved in this, the costs can be recovered. The improvement in air quality in addition to the savings in CO₂ emissions offers an argument for working on the attainment of the second stage of the Warmtebedrijf. As well as connection to residual heat, measures aimed at energy saving in households (measures as part of renovation, information) are also important.

Fireplaces form the second relevant source. According to national figures, fireplaces account for approx. 10% of fine particulate emissions in the Netherlands. These figures are not exactly hard, but they nevertheless provide an indication that fireplaces are indeed an important contributor to emissions, particularly in the immediate living environment. In the case of fireplaces, too, communication is an important point of action. The most important measure proposed is that on peak days (days on which the limit values for air quality are exceeded) citizens should be specifically advised not to use their fireplaces. This would be the first step towards increased awareness. This measure forms part of the Rotterdam's Approach to Air Quality and may be extended across the region. A second measure is to not build any facilities (chimney flues) for installing fireplaces.

3.4 Analysis of communication aspects

Measures which involve a communication aspect have been investigated for communication instruments which might be deployed. This exercise is limited to the task groups dealing with road traffic and households because it is primarily these that contain measures which relate to the public. Results are shown in appendix 4.

3.5 Proposal for the selection of 'promising measures'

In the project an assessment has been made of which measures are the most promising. This was a qualitative assessment carried out on the basis of five criteria:

Criteria for 'promising measures'

- impact on air quality
- costs
- feasibility
- side-effects
- timeframe

This selection should be seen as an 'expert judgement', based on the broad expertise collected together in the project, making use of the five criteria listed above. It should be noted here that in view of the problems with air quality (effects on public health and standstill of spatial developments) a further analysis would have been desirable, which would have looked specifically at:

- the impact of measures on the numbers of residents in the region and their level of exposure;
- the possible opportunities offered by the measures in the light of the proposed Air Quality Act and the local net effects approach included in it.

Such an elaboration was not possible within the timeframe of this task, however, partly due to the uncertainties in the current legislation process: it is still unclear how and on the basis of which criteria (exposure, concentrations, emissions) the local net effects approach should take place. In view of the urgency of the issue it was decided to make an initial proposal for prioritization using the available know-how.

In total 34 measures were designated as 'promising'. These were divided among the five target groups. The 'promising' measures include all the measures from 'Rotterdam's Approach to Air Quality'. In addition to these measures, however, various other measures have been incorporated. The 34 'promising measures' are shown in appendix 3.

The selection of 'promising' measures means that approx. 65 other possible measures did not receive that designation. Among these measures there are a number that could be very useful. It is certainly important not to lose track of these. But in the context of prioritization, it is advisable in any case to get to work on the 34 most promising measures.

3.6 Elaboration and phasing of 'promising' measures

The 34 measures distinguished are at different stages of development. Some can be adopted immediately. Some must first be elaborated. Others require a constant effort.

On the basis of their particular phase of development and the timeframe within which effects may be expected, the measures may be distinguished into four categories:

Category	Feature	Achieve measure/ effect	No. of measures
Already being implemented		Before 2010	5
I	Implementation in 2006	Before 2010	6
II	Research in 2006 If research results are positive: Implementation in 2007 (sometimes in 2006)	Before 2010	17
III	Research/lobby aimed at the long term	After 2010/2020	6

The tables below show the measures concerned. Per table a party is shown in bold. These parties can function in the ROM-Rijnmond Executive Council as main contact person for the measure concerned.

Table 1. Category I] Measures which are ready to be implemented in 2006

No	Target group		Impact	Costs	Administrative task for Rotterdam	Responsible party
2		'Clean' municipal vehicle fleet (+ 'clean' vehicle fleets from lease companies)	Exemplary function ⁶	> 2.2 million ⁸	Yes	City , municipalities, provincial and local authorities
3		'Clean' public transport (requirement for granting a permit)	Local (Public Transport junctions)	> 1.2 million ⁸	Yes	City , municipalities
4		Communication/ additional policy (e.g. phased traffic lights)	Local	P.M.	Yes	City , municipalities
6		P&R transferia ⁷ (combined with customised parking rates)	Urban area	> 5.5 million ⁸	Yes	City , municipalities
8		Requirements with regard to 'clean' transport in contracting out local government work	Exemplary function		Yes	Rotterdam , local authorities
15		No facilities in new housing for a fireplace chimney flue (to be decided)	Local, new housing locations	-	No	City , municipalities

⁶ Substantial impact if private vehicle fleets also become 'clean'

⁷ Implementation over a much longer period; combined customised parking rates

⁸ Estimate for Rotterdam (for period up to 2010) from Rotterdam's Approach to Air Quality

Table 2. Category II] Measures which could be further elaborated in 2006 and – if the research results are positive – converted into a plan of implementation, to be carried out in 2006/2007:

No	Target group	Measure	Impact	Costs	Responsible party	Measure of Rotterdam approach on "Air Quality"
1	Road traffic	Low emission zones ⁹	Considerable at local level	> 1.5 million ¹⁰	City , municipalities, hauliers	Yes
5		Dynamic speed regulation along whole Rotterdam Diamond ¹¹	Along the diamond	Central government	Min. of Transport, Public Works and Water Management	Yes
11	Companies	Tighten licence conditions of some companies as regards emissions of fine particulates cf. BREF/NER	Local (up to a few µg/m ³)	Vary	DCMR , Province, companies	No
12		Subsidy for additional measures at some low NOx sources (incl. three power stations in Pernis and Botlek)	"	High (approx. 50 million investment per company)	DCMR , Min. of Housing, Spatial Planning and the Environment, companies	No
13		Stimulate quiet/clean/efficient AGVs at container terminals	"	High, will be recovered	DCMR , Min. of Transport, Public Works and Water Management (PMR), ROM-R3, companies	No
18	Railways	Stimulate research into use of 'cleaner' diesel locomotives and soot filters in the port	"	P.M.	HbR , Min. of Housing, Spatial Planning and the Environment, Min. of Transport, Public Works and Water Management, ProRail, producers, lease companies	No
20		Refuelling, repairing and cleaning in Rotterdam	Local	P.M.	HbR , ProRail	No
23	Shipping	Demonstration project	Local		HbR , V&W, Min. of Housing, Spatial Planning and the Environment, shipowners	No

⁹ Might take the form of: banning old lorries from inner cities; tie-in with measures to stimulate intelligent loading and distribution

¹⁰ Estimate for Rotterdam from Rotterdam's Approach to Air Quality

¹¹ Following on from the speed limits already attained on the Terbregseplein/Kleinpolderplein/Overschie section and in relation to the corresponding road network

24		Certification of inland shipping [stimulate adoption of emission-reducing measures]	P.M.	P.M.	V&W , HbR	No
25		Shore-side electricity for inland shipping	Local		HbR	Yes
28		Demonstration projects shipping	Local		HbR , Min. of Housing, Spatial Planning and the Environment, Min. of Transport, Public Works and Water Management, shipowners	No
29		Financial instruments in port (expand Green Award)	P.M.	P.M.	HbR , Min. of Transport, Public Works and Water Management	No
30		Shore-side electricity for: - ferries/ short sea craft - cruise ships	Local		HbR	Yes
31		Fit port authority vehicles with 'clean' engines or filters	Exemplary function	P.M.	HbR , port police, other services	Yes
32	Communication and innovation	Broad public campaign	Raising awareness	P.M.	ROM , Rotterdam, SRR, local authorities, DCMR, HbR and others	Yes
33		Peak days approach - do not use fireplaces - soot emissions campaigns - reduce max. speed for ships - spray streets	Locally on peak days	P.M.	Rotterdam , ROM, SRR, local authorities, DCMR, HbR and others (depending on activity)	Yes
34		Experimental area for new technologies	-	1 million ¹²	Rotterdam , local authorities, business community	Yes

¹² Estimate for Rotterdam from Rotterdam's Approach to Air Quality

Table 3. Category III] Measures which can be initiated from 2006 with a view to achieving substantial long-term (>>2010) improvements:

No	Target group	Measure	Impact	Costs	Responsible party	Measure of Rotterdam approach on "Air Quality"
14	Companies	Promote modal shift (incl. possible point of attention in land development grants and contracts)	Along major arterial roads		HbR, companies	No
17	Railways	Electric drive in locomotives	Local, increasing after opening Betuwe Railway Line	P.M.	Min. of Transport, Public Works and Water Management HbR, hauliers, railways	No
19		Lobby to tighten up EU regulations	"		Min. of Transport, Public Works and Water Management Min. of Housing, Spatial Planning and the Environment, HbR, hauliers, railways	No
21	Shipping	Lobby to tighten up EU regulations	Considerable	-	Min. of Transport, Public Works and Water Management Min. of Housing, Spatial Planning and the Environment, HbR	No

22		Research into extending subsidies for emission-reducing measures (de-NO _x , soot filters)	Considerable	Approx. 300 million	Min. of Housing, Spatial Planning and the Environment, HbR, CBRB	No
27		Lobby to tighten up EU / IMO regulations	Considerable	-	Min. of Transport, Public Works and Water Management Min. of Housing, Spatial Planning and the Environment, HbR	No

4. CONCLUSIONS

1. A large number of measures are possible by means of which a contribution can be made to improving air quality. These comprise a whole range of measures at different types of sources for which various parties have primary responsibility.
2. The greatest improvements are to be attained for air pollution through NO₂. As far as particulate matter is concerned, the air quality can only be improved to a limited extent through measures in the region. For particulate matter, however, it does apply that small improvements in the air quality can be sufficient to bring levels near to or even below the limit value. In addition, measures with regard to particulate matter chiefly affect primary particulate matter (in particular soot particles) which are the most harmful to the public health of the residents of Rijnmond.
3. Broadly speaking, local and regional measures contribute principally to improving local air quality. Within the local and regional measures there is no one 'comprehensive' measure: it is best to take measures at various sources.
4. An important effect on the air quality in the region may come from measures at national level and the greatest result will be achieved through tightening up the EU source control policy (and IMO).
5. In addition, local and regional measures can have a considerable spin-off effect, partly because regional incentives can prompt companies to step up the adoption of national subsidy schemes for the installation of filters or 'clean' engines. For example, a measure such as low emission zones (banning highly-polluting lorries from inner cities) including outside the region lead to a reduction in environmental burden. The same applies to an additional, stimulating policy in the region with regard to sectors such as shipping and railways. There can also be spin-off effects in other areas. Examples include:
 - trains which run on electricity instead of diesel, will keep their 'clean' image far into Europe;
 - dynamic speed regulation also leads to in a reduction in noise nuisance and an improvement in the safety situation along the Rotterdam diamond;
 - measures with regard to oil-fired boilers in refineries and seagoing shipping also contribute to a reduction in emissions of secondary particulate matter.
6. In the short and long term the best results will be achieved in the region using a combined approach comprising:
 - a package of local and regional measures;
 - lobbying central government and the EU for the accelerated introduction of source-based measures.To this end, a selection of 34 'promising measures' has been made.
7. Using the calculation models currently available (and the level of detail of the input of source data in them) it is not yet possible to ascertain the extent to which this package of measures will resolve future bottlenecks for the air quality in Rijnmond.
8. The measures distinguished are at different stages of development. Some can be adopted immediately. Some must first be worked out in detail. Others require a constant effort. On the basis of their accumulated know-how and insights obtained, the project group made an assessment of the most promising measures, based on a number of criteria (impact, costs, feasibility, side-effects and timeframes). These 34 measures are included in appendix 3. They are broken down into:
 - 5 measures which are already in the process of implementation.
 - 6 measures which can be taken in 2006 (in several cases an acceleration of policy already set in train).
These will yield their effect before 2010.
 - 17 measures for which research is needed in 2006, on the basis of which – if the research result is positive – actual implementation can begin from 2006/2007.
These will mostly also yield an effect by 2010.
 - 6 measures and initiatives which must be set in train aimed at the longer term (in particular lobbying and research).
These will yield an effect in the longer term (>2010/2020).
9. For many local and regional measures the best results will be obtained in regional or supraregional cooperation. This will also considerably strengthen the spin-off effects.

5. RECOMMENDATIONS

In response to the research results stated, the project group has come up with the following recommendations:

1. **'Promising measures'**

With regard to the measures to be taken in the region it is recommended to start with the overview of 'promising measures' set out in this report, which is based on a substantive assessment of the total number of possible measures in terms of 'impact', 'costs', 'feasibility', 'side-effects' and 'timeframes'. Moreover, to bear in mind that in addition to these measures, the other measures charted may also be very useful and should not be forgotten.

2. **Category breakdown**

To base the implementation of the measures on a breakdown into three categories:

- I: measures for which the implementation can start in 2006 which will yield an effect before 2010;
- II: measures for which further research in 2006 is needed in order to achieve an implementation plan, with a view to putting this into implementation from 2007 in order to yield an effect before 2010;
- III: other measures (lobbying, research) which will only have an effect in the longer term.

3. **Measures.**

On the basis of a substantive assessment of the total number of possible measures, an estimate of the timeframe in which measures will yield an effect, and an estimate of the possible timeframe for implementation, the project group recommends the following:

- ✓ **To implement the measures from category (section 3.6, table 1) in 2006;**
- ✓ **To implement the measures from category II (section 3.6, table 2) in 2006 and, - if the research results are positive – to convert them into an implementation plan;**
- ✓ **To set in train the measures and initiatives from category III (section 3.6, table 3) in 2006 and beyond with a view to achieving longer term (>>2010) improvements.**

4. **Responsibilities.**

The project group recommends that the leading role in the research and implementation processes mentioned under point 1. should be allocated to the various parties, and proposes appointing the 'responsible parties' printed in bold in the tables above for this role.

5. **Financing.**

Joint agreements will need to be made with regard to the financing of the implementation of measures from the Regional Action Programme, in so far as the costs of research and/or implementation of measures cannot reasonably be borne by a single party.

The project group proposes that the project leaders should in the short term draw up a (rough) budget of the implementation costs of 'their' measure as well as a proposal for the division of these costs.

These proposals will subsequently be included in agreements to be made (with central government among others) regarding the financing of the Regional Action Programme.

6. Calculations

Ensuring the permanent upgrading of the calculation models used including the complete documentation of the data used. Close coordination of this with the national agencies in this field (ER, MNP, RIVM). In this way, future explorations will be based on the most up-to-the-minute prognosis so that the best insight will be gained into bottlenecks and possible measures for resolving them. It is important that regionally-devised plans should not be included in national prognoses for air quality background levels (to avoid figures being counted twice). This fits in with the initiatives for setting up a Regional Air Expertise Centre.

In addition to upgrading the calculation models, undertaking the implementation of supplementary calculations. This applies among other things to measures which have not yet been assessed (e.g. the introduction of dynamic speed regulations on the ring road), but also for the incorporation of planned economic and spatial developments in the calculations. An example of this is the assessment of the contribution to air pollution caused by the Betuwe Railway Line as soon as this is running at maximum capacity.

7. Synergy between the input from parties and the measures to be taken

With regard to the elaboration and possible implementation of local and regional measures to work on maximising synergy with the measures at national and EU level. To that end, to ensure close coordination with the business community, non-governmental organisations and central government.

8. Close collaboration in the region and working on coordination and integration in the context of the Zuidvleugel

The recommendation with regard to most measures is to implement these jointly in a regional context. In addition, it is useful to coordinate with other regions and municipalities in the Province of Zuid-Holland in the framework of an integrated Zuidvleugel approach.