Harmonious coexistence between industry and housing in **Haven-Stad**

Abstract

This research analyses the integration of housing and industry in Haven-Stad, Amsterdam, with the aim of creating a harmonious coexistence.The central problem is the acute housing shortage in Amsterdam, while vacant industrial sites in Haven-Stad remain unused.The study presents concrete urban planning, architectural and technical solutions, such as green corridors, flexible housing typologies with double facades, and waste heat utilisation.The implementation is divided into five phases: inventory, area preparation, housing construction and cooperation/integration. The conclusion drawn is that harmonious integration is indeed feasible, provided that a number of factors are taken into consideration. These include minimising nuisances, exploiting synergies and ensuring that the needs of residents are central to the process. The approach developed in this study can serve as a model for other urban-industrial areas.

Keywords

Haven-Stad, housing shortage, industry and housing, mutualism, sustainability

illustration 1: overview illustration of the Haven-Stad after applying the interventions of this study.

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1. Introduction

1.1 Context

Amsterdam faces a housing shortage of more than 400,000 homes, while large parts of the city, including the western port zone, remain unused. Within this zone lies Haven-Stad, an area the municipality has designated as a key area for urban development. The aim is to realise 40,000 to 70,000 new homes and 58,000 jobs by 2040 in a healthy and easily accessible live/work environment (Municipality of Amsterdam, 2017). The premise here is that living and working go hand in hand.

However, the municipality's ambition to integrate living and working in Haven-Stad encounters considerable challenges. Initially, it was presented to the industry in this area that a mixed live/work function would be created, in which activity and living would coexist. This got the industry excited about the plans. However, the environmental impact assessment (EIA) shows that residential development in this area is only possible if industry is relocated and sites are donated (Antea Group, 2017). This contradicts the earlier promise and has led to friction between the industry and the municipality.

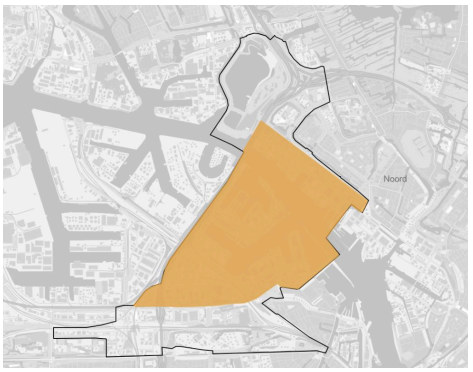

figure 1: Pas-Op-De-Plaats area

To address this friction, the ‘pas-op-de-plaats’ policy, laid down in the *Convenant Houthavens/NDSM-werf* (Provincie Noord-Holland, Gemeente Amsterdam, & Cargill B.V., ICL Fertilizers Europe C.V., Eggerding B.V., 2008), has been in place since 2008. This covenant stipulates that the industry has the right to continue operating in this area until 2040. This is problematic as these very areas have been designated by the municipality as the core locations for the realisation of a large part of the planned housing and workplaces in Haven-Stad. The policy, intended to reduce housing pressure and prevent disruption of industrial activities, has paradoxically led to stagnation in urban development at a time when housing pressure in Amsterdam is historically high.

This combination of problems - the need for large-scale housing development, the leasehold position of industry, the need to relocate activity, and stalled cooperation - lies at the heart of this research.

This research focuses on exploiting the opportunities arising from these complexities in Haven-Stad: how can living and working be sustainably integrated without relocating industrial functions? The aim is to discover how a harmonious coexistence between living and industry can be realised. To this end, technical, urban planning and architectural measures are examined to develop an integrated approach.

The research aims to provide a framework that balances both the needs of future residents and the interests of industry and housing. In doing so, it aims to break the stagnation in housing construction and contribute to future-proof urban development in Haven-Stad, and possibly in similar urban-industrial areas.

1.3 Main Question

How can housing and industry be harmoniously integrated in a heavy industrial area like Haven-Stad?

1.4 Sub Questions

1. What is the current state of industrial activities in Haven-Stad?
2. Who are the potential residents of this area and what are their needs and expectations?
3. What are the potential interactions and relationships between industry and residents in an industrial urban port such as Haven-Stad?
4. What urban planning, architectural and technical solutions can improve these interactions?
5. What strategies can be developed to promote mutualistic relationships between industry and housing?

2. Method

By using the methodology below, the main question is answered:

1. **Literature and policy research:** Analysis of existing literature and municipal plans, such as pass-the-parcel policies, to understand the context and challenges of Haven-Stad.
2. **Site analysis:** Visit(s) to Haven-Stad to examine industrial activities, environmental impacts and spatial relationships.
3. **Stakeholder Interviews:** An analysis of existing interviews and data obtained from industrial parties, policymakers and residents to identify needs and expectations.
4. **Relationship Analysis:** Exploring conflicts and synergies between industry and residents with ecological concepts such as mutualism.
5. **Reference projects:** **A**nalysis of similar projects to identify best practices applicable to Haven-Stad.
6. **Technical solutions:** Research into innovative technologies, such as green buffer zones, waste heat utilisation, and double façade systems, that enable co-existence.
7. **Strategy development:** Design of urban planning, architectural and technical solutions for co-existence.
8. **Synthesis:** Integration of results into an overall approach, validated with feedback from stakeholders.

3. Resultaten

3.1 Current Situation

Haven-Stad is an important hub for various industries, including chemical companies and storage facilities. Its strategic waterfront location, combined with well-developed infrastructure, makes the area attractive for industrial activities. However, these economic functions are accompanied by significant environmental impacts that affect liveability for future residents.

The main forms of nuisance are:

- **Noise nuisance:** Caused by heavy machinery, transport activities and production processes.
- **Odour nuisance:** Originates from chemical emissions and industrial processes.
- **Dust nuisance:** Mainly from storage and transport of raw materials.

The intensity of this nuisance is not the same everywhere in Haven-Stad. The area has therefore been divided into three zones based on the degree of environmental nuisance.

- **Zone 1 🟡:** Area with minimal nuisance, where transformation to residential-working areas is possible with limited adjustments.
- **Zone 2 🟠:** Area with noticeable noise nuisance and some odour and dust problems. Transformation is possible but requires strategic interventions such as noise barriers and air filters.
- **Zone 3 🔴:** Area with heavy industry and significant nuisance. Transformation requires major interventions such as green buffer zones, emission reduction and raised chimneys.

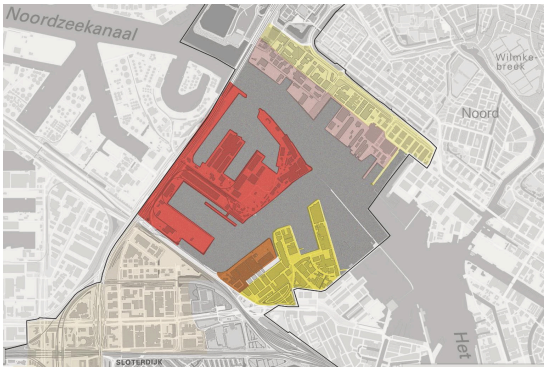

figure 2: Different zones in de pas-op-de-plaats areas

This classification forms the basis for the study of appropriate strategies and solutions, which can achieve the integration of housing and industry in Haven-Stad. For the full analysis of industrial activities, see the full study.

3.2 Potential residents and their needs

The potential residents of Haven-Stad form a diverse group with diverse needs. The Integraal Raamwerk Haven-Stad (Gemeente Amsterdam, 2021) aims for an inclusive community with a varied housing stock for target groups such as young people, starters, people moving on and families.

For an attractive and healthy living environment, it is essential to minimise nuisance from industry, such as noise and air pollution. Importantly, residential satisfaction is influenced by a combination of objective factors and subjective perceptions. A successful strategy for Haven-Stad should therefore take into account both the practical needs and the emotional perceptions of future residents.

3.3 Interactions and relationships

To better understand the relationship between industry and residents, eight themes relevant to both urban planning and daily interactions between the two groups were examined. Below is a comparison matrix developed as part of this examination of the different interests with a rating of priority next to it.

Themes	Importance for industry (Priority)	Importance for residents (Priority)
Location and space	1. Availability of sufficient space for production and storage	8. Proximity to work and amenities
Logistics and mobility	2. Efficient transport routes for goods and raw materials	6. Accessibility to public transport and roads
Nuisance and disturbance	3. Minimizing complaints to avoid operational delays	1. Reducing noise, air, and traffic pollution
Costs and regulations	4. Compliance with affordable and realistic regulations	3. Affordable living and clear regulations
Safety	5. Secure operations and minimizing risks to surroundings	2. Safe living environment
Flexibility and future	6. Adapting to technological and market changes	7. Long-term livability and adaptability
Green and sustainability	7. Energy efficiency and sustainable processes	4. Green spaces and sustainable energy sources
Economy and employment	8. Contribution to the local economy and job creation	5. Access to job opportunities

matrix 1: interest matrix industry and residents with priorities

The interest matrix highlights the divergent priorities of industry and residents in Haven-Stad:

- **Location and space:** Industry chooses locations based on functional and economic reasons, while residents prioritise living environment quality. Finding a balance between industrial efficiency and residential quality is essential.
- **Nuisance and annoyance:** Residents want minimal nuisance (noise, odour, pollution), while industry focuses on operational freedom and cost control. Solutions must reconcile both interests.
- **Green and sustainability:** For residents, sustainability is a welfare factor, while industry approaches it economically. Linking sustainable benefits for both parties is necessary.
- **Economy and employment:** Industry drives direct economic growth, while residents benefit indirectly through employment, provided liveability is safeguarded.

The relationship between industry and residents can be compared to the biological concept of symbiosis, which describes long-term interactions between different organisms. (Begon, Townsend, & Harper, 2006) This model provides a framework to categorise relationships in Haven-Stad based on mutual impact:

- ❌ Parasitism: Industry benefits at the expense of residents, e.g. through pollution or noise that harms the living environment without compensation.
- ⚡ Commensalism: Industry achieves benefits without directly affecting residents, such as technological improvements without noticeable impact on the environment.
- 🌱 Mutualism: Both industry and residents benefit, for example by using waste heat from factories for home heating, which reduces costs and promotes sustainability.

The aim is to strengthen mutualistic interactions in Haven-Stad by deliberately designing solutions that maximise benefits for both industry and residents. By minimising nuisances and exploiting synergies, a balanced relationship can emerge in which industry and residents actively support each other.

3.4 Urban, architectural and technical solutions

The proposed solutions in the study are arranged according to three pillars that have emerged from the previous chapters.

- **Zones of adaptation:** Solutions are linked to the three zones in Haven-Stad (🟡, 🟠, 🔴) depending on the degree of industrial nuisance and measures needed. See chapter 3.1
- **Residents' needs:** Solutions address ⚖️ objective needs (e.g. air quality, housing quality) and 👁️ subjective preferences (e.g. aesthetics, atmosphere). See chapter 3.2
- **Relationships between industry and residents**: The aim is to avoid parasitic relationships (❌) and promote mutualistic (🌱) or commensalistic (⚡) relationships, where residents and industry are mutually reinforcing or unaffected.1

This framework provides a method to assess solutions for suitability, impact and effectiveness within the Haven-Stad strategy.

Urban planningsolutions

illusstration 2: Illustration of a green corridor in Port-City, where a canopy with green spaces serves as a visual and physical buffer between industry and residential areas. (Own illustration)

- **Natural boundaries and green buffers:** Green zones separate industrial and residential areas and reduce noise, air pollution and visual disturbance. These multifunctional buffers provide space for parks, recreational areas and green corridors.
- **Smart rearrangement of infrastructure**: Separated routes for freight traffic and residential mobility improve accessibility and liveability. This includes smart supply routes, cycling networks and investment in public transport.
- **Flexible zoning**: Adaptation of rigid zoning plans to zones combining living, working and recreation, including review of pass-through policies.
- **Climate-adaptive measures**: Integration of water buffers, green roofs and heat-resistant materials increases resilience to climate change.
- **Sustainable area development**: Promoting circular economy through shared energy and waste systems and reuse of materials.
- **Training and employment programmes**: Development of programmes and jobs in line with industry in Haven-Stad, promoting social and economic integration.

Architectural solutions

- **Double façade systems:** Soundproofing and insulating facades minimise nuisance and improve air quality.
- **Vertical gardens and roof gardens**: Green facades and roofs improve air quality and reduce heat stress.
- **Flexible housing typologies:** Modular and multifunctional housing adapts to changing occupant needs.
- **Membrane domes**: In highly stressed areas, these structures create a controlled microclimate that protects residents from air pollution and noise.

illustration 3: Architectural design with integrated vertical gardens and roof gardens in Port City (Own illustration).

- **Orientation and zoning of buildings:** Strategic positioning minimises nuisance, with closed facades towards industry and open facades towards green areas.

Technical solutions

- **Raised chimneys and emission pipes:** Higher chimneys reduce the local impact of emissions, combined with advanced filters.
- **Waste heat utilisation:** Heat networks connect industrial waste heat to homes.
- **CO_2 capture and reuse:** CO_2 is captured and used for circular applications, such as vertical farming.
- **Energy generation:** Integration of renewable energy sources, such as solar panels and wind turbines, in both residential and industrial buildings.

Quantification and Analysis of Solutions

The proposed solutions in this chapter have been assessed for their suitability for the zones, their contribution to residents' needs and their impact on the relationship between industry and residents.

Zones

- 🟡 **Zone 1**: 5 solutions focused on aesthetics and climate adaptation, such as green buffers and flexible housing typologies.
- 🟠 **Zone 2**: 7 solutions, including double façade systems and waste heat utilisation, focusing on nuisance reduction and social interaction.
- 🔴 **Zone 3**: 6 solutions, such as membrane domes and raised chimneys, requiring intensive retrofitting to ensure liveability.

Residents' needs

- ⚖️ **Objective needs**: 10 solutions improve health, safety and energy efficiency.
- 👁️ **Subjective needs**: 8 solutions, such as vertical gardens and green corridors, increase well-being and aesthetic appeal.

Relationship between Industry and Residents

- ❌ **Parasitism**: 0 solutions, all measures avoid negative impact on residents.
- ⚡ **Commensalism**: 5 solutions, such as raised chimneys, reducing nuisance for residents.
- 🌱 **Mutualism**: 9 solutions, such as waste heat utilisation and CO_2 capture, which provide benefits for both parties.

The quantification highlights that most solutions target Zone 3 and primarily address objective residents' needs, such as air quality and noise mitigation. Many of the measures create mutualistic relationships, in which residents and industry jointly benefit.

This approach combines smart infrastructure, green architecture and technological innovations to minimise nuisance and promote social cohesion. This achieves the goal from chapter 3, realising mutualism. For full details of the solutions, see the full study.

3.5 Implementation of solutions

Implementing solutions in Haven-Stad requires a phased and integrated approach that takes into account the (complex) relationship between industrial activities and residential functions. The proposed roadmap provides a structured framework for the transformation. See the appendix for the full roadmap.

The roadmap to harmonious coexistence

Phase 1: Inventory and analyse current situation 🔍📝

This first phase involves a thorough analysis of the current situation in Haven-Stad:

- **Detailed mapping:** Map industrial zones, environmental impacts and infrastructure.
- **Nuisance analysis:** Identify companies that have the greatest impact on odour, noise and dust, and determine their specific impact on the surrounding area.
- **Mix of functions policy:** Draft new regulations to enable a safe mix of residential and industrial.
- **Zoning:** Define zones (light, medium, heavy) with guidelines for transformation.

Phase 2: Prepare area for housing 📋🏠

This phase focuses on physical and policy adjustments:

- **Green buffer zones:** Create natural barriers between industry and homes to reduce nuisance and provide recreational space.
- **Raised chimneys:** Minimise emissions and odour nuisance by raising chimneys and applying filters.
- **Modernise infrastructure:** Develop segregated transport networks and smart supply routes.
- **Green corridors:** Design connecting green structures between residential and commercial areas.
- **Transition zones:** Introduce shared spaces with flexible functions, such as pop-up parks and recreational zones, which serve as buffers and meeting places.

Phase 3: Phased residential construction 🏗️🌳

The third phase focuses on building housing in closely coordinated phases:

- **Sustainable energy solutions:** Integrate solar and wind energy and harness waste heat from industry.
- **Adaptive housing typologies:** Adapt housing designs by zone with solutions such as double facades, roof gardens and membrane structures.
- **Pilot projects:** Start small-scale experiments in light zones to test and further develop plans.

Phase 4: Promote cooperation and integration 🤝🔗

This phase encourages cooperation and synergy between residents and industry:

- **Stakeholder cooperation:** Create a partnership between municipality, industry and residents.
- **Local training and employment:** Develop training programmes and promote industry employment opportunities for new residents.
- **Smart mobility solutions:** Strengthen public transport and separate freight and residential traffic for safe and efficient infrastructure.

Phase 5: Monitor, evaluate and adjust ✅📊**.**

The final phase focuses on ensuring progress and effectiveness:

- Establish KPIs: Define measurable indicators for sustainability, liveability and economic impact.
- Evaluate progress: Analyse collected data to assess impact of measures.
- Flexible adjustments: Adjust strategies to anticipate changing circumstances and new insights.

4. Conclusion

The study ‘Harmonious coexistence between industry and housing in Haven-Stad’ concludes that the integration of housing and industry in an area like Haven-Stad is feasible, provided a well-thought-out strategy is followed. By acting on three pillars, harmonious coexistence can be achieved:

- **Zone-oriented solutions:** Classifying areas according to industrial intensity (light, medium and heavy industry) makes it possible to specify measures. Lighter zones require simpler adaptations, while heavier zones require radical and innovative solutions, such as membrane structures and raised chimneys.
- **Mutual relationships:** By encouraging synergies, such as shared infrastructure and energy exchange, industry and housing can reinforce each other. This approach not only minimises nuisance, but transforms the interaction between the two functions into a mutually beneficial collaboration.
- **Resident-centred design**: residents' needs, both objective (such as air quality and safety) and subjective (such as aesthetics and experience), are at the heart of the process. This results in a living environment that is not only functional but also attractive.

The study offers concrete strategies, including urban planning measures (green buffers, smart infrastructure), architectural innovations (flexible housing typologies, double facades) and technical solutions (waste heat utilisation, carbon capture). Implementing these requires a phased approach and close cooperation between all stakeholders.

Using Haven-Stad as an example, this project shows that the integration of housing and industry can be feasible. The findings provide a framework that is applicable in Amsterdam and, with attention to local context, can also inspire urban-industrial transformations elsewhere. Harmonious coexistence is possible through a smart combination of strategy, collaboration and innovation.

Reflection
Haven-Stad shows that the integration of housing and industry is not only a complex challenge, but also offers opportunities for more sustainable and inclusive urban development. This research provides policymakers with a practical framework, offers designers inspiration for innovative solutions, and forms a solid basis for further academic studies.

The focus on Haven-Stad provides valuable insights, but limits the generalisability of the results. For wider application, additional research is needed on similar urban-industrial areas. This can help refine the developed framework and adapt it to diverse contexts and challenges.

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(See the full research for the complete list of references)