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Urban development in the port area of Rotterdam: Challenging noise constraints

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ABSTRACT

The city of Rotterdam is facing economic and environmental challenges in strengthening employment, mobility and housing in the next decades. One of the major projects until 2040 is reconstructing and redesigning former harbours into areas assigned for clean activities (education and offices) and living; the so-called "Cityharbour" project (in Dutch: Stadshavens).
The Netherlands, academically reckoned for its spatial planning system, has been a forerunner in integrating noise and spatial planning. Its Noise Abatement Act contains the principle of zoning and – rather unique – even sets (immission) limits for various noise source. However, operationalisation of urban environmental planning at the local level encountered various challenges, as – in a dense populated country – regional and local spatial planning initiatives faced strict noise limits set at national level. Since the nineties several instruments for integrating environmental policy and spatial planning have been developed, such as ROM projects (acronym for Spatial Planning and the Environment); MILO and LOGO (acronyms for environmental aspects of living conditions) and City & Environment Act (legally embedded tool).
Noise from industries and transport of Rotterdam's port has been one of the major issues addressed in urban development projects during the last decades. In this paper a short overview of the instruments for (noise) policy integration used in the Rotterdam port area will be presented. Furthermore, noise and spatial planning challenges for the coming years and possible mechanisms, identified in the "Cityharbour" and the River Zone projects, will be focused on. Various instruments, with a basis on noise (zone) management and permitting, through innovation projects and early involvement and integration of noise in spatial planning initiatives are presented.

1. INTRODUCTION

Among other sectoral regulations, in 1979 the Dutch Noise Abatement Act was introduced including various norms for each source of noise, such as road traffic, industry, and railways. These norms have to be included in spatial planning and permissions; fitting the typical discourse of the eighties of noise steering environmental and spatial policies. During the last decades the noise law has been amended and adjusted frequently, as the hierarchical and normative legislation was considered inflexible. Examples of exemptions incorporated in the act are the 'higher value procedure' providing for local deviation of noise standards, the design of a 'deaf frontage' and the use of a 'harbour limit' allowing an increase of 5 dB(A) in living areas near port-related industrial zones.

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Strict noise levels, set at the national level, hampered integration of noise issues at an early stage in local spatial planning. A paradigm shift to flexible, area-based integrative noise policy was deemed necessary in order to facilitate the introduction of noise at an early stage in the spatial planning process and to stimulate creativity in the urban design.
The City of Rotterdam, with it's harbour, infrastructure and dense population, has been a leading actor during the last decades in the integration discourses, and the search for legal, policy and other solutions.

2. NOISE AND SPATIAL PLANNING INTEGRATION

The principle of zoning, as introduced in the Noise Abatement Act (1979), was regarded as an efficient and effective tool in separating environmentally intrusive activities and environmentally sensitive land use. Quantitative noise standards as well as other environmental loads can be translated into spatial requirements.

Table 1: *Overview of noise limits (Noise Abatement Act)*

Houses	**7.00 – 19.00 h**	**19.00 – 23.00 h**	**23.00 – 7.00 h**
On facade	50 dB(A)	45 dB(A)	40 dB(A)
Inside house	35 dB(A)	30 dB(A)	25 dB(A)

Although the government initiative by the end of the 1980s on integrated environmental zones failed, a basis was laid for a new integrative initiative, the ROM policy.

A. ROM policy

The Dutch Fourth National Policy Document on Spatial Planning (1988) and the National Environmental Policy Plan (1989) introduced so called area-based ROM projects, in which various stakeholders cooperated in solving environmental problems and improving spatial planning characteristics at local level[1]. Although legal noise and other environmental norms should be adhered to, deviation was allowed during a period of transformation of the area.
In the Greater Rotterdam Area ROM policy has been, and still is, instrumental in the redevelopment of living areas. Noise limits have been increased to 60 dB(A), exceeding legal maximum norms by 5 dB(A). And consequently, noise contours of industrial sites will have to be decreased in future through the implementation of best available techniques. In the project organization, ROM Rijnmond, established in 1993, all government levels and private organizations jointly decide and implement binding agreements on the economic expansion and liveability of the area.
The shift from 'command-and-control' through national-set standards towards participative, externally integrated and area-specific policy mirrors the political and policy setting of the late 1980s and early 1990s.

B. City & Environment Act

In the nineties another remarkable shift was introduced allowing flexibility in regulations for specifically difficult areas, i.e. the City & Environment Law[2]. The Second National Environmental Policy Plan (NMP-2, 1993) referred to the 'compact city dilemma' and the introduction of area-specific differentiation of existing standards.
Within the City & Environment Law, city-planning projects are allowed to deviate from existing norms if specific conditions are fulfilled. The law adds process-oriented requirements to legally binding norms on noise and other environmental topics in the respective acts. Local authorities have to apply a three-step approach; in the first step attempts have to be made to address the noise source. In the second step solutions are looked for within the legal, normative context.

For example by applying 'deaf frontages', a 'higher value procedure' et cetera. In the third step local authorities can deviate from noise norms in those planning projects where the source-oriented and tailor-made steps are deemed to be insufficient to cope with legislative noise restrictions and limitations[3]. The City & Environment Law formulates rules for compensation of exceeded norms and for the planning process. Regarding this latter prerequisite, transparency and stakeholder involvement are key requirements.
For example, the noise contour of one of Rotterdam harbour's industrial areas, Botlek/Pernis, is hampering the (re)development of living areas in Vlaardingen. The noise contour and other 'noise dilemmas' have been introduced at the start of the spatial planning project and a broad range of stakeholders from NGOs, health department, authorities, industry and the population have been involved. In the next section this so-called River zone project is further elaborated on as one of the empirical cases.

C. MILO and LOGO

Paradigm shifts during the 1990s introduced decentralization, participative and integrative policies in subsequent national plans. MILO (acronym for environmental aspects in the living conditions) was the result of the Fourth National Environment Plan (2001). Based upon existing practices, such as the Rijnmond's LOGO, within several municipalities, the MILO method is a typically bottom-up initiative, contrasted to both other tools originating from the national administrative level.
MILO aims at improving the environmental quality of certain city areas by integrating area-specific environmental ambitions in the planning process. In striving for a qualitative approach within certain areas, the tool is rather ambitious and integrative-oriented and less 'problem-solving' than ROM policy and City & Environment. Experiences with MILO with a focus on noise are rare, although recently the tool and comparable local tools such as LOGO, have been used in preparing a third-step within City & Environment. The Rotterdam Cityharbour project provides some examples.

3. ROTTERDAM CITYHARBOUR AND RIVER ZONE PROJECTS

The Greater Rotterdam Area is facing a new era, launching the ambitious Cityharbour project. The project has two main goals, i.e. giving both the city and harbour a stronger economic structure ánd improving the living environment. Rotterdam's harbour is a very important Dutch transport hub and thus crucial in the Dutch economy. On the other hand, the Green Heart near Rotterdam and the Randstad, is an open, green area with less densely populated villages, that since decades is captured and prevented from intruding building activities. Consequently, building targets have to be met within the existing living areas. As such the compact city dilemma, i.e. housing ambitions facing impeding, strict legal noise norms, has to be addressed and solved.
A positive advantage within the Rotterdam Area will be Maasvlakte 2, the reclaimed land west from the existing harbour. Some harbour related industries will move from the Rotterdam inner-city to this new industrial area in the North Sea, which will free up kilometers of prime waterfront sites along the primary artery of the city, just a stone's throw from the centre. As such, spacious advantages are faced and translated in ambitious plans for the next years.

A. Cityharbour project

The area of the Cityharbour project is about 1600 hectares (4000 acres) in total and consists of four different parts. In two parts the present industrial sites will be transformed into high quality residential and working areas. In the other two parts the existing industry will be intensified.

The ambitions within the Cityharbour project are the following:

- 5000 new houses in the water (so called floating communities) or near the waterfront, situated in a quiet area;
- 60 hectares of SME activities, including about 1.2 million square meter offices and smaller companies;
- 40 hectares of delta technology and creative companies in Merwe- and Vierhavens;
- 10 hectares of new living areas in Rijn-Maashavens;
- doubling of container handling up to 2.4 million TEU in 2025, and increasing up to 3.5 million on the long term;
- education for at least 1000 students;
- 13.000 new job opportunities.

Area plans have been drafted recently (2009), and transitions of some (parts of the) Cityharbour areas are prepared.

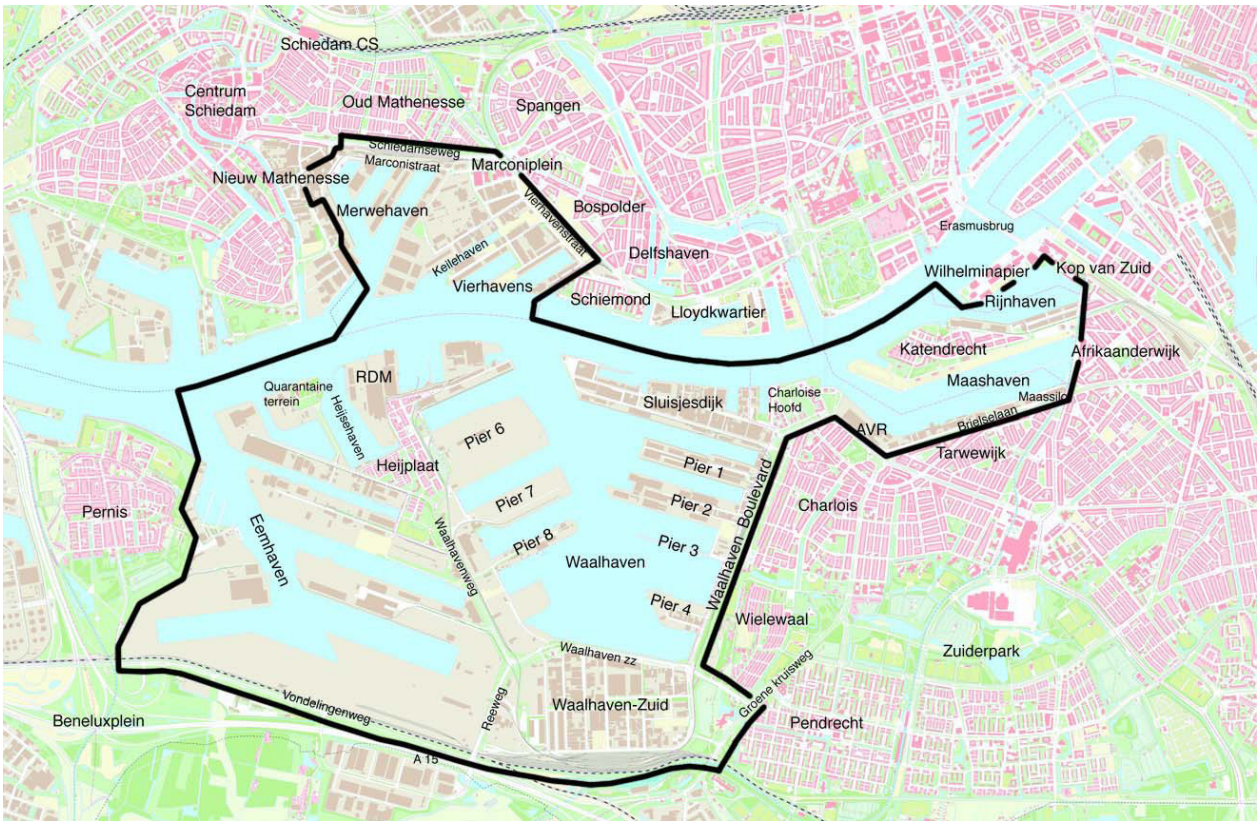

Figure 1: Cityharbour area and its projects (Rotterdam)

Within the area of **Rijn-Maashaven** larger industries are situated near existing and newly developed living areas[4]. Major challenges to be faced are the noise contours of these individual industries. Political agreement on decreasing noise contours from **Waal-Eemhaven** is one of the instruments in developing this Cityharbour area into a modern, sustainable harbour. After 2015 container handling will be doubled up to 2.25 to 3.5 million TEU/year. The same noise contours, and thus formal agreements on the zones strived for, are influencing the transformation of **Merwe-Vierhavens**. Developments in this specific area are depending upon relocation of the existing (fruit)industries in other industrial areas in Rotterdam, and consequently a decrease of noise contours.

Finally, the fourth area plan of Cityharbour, the so called **RDM-area**, is influenced by the noise contours from Waal-Eemhaven as well. Ambitions for this area are a living-working area including a new college for harbour related studies.
As many of the above presented spatial plans are in a rather early phase, little empirical data is available on noise and spatial planning integration. Rather, probably the recent experiences within the River zone project and other developments in the Greater Rotterdam Area will be exemplary for the processes within the Cityharbour project.

B. River zone project

The process for reconstruction of the River zone in Vlaardingen started in 1999 as a more or less logic follow up of the ROM Rijnmond project[5]. A combination of living, working, recreation and other facilities will improve the living quality of the area. Obsolete industrial areas at the **VOP/Westhavenkade** will be reconstructed into an area of small shops and businesses and apartments above. Offices, a new railway station, shops and houses will be constructed in the area of **Vlaardingen railway station**. The greatest challenge is reconstructing the **Koningin Wilhelmina haven** by replacing and concentrating current industrial activities at a newly developed industrial area at the Maas river zone. The area left behind will be available for houses, green space and a small sea yacht harbour.

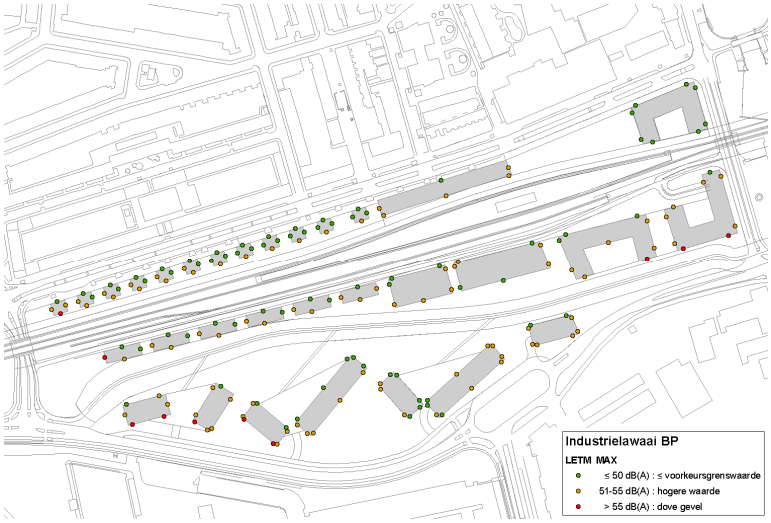

Figure 2: Vlaardingen railway station area and noise immission levels

4. NOISE DILEMMAS: HARBOUR AND THE CITY

The Rotterdam harbour with it's many industrial areas is surrounded by densely populated cities that are facing challenging housing targets. Industrial noise levels often exceed the preferred limit of 50 dB(A). Separating intrusive activities from living areas by noise contours based upon the legal based norms will either impede economic growth or spatial ambitions. Consequently noise zones have been defined using the exemptions provided in the Dutch Noise Abatement Act, i.e. between 50-55 dB(A) applying the higher value procedure and between 55-60 dB(A) applying the higher value procedure and the sea harbour limit. Compensation of high noise levels in quality of life aspects is thus required in the Cityharbour and the Maas River Zone projects.

A. Cityharbour: the impacts of industry in Waal-Eemhaven

The intensive industrial activities in Waal-Eemhaven will affect thousands of new houses with noise levels above 55 dB(A). Therefore in the nineties the municipalities Rotterdam, Schiedam and Albrandswaard, the province of Southern-Holland, the Rotterdam Port Authority and Deltalinqs (Rotterdam organization of industries) initiated the so-called T+ agreement on:

- development of Waal-Eemhaven as one of the main harbour areas;
- construction of new living areas around the Waal-Eemhaven;
- optimal environmental and living quality in the area.

The result of the T+ agreement is the so-called 2025 contour which will be the end contour to be strived for. As such permitting of industrial activities will have to fit within this noise contour e.g. by applying best available techniques at the plants. Mitigation and compensation of noise impacts are applied during the spatial planning phase.

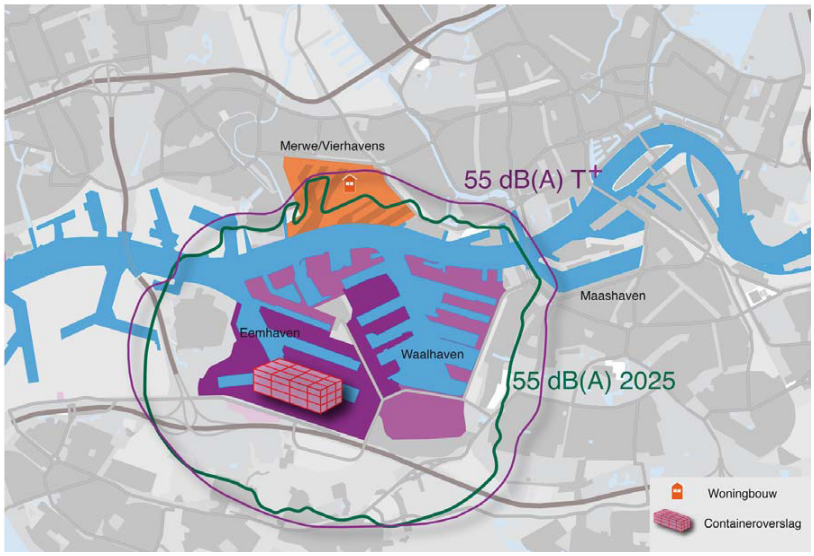

Figure 3: Noise contours Waal-Eemhaven and spatial planning

B. River Zone project: the impacts of industry in Botlek/Pernis and KW-haven

A part of the River zone has been designated as a City & Environment area, as a preliminary study proved that redevelopment of living areas would not be feasible without the City & Environment third step. The noise immission of the industrial area of Botlek-Pernis will be 60 dB(A) at the facades; and thus exceed the legal maximum norm of 55 dB(A). In the Dutch Noise Abatement Act an increase up to 60 dB(A) is allowed in areas close to harbour related industrial areas; this is the so-called sea harbour norm. However, in a part of the Koningin Wilhelmina-haven the existing industrial activities do not fit the formal criteria defined for application of the sea harbour limit. Thus a third step of the City & Environment Law is needed.

Table 2: *Overview of procedures and number of houses*

Area	Procedure	Noise immission	No. houses
KW Haven SW	Step 3 City & Environment	55-60 dB(A) Botlek/Pernis	360
		50-55 dB(A) KW-Vulcaanhaven	400
Nieuwe Maas	Higher value	50-55 dB(A) Botlek/Pernis	200
Station	Higher value	50-55 dB(A) Botlek/Pernis	150
		50-55 dB(A) Maasoever West	
KW Haven NW	Higher value	50-55 dB(A) Botlek/Pernis	40
		50-55 dB(A) KW-Vulcaanhaven	

5. AMBITIONS: SOLVING THE NOISE AND SPATIAL PLANNING DILEMMA

The dilemmas presented above have often to be addressed in step 3 of City & Environment. A thorough preparation of this step is crucial; without approval of this step 3 decision by the province the spatial and housing targets can not be met. Recent experiences in the Maas River Zone projects have provided a solid basis for successful and innovative cooperation between all stakeholders, i.e. authorities, NGOs and industries. Specifically involvement of inhabitants is a prerequisite in defining the key elements of quality of life and thus the compensation to be looked for.

A. Mitigation and compensation in spatial planning projects

A workshop during spring 2009 suggested mitigation and compensation measures to be applied in all spatial planning projects have been defined. Mitigation measures are for example technological innovations, introduction of silent equipment and other noise source targeted improvements regarding industries and transportation (road, railway and shipping). Regarding compensation, larger houses, 'outside living quality' improvement, broad range of facilities such as public transportation, strengthening of cultural or heritage identity, maximization of sustainable planning are proposed. As for mitigation measures the permitting authorities, i.e. Rotterdam and the province of South Holland (tasks delegated to DCMR EPA), will constantly search for and require best available techniques at industrial sites. The Kennis Centrum Geluid (Dutch for Knowledge Centre Noise) at DCMR is supporting, through financial support and information dissemination, the continuous improvement of available techniques.

B. River Zone project: compensating noise by improving environmental quality

As concluded above, new living areas in the River zone will face negative environmental health impacts, specifically by the industrial activities of Rotterdam harbour. Consequently, additional living quality aspects have to be realized as to overall positively assess the living area. The authorities defined so-called environmental (attention) zones and respective compensation and mitigation measures[6]. Regarding noise impacts within the green zone noise immission is limited to 55 dB(A); within the orange environmental attention zone from 55-60 dB(A); and within the red environmental attention zone above 60 dB(A). In the latter zone no spatial planning is allowed. Housing is, without any specific measures, feasible in the green zone. All zones are incorporated in the spatial plans, conform legal requirements of the Dutch Noise Abatement Act and the Spatial Planning Act. The environmental impacts within the orange environmental attention zone are to be compensated. Examples of proposed measures within this orange zone, for the open living areas, are housing blocks sheltering quiet gardens and green areas; trees reducing wind born noise; masking noise. Examples of proposed measures for houses are 'deaf frontage', flexible positioning of rooms; sound insulation and glass facades.

In addition to the definition of (environmental attention) zones and proposed mitigation measures, an assessment framework for spatial planning has been developed, including compensation measures.

Table 3: *Example of spatial planning assessment framework*

Area typology: View on river, harbour and industry	**Assessment framework**		
Requirements	**Desirable**	**Acceptable**	**Debatable**
% houses with good view	> 90 %	70-90 %	< 70 %
green surface and water in % of total area	> 90 %	70-90 %	< 70 %
collective buildings	yes		no
additional measures to comply with legal norms	> 2	1 or 2	none

6. CONCLUDING REMARKS

In the Netherlands noise and spatial planning interests often are balanced through 'flexibilisation' instead of 'normative prioritization', as can be concluded from the cases presented above. Consequently some dilemmas might arise, such as the local-level practice of 'filling up the legal norms'. A recent study of the Dutch Environmental Inspectorate[7] concluded that municipalities apply the legal exemption of high value procedure in a maximal way; i.e. allowing maximum deviation of the norm and not striving for acoustical quality.

Secondly, new concepts, such as quality of life and liveability, introduce a new idiom, that is expected to facilitate integration of spatial planning and noise policies. The City & Environment Law adheres to this quality perspective by requiring the local authorities to compensate noise levels within the other aspects of quality of life. An idiomatic framework and indicators to weigh the components of this quality perspective however are lacking[8-9].

And finally, flexibility in noise standards rises discussions on environmental equity. 'Calculating' local councils evaluate and prioritize environment versus economy. Exceeded noise norms are compensated in other geographic areas and other environmental domains. The obligation of stakeholder involvement in City & Law is often minimized as future inhabitants of the areas to be developed are anonymous.

Nevertheless, flexibility in norm-setting at an area-specific level will be crucial in integration of noise and spatial planning and in reaching the goals and ambitions set in the Greater Rotterdam area. Decision-making based upon a participatory approach and 'objective' compensation mechanisms are strongly advised in order to ascertain equity principles.

ACKNOWLEDGMENTS

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