

*Social Sustainability Indicators of Quay Wall
Interventions in Amsterdam: A Comparative
Analysis During and After Implementation*



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Executive summary

Sustainability is a concept that involves balancing economic, environmental, and social aspects. While economic and environmental aspects have been extensively studied, social sustainability has not received as much attention in the urban infrastructure interventions. Therefore, this study aims to identify key social sustainability indicators specifically tailored to the interventions on historic inner-city quay walls in Amsterdam that can be integrated into the asset management decision-making processes of the municipality. Social sustainability in this study addresses the social impacts of infrastructure interventions throughout their life cycle, evaluated by using Social Life-cycle Assessment (S-LCA) method. This involves identifying relevant social indicators, considering the stakeholders perspectives, and examining interventions life-cycle phases. Social indicators are measures that address social concerns.

The potential social indicators were identified from existing literature and further investigated through case studies of two projects: Rechtboomsloot (quay wall renewal) and Leliegracht (temporary sheet piles installation). Interviews with experts and the local community identified ten key social indicators, including health and safety, accessibility, cultural and historical heritage preservation, local community involvement in flora and fauna preservation, quality of life, transparency in decision-making, local community engagement, impact on local business activities, local employment opportunities, and houseboat relocation. These indicators are divided into sub-indicators such as compliance with health and safety protocols, frequency of safety incidents, duration of road closures, distance to parking spaces, damage assessment processes and compensation, community satisfaction, local community involvement in greenery efforts, disturbance frequency, well-being, local community support, communication frequency, local community trust, and participation in post-construction evaluation.

The social indicators are used to evaluate the social impact of quay wall interventions on the local community during and after the implementation phase of both projects. The findings reveal that Project Rechtboomsloot was most impactful during the implementation phase due to the long construction period and lack of communication. In contrast, Project Leliegracht had the most social impact after the implementation phase. Both projects implemented strict health and safety measures and faced challenges in accessibility, with Project Rechtboomsloot experiencing a greater long-term impact due to the "Autoluw Amsterdam" policy, while Leliegracht had temporary accessibility disruptions. Furthermore, Project Rechtboomsloot successfully involved the community in greenery efforts, achieving positive long-term engagement and appreciation regarding the renewal of the quay wall. In contrast, Leliegracht faced long-term dissatisfaction arising from structural changes, lack of communication, and damage to homes after the implementation phase, leading to a negative long-term impact on the local community's quality of life and trust in local authorities. Both projects also presented short-term challenges for local businesses and limited employment opportunities. The relocation of houseboats involved relocating and return, causing short- and long-term impacts. The impact on the local community varies based on project context, intervention method, duration, frequency, groups, and intervention phases.

The current asset management decision-making process of municipality includes technical evaluation, environmental and execution feasibility, sustainability, and cost analysis. However, social sustainability is not fully integrated. To address this, a proposed framework includes technical evaluation, sustainability evaluation incorporating environmental, economic, and social dimensions, and robust implementation and monitoring. By considering both short-term and long-term social sustainability, the municipality can better understand the impacts on the local community and socially improve future infrastructure interventions. Future research is needed to effectively evaluate social indicators and refine this framework for more sustainable urban infrastructure interventions.

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1. Introduction

Sustainable development is a concept that focuses on meeting the needs of the present without compromising the ability of future generations to fulfill their own needs (Secretary-General, 1987). To achieve sustainability, a set of environmental, social, and economic considerations need to be balanced (Ghahramanpouri et al., 2013). Sustainability ensures that human activities and systems can persist over the long-term without degrading natural resources, harming the environment, or undermining social well-being. It plays a crucial role in decision-making, including the field of infrastructure asset management (Niekamp et al., 2015).

Infrastructure asset management refers to the strategic and systematic approach of overseeing, maintaining, and optimizing infrastructure assets, such as bridges, roads, quay walls, and buildings, to ensure their optimal performance, longevity, and functionality (Chen & Bai, 2019). However, the management of these assets can have significant economic, environmental, and social impacts (Colantonio, 2011). Specifically, when managing an infrastructure asset that reaches the end of its life cycle. It faces challenges related to deterioration, increased maintenance costs, safety risks, and value losses (Furuta et al., 2012); (Chen & Bai, 2019). These challenges necessitate careful planning and decision-making to consider the impacts and renovate the assets.

While economic and environmental aspects have received significant attention during infrastructure interventions, social sustainability is usually neglected (Sierra et al., 2016); (Kordi et al., 2021); (Sierra, Yepes, et al., 2017). Social sustainability is a concepts that focuses on improving the well-being, preserving historic and cultural heritage, ensuring good governance, fostering community engagement, promoting equity, and enhancing quality of life for both current and future generations (Colantonio, 2011); (Sierra, Yepes, et al., 2017); (Vijayakumar et al., 2022). Neglecting social sustainability during infrastructure interventions can lead to various critical social issues, including the destruction of cultural heritage, mobility restrictions, economic challenges for local community and local businesses, and increase public safety risks (Asomani-Boateng et al., 2015) ; (Valdes-Vasquez & Klotz, 2013); (Li et al., 2018).

1.2 Problem statement

In cities, with diverse populations and where infrastructure assets are an integrated part of society, addressing social issues during interventions on aging assets poses significant challenges. A particular case of this issue is the historic quay walls of Amsterdam, which face similar social challenges as they age (Gemeente Amsterdam, 2019). These quay walls hold significant historical and cultural value and play an important role in the city's overall accessibility and connectivity. These assets are struggling with challenges such as the increased weight from modern transportation, the risks of deferred maintenance, and the lack of a comprehensive approach to ensure their safety and functionality, as defined by (Gemeente Amsterdam, 2019). To deal with these challenges, the municipality of Amsterdam has initiated the 'Program Bruggen en Kademuren' to maintain the structural integrity of 1600 bridges and 600 km of the quay walls (Melanie van der Horst, 2023). Furthermore, the municipality conducted an integrated assessment including several critical aspects such as asset safety, implementation feasibility, environment analysis for quay wall location, sustainability, and cost consideration, as outlined in decision-making process of the municipality, namely "Afweging Toekomstbestendig Herstel" (Melanie van der Horst, 2023). After these assessments, the municipality proposes interventions on quay walls that includes safety measures, function re-evaluation, renovation for lifespan extension, and demolition and renewal. This process relies on experts' advice.

The decision-making process is illustrated in figure 1:

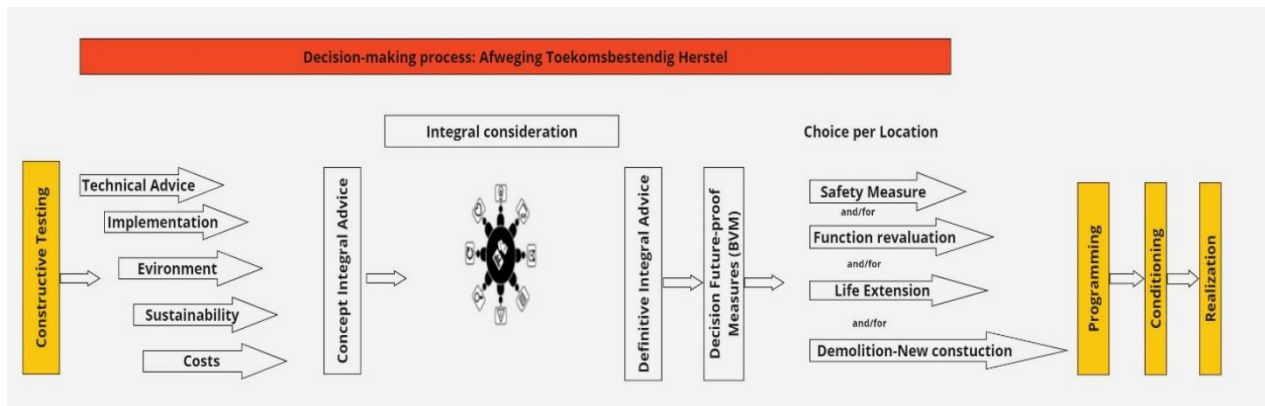


Figure 1: Decision-making framework of municipality (Melanie van der Horst, 2023)

Despite the integrated assessment, it is worth noting that the municipality approach to sustainability differs from the conventional scientific perspective, which typically encompasses three key dimensions: environmental, economic, and social (Ghahramanpouri et al., 2013). The social dimension has not adequately been considered in the decision-making process. In contrast, the municipality's sustainability approach aligns with its specific sustainability objectives related to circularity, emission-free practices, and climate-resilient construction, as outlined in the (Melanie van der Horst, 2023).

The implementation of infrastructure interventions can cause social challenges, including detours and limited accessibility of certain streets. This can disrupt traffic flow and cause longer travel time for residents and visitors. Furthermore, interventions often generate significant noise disturbances, which can be disturbing for local residents and businesses, especially when the intervention is implemented early in the morning or late in the evening (Gemeente Amsterdam, 2022); (Melanie van der Horst, 2023). Local businesses may also face accessibility difficulties for customers, suppliers, and workers, negatively impacting their revenue. Additionally, the implementation of interventions long-term disturbances can affect overall quality of life of the local community and cultural heritage (Asomani-Boateng et al., 2015); (Fulford et al., 2015); (Sierra, Yepes, et al., 2017).

To address the social challenges and ensure that actions taken for implementation of interventions promote equity, safety, public health, and reliable access to essential services, greater consideration of social sustainability is needed in the decision-making process of municipality.

It can be considered by using Social Life Cycle Assessment methodology (S-LCA). This methodology offers a framework for the systematic evaluation of the social sustainability by considering relevant social indicators depending of specific context of the study (*Guidelines for Social Life Cycle Assessment of Products*, 2009); (Benoît Norris et al., 2020); (Zheng et al., 2020). Social sustainability indicators can play a crucial role in guiding decision-making and ensuring that social sustainability is adequately addressed (Sierra, Yepes, et al., 2017); (Noll, 2013). However, research on the social sustainability indicators that are relevant for the infrastructure interventions is limited. Therefore, this research focuses on identifying social sustainability indicators and integrating them into the infrastructure asset management decision-making process of municipality.

By doing so, this study aims to promote a holistic and sustainable approach that aligns with sustainable development goals, ensuring the quality of life of present and future community in long-term and supporting decision-making for infrastructure interventions (Sierra, Pellicer, et al., 2017).

1.3 Research objectives and questions:

The main objective of this research is to identify a set of key social sustainability indicators specifically tailored to the interventions on historic inner-city quay walls in Amsterdam that can be integrated into the asset management decision-making processes of the municipality.

To achieve this objective, the following research questions will be addressed:

1. What are the key social sustainability indicators that should be incorporated in decision-making process for inner-city quay wall interventions, and how can they be evaluated?
2. How can the key social sustainability indicators be integrated into the Amsterdam municipality's asset management decision-making processes?

To address these questions, the study will employ a methodology, combining background research including literature review, case studies of previous interventions such as renovation and renewal on quay walls in Amsterdam and stakeholders' interview. The research will involve gathering qualitative data by interviews with experts and local community to identify relevant social indicators and evaluate their short-term and long-term social impacts by considering implementation and post-implementation phase. The next chapter will provide a more specific explanation of the relevant concepts.

2. Literature review

This chapter presents a literature review of the key concepts explored in this study. Relevant scientific information has been gathered through a comprehensive literature search, which has been analyzed to provide a clear understanding of the available knowledge concerning the central themes addressed in this research, such as social sustainability and infrastructure asset management.

According to the literature, a crucial challenge in addressing social sustainability within the infrastructure domain is the complexity associated with defining, measuring, and implementing it (Valentin & Bogus, 2015); (Martini, 2021).

2.1 Defining social sustainability

In recent years, important steps have been made to enhance the visibility of the social dimension of sustainability in the general sustainability debate (Marti et al., 2007). Nevertheless, despite all these efforts, only marginal attention has been paid to this dimension compared to the economic and environmental dimensions (Kordi et al., 2021);(Sierra, Yepes, et al., 2017), especially from an infrastructure management perspective.

Compared to economic sustainability and environmental sustainability, measuring social sustainability is a relatively more challenging task (Martini, 2021); (Karji et al., 2019); (Rasouli & Kumarasuriyar, 2016). As stated before, one of the main challenges associated with the concept social sustainability is the apparent difficulty in precisely defining it (Karji et al., 2019). It appears that the term 'social sustainability' has a broader meaning than the other two sustainability pillars, which makes it more challenging to develop concrete standards for it. Social sustainability is in many ways subjective and is likely to vary from one assessment to the other (Karji et al., 2019). Therefore, what is considered socially sustainable in one project may not meet requirements in another one. The assessment challenge is further compounded by the sustainability perspective adopted, with social impacts that can be divided in short-term and long-term effects(Sierra, Pellicer, et al., 2017); (Sierra et al., 2016). Short-term social impacts include immediate changes, while long-term effects involve sustained alterations on local communities due to infrastructure interventions (Shukla & Jani, 2018).

In general, defining social sustainability involves stakeholders such as government, local community, customers, and the supply chain, with a focus on meeting the needs of present and future community(Valdes-Vasquez & Klotz, 2013); (Benoît Norris et al., 2020). This concept can be interpreted differently, depending on the stage of the infrastructure asset life-cycle, specific infrastructure interventions, and the perspective of involved stakeholders(Valdes-Vasquez & Klotz, 2013); (Sierra et al., 2016). The life cycle of infrastructure assets typically includes the phases of Planning and design, construction, operation, maintenance, and demolition, with each phase bringing unique considerations for social sustainability. During the planning phase, the focus is on stakeholder engagement, assessment of community needs, and consideration of long-term social impact(Sierra et al., 2016). The design phase then focuses on inclusive design principles, accessibility, and minimizing adverse social issues. In the construction phase, health, and safety, and minimizing disruptions for the community are addressed (Vijayakumar et al., 2022). Throughout the operation period, access to services, social equality, and ongoing community engagement are ensured. Furthermore, the maintenance phase revolves around sustainable practices for maintaining the infrastructure and ensuring continuous benefits for the community(Vijayakumar et al., 2022). Finally, the demolition phase involves the safe removal or

repurposing of infrastructure with minimal social disruption and consideration for the future needs of the community(Sierra et al., 2016). In this way, the interpretation of social sustainability can evolve based on the specific challenges and priorities in each phase of the infrastructure life cycle and the perspectives of the involved stakeholders. These stakeholders hold significant influence over project processes and outcomes(Kordi et al., 2021).

This research focuses on infrastructure asset interventions, including an examination of a few infrastructure projects and asset management examples. Since there is no clear definition of social sustainability at this stage, it is necessary to formulate own definition that will serve as the foundation for this research. Table 1 provides an overview of various social sustainability definitions in the context of infrastructure asset management along with their respective sources.

Definition	Source
Social sustainability in asset management refers to the ability to effectively and responsibly manage infrastructure assets to meet the needs and expectations of society, taking into account various challenges and complexities. It involves the application of optimization methods in decision-making processes to ensure that infrastructure services are maintained, upgraded, and operated in a way that benefits society.	(Chen & Bai, 2019)
Social sustainability in the context of infrastructure life cycle management involves the systematic consideration of a range of criteria and factors that impact society throughout the different stages of an infrastructure asset. The relevance of these criteria varies depending on the phase of the asset, and experts emphasize the importance of engaging stakeholders, promoting innovation, and empowering the community to achieve social sustainability goals. This approach aims to increase the positive social impacts of infrastructure development and reduce the negative social impacts.	(Sierra et al., 2016)
Social sustainability in the context of infrastructure projects , refers to the assessment and consideration of the social aspects of sustainability throughout the life cycle of infrastructure assets. This approach emphasizes the need to evaluate and prioritize infrastructure practices based on their potential for short- and long-term social improvement, in addition to commonly assessed environmental and economic factors.	(Sierra, Pellicer, et al., 2017)

Table 1: Social sustainability definitions

2.2 Short- and long-term social sustainability

The definitions of social sustainability show the importance of considering short- and long-term social sustainability across the life cycle of infrastructure interventions (Sierra, Pellicer, et al., 2017), which depend on the conditions, circumstances, and *social indicators*, which vary between assessments. From these aspects, a comprehensive definition specific the context of this research will be formulated in section 2.4.

Table 2 serves to illustrate the relationships between key social sustainability principles as identified by (Valentin & Bogus, 2015) and (Hill & Bowen, 1997) and their implications for short- and long-term social sustainability in the infrastructure domain. These principles are tailored to focus on infrastructure projects and are intended to provide decision-makers with a framework for evaluating the level of social sustainability within an infrastructure project (Valentin & Bogus, 2015).

Principle 1: Improve the quality of human life by ensuring secure and adequate consumption of basic needs.
Short-term Sustainability: Primarily addresses immediate basic needs like food, shelter, and clean water.
Long-term Sustainability: Focuses on improving the long-term quality of life by ensuring these basic needs are met
Principle 2: Make provision for self-determination and cultural diversity in development planning and ensure the operation of development (after the construction process is complete) is compatible with local community institutions and technology.
Short-term Sustainability: Respects local cultures and traditions in development planning.
Long-term Sustainability: Ensures that development remains aligned with local institutions and technology even after the construction, promoting long-term social sustainability.
Principle 3: Protect and promote human health through a healthy and safe working environment. Plan and manage the construction process to reduce the risk of accidents, and carefully manage the use of substances, which are hazardous to human health.
Short-term Sustainability: Ensures the safety and health of workers and community during construction in the short-term.
Long-term Sustainability: Continues to protect and promote well-being of community in the long term.
Principle 4: Implement skills training and capacity enhancement of disadvantaged people to allow them to meaningfully participate in a project. Such training and participation should ensure that the development of human resources is a lasting legacy of construction, in addition to the physical presence of services.
Long-term Sustainability: This aims for a lasting impact by improving skills and enabling meaningful participation in projects.
Principle 5: Seek fair or equitable distribution of social costs of construction and, where this is not achieved, determine fair compensation for people adversely affected by construction operations.
Short-term Sustainability: Emphasizes fair compensation, equitable distribution of social costs, and intergenerational equity to ensure that the consequences are not disproportionately passed on future generation.
Short-term and Long-term Sustainability: Focuses on ensuring equitable distribution of social benefits during and after construction phase.
Principle 6: Seek intergenerational equity so that significant social, biophysical, and financial costs of current construction are not passed on to future generations.
Long-term Sustainability: Emphasizes intergenerational equity and long-term social well-being, ensuring that the costs of current construction do not burden future generations.

Table 2: Social sustainability principles and their impacts (Valentin & Bogus, 2015) and (Hill & Bowen, 1997)

For this research, it is essential to recognize the relationship between short- and long-term social sustainability impacts within this infrastructure asset management life cycle. The distinction between these two perspectives is critical as it underlines the multifaceted nature of decision-making processes that must address immediate community concerns while ensuring that the community's long-term well-being and cultural heritage are protected (Colantonio, 2011); (Bagnall et al., 2018).

According to (Sierra et al., 2016), short-term social sustainability is indispensable during design, planning and construction phase. It ensures that immediate community concerns are addressed during these phases (Sierra et al., 2016); (Bagnall et al., 2018); (Shukla & Jani, 2018). In the design and planning phase, short-term sustainability includes the safety and convenience of local community are prioritized during construction phase, fostering a sense of trust, and building positive relationships with the community (Bagnall et al., 2018). It also includes immediate access to services and minimizing disruptions during the construction phase (Gannon & Liu, 1997; Sierra et al., 2016; Valdes-Vasquez & Klotz, 2013). The disruptions can be minimized by taking measures such as noise reduction, easy access to services and preserving historical and cultural heritage that may be affected during implementation of the interventions, as indicated by Valentin & Bogus, (2015). These efforts mainly address temporary changes in the quality of life of the community including well-being during implementation phase. In this phase it is important to ensure the most vulnerable members of the community are included (Mostafa & El-Gohary, 2014; Sierra, Pellicer, et al., 2017).

Studies have shown that short-term social sustainability efforts do not always lead to a fair distribution of social benefits and in some cases may unintentionally harm socially disadvantaged sectors (Foth et al., 2013). Short-term social sustainability efforts can be observed when decision makers prioritize opportunistic but temporary solutions to address immediate problems. For example, during the implementation of interventions on quay wall, a temporary solution may include repairing visible structural damage to ensure the quay wall remains accessible for a specific upcoming event or for the local community. While this action addresses immediate needs, it does not consider the long-term structural integrity and safety of the quay wall and community. This temporary solution could lead to recurring repairs, as other parts of the structure might develop structural damage over time, causing inconvenience for the local community. It can be concluded that such temporary measures may help minimize disruptions and potential safety issues for the community in the short-term but can lead to recurrent problems and increased inconvenience in the future.

Since infrastructure asset management involves keeping assets in good condition over long periods of time, the integration of long-term social sustainability within asset management is essential (Chen & Bai, 2019). This ensures sustainable approach that is balanced. Long-term social sustainability should be considered throughout the entire life cycle of the asset. This approach recognizes the critical interplay between infrastructure and the local community it serves. It aims to avoid possible dissatisfaction of the local community and unforeseen challenges that may arise during the asset's life cycle that may not only affect the community's well-being but also posing risks to the preservation of their historical and cultural heritage (Sierra et al., 2016).

Furthermore, long-term social sustainability involves ongoing community engagement fostering collaboration and interaction between local community and the government. Additionally, ongoing dialogue and active participation empower community members and ensures their inclusion in decision-making processes regarding the preservation of their cultural heritage and overall quality of life of the community (Valdes-Vasquez & Klotz, 2013). Examples of such engagement include regular community meetings, workshops, or forums aimed at eliciting and incorporating the community's perspectives, concerns, and suggestions regarding the interventions that may impact the local community. This engagement further aimed at integrating and supporting vulnerable communities, ensuring their sustained development over time.

By actively involving these groups in decision-making processes related to asset interventions and tailoring initiatives to meet their specific needs, the approach to asset management becomes more inclusive, transparent, and socially responsible (Lenferink et al., 2013). The implementation of social sustainability throughout the asset's life cycle has the potential to benefit society for years to come (Chen & Bai, 2019; Sierra, Pellicer, et al., 2017).

Table 3 illustrates further refinement of the short-term and long-term social sustainability, which focuses on social effects or consequences resulting from the infrastructure projects, interventions, or policy over both short and long time periods with their respective papers.

Short-term impacts	Long-term impacts	Sources
Short-term impacts include promoting social cohesion and trust	Long-term impacts include enhancing sense of belonging, pride, and social interactions within the local community through infrastructure interventions	(Bagnall et al., 2018)
Implementing infrastructure interventions can minimize community disruption and discomfort in the short term	Reducing work duplication and improving overall social, environmental, and economic impacts in the long term.	(Abu Samra et al., 2018)
Short-term social impacts include employment and services.	Long-term effects involve economic growth, poverty reduction, and social inequality reduction through community investment programs in infrastructure projects.	(Montgomery et al., 2008)
Short-term impacts include immediate access to services.	Long-term effects involve sustained community development and improved quality of life due to infrastructure interventions in Community of Nigeria.	(Olusa, 2021)
Short-term social impacts include improved social environment and increased street use.	Long-term impacts may involve enhanced community relationships, social capital, and interactions, promoting walking for transport.	(Adams & Sherar, 2018)
Implementing infrastructure interventions can have short-term benefits like improved services	Long-term impacts such as enhanced community wellbeing, integration, and satisfaction, as highlighted in the Lithuanian study.	(Vazonienė & Kiaušienė, 2018)
	The paper discusses impact evaluation of infrastructure interventions, emphasizing the importance of understanding project context, different ways of impact, and anticipating of different groups to evaluate <i>short and long-term social impacts</i> on local communities.	(Hansen et al., 2011)
Large-scale infrastructure projects can lead to social injustices for local communities, with blurred responsibility for equity.	Limited participation in benefit-sharing, impacting both short-term and long-term social dynamics.	(Otsuki et al., 2016)
Short-term social impact includes improved construction quality with community participation.	Long-term impact shows no effect on ongoing maintenance, suggesting a need for contractual maintenance provisions in infrastructure projects.	(Holcombe et al., 2018)
Short-term impacts include improved services and community cohesion	Long-term effects involve sustainability, empowerment, and enhanced quality of life for residents through community involvement in infrastructure projects.	(Cotton et al., 1998)

Table 3: Short-term and Long-term social impacts

The studies show that there are variety in interpretation of short-term and long-term social impacts. In the short term, studies indicate immediate benefits such as improved services, social cohesion, and trust within communities (Bagnall et al., 2018; Cotton et al., 1998; Vaznonienė & Kiaušienė, 2018). Other studies point to specific improvements such as minimized community disruption (Abu Samra et al., 2018) and increased street use (Adams & Sherar, 2018).

The long-term impacts of infrastructure interventions vary and can encompass sustained community development, improved quality of life, and economic growth (Montgomery et al., 2008; Olusa, 2021). Some studies emphasize the enhancement of social capital and a sense of belonging (Adams & Sherar, 2018; Bagnall et al., 2018), while other studies address broader social and environmental justice issues (Otsuki et al., 2016). Furthermore, some studies point out challenges or limitations in achieving long-term outcomes. For instance, Holcombe et al. (2018) found that while community participation can enhance construction quality in the short term, it may not have a significant impact on ongoing maintenance. This suggests the necessity for additional measures such as contractual maintenance provisions.

These studies highlight the complexity of infrastructure interventions and the significance of considering social sustainability impacts. Both the immediate and long-term impacts of infrastructure interventions is crucial for developing effective and equitable policies and practices (Sierra, Pellicer, et al., 2017). Addressing this dual perspective can maximize social benefits (Chen & Bai, 2019). The short-term and long-term social impacts can be evaluated by considering the social sustainability indicators throughout the life cycle of the infrastructure asset to ensure that it is maintained, upgraded, and operated in a manner that increase the health and safety of the community, preserve historical and cultural heritage and improves the overall quality of life including well-being (Chen & Bai, 2019; Sierra et al., 2016; Sierra, Pellicer, et al., 2017).

2.3 Social Sustainability Assessment

This part delves into the challenges associated with measuring and implementing social sustainability in infrastructure asset management. While considerable attention has been paid to environmental evaluation through methods such as Life-cycle assessment (LCA), the focus on social sustainability assessment remains comparatively limited.

This study explores the importance of Social Life Cycle Assessment (S-LCA) as methodology for evaluating the social impact of infrastructure assets throughout their life cycle, which is based on ISO 14040 framework for LCA.

2.3.1 Challenges Measuring and Implementing Social Sustainability

After defining what social sustainability means from infrastructure asset management perspective, the next step is to measure social sustainability impact through social indicators and metrics. Recent efforts have focused on developing systematic methods for assessing sustainability, such as Life-cycle assessment (LCA) for environmental evaluation (Ayassamy & Pellerin, 2023). Social sustainability assessment, on the other hand, has not gained as much attention, despite it is recognized as key component in design and development of sustainable products (Ayassamy & Pellerin, 2023). One of the efforts for assessing the social aspect of any product, process or system across their life-cycle is social life cycle assessment, as stated by (Benoît Norris et al., 2020; Goedkoop et al., 2024; *Guidelines for Social Life Cycle Assessment of Products*, 2009).

Social Life Cycle Assessment (S-LCA) can be used to evaluate social performance of infrastructure assets throughout their entire life cycle. This methodology is largely based on the ISO 14040 framework for LCA. It includes four phases: Goal and Scope, (Social) Life Cycle Inventory (S-LCI), (Social) Life Cycle Impact Analysis (S-LCIA) and interpretation.

For a clear vision, the four phases according to Social Life Cycle Assessment of Products and Organization guidelines (Benoît Norris et al., 2020) is presented in figure 2.

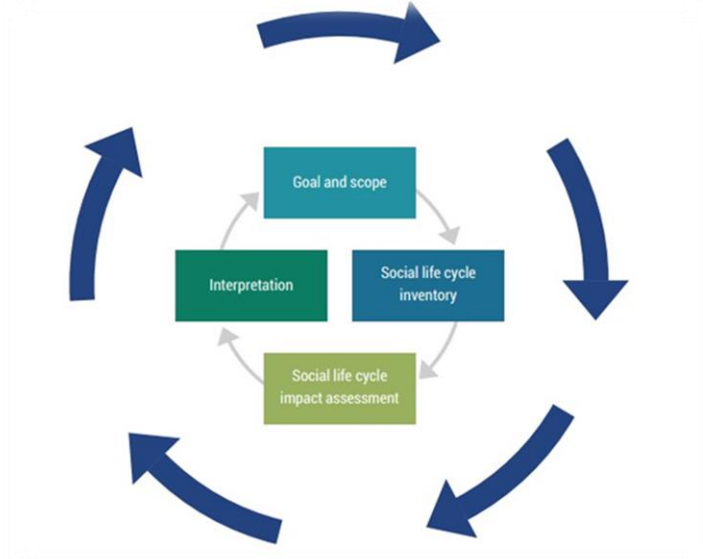


Figure 2: Four phases in Social Life Cycle Assessment (S-LCA) (Benoît Norris et al., 2020)

After introducing the four phases in Social Life Cycle Assessment (S-LCA), it is important to understand the purpose of each of these phases (Benoît Norris et al., 2020; *Guidelines for Social Life Cycle Assessment of Products*, 2009):

1. **Goal and Scope Definition:** This phase aims to establish the study's objectives and focus by defining what social sustainability aspects of the infrastructure asset will be examined. It outlines the scope of the assessment, including which social indicators and life stages of the asset will be considered.
2. **Inventory Analysis:** The purpose of this phase is to gather relevant data and information about the social aspects which is in this study related to interventions on infrastructure assets. It involves creating an inventory of social data by collecting information about relevant stakeholders, their concerns, and the social impacts associated with the asset in specific case.
3. **Impact Assessment:** In this phase, the goal is to assess and understand the potential social impacts on infrastructure assets throughout its life cycle. It involves using the collected social data to evaluate the effects on various social aspects, such as stakeholder well-being, community engagement, and cultural heritage.
4. **Interpretation:** The final phase focuses on interpreting the results of the assessment related to a specific context. Its purpose is to draw conclusions, make recommendations, and provide insights into how to improve social sustainability based on the identified impacts and stakeholder concerns. This phase may also involve developing strategies, policies, and actions to enhance social sustainability throughout the asset's life cycle.

2.3.2 Social Impact Categories and Indicators

According to the guideline UNEP/SETAC (2009), S-LCA methodology relies on several social impact categories and social indicators. Social sustainability indicators and impact categories refer to the measurable elements or aspects and thematic groups that are used to assess the social impacts of product, processes or systems over their life cycle (Benoît Norris et al., 2020; *Guidelines for Social Life Cycle Assessment of Products*, 2009).

Social sustainability indicators do not always need to be strictly quantifiable, but they should be measurable in some way to assess their impact and progress effectively. The impact categories and their indicators provide a structured framework for understanding the social impact on relevant stakeholders and communities. These social indicators can be quantitative, qualitative, or semi-quantitative, depending on the problem and the study’s goals. Quantitative indicators provide specific numerical values to describe assessed issues like the number of work accidents. Qualitative data, on the other hand, includes non-numerical information (Benoît Norris et al., 2020; Jørgensen et al., 2008). It can include stories, literature reviews, surveys, interviews, focus group discussions, and observational data (Li et al., 2018; Sierra et al., 2016). While semi-quantitative indicators use scoring systems or a yes/no format to quantify qualitative information (Liu & Qian, 2019).

Social impact categories, on the other hand, are logical groupings of these social indicators that align with stakeholder interests and their social concern, as stated in (Benoît Norris et al., 2020). These categories provide a higher-level overview of the social impacts, allowing decision-makers to identify and prioritize key social aspects.

Table 4 presents studies that commonly consider social impact categories and social indicators related to social sustainability within infrastructure asset management and other construction projects:

Social Impact Category	Social Indicators	Sources
Health and Safety	Occupational safety measures, accident rates, presence of safety protocols, accessibility measures, alternative transport routes, disturbances	(Benoît Norris et al., 2020; Blaauw et al., 2021; Y. Dong & Ng, 2016; Jørgensen et al., 2008)
Cultural and historical Heritage	Preservation of historical and cultural assets, assessment of damage, monitoring changes, maintenance of cultural sites	(Benoît Norris et al., 2020; Blaauw et al., 2021; Jørgensen et al., 2008)
Quality of life	Well-being, community engagement, local community support, community acceptance, noise disturbance, vibrations, air pollution,	(Afshari et al., 2022; Benoît Norris et al., 2020; <i>Guidelines for Social Life Cycle Assessment of Products</i> , 2009; Jørgensen et al., 2008; Vijayakumar et al., 2022)
Governance	Transparency in decision-making processes, accountability, public trust, community integration, compensation strategies.	(Benoît Norris et al., 2020; Blaauw et al., 2021; <i>Guidelines for Social Life Cycle Assessment of Products</i> , 2009; Vijayakumar et al., 2022)
Local Business	Changes in local business activity, local employment opportunities	(Benoît Norris et al., 2020; Goedkoop et al., 2024; Li et al., 2018; Vijayakumar et al., 2022)

Table 4: Social impact categories and their social indicators

It is worth noting that social impact categories such as health and safety, cultural and historical heritage, and quality of life can also be seen as social indicators, as presented in studies.

Currently, more researchers are considering the use of combined types of social indicators, such as quantitative and quality indicators (Hosseinijou et al., 2014), quantitative and semi-quantitative indicators (Y. H. Dong & Ng, 2015), and quantitative, semi-quantitative, and qualitative indicators (Lehmann et al., 2013). The second approach focuses on formulating social indicators to evaluate social impacts directly or indirectly. Direct social indicators are typically associated with specific performance measures, while indirect social indicators tend to assess the management efforts of organizations involved in social issues. The causal link exists from the conduct of these organizations throughout the product life cycle to social impacts (Jørgensen et al., 2008; Zheng et al., 2020).

According to the guideline of UNEP (2020) and Goedkoop, et.al. (2024), the quantitative social indicators can be scored and normalized within a range of -2 to +2. Scoring typically involves assigning numerical values to assess performance and normalization ensures fair comparison by adjusting scores to a common scale. The normalization is based on the actual societal significance of each indicator (Benoît Norris et al., 2020). For example, a positive value represents above-average social performance, and a negative represents poor social performance. The social indicators can be weighted through surveys, as outlined by (Liu & Qian, 2019; Sierra et al., 2016). The survey-based approach allows for capturing the perspectives and preferences of relevant stakeholders, providing the relative importance of different social impact indicators generated by processes at different stages of the asset's life cycle.

2.3.3 S-LCA challenges

Social Life Cycle Assessment (S-LCA) presents several challenges for assessing the social impact of the asset's stages and processes. Collecting data for choosing social impact indicators is difficult due to limited data availability and the need for precise information (Liu & Qian, 2019). This can lead to uncertainties in assessing the holistic social impact of the assets.

The S-LCA methodology can be applied to a case study to identify trends and evaluate the effectiveness of social sustainability indicators within the SLCA framework. This is known as a complex task (Y. H. Dong & Ng, 2015; Y. Dong & Ng, 2016). This analytical process involves analyzing large datasets over time according to S-LCA guidelines (Benoît Norris et al., 2020; *Guidelines for Social Life Cycle Assessment of Products*, 2009). Furthermore, integrating and interpreting both qualitative and quantitative data such as social indicators within SLCA can be challenging. Ayassamy & Pellerin (2023) limitations on the qualitative and quantitative data in evaluating the social indicators. These challenges arise from the need to standardize or normalized these different data types to create a coherent social sustainability assessment (Y. H. Dong & Ng, 2015). Moreover, collecting feedback from stakeholders, especially from the local community, within S-LCA introduces challenge of meaningful stakeholder engagement (Y. H. Dong & Ng, 2015; Liu & Qian, 2019). Stakeholder engagement is an important aspect of S-LCA and adds complexity to the process.

Additionally, surveys and questionnaires can be conducted to assess community satisfaction, well-being, and perception of interventions on assets within an SLCA approach. This approach requires rigorous research design and implementation that must be aligned with SLCA principles (Benoît Norris et al., 2020; Blaauw et al., 2021; Y. Dong & Ng, 2016; Mohamed & Elshaikh, 2022). After obtaining the results, sharing the findings of social sustainability assessments with the decision-makers and relevant stakeholders through clear reporting becomes essential. This necessitates effective communication and transparency (Benoît Norris et al., 2020; Colantonio, 2011), which are central elements of SLCA reporting.

Overall, studies show potential gaps in the application of S-LCA include limited data such as social indicator coverage, data quality uncertainty, challenges in data standardization and normalization, and the exclusion of certain life cycle phases (Ayassamy & Pellerin, 2023; Y. H. Dong & Ng, 2015). Further research is necessary to advance its applicability within the infrastructure asset management domain. Given the current challenges, S-LCA methodology forms as a basis for this research.

2.4 Summary literature review

This section will summarize the concepts that were reviewed and are deemed important for understanding and interpreting the findings from the case study later in this paper. The literature review is conducted to explore existing scientific literature on social sustainability in infrastructure asset management, forming the basis for this research.

The review starts by clarifying the concept of social sustainability and explaining the associated challenges. Social sustainability has not received enough attention, and it is difficult to define, measure, and implement. It further indicates diverse stakeholders' involvement throughout the lifecycle of infrastructure asset management. Therefore, various definitions and perspectives on social sustainability in the context of infrastructure management have been provided. Furthermore, the literature outlines the short-term and long-term impacts caused by interventions on infrastructure assets across their life-cycle stages. Short-term social impacts include immediate changes, while long-term effects involve sustained alterations to local communities (Shukla & Jani, 2018). Both perspectives are essential for infrastructure asset management, aiming to benefit society.

To evaluate short-term and long-term social impacts, it is important to consider social indicators. The literature discusses that social sustainability indicators can be considered by applying Social Life Cycle Assessment (S-LCA) based on the ISO 14040 framework for LCA. S-LCA methodology uses these social indicators to evaluate the social impact of infrastructure assets across their life cycle. The methodology relies on social impact categories and indicators, which can be quantitative, qualitative, or semi-quantitative. The social indicators can help guide decision-makers in the asset management process and the social impact categories group these indicators to align with stakeholder interests.

The literature extends to a discussion on evaluating these social indicators can be challenging associated with its practical application. For example, some difficulties or obstacles that may arise including accurately collecting data, engaging with stakeholders, and verifying the trustworthiness of subjective evaluations. By considering these aspects, the objective of this research lies in social dimension and highlights the importance of identifying social sustainability indicators related to the interventions on the quay walls in Amsterdam and integrating them into the asset management decision-making process of the municipality. Therefore, the definition of social sustainability is renewed as followed:

Social sustainability in the context of this study involves addressing the social impacts that arise from interventions on infrastructure assets throughout their life cycle. These impacts can be evaluated by identifying the relevant social indicators, considering the perspectives of the stakeholders, as well as the phases of the interventions. Social indicators play a crucial role in infrastructure planning by evaluating both the short-term and long-term social impacts of interventions. The evaluation ensures community health, safety, equitable access, overall well-being, and effective governance. These goals can be achieved by mitigating negative effects such as traffic disruptions, accessibility issues for the local community, noise, and air pollution. Furthermore, integrating social indicators into the asset management decision-making

process helps guide decisions and promotes a more holistic approach to sustainable development that not only focuses on environmental and economic dimensions, but also ensures that the social dimension is considered in urban infrastructure interventions.

Within the literature review, several potential social impact categories and social indicators are proposed as the basis for this research.

These potential social impact categories are identified as relevant to continuing this research. The indicators are related to health and safety, historical and cultural heritage, the overall quality of life of the community, local business activity and the governance or decision-making (Benoît Norris et al., 2020; *Guidelines for Social Life Cycle Assessment of Products*, 2009; Vijayakumar et al., 2022).

Table 5 presents the potential social sustainability categories and related social indicators for this research:

Social Sustainability Category/ Main social indicator	Description	Social Indicators
Safety and Health	Focus on protecting and promoting human health through a safe and healthy work environment (Valentin & Bogus, 2015) and (Hill & Bowen, 1997). This involves planning and managing interventions to reduce the risk of accidents and the careful handling of substances harmful to human health.	<ul style="list-style-type: none"> - Accident rate: Number of workplace accidents reported annually. - Percentage of compliance (levels) with safety protocols: this refers to the extent to which organizations are following the established safety guidelines and measures, such as wearing personal protective equipment, maintaining physical distance, and prevent accidents. - Accessibility: Level of accessibility for pedestrians, cyclists, and vehicles accessing services (Gannon & Liu, 1997; Olusa, 2021), alternative transport routes or other disturbances.
Historical and Cultural Heritage Value	This should be considered when planning local traditions and cultural diversity (Valentin & Bogus, 2015) and (Hill & Bowen, 1997) and implementing interventions such as renovation and renewal of historical quay walls. The idea is that projects not only fit physically but also culturally with what the local community values and preserves, even long after the interventions have been carried out.	<ul style="list-style-type: none"> - Heritage Preservation Status: Instances of damage or loss to heritage sites, including measures. - Evaluation of interventions affecting heritage: Influence of projects on historical preservation.
Quality of Life	This includes mental health, social relationships, ensuring everyone has access to essential needs such as food, shelter, and clean water, addressing immediate needs and improving long-term quality of life.	<ul style="list-style-type: none"> - Community quality of life: Measures overall community support, mental health care, disturbance in daily life, and job stability. - Community engagement and support. - Noise disturbance and air pollution levels.
Impact on Local Businesses	The impact of interventions on local businesses, including economic challenges and long-term consequences.	<ul style="list-style-type: none"> - Local employment: Job opportunities created by a project. - Local business disruptions frequency: Frequency and duration of disruptions to local businesses.
Governance	Examining decision-making processes within the municipality	<ul style="list-style-type: none"> - Transparency, responsibility, community trust level. - Community participation: in meetings and public consultations.

Table 5: Potential social impact categories and indicators for this research (Benoît Norris et al., 2020; *Guidelines for Social Life Cycle Assessment of Products*, 2009; Hill & Bowen, 1997; Mohamed & Elshaikh, 2022; Valentin & Bogus, 2015)

3. Research Design

The research design provides a structured approach to answer the research questions of this study. The primary question addressed is: 'What are the key social sustainability indicators that should be incorporated into the decision-making process for inner-city quay wall intervention, and how can they be evaluated?' The research is conducted in five steps: (i) Literature review; (ii) selection of case study through desk research to ensure relevance and applicability; (iii) data collection, achieved through stakeholder identification and in-depth interviews with relevant expert and local community; (iv) analysis of results; and (v) interpretation and validation of findings, as shown in Figure 3. The green box in the figure corresponds to question 1 of the research that focuses on social sustainability indicators, including the red dashed rectangle which indicates the case study analysis. Furthermore, the purple box addresses question 2. Both questions are ultimately addressed in the conclusions and recommendations section.

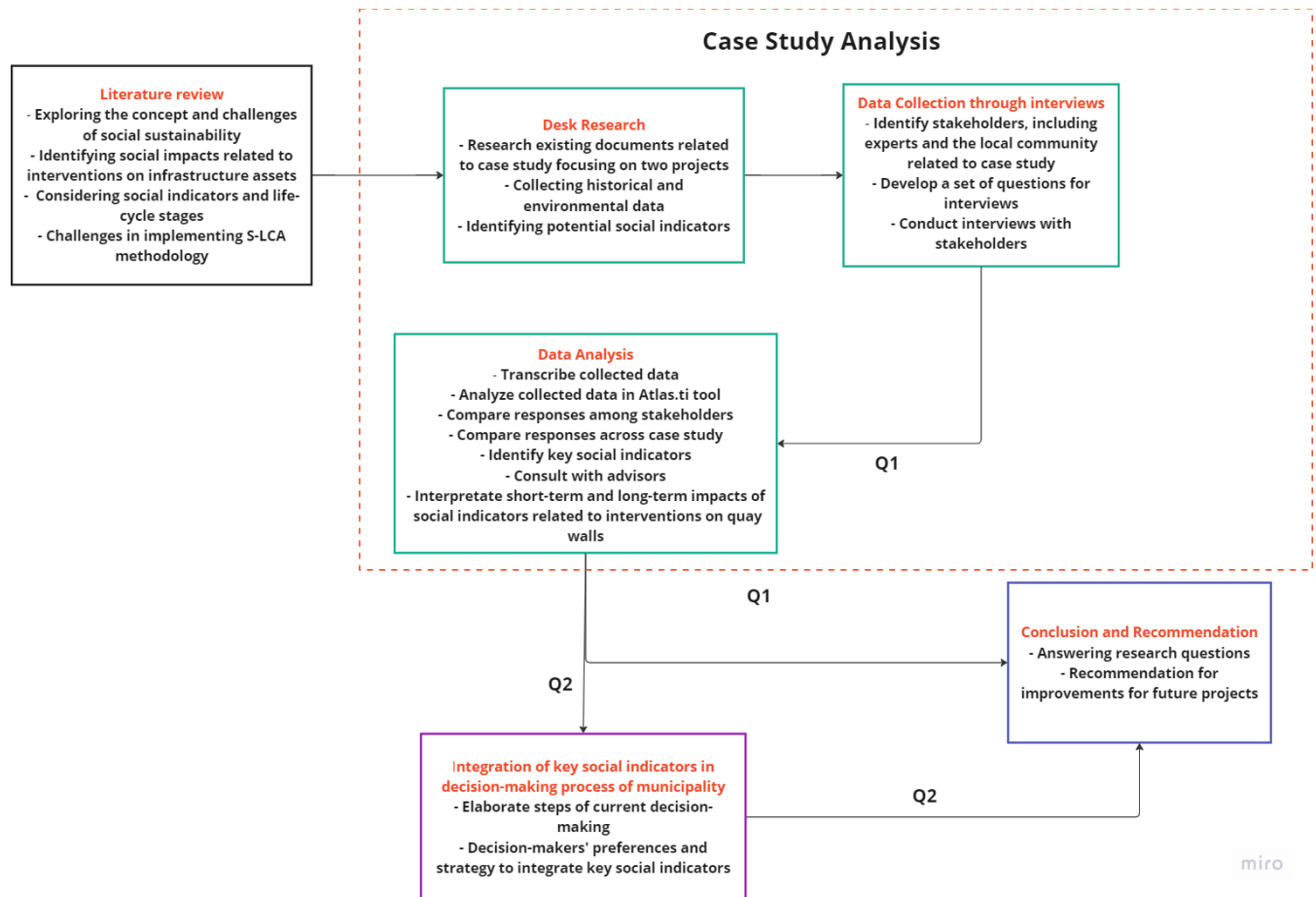


Figure 3: Research Design

To begin answering these questions, it was essential to define the concept of social sustainability, including social indicators and the life-cycle stages in the context of the quay walls of Amsterdam in the literature review.

With the literature review, it becomes feasible to identify potential social sustainability indicators. These identified potential social indicators formed the basis of data collection and are considered in the interview guide which can be found in the appendix.

The social indicators will be evaluated to obtain a comprehensive understanding of the social impacts on the local community that are relevant to interventions on these quay walls. The relevance of the set of social indicators is further investigated through a case study selection. Furthermore, a diverse range of sources, including scientific literature, municipal documents acquired through desk research, and relevant guidelines and websites, were consulted for this research. The following sections describe the steps and desired outcomes per research question.

3.1 Case studies Selection

The case study examines two previously conducted projects, namely Project Rechtboomsloot and Project Leliegracht. These projects are chosen through desk research, which will be explained in the next section. The selection is made to identify potential social indicators and evaluate both the short-term and long-term social effects of the previous interventions on the quay walls. These effects can be determined by focusing on the different phases, including the implementation and post-implementation of the interventions on the quay walls. The justification for choosing these projects lies in their unique characteristics and the potential insights they offer into social impacts.

Project Rechtboomsloot

The quay walls in Project Rechtboomsloot are being renewed due to their poor condition. This replacement was identified in early 2020 and was urgently needed for replacement, because the situation was worse than expected (Nick Rijlaarsdam, 2020). Figures 5 and 6 illustrate the project area and the renewal of the quay wall during the implementation phase.



Figure 4: Project Rechtboomsloot area (Nick Rijlaarsdam, 2020)



Figure 5: Rechtboomsloot during implementation phase

In Project Rechtboomsloot, the urgent need for replacement due to safety risks emphasizes the importance of public health and safety as a potential social indicator. Additionally, the rapid implementation of the intervention could potentially have an impact on the quality of life of the local community. These could be potential indicators when evaluating the social impact of the intervention.

Project Leliegracht

The second part of the case study is related to Project Leliegracht, where 2 years ago sheet piles are installed as a temporary solution due to safety risks and implementation cost (Oscar Keunen, 2023). Currently, the municipality is considering renewing the quay wall. The reason for this is that the removal of sheet piles has a deteriorating effect on the already poor quay wall constructions, making renovation for lifespan-extension not a viable solution.

The Leliegracht is located in the Western Canal Belt, City Center. The area is lively with a mix of (monumental) buildings and offices, as well as restaurants, cafes, and retail stores. This includes Anne Frank House and the Westerkerk, which serves as tourist attractions. Furthermore, the local community speaks up for itself, as they filed a lawsuit against cutting down trees in the past, leading to multiple legal battles (Koen Hondebrink, 2024). Moreover, Leliegracht is a part of bike and pedestrian-friendly area, and it serves as an important waterway connecting Herengracht, Prinsengracht, and Keizersgracht.

Figure 6 illustrates the location of the quay walls (LLG0101, LLG0102, LLG0201, LLG0202) along the Leliegracht, between the Herengracht and the Prinsengracht (Koen Hondebrink, 2024; Oscar Keunen, 2023).

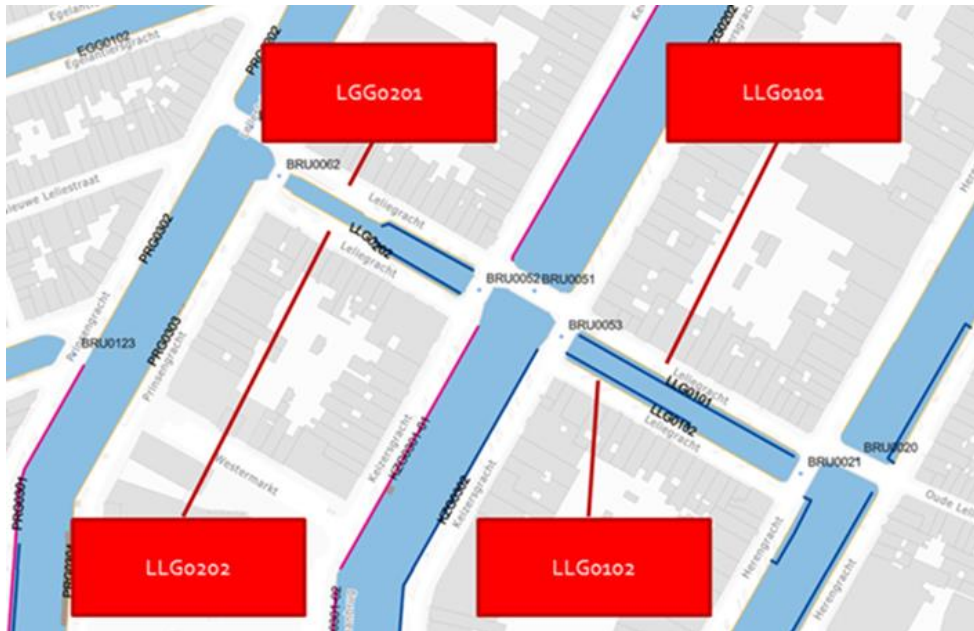


Figure 6: Quay walls located in Leliegracht

For a clear visualization, figure 7 illustrates the situation of the quay wall at Leliegracht.



Figure 7: Current situation of Leliegracht

The key characteristics influencing potential social indicators in Project Leliegracht:

1. Cultural and Historical Value: The presence of important monumental buildings and old trees requires the protection of cultural and historical value.
2. Community participation: The active participation of the local community in legal matters emphasizes the significance of community engagement.
3. The combination of residential, local businesses, and tourist activities in the area makes accessibility a potential social indicator.

The potential social indicators from the literature study and case study are used in this research and their relevance is evaluated through interviews. By considering these indicators, stakeholders can better understand why the social indicators are important and their short-term and long-term impacts of the interventions in these projects.

3.2 Desk Research

Desk research is conducted to select the case research and extract the potential social indicators related to it. This research is conducted through several steps that include:

1. **Identifying existing documents related to the case research:** The first step was to seek out municipal documents related to the interventions of both projects, including Project Rechtboomsloot and Project Leliegracht. This was important to investigate the interventions implemented in both projects, to identify the important services in the project area and to extract potential social indicators. The documents included technical advice reports, BLVC (Bereikbaarheid, Leefbaarheid, Veiligheid en Communicatie) plans, and environment assessments documents.
2. **Collecting historical data:** Specific historical data related to the quay walls within the case research was collected. The data was obtained from technical reports related to the interventions in both projects.
3. **Explore databases:** Databases were searched to find information on the stakeholders involved in both projects. This was important to determine the people with whom interviews should be conducted.

3.3 Data Collection

Stakeholder identification

In this research, stakeholder identification is essential for understanding the various groups involved or affected by the interventions. A list of stakeholder's names was created involved in both projects is obtained from desk research. The involved stakeholders are mainly experts within municipality including environmental and sustainability managers, urban planners, and local intermediate person who is responsible for communicating with the local community about any social concerns and inconvenience arising from the interventions. Additionally, affected stakeholders include residents, entrepreneurs, and road users. This identification was crucial for the interviews, consultation, and validation to understand and confirm their responses based on their expertise, priority, and social concerns during and after the interventions, and to identify short-term and long-term social impact arising from the interventions.

Interview planning

After identifying stakeholders, a set of questions is designed. These questions are divided into two groups: one for experts and one for the local community. This is intended to gather the perspectives of experts and uncover the experiences and concerns of the local community.

The questions encompass the social impact categories such as safety and health, preservation of cultural heritage, well-being of the local community, impact on local businesses, transparency, and accountability in decision-making (Benoît Norris et al., 2020). These categories are further divided into a list of social indicators, detailed in the interview guide in the appendix. Additionally, open questions are formulated to identify additional social indicators and other effects. This process helps in identifying the social indicators and their impacts related to the quay walls interventions.

The first set of questions is consulted with experts, including University of Twente (UT) advisors and municipal advisors. Following this consultation, semi-structured interviews are conducted with stakeholders involved in the case research. These interviews are chosen to deepen the understanding of the analyzed documents and to structure the responses of the stakeholders (Martini, 2021).

The interview process is scripted questions that aim to explore the social indicators related to the interventions in more detail as mentioned. This allows for follow-up questions based on initial responses. The ultimate goal is to gather rich qualitative data from these interviews, capturing the stakeholder's perspectives, experiences, and opinions in-depth (Sierra et al., 2016) and to address research question 1.

Experts are invited via email and letters presenting the research's objectives and methodology. Once they agree to participate, individual meetings are organized, either by video conference (Teams) or in person. Additionally, interviewees received the interview guide in advance, ensuring transparency in the conversation and allowing them adequate preparation if needed. To facilitate a meaningful conversation, relevant documents from desk research are carefully studied to address any questions regarding their content. Furthermore, information from the local community is gathered through contacting an intermediate person involved in the research area, sending letters to the local community, and direct door-to-door interactions.

After conducting the first three interviews, the collected data undergone validation through consultation with experts, including municipal advisors and UT advisors. This validation process involved organizing online meetings via Teams, where discussions and feedback sessions were held with the advisors. This step was crucial to confirm the accuracy and relevance of the data obtained from the interviews. Following this consultation, the interviews proceeded. In total 20 interviews have been conducted for this research. Out of these, 10 were conducted with experts who have relevant knowledge and experience related to the projects being studied. The remaining 10 interviews were conducted with members of the local community who are either involved in or impacted by Project Rechtboomsloot and Project Leliegracht.

3.4 Data Analysis

The data of the interviews are analyzed by recording on smartphone and then transcribing the audio recordings into Microsoft Word. The recordings are transcribed in Word by using the built-in transcription feature, allows to upload an audio file and automatically transcribe the spoken content into text. Additionally, the transcription method used in this research followed the edited transcript (Martini, 2021).

This method is used to summarize the most relevant social aspects of the conversation relevant to the research questions, which were sent via e-mail to the interviewees for validation.

A thematic analysis approach is used to further identify the important social indicators obtained from the interviews. Transcriptions are analyzed using the interview questions and the list of potential social indicators as a guide, alongside the Alas.ti tool for organization of the responses collected from the interviews. Furthermore, in the Atlas.ti tool codes and quotations are created by highlighting the most important information in the transcription document. These codes or themes referred to the social indicators, which are then grouped based on the social impact categories developed in the interview guide. This method is used to ensure coherence in the analysis process and to provide clear visualization of quotations and codes in the form of a quotation report. After this step, the quotation reports are imported into Microsoft Excel, where comparison tables are created to compare the responses between experts and local community for each social indicator and between the two projects. These comparisons are elaborated in the next chapter.

Following this analysis, the key social sustainability indicators are categorized into short-term and long-term social impact, aligning findings obtained from the literature review, desk research and stakeholders' interview. Additionally, the research limitations will be discussed and question 1 is answered in the conclusion and recommendation chapter.

3.5 Social Sustainability Integration

In the response to question 2 of how social sustainability indicators can be successfully integrated into the Amsterdam municipality's asset management decision-making processes, it is essential to identify the social indicators and consider the short-term and long-term impact of the social indicators on the community. The identification of social indicators represents an initial phase within the Social Life Cycle Assessment (S-LCA) methodology which is based on the guidelines (Benoît Norris et al., 2020; Goedkoop et al., 2024; *Guidelines for Social Life Cycle Assessment of Products*, 2009). Within this methodology, social indicators can be used to evaluate the social impacts of interventions on quay walls throughout their life cycle.

The effectiveness of the evaluation and the integration of the social indicators relies on the municipality's current way of decision-making framework, namely "Afweging Toekomstbestendig Herstel". As indicated in the problem description, the decision-making process involves several steps and includes an integrated assessment by experts. Therefore, the first step is to analyze the current decision-making process.

To gain a better understanding of the decision-making process and where social indicators fit into the decision-making process, municipal reports related to these aspects are explored. These reports include technical details, environmental scans, BTM (Besluit Toekomstige Maatregelen) reports. Additionally, participation in meetings with experts/ decision-makers of the municipality was essential to gain knowledge about the current decision-making process and explore ways to integrate the identified social indicators into those decision-making process. This will be further explained in the next chapter of this research.

In the end, conclusions are drawn and recommendations for the integration of the social indicators in the municipality's decision-making process are proposed. These are consulted with the municipal advisors and experts involved in the decision-making process to ensure the effectiveness and practicality of the integration.

4. Findings

In this chapter, data is gathered through interviews with experts and the local community involved in Project Rechtboomsloot and Project Leliegracht. The main goal of these interviews is to identify the key social indicators based on the responses from both groups. The analysis involves comparing the responses of experts and the local community and evaluating the projects themselves. These comparisons are important to evaluate the short-term and long-term impact of these indicators for both projects. The implementation of interventions in both Project Rechtboomsloot and Project Leliegracht has various short- and long-term effects on the local community. The short-term impacts include immediate impact during implementation, while the long-term impacts relate to the period after the implementation of the interventions. Furthermore, this chapter focuses on integrating the identified social indicators in the decision-making process of the municipality.

4.1 Health and Safety

Health and Safety refer to following regulations, safety protocols, and implementing measures to prevent accidents and injuries, ensuring the health and safety of workers and the local community, in the working environment (Valentin & Bogus, 2015) and (Hill & Bowen, 1997). The incorporation of health and safety in infrastructure interventions improves workers' working conditions and minimizes the rate of accidents and inconvenience caused during the intervention lifecycle to the local communities (Vijayakumar et al., 2022). In projects Rechtboomsloot and Leliegracht, this includes strictly adhering to safety regulations, conducting safety assessments, effective planning, and implementing safety protocols and measures to reduce risks during implementation of the interventions on the quay walls.

4.1.1 Safety Measures

Experts in projects Rechtboomsloot and Leliegracht emphasized the importance of following strict regulations and safety protocols. They conducted safety assessments of equipment, structural stability, and the work environment before implementing interventions. During the interventions, BLVC plans (Accessibility, Livability, Safety, and Communication) were implemented, work areas were cordoned off, and workers were ensured to use personal protective equipment. Additionally, environmental managers and supervisors were responsible for monitoring and oversight to prevent accidents.

Specifically, experts involved in project Rechtboomsloot, identified that the quay walls were very old and unstable project, which necessitates their immediate renewal of the quay wall. Experts in Leliegracht, on the other hand, addressed safety concerns related to the unstable ground caused by the old structure and the growth of tree roots. Furthermore, there was a need to replace underground gas pipelines. To proactively address these issues, the municipality removed two trees and installed sheet piles as a temporary solution to stabilize the ground and the quay walls.

4.1.2 Local community concerns on safety

The community in project Rechtboomsloot, on the other hand, expressed several concerns about safety measures. They were troubled by unsafe routes such as narrow and uneven sidewalks with sand on them. This was especially unsafe to walk for the elderly and people with disabilities. They also experienced safety risks due to risk of quay wall collapse. Furthermore, residents were worried about children who were playing unsafely on construction sites during the implementation of interventions. They were climbing on machines and throwing stones into the water.

Some people have also complained about materials and fences being blown away during storms. To illustrate the situation of the sidewalks, figure 8 shows an example of the sidewalk conditions with construction fences and walkways near the Rechtboomsloot area.



Figure 8: Construction fences and sidewalks Rechtboomsloot area.

Similarly, the local community in project Leliegracht, expressed concerns about safety measures. For instance, road closures and narrow sidewalks made it unsafe and difficult for pedestrians and cyclists to navigate. Moreover, there were concerns about the trees that have been removed for safety reasons. The community disagreed that safety is the main reason for the tree removal, a point which will be explained later in this chapter.

4.1.3 Experts and local community perceptions on safety

Experts involved in both projects believe that the safety measures were well-designed, strictly followed, and effective. They also believe that safety becomes less of a concern after the implementation of the interventions, as the situation will then be improved. However, the local community requests continuous evaluation and improvement of safety measures. They emphasized that potential risks should be taken more seriously, especially considering the unstable quay walls and the potential hazards for vulnerable groups such as the elderly and disabled.

In conclusion, the key social indicator is health and safety. This indicator is important because it directly impacts the health of the local community and the effectiveness of safety measures in the projects.

Table 6 provides key social indicators and the identified sub-indicators related to health and safety interventions in Project Rechtboomsloot and Project Leliegracht. It also includes the stages of intervention in which they are relevant and whether they lead to short-term or long-term impacts.

Key Social Indicator	Project	Sub-indicators and description	Lifecycle stage of interventions	Impact
Health and Safety	Rechtboomsloot	Compliance with Health and Safety protocols and measures: This indicator represents compliance with regulations, safety assessments, use of personal protective equipment (PPE), BLVC plans, and monitoring.	Planning, during and after implementation phase	Short-term and long-term
		Frequency of safety incidents: This indicator represents community feedback about potential safety incidents for vulnerable groups due to narrow, uneven, and sandy sidewalks; concerns about children's safety risks; and issues arising during storms.	During Implementation	Short-term impact
	Leliegracht	Compliance with Health and safety protocols and measures: This indicator represents Compliance with regulations, safety assessments, use of personal protective equipment (PPE), BLVC plans, and monitoring.	Planning, during and after implementation	Short-term and long-term impact
		Frequency of safety incidents: This indicator represents community feedback on safety of local community due to unstable quay wall leading to tree removal, the challenges posed by narrow sidewalks, especially for vulnerable groups.	During and after implementation	Short-term and long-term impact

Table 6: Health and safety with related impact on identified sub-indicators.

Following health and safety protocols and implementing measures have both short-term and long-term impacts. In the short term, the focus is on making sure that safety assessments are conducted during planning, safety regulations, protocols and BLVC plans are followed, and personal protective equipment are proved during the implementation phase. These steps help to reduce the immediate risks and prevent accidents during the implementation phase. Once the safety measures are implemented, ongoing monitoring safety measures can be done to maintain a safe environment for workers and the local community in the long term. This contributes to the overall health of everyone involved.

The local community concerns in Rechtboomsloot and in Leliegracht about safety in the short-term and long-term. In the short term, community members worry about safety risks such as instability of quay walls, narrow sidewalks, and road closures during the implementation phase. These concerns can affect how safe people feel in the area at that time. The concerns can also continue after the intervention is completed. By addressing the number of safety concerns and ongoing evaluation of safety measures, the community can ensure long-term health and safety improvements in the neighborhood (Sierra et al., 2016; Sierra, Pellicer, et al., 2017).

4.2 Accessibility

The accessibility to essential services for pedestrians, cyclists, and vehicles is important during the implementation phase of the interventions. This also involves minimizing disturbances and providing transportation alternatives for the local community (Gannon & Liu, 1997; Olusa, 2021).

4.2.1 Changes in traffic flow and parking availability

Project Rechtboomsloot and Project Leliegracht include changes in traffic flow and parking availability. These changes have impact on accessibility for residents, pedestrians, and cyclists. Both experts and the local community in these projects emphasized the temporary road closures and restricted areas during the implementation of interventions on the quay walls, which resulted in accessibility disruptions for the local community. Experts have focused on the technical aspects, alternative transportation routes, and scheduling interventions during non-peak hours to minimize disruptions. However, some experts noted the lack of parking facilities and alternative solutions for parking.

Furthermore, the local community and experts in Rechtboomsloot emphasized the importance of consulting with the community when designing parking lots and redesigning streets. The discussion revolved around potential relocations of parking spaces and the integration of electric charging places, in line with policies such as 'Autoluw Amsterdam'. This is a car-reduced policy that prioritizes pedestrian, cyclist, and public transportation over car traffic. Furthermore, parking along the quay wall sometimes adds extra weight to the structure, which makes it necessary to relocate or eliminate parking spaces. The implementation of the policy can improve safety for the quay walls, air quality, and overall quality of life in Amsterdam. Figure 9 shows an example of a car in Rechtboomsloot area parked very close to the edge of the quay wall, without any physical barrier in place to keep it from going into the water. This closeness and lack of safety barrier present a high risk of the car accidentally falling into the canal.



Figure 9: unsafe car parking in Rechtboomsloot area.

Project Rechtboomsloot had to comply with policies such as "Autoluw Amsterdam". This led to the elimination of parking spaces and the establishment of a car-free environment. This policy's application means the parking spaces are not reinstated after the intervention. Experts involved in Project Rechtboomsloot emphasized that the parking spaces are replaced with areas for other activities, such as flower boxes, trees, and bike racks to meet transportation needs without relying on traditional car parking spaces. Not everyone is happy with these changes. It is a challenge for people with a car or a disability, especially if they have to park their car far away.

Figure 10 shows an example of the current situation in Rechtboomsloot.



Figure 10: Current parking situation in Rechtboomsloot.

4.2.2 Community on concerns on parking spaces

The local community in Rechtboomsloot has also shared their experiences with parking issues. There are people who are used to park their cars near their homes and are now facing a car-free environment. They emphasized practical disruptions during the implementation of interventions and expressed concerns related to issues such as unauthorized parking in front of their doors, distance to parking areas, and the practical implications of vehicle charging. It is noteworthy that the concerns about the elimination of parking spaces were related to the project and not the entire city.

In contrast, experts in Project Leliegracht indicated that essential services, such as parking spaces for people with disabilities, were retained and relocated if necessary, during the implementation phase. After the implementation of the intervention, the parking spaces were restored, which makes the situation normal again in Leliegracht.

The situation of parking is illustrated in figure 11:



Figure 11: Current parking situation in Leliegracht

Furthermore, some local businesses have indicated that they would like to receive advance notice of road closures and information about alternative routes so that they can keep their customers informed. Moreover, both groups emphasize the importance of improving accessibility for customers and loading and unloading trucks. Experts further state that the disruptions for local businesses can be minimized by creating designated access routes and implementing practical solutions for freight transport, such as utilizing smaller trucks and establishing external delivery hubs. Overall, the community is satisfied with the accessibility alternatives after the implementation of the intervention. Nevertheless, accessibility remains an important social indicator during the implementation of interventions in both projects.

Table 7 provides the key social indicator and the identified sub-indicators related to accessibility interventions in Project Rechtboomsloot and Project Leliegracht. It further includes the stages of intervention in which they are relevant and whether they lead to short-term or long-term impacts.

Key Social Indicator	Project	Sub-indicators and description	Lifecycle stages of interventions	Impact
Accessibility	Rechtboomloot	Duration of road closure: This indicator represents the length of time that roads are closed, impacting the traffic flow and accessibility for (vulnerable) people.	During implementation	Short-term
		Distance to parking spaces: This represents the distance to parking spaces for local community resulted from Autoluw Amsterdam policy, elimination and relocation of parking spaces for other activities. It also includes community feedback on unauthorized parking, and practical implications of vehicle charging due to relocation.	During and after implementation	Short-term and Long-term
	Leliegracht	Duration of road closure: This indicator represents the length of time that roads are closed, impacting the traffic flow and accessibility for (vulnerable) people same as rechtboomsloot.	During implementation	Short-term
		Distance to parking spaces: This indicator represents the distance to parking spaces for the local community resulted from retention and relocation of parking spaces for people with disabilities during the implementation phase.	During implementation	Short-term

Table 7: Accessibility with related impact on identified sub-indicators.

The difference between short-term and long-term impacts is determined by whether the changes made during interventions such as removing parking or changes in traffic flow are expected to last for an extended period or if they are more temporary, primarily impacting accessibility during the implementation phase. In the case of Rechtboomloot, the implementation of "Autoluw Amsterdam" policies, the elimination of parking spaces, and the implementation of infrastructure alternative such as installation of flower boxes and bike parking racks have long-term impacts. These changes have a long-term impact on parking availability for cars. However, these alternatives reduce disruption and improve the quality of life of the community (Gannon & Liu, 1997; Sierra, Pellicer, et al., 2017).

Additionally, community concerns about parking spaces in Rechtboomloot encompass both short-term and long-term impacts. The short-term impacts include Immediate disruptions, such as include unauthorized parking and distance to parking spaces during implementation. However, accessibility changes in Leliegracht are classified as short-term impacts. The short-term impacts include temporary road closures and traffic disruption that affect accessibility for the community during implementation of the intervention. After the implementation, the relocation and retention of parking spaces are long-term improvement (Gannon & Liu, 1997; Sierra, Pellicer, et al., 2017).

4.3 Local Cultural and historical heritage preservation

Culture and historical heritage preservation is crucial for honoring the values of local communities and upholding fundamental human rights (Vijayakumar et al., 2022). It is essential to preserve monuments, cultural sites, and buildings with historical significance during interventions and to ensure that any interventions or changes made to these structures do not harm their integrity and aesthetic value or visual appearance. Moreover, it is also crucial to consider preservation priorities and cultural values of the local community, even long after the interventions have been completed (Valentin & Bogus, 2015) and (Hill & Bowen, 1997). This enhances sense of belonging, pride, and social interactions within the local community (Bagnall et al., 2018).

4.3.1 Historical preservation Efforts

Experts involved in both projects emphasize the importance of preserving historic elements, such as monumental buildings, quay walls, and bridges, during the implementation of the interventions. They highlight the need to follow guidelines for maintaining historical elements and quality standards. These quality standards involve measures such as numbering and repositioning the same type of natural stones on quay walls. Additionally, experts emphasize that the municipality is taking pre-cautionary measures to safeguard historical heritage. This includes methods such as monitoring damage or conducting baseline measurements (nulmetingen), where specialists photograph monumental buildings before implementing the interventions on the quay walls. They record and compare any damage that occurs from the interventions. Moreover, the experts indicated that residents also have the option to report damage, following which an expert evaluates it. If needed, appropriate measures are taken to repair the damage while preserving the historic character of the structures and buildings.

4.3.2 Damage assessment and compensation

Damage assessment and compensation refer to the process of evaluating and providing restitution for any harm or loss caused to people or property. The local community of project Rechtboomsloot indicated that no damage to their homes occurred during the implementation phase. In contrast, some members of the community in project Leliegracht claimed their homes and other buildings suffered damage from vibrations after the implementation of the interventions, resulting in cracks in walls. They are aware of the damage assessment and available compensation. Despite the availability of these damage assessment process, they feel unfairly compensated and question the fairness of it. They feel that the impact of cultural heritage loss on people after implementation of the intervention might not be adequately assessed.

Experts involved in both projects, on the other hand, argue that damage monitoring is carried out correctly, and compensation is provided when there is evidence of damage caused by the interventions.

4.3.3 Experts and local community preferences regarding renewal and lifespan-extension

Furthermore, experts have different opinions on how the historic character of the quay walls should be preserve, with some advocating for lifespan extension and others for renewal. Some experts advocate for lifespan extension to maintain existing elements with regular maintenance, lasting over 30 years or more. They argue that historic elements can be preserved by using similar stone types during renovation to keep the original appearance and highlighting benefits such as reduced disturbances in daily life of the local community and long-term cost savings. However, other experts expressed concerns about potential disadvantages, such as limited lifespan and the need for frequent maintenance. They prefer renewal where the entire quay wall will be replaced with new or modern materials that will last over the next century (100 years) without burdening future generations.

Similarly, the preference of the local community in the projects is also divided between lifespan extension and renewal. Some prioritize preserving historical elements, while others prefer renewal as long the quay walls are stable and appear aesthetically pleasing.

4.3.4 Local community on aesthetic value

When focusing on the aesthetic value or visual appearance of quay walls at Rechtboomsloot and of Project Leliegracht, the opinions of local community appear different. The reason behind this is that project Rechtboomsloot have undergone complete renewal. In contrast, sheet piles walls have been installed as a temporary solution in Leliegracht. Therefore, the local community's' opinions on the appearance of the quay walls vary between the two projects. The local community of project Rechtboomsloot is being content with the renewal, while the local community of Leliegracht is unhappy with the appearance of the sheet piles. Nonetheless, residents appreciate the greenery planted on the sheet piles.

Table 8 provides the key social indicator and the identified sub-indicators related to cultural and historical preservation in Project Rechtboomsloot and Project Leliegracht. It also includes the stages of intervention in which they are relevant and whether they lead to short-term or long-term impacts.

Key Social Indicator	Project	Sub-indicators and description	Lifecycle stages of interventions	Impact
Local cultural and Historical Preservation	Rechtboomsloot	Historical preservation efforts: This indicator represents the efforts to preserve historic elements including following guidelines, quality standards by using same type of stones, it also includes community's preferences on renewal and lifespan-extension.	Planning, during and after implementation	Long-term impact
		Local Community satisfaction with visual appearance: This indicator represents community feedback on the contentment with the appearance of renewed quay walls.	After implementation	Long-term impact
	Leliegracht	Historical preservation effort. This indicator represents the efforts to preserve historic elements by following guidelines, quality standards, including community's preferences on renewal and lifespan-extension.	Planning and during implementation	Long-term impact
		Damage assessment process and compensation: This indicator represents the process of damage assessment and the provided compensation. Also, community feedback on damage assessment and compensation that questioning the fairness and transparency. Because some homes in leliegracht suffered damage due to vibrations from the interventions.	During and after implementation phase	Short-term and long-term impact
		Local community satisfaction with visual appearance: This indicator represents community feedback on the discontentment with the appearance of sheet piles, and appreciation of the greenery planted on them.	After implementation phase	Long-term impact

Table 8: Cultural and Historical preservation with related impact on identified sub-indicators.

The preservation efforts to protect and maintain cultural and historical elements includes the planning and implementation stages. This ensures that the preservation of historical elements is valued and kept up over time.

Furthermore, damage assessment and compensation process occurs during and after the intervention's implementation phase. It has immediate effects in Leliegracht and it also has impacts that are seen in the long-term, such as building trust and satisfaction in how compensation is handled over time (Bagnall et al., 2018). The level of satisfaction or dissatisfaction typically becomes apparent after changes or improvements have been made and can significantly impact how the projects are perceived and accepted by the community in the long term (Vijayakumar et al., 2022). Moreover, the preferences of the community regarding historical preservation play a significant role in both the planning and implementation phases of interventions. These preferences can have a potential long-term impact on the community, depending on how well they are involved in the preservation efforts (Bagnall et al., 2018).

4.4 Local community involvement in flora and fauna preservation

The preservation of flora and fauna involves efforts to protect greenery, biodiversity, and natural habitats during and after the implementation of interventions on the quay walls. Both experts and the local community emphasize the importance of preserving flora and fauna during and after these interventions. They value greenery such as trees, plants, and flowers in the city and recognize the need to protect biodiversity. Therefore, experts are taking specific measures to protect flora and fauna, such as consulting tree experts when removing trees, replacing them with smaller ones, avoiding work during bird breeding seasons, installing bat boxes, and creating new habitats for fish. The involvement of the community is essential in these efforts. Because they can offer important feedback and assistance in flora and fauna preservation efforts. This will make sure that the opinions and knowledge of the local community are considered during the intervention phases.

In both projects, trees had to be removed due to safety concerns and technical constraints. For example, unhealthy trees with large roots that contribute to the instability of the quay wall were removed and gas pipelines had to be replaced in Leliegracht. The municipality made efforts to replant new trees and vegetation, focusing on providing suitable growing conditions for their long-term health. Experts involved in both projects emphasize that tree removal is a carefully considered process, involving thorough research and consultation with advisory committees and tree care providers.

4.4.1 Local community involvement and conflict

Both groups in Rechtboomsloot emphasize the involvement of the community in preserving greenery in the neighbourhood. Experts of the Rechtboomsloot project even indicated that agreements can be made between the municipality and residents to create mini gardens in their neighborhood and preserve green spaces. The local community of project Rechtboomsloot generally appreciates efforts to preserve existing vegetation and participates in creating mini gardens. They also understand the reasons behind tree removal. However, the municipality faces criticism for Project Leliegracht due to the urgent removal of trees and struggles to engage the community, which was involved in protests about the tree removal. Some members of the community even filed a case against it. The community of Leliegracht still believes that the municipality had options to protect the trees, but due to high costs or financial issues, they were removed. This has an impact on the local ecosystem and their well-being. According to experts involved in project Leliegracht, two trees were urgently cut down due to limited space along the quay walls and other technical constraints such as replacing gas pipelines, as mentioned earlier. The two trees were replaced with flowers and shrubs planted on the sheet piles.

They further emphasize that alongside tree preservation efforts, other aspects including safety, environmental impact, and costs are considered to create a balance. Figure 12 shows the current situation of project Leliegracht where the sheet piles are planted with greenery on them.



Figure 12: Greenery on sheet piles in Leliegracht

The preservation of flora and fauna is an important theme in both projects because it shows how much experts and the local community cares about the environment and biodiversity.

Table 9 provides the key social indicator and identified sub-indicators related to flora and fauna preservation in Project Rechtboomsloot and Project Leliegracht. It also includes the stages of intervention in which they are relevant, and whether they lead to short-term or long-term impacts.

Key Social Indicator	Project	Sub-indicators and description	Lifecycle stages of interventions	Impact
Local community Involvement in Flora and Fauna Preservation	Rechtboomsloot	Local community involvement in flora and fauna efforts: This indicator represents the extent of community engagement in efforts to preserve and improve local flora and fauna and community feedback on the appreciation of these efforts. It includes the number of agreements with residents to create mini gardens, the area of green spaces preserved, and the number of local community participants in green initiatives. It also includes	During and after implementation	Long-term impact on community engagement and satisfaction
	Leliegracht	Local community involvement in flora and fauna efforts: This represents the community feedback on urgent tree removal and number of community participation to tree removal protest. It also includes the frequency of protests and legal actions against tree removal.	During and after implementation	Short-term impact and long-term on community cohesion, trust and dissatisfaction

Table 9: Community engagement in flora and faunal preservation with related impact on identified sub-indicators.

4.5 Quality of life of local community

Quality of life refers to the well-being such as mental and emotional health, social relationships, acceptance and disturbances in daily life of the local community (Hill & Bowen, 1997; Valentin & Bogus, 2015; Vijayakumar et al., 2022). It deals with the impacts of interventions of the quay walls on the community. A good quality of life indicates that people are generally happy and content with their living conditions and the environment.

4.5.1 Disturbances and community wellbeing

Experts and the local community involved in the projects understand the importance of considering the potential long-term impacts of any interventions on the quality of life of the community. They share their concerns, while their perspectives and experiences vary. Furthermore, both groups acknowledge the importance of finding a balance between necessary interventions on quay walls and considering the concerns and interests of the community. However, experts cannot always take community concerns into consideration. Additionally, the well-being of the community during and after the implementation of interventions is important to consider. Well-being indicates the community's mental health such as the level of stress and frustration experienced by residents and reflects satisfaction. This includes how residents cope with disturbances in their daily life.

In particular, project Rechtboomsloot has a significant impact on the daily lives of the local community due to its complexity and long construction period. They have experienced stress and frustration due to noise, dust, and occasionally oil pollution. They felt uncertain regarding the project status and due to lack of communication. Furthermore, noise pollution came from various sources, including the vibration of machines and equipment. Additionally, the open street construction led to nuisances such as dust and sand. The project has been ongoing for about 4 years, with a year of standstill. The residents also had to cope with working from home amidst noise disturbances and a lack of suitable workspaces during that time. The long construction period was particularly challenging for the elderly and those with mobility issues, as they faced disturbances such as dust pollution when walking on the walkways during the implementation phase.

Similarly, the local community of Leliegracht has expressed uncertainty about the status of the replacement of temporarily installed sheet piles. These sheet piles have been there for two years now and the construction period lasted 6-8 weeks (about 2 months). Nevertheless, the concerns among the local community about the appearance of the sheet piles and impact on their local ecosystem remain. Additionally, community members have experienced sadness, disappointment, and distrust due to what they perceive as inadequate communication from local authorities. They are requesting concrete measures to mitigate the negative effects of these interventions on their well-being, as the current measures may not be sufficient. Experts, on the other hand, emphasize that noise has no lasting long-term impact on the quality of life of the community after the implementation phase.

The municipality is taking steps to reduce these disturbances during the implementation of interventions by ensuring access to essential services through walkways and other transportation routes. Currently, it implements innovative methods such as grout injection where it is possible, monitors vibration-related damage according to established standards, and works from water instead of land (Nick Rijlaarsdam, 2020).

Table 10 presents the key social indicators and the identified sub-indicators related to quality of life in Project Rechtboomsloot and Project Leliegracht. It also includes the stages of intervention in which they are relevant and whether they lead to short-term or long-term impacts.

Key Social Indicator	Project	Sub-social indicators and description	Lifecycle stages of interventions	Impact
Quality of Life	Rechtboomsloot	Frequency of disturbances in daily life: This indicator represents the disturbances experienced by the local community. It includes the frequency of noise disturbances, dust level, incidents of oil pollution, and the construction period.	During implementation phase	Short-term impact lasted 4 years
		Local Community Well-being: This indicator represents the well-being of the local community and their strategies for coping with stressors. It includes community feedback on the impact on their mental health and satisfaction such as stress and frustration, and the frequency of communication updates from authorities. As well as their coping strategies, particular attention is given to the challenges faced by vulnerable people and people working from home.	During implementation phase	Short-term impact lasted 4 years
	Leliegracht	Frequency of disturbances in daily life: This indicator represents the disturbances experienced by the local community. It includes frequency of noise disturbances due to vibrations of sheet piles installation, and dust level.	During implementation phase	Short-term impact
		Local community well-being: This indicator represents the well-being of the local community such as experiences of sadness, disappointment, mistrust, and uncertainty about project status from interviews. It includes reported the frequency and quality of communication from authorities.	During and after implementation phase	Short-term impact and long-term impact

Table 10: Quality of life with related impact on the identified sub-indicators

4.6 Local community Support

Community support refers to the extent to which the community is supported to cope with the disturbances (Afshari et al., 2022; Vijayakumar et al., 2022). This includes support for local businesses, residents, and specific groups such as houseboat residents, as well as the availability of *municipal programs and communication channels* to help the community deal with the changes and challenges during the implementation of interventions.

Experts in both projects emphasize the importance of support during the implementation of interventions. According to the experts, environmental managers are consistently available to address issues and complaints during the implementation phase. The city manager is available after the completion of the interventions. However, some community members in both projects have mentioned that there is a lack of support programs from the municipality which makes it difficult to get in touch with the right people due to staff turnover. They feel that they have not received enough support, both before and after the interventions were implemented. This support is especially needed for local businesses because of the limited access for customers, trucks, and houseboat residents due to relocation, which is elaborated in the next sections of this chapter.

In the short term, community support is important for the well-being and satisfaction of the community during major infrastructure projects (Vijayakumar et al., 2022). Without sufficient support, local businesses can suffer financially, and residents may experience feelings of uncertainty, stress, and frustration. The lack of consistent support can also undermine trust in municipal authorities, leading to dissatisfaction and a negative perception of the interventions in long-term.

4.7 Transparency decision-making process

Transparency refers to clarity, accountability, and access to relevant information that is shared with the local community (Vijayakumar et al., 2022). It includes the methods and frequency of communication and community involvement for input and feedback during and after interventions.

Furthermore, transparency in communication is crucial for building and maintaining trust between the municipality and the local community. In Amsterdam, where people have a critical attitude, transparent communication helps the local community to understand why certain decisions have been made and minimizes the impact on the quality of life of the community. Experts and the local community in both projects highlighted the importance of transparency in decisions. To achieve this, a range of communication channels including letters, community meetings, surveys, and digital platforms such as the Bouw app are utilized. The communication channels are used to keep the local community informed. Experts emphasize that the local community can engage, ask questions and express concerns during the interventions. They further indicated that the neighborhood is notified 4-6 weeks (about 1 and a half months) before the start of the interventions on the quay walls. This kept the local community informed about the decisions and the project's progress. After the project completion, experts believe that communication becomes less relevant because the infrastructure improves, and the responsibility of the area shifts to the city manager (stadsbeheerder).

4.7.1 Local community concerns regarding communication

The local community in both projects, on the other hand, has expressed concerns about the way the municipality is communicating. They indicate that communication from the municipality can be confusing at times. They request more involvement and support from local authorities.

As mentioned earlier, some community members in Leliegracht feel that decisions about the implementation of the intervention and the urgent tree removal were made without prior communication, leading to decrease in trust. In the Rechtboomsloot project, on the other hand, uncertainties arose about the status and duration of the project due to a lack of communication. The need for communication remains after the project's completion because some residents are still unaware of the reasons for the project delay. Similarly, residents in Leliegracht are unaware about the status of the sheet pile replacement.

4.7.2 Local community trust

The decrease in trust in the municipality is evidenced by the negative reactions of residents in both projects. However, there is variation in the level of trust in government, with some people having faith in the system while others are skeptical or uncertain. This feeling is common and is often based on personal experiences with the government. Especially, residents of Leliegracht have less trust in the municipality's decisions. They specifically mentioned reasons of mistrust such as perceptions they find misleading, unfulfilled promises about keeping the number of trees in case of Leliegracht, and failure to uphold agreements. However, this lack of trust seems to be less important in the Rechtboomsloot project.

The decrease in trust shows that communication should be maintained by engaging the local community even after the implementation of interventions. This will also not only increase trust but also prevent ongoing concerns (Tokede & Traverso, 2020).

4.8 Local community engagement

Local community engagement encompasses actively engaging the local community in all phases of the interventions, including planning, implementation, and evaluation phase. The aim is to give the community a voice in decision-making and keep them informed about project progress.

Experts acknowledge the importance of local community engagement during the interventions and the importance of evaluating the actions taken for interventions on quay walls after implementation phase. However, they have different perspectives on the extent of community engagement and its evaluation. Experts involved in both projects believe that involving the local community in the planning phase may cause anxiety for them because they are sometimes uncertain about the project planning. They prefer community engagement during the implementation phase and do not see the need for involvement afterward. As previously mentioned, they believe that everything will return to normal once the infrastructure is improved. Local communities, on the other hand, feel heard when they are involved. This leads to better acceptance of the project. For example, residents of the Rechtboomsloot project indicated that they would feel reassured when they are informed about the status of the project. Furthermore, involvement throughout all phases of a project leads to better communication (Tokede & Traverso, 2020). This can reduce misunderstandings and uncertainties, as evidenced by the conversations with the local community on both projects. Especially in Leliegracht project, where the absence of ongoing communication led to uncertainty and mistrust. It is worth noting that experts have confirmed the renewal of the quay walls at Leliegracht which is currently in the planning stage. Despite this, they do not know the exact date to implement the intervention in Leliegracht.

4.8.1 Participation post-construction evaluation

Furthermore, evaluation involves collecting feedback from the community and analyzing results to draw lessons or successes for future projects (Vijayakumar et al., 2022).

Experts prioritize internal evaluations to learn from past interventions, while community members from both projects insist on joint evaluations to share their experiences and concerns. By conducting both internal and joint evaluations with the community, both groups can gain valuable insights that contribute to improving future interventions.

In conclusion, community engagement throughout intervention phases and the evaluation after implementation of interventions are important social indicators in these projects. They are essential for building and maintaining trust, ensuring transparent and effective communication, and improving well-being of local community (Vijayakumar et al., 2022). Table 11 and 12 present the key social indicators and the identified sub-indicators related to transparency in decision-making for interventions in Project Rechtboomsloot and Project Leliegracht. It also outlines the intervention stages and specifies whether they result in short-term or long-term impacts.

Key social Indicator	Project	Sub-social indicators	Lifecycle phases of interventions	Impact
Transparency in decision-making	Rechtboomsloot	Communication frequency: This indicator reflects community concerns about the frequency of communication updates from authorities regarding the project's status and duration.	<i>During and after implementation</i>	Short-term: Stress and frustration due to lack of information Long-term: Potential improvement if communication improves.
	Leliegracht	Communication frequency: This indicator reflects the community concerns about the frequency of communication updates from authorities regarding projects decisions and upcoming intervention in Leliegracht.	<i>During and after implementation</i>	Short-term: Stress, frustration and uncertainty. Long-term: Ongoing dissatisfaction if not addressed

Table 11: Transparency related impact on identified sub-indicators.

Key Social Indicator	Project	Sub-social indicators and description	Lifecycle stages of interventions	Impact
Local community involvement	Rechtboomsloot	Local community involvement: This indicator represents number of local community participation in decision-making process and activities of the interventions.	During and after implementation	Short-term: Increased reassurance, reduced stress, better acceptance, and cooperation. Long-term: Greater community satisfaction, Increased trust and engagement.
		Local community trust: This indicator represents level of trust which is higher than Leliegracht.		
		Participation in post-construction evaluation: This indicator represents the impact on the community and their feedback after the implementation phase. It includes the number of joint evaluation sessions held, the participation rate of local community members, and the feedback received during these sessions.	After implementation	Long-term: Better feedback for improvements and future projects (Sierra et al., 2016)
	Leliegracht	Local community Involvement	Throughout all phases	Short-term: Increased engagement and feedback. Long-term: Better project outcomes and community trust.
		Local community Trust level: This indicator presents the level of trust residents have in municipality's decisions which is less than Rechtboomsloot.		
		Participation in post-construction Evaluation: This includes quantitative variables such as number of evaluation sessions conducted, and the qualitative variable such as community feedback shared during these evaluation sessions for future project improvements as they requested in Leliegracht.	After implementation	long-term

Table 12: Local community engagement and impact on identified sub-indicators.

There is a need for physical meetings for the local community during and after the implementation phase, where the local community comes together to exchange ideas, give input and feedback. As previously mentioned, community members prefer to be involved in all phases of the intervention process. It is further important to promote social cohesion and trust during implementation phase because it enhances sense of belonging, pride, and social interactions within the local community in long term (Shukla & Jani, 2018). An example of this is the project Rechtboomsloot, where after the implementation of the interventions, a street party was organized by the neighborhood. This was funded with government money. The party aimed at strengthening social cohesion in the neighborhood and brought neighbors together with food, drinks, music, and festivities. The initiative was well received and considered successful because it was an effective way to unite the neighborhood and end the work on a positive note.

4.9 Impact on Local Businesses Activities

The impact on local businesses activity should be considered due to its role in attracting extra investment into the local economy, creating job opportunities for the local community, and utilizing local materials (Vijayakumar et al., 2022). This approach reduces transportation costs and promotes economic growth and sustainability within the community. During the interviews, experts and the local community in projects Rechtboomsloot and Leliegracht emphasize the importance of considering the impact on local businesses during the implementation of the interventions. There are few local businesses in the area of both projects, but the fact that currently more businesses are located in Leliegracht makes this aspect important in order to minimize the impact on the local businesses in future projects. The interviews show that entrepreneurs face challenges such as longer delivery routes, reduced customer flow due to limited access, and economic challenges, especially during implementation phase. The experts indicate that there is a compensation policy (Nadeel compensatie) to support affected businesses. This compensation policy is a form of restitution for financial damage caused by interventions or government decisions. It is often difficult to obtain due to complex procedures such as proving turnover loss, limited scope of compensation, and navigating legal restrictions. The compensation process is particularly challenging for businesses affected by projects such as Rechtboomsloot and Leliegracht, which were carried out during the COVID-19 pandemic. The pandemic makes it complicated to prove if it is by the implementation of the interventions or by the pandemic.

Despite potential temporary economic challenges resulting from reduced customer flow, experts assure that these effects are typically short-term and lead to overall infrastructure improvements in the long run.

4.10 Local employment opportunity

The interviews show that there is limited local employment opportunities in the projects. The interventions are typically carried out by specialized experts such as technical contracting companies. For instance, at Leliegracht, workers had the opportunity to order lunch at local restaurants or cafes so that the restaurant to support these businesses, but this was the extent of local job opportunity during the construction period. Furthermore, Amsterdam has introduced the 'social return' policy, requiring contractors to offer employment opportunities to Amsterdammers, including those distance from the labor market, during tender processes. However, this initiative could be rolled out on a larger scale in the future as it often seen as a mandatory requirement.

4.11 Houseboats Relocation

The houseboats are not directly located in Leliegracht and Rechtboomsloot, but they can be found in nearby areas such as Oude Schans, Oude Waal, and Gelderse Kade. The ongoing interventions in these nearby areas have brought attention to the need for relocating houseboats and the impact on the residents, which is a concern emphasized by experts and the local community. The interventions on quay walls could potentially endanger the residents of the houseboats, with the risk of quay wall collapse creating unsafe conditions for them. Therefore, it is imperative to temporarily move the houseboats to a nearby location.

Experts have identified several risks linked to the relocation of houseboats, including structural damage to the houseboats, safety hazards for residents during the relocation process, financial risks such as relocation expenses and potential damages, and the uncertainty and stress faced by the residents. It is essential to carefully assess these risks and implement appropriate measures to prevent harm to houseboats in the neighborhood and other structures. To achieve this, skilled professionals are enlisted for the relocation of the boats and support, along with protocols to assist the residents throughout the process, including financial compensation. However, these are the stories from the expert's perspective and the experience of houseboat residents still need to be considered.

Experts indicate that the process of relocating houseboats during quay wall renovations begins with timely (depending on the situation) informing houseboat residents about the renovation plans. This is facilitated through communication with environmental managers and experts. In addition, preparation for relocation to a temporary location is done meticulously, with residents offered alternative accommodation options during the intervention period. Despite these relocations being temporary, houseboats residents and their neighbors may experience stress and uncertainty due to the variable duration of houseboats relocation and unknown status of the project. Therefore, protocols exist not only to guide the process but also to grant residents the right to return to their original location, with exceptions in some cases. The ultimate goal remains for houseboat residents to ideally return to their original location upon completion of the works. Currently, considerations such as blocking roads rather than relocating boats are made to mitigate risks and costs involved. However, experts are not sure that this can be applied to every situation. Therefore, it is important to pay extra attention to the aspect of houseboat relocation.

Table 13 shows summary of the impact of the three social indicators such as Impact on local businesses, local employment opportunities, impact of houseboats relocation in the Rechtboomsloot and Leliegracht projects:

Key Social Indicators and description including sub- indicators	Project	Lifecycle phases of the interventions	Impact
Local Businesses Activity: This indicator represents the impacts of interventions on local businesses. It includes customer flow and parking distance for loading and unloading delivery trucks.	Rechtboomsloot	-	-
	Leliegracht	During implementation and after implementation	Short-term and Long-term
Local Employment Opportunity: This indicator presents the job opportunity for local community which is limited because intervention is implemented by contractors.	Rechtboomsloot	During implementation	Short-term
	Leliegracht	During implementation	Short-term
Houseboats Relocation: This indicator presents the effects of relocating and return on houseboats residents and their experiences of the living conditions. It includes aspects such as distance and duration of houseboat relocation.	Rechtboomsloot	During and after implementation	Short-term and Long-term

Table 13: Impact on local businesses activity, local employment opportunity rate and houseboats relocation.

4.12 Social indicators integration in decision-making of the municipality of Amsterdam

This section aims to integrate the key social indicators in the asset management decision-making process of the municipality. To integrate the social indicators effectively, it is crucial to first examine the current decision-making process of the municipality regarding interventions such as lifespan extension (renovation) and renewal. This process has been clarified through the BTM (Besluit Toekomstbestendige Maatregelen) reports and discussions with experts involved in the decision-making experts (Koen Hondebrink, 2024; Melanie van der Horst, 2023; Oscar Keunen, 2023). The decision-making steps followed in Amsterdam for such interventions is outlined below, along with proposed framework where to best integrate the social indicators.

1. **Technical Evaluation:** The first step in the decision-making process is the technical feasibility. The experts are conducting safety assessments to consider whether extending the lifespan of the quay wall is technically possible. If the quay wall is very bad condition, demolition and new construction (renewal) are necessary. During this phase, the municipality adheres to regulations and safety protocols, conducts safety assessments, follows BLVC plans (Accessibility, Livability, Safety, and Communication), plans supervision, assesses equipment and structures, secures work areas, and plans to replace unstable quay walls. This depends on the current state of the quay wall and the foundation of it. If the structure of the quay wall is in a good condition, lifespan extension of the quay walls can be considered.

2. **Environment Analysis:** This is the second step in the decision-making process, where experts assess the impact of the proposed intervention on the surrounding of quay wall. Currently, the municipality is conducting local environmental scans to identify affected stakeholders and potential impacts, including accessibility disruptions, noise, dust, and effects on cultural and historical heritage, as well as flora and fauna. To mitigate these impacts, the municipality implements measures such as temporary road closures, the Autoluw Amsterdam policy, and the relocation and replacement of parking spaces as needed. Factors such as inconvenience to the local community, traffic diversions, and the potential to preserve greenery (such as trees) play a significant role in these considerations.
3. **Execution Feasibility:** The third step in the decision-making process involves examining the practical feasibility of the proposed interventions. It includes considering noise reduction measures and innovative intervention methods, such as grout injections for vibration reduction and working from the water instead of land to minimize accessibility disturbances. Additionally, it involves assessing the necessary resources and equipment.
4. **Sustainability:** Sustainability is the fourth step in the decision-making process. At this stage, the focus is on the sustainability assessment of the possible interventions. Sustainability in this step includes circularity such as reuse of materials, working with zero emissions, and climate-adaptive measures. The aim is to choose the most sustainable option using Milieu Kosten Indicator (MKI) that contributes to reducing environmental impact in terms of cost.
5. **Cost analysis:** A cost comparison of the different interventions is conducted. This includes both the direct costs of the intervention and potential future cost savings. For example, saving cost through reduced the frequency of maintenance. Costs play a crucial role in the final process of decision-making.
6. **Decision-making:** In the end, all the assessments mentioned above are integrated in a framework for consideration through meetings with experts. Based on the integrated assessment of these aspects, a decision is made on which intervention will be applied: extending the lifespan, demolition and new construction, or an alternative safety approach.

According to the literature review, sustainability encompasses not only environmental and economic dimensions but also the social dimension (Kordi et al., 2021; Sierra, Yepes, et al., 2017), which the municipality should consider in step 4 of its decision-making process. In Step 4, social indicators such as health and safety, accessibility, cultural heritage preservation, quality of life, and impact on the local business activities should be evaluated. The social of these indicators can be evaluated throughout the life cycle of infrastructure asset using the Social Life Cycle Assessment (S-LCA) methodology (Benoît Norris et al., 2020). This methodology includes defining clear goals and scope, conducting inventory analysis through stakeholders' engagement such as assessments based on experts' consultations, local community meetings, interviews, workshops, and surveys to collect data. It also involves prioritizing data based on the stakeholders interest and concerns, performing social impact assessments through classification such as impact categories, subcategories, indicators and characterization by scoring or calculation them, and interpreting results through stakeholder engagement (Benoît Norris et al., 2020; *Guidelines for Social Life Cycle Assessment of Products*, 2009). It is crucial to consider both short-term and long-term social sustainability impacts in the decision-making process. These impacts focus on direct community concerns while planning for long-term social benefits (Sierra et al., 2016), depending on the phases of the infrastructure interventions.

These include planning, implementation, and post-implementation of the interventions. The social performance of the interventions should be consistently measured, monitored, and reported. This is important to better understand the importance of the social indicators and the impact on the local community.

The proposed decision-making framework includes four types of components that should be considered:

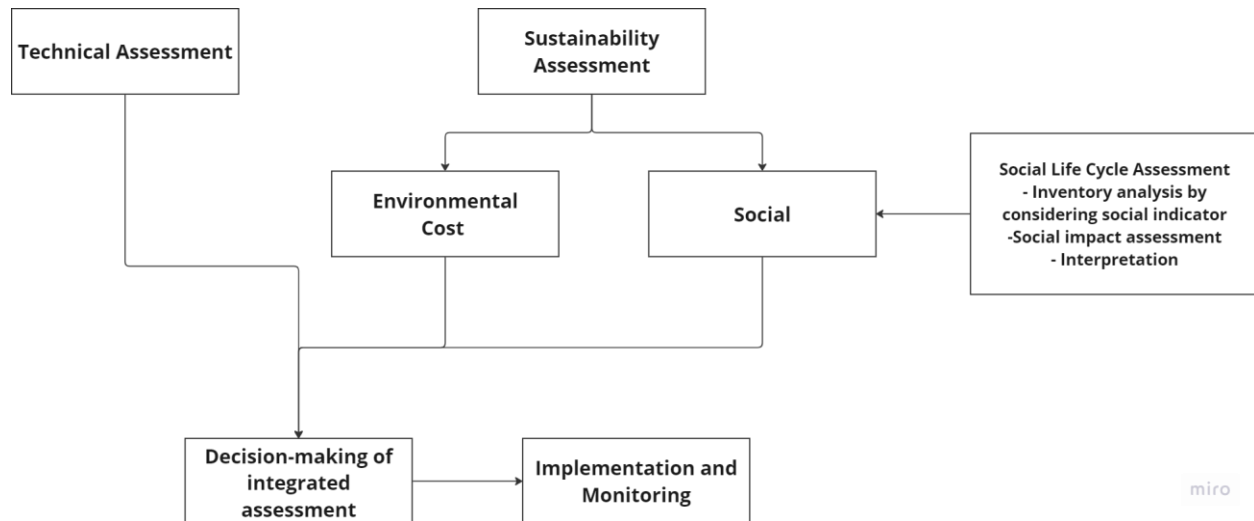


Figure 13: Proposed Decision-making Framework

- 1. Technical Assessment:** The first step is similar to the step that the municipality is considering, which is assessing the structural integrity of the quay walls. Despite the safety efforts mentioned before, the community has concerns about safety risks. Therefore, it is crucial to improve BLVC plans with community-specific enhancements, such as better signage, broader walkways, and evaluating potential incidents. Additionally, experts should communicate clearly with the community about the findings of safety assessments to explain why the municipality is planning the interventions. This communication can be facilitated by involving the local community in safety assessments, including meetings and access to relevant safety reports, which can also increase the community's trust in the municipality.
- 2. Sustainability:** In this step, social dimension should be considered alongside environmental and economic dimensions. As previously mentioned, social sustainability can be addressed using the Social Life Cycle Assessment (S-LCA) Methodology. This involves integrating social indicators, evaluating the social impacts of the interventions through stakeholders' participation, including experts and the local community to ensure their concerns and expectations are part of the decision-making process. Despite the current efforts of the municipality, improvements are still needed, such as providing advance notice and clear communication with residents and local businesses about road closures, including the duration of road closures and alternative transport routes with minimal parking distances. Additionally, residents and local business should be involved in parking solutions, damage assessments and flora and fauna preservation efforts. To accurately evaluate the impact on the quality of life in the community, the municipality should offer local community support services to address their well-being and determine what kind of disturbances the local community experience during the implementation phase.

3. **Decision-making of integrated assessment:** This phase involves integrating the results from various assessments to make informed decisions. As previously mentioned, the municipality currently bases its decisions on integrated assessments, relying on experts' advice and is communicating with the local community through multiple channels during the implementation phase. However, it is crucial to consider input from the local community during the planning phase as well. The municipality should regularly communicate with the local community about the findings of the assessments and planned interventions. This can be improved by enhancing both digital and in-person communication through frequent meetings, workshops, and gathering feedback through surveys. The goal is to make balanced decisions that consider social sustainability impacts alongside other aspects, which increases transparency and informs the community about why certain decisions are made.
4. **Implementation and monitoring:** This phase should be included in the decision-making process of the municipality. It includes following technical and sustainability criteria during the implementation of the chosen interventions and monitoring long-term social impacts. Currently, the municipality monitors and implements quality standards, conducts damage assessments and compensation, balances life extension and renewal preferences, and ensures stability with temporary. These efforts can be improved by increasing transparency in the damage assessment and compensation processes, involving the local community in assessments, educating experts and the local community on historical preservation through workshops, and enhancing aesthetic improvements to increase local community satisfaction. Furthermore, the municipality consults tree experts when removing trees, replaces them with smaller ones, avoids work during bird breeding seasons, installs bat boxes, creates new habitats for fish, and engages the community in creating mini gardens to reduce the impact on flora and fauna. However, conflicts remain regarding tree removal in some area. This also highlights the need for increasing transparency, enhancing community involvement in preservation efforts, and holding evaluation and feedback sessions to gather community input regarding this matter. Moreover, the long-term impacts can be monitored by post-construction evaluation (Vijayakumar et al., 2022). Post-construction evaluation is crucial for infrastructure interventions and provides valuable insights for future projects and long-term social improvement (Sierra, Pellicer, et al., 2017). By conducting regular evaluation sessions with experts and local community, experiences can be shared, concerns can be addressed, and lessons can be learned.

The overview of the current municipality's efforts in project Rechtboomsloot and Leliegracht and the proposal for improvements related to key social indicators are shown concisely in Appendix A of this report.

By considering these steps, the municipality of Amsterdam can ensure that the implementation of infrastructure interventions is not only technically, environmentally, and economically viable but also socially sustainable. This approach reduces the social impact and meets the community's needs and expectations now and in the future. It also strengthens the relationship between the municipality and the local community.

5. Discussion

In this chapter, the findings from the interviews with the local community and experts involved in the Rechtboomsloot and Leliegracht projects are linked to the literature review, which focuses on social sustainability in asset management practices.

The literature often points out that the social dimension remains less tangible compared to environmental and economic dimensions (Kordi et al., 2021; Sierra, Pellicer, et al., 2017). This is also reflected in this study, which reveals that the social dimension is not adequately addressed in the municipality's asset management decision-making process. An important issue in the literature review is the absence of a precise definition for social sustainability and its indicators for infrastructure asset management practices. The variety of definitions available makes it difficult to address social sustainability. This study agrees with existing literature and proposes its own definition social sustainability and identifying key social indicators such as health and safety, accessibility, cultural heritage, quality of life and community involvement as important for urban infrastructure interventions. However, it also emphasizes the need of standardized and more practical definition that can be directly applied to these interventions.

This study agrees with the literature regarding difficulties in quantitatively measuring social sustainability. Despite the existence of tools and frameworks such as Social Life Cycle Assessment (S-LCA), practical application is often limited by issues such as data availability, indicator selection, classification, and characterization (Liu & Qian, 2019). The complex nature of urban infrastructure interventions makes it hard to include social aspects due to varying geographical context of different projects, type of infrastructure, different stakeholder groups and concerns, a point supported by Sierra et al. (2016; 2017). This findings from the Rechtboomsloot and Leliegracht projects illustrate these challenges, with difficulties in characterizing social sustainability indicators being a recurring theme, a point elaborated in the limitations section.

The study reveals that while the same social indicators are used in both projects, their impacts vary between the implementation and post-implementation phases, particularly in terms of short-term and long-term social impacts. The findings show that Project Rechtboomsloot was most impactful during the implementation phase. The construction disturbances and accessibility challenges had a noticeable direct impact on the local community's daily life and well-being. Project Leliegracht, on the other hand, has the most social impact after the implementation phase. Long-term dissatisfaction rising from structural changes and a lack of community involvement, leading to negative long-term impact on the local community's quality of life and trust in local authorities. These findings highlight the importance of evaluating social indicators to understand both the immediate and long-term impacts of urban infrastructure interventions by considering their life-cycle stages. The approach can socially benefit urban interventions now and in the future.

The empirical findings suggest that enhancing community engagement in decision-making, ensuring transparent communication, and conducting ongoing evaluations can address social concerns and improve project outcomes over the long term. These strategies align with studies by (Sierra et al., 2016; Sierra, Yepes, et al., 2017; Valdes-Vasquez & Klotz, 2013; Vijayakumar et al., 2022), which also emphasize the importance of building trust, increasing community satisfaction, and improving stakeholder understanding of social impacts occurring from the interventions. The study concludes that these aspects become more important during prolonged stages for the successful functioning of infrastructure interventions.

The diverse perspectives and empirical findings presented in this study are intended to enhance the understanding and evaluation of social sustainability in decision-making. This not only ensures that social sustainability is adequately addressed but also aligns with environmental and economic aspects, ensuring a balanced and sustainable approach for urban infrastructure interventions.

6. Limitations

The literature indicates that social sustainability can adequately be addressed using methodologies such as S-LCA Social Life Cycle Assessment that offers various methods to evaluate the social impact of products and processes throughout their life cycle (Benoît Norris et al., 2020; *Guidelines for Social Life Cycle Assessment of Products*, 2009). The first step in this study is to identify social indicators. This involves using subcategories and specific indicators, which can be either qualitative or quantitative. Social impacts are assessed based on predefined indicators, with performance scored on a scale (e.g., from 1 to 5) to quantify different levels of social impact. This approach also measures the impact on various stakeholders through surveys, interviews, and other data collection methods. This helps identify and measure social impacts for different stakeholders. However, there are several notable gaps such as the limited data for characterization of certain social indicators. Despite conducting 20 interviews with experts and local communities, some groups of the local community, such as local business owners, refused to participate in the interview. Additionally, there were no houseboats directly in the project area, making it difficult to determine the impact on houseboat residents. Nevertheless, experts provided information on procedures and potential impacts on houseboat residents, which makes it an important indicator to consider in the future.

As previously mentioned, another challenge was the difficulty in quantifying the social indicators. During the interviews, both experts and the local community could assess social indicators on a scale of 1 to 5, with 1 indicating the indicator was not important and 5 indicating it was very important. It turned out that both experts and the local community had difficulty assigning scores to social indicators. Experts found the proposed indicators important during the implementation of interventions, but later found them less important or even irrelevant, assuming that the infrastructure improves after implementation. The local community, on the other hand, found the indicators important both during and after the implementation of interventions. The study also revealed challenges in evaluating social indicators over short and long term due to their subjectivity and the complexity (Karji et al., 2019; Noll, 2013). Social indicators are based on perceptions and experiences of people, which may be considered an important social indicator for one person may be interpreted differently by another. Additionally, the application of these indicators in policymaking is influenced by cultural, ethical, political, and economic factors, complicating the identification of causal relationships (Noll, 2013). Technological advancements and geographical variations further complicate the interpretation of social indicators and the reliability of their impact (Afshari et al., 2022; Sierra et al., 2018). The evaluation of the subjective social indicators in the long term requires ongoing monitoring and analysis of trends and developments over several years, which poses a challenge for this research due to limited time.

The identified gaps can be addressed through refined definitions of social sustainability, along with the use of other assessment tools such as Social Impact Assessment (SIA) and Social Return on Investment (SROI), better stakeholder engagement strategies, and comprehensive evaluation of the impact on the local community. SIA involves predicting and evaluating the social impacts of projects or policies (Sadler et al., 2000). SROI, on the other hand, quantifies social impact in monetary terms by calculating the ratio between the benefits of social impact and the costs required to achieve it (Maldonado & Corbey, 2016). These methods will enhance the measurement of social sustainability indicators, provide a better understanding of the social impacts and strengthen the social dimension of urban infrastructure interventions.

7. Conclusion & Recommendations

Conclusion

Social sustainability is not adequately addressed in the current asset management decision-making process of the municipality of Amsterdam. Therefore, the study aims to address this gap by identifying key social sustainability indicators tailored to quay wall interventions and integrating them into the municipality's asset management decision-making framework.

Social sustainability in this study refers to a concept that evaluates the social impacts arising from interventions on infrastructure assets throughout their life cycle. This can be achieved using Social Life cycle Assessment (S-LCA) methodology, which involves identifying relevant social indicators, considering stakeholders perspectives, and examining various phases of interventions. Social indicators are components or measures that address social concerns and used to evaluate the social impacts of infrastructure interventions throughout their life cycle. Integrating social indicators into decision-making help policymakers and stakeholders can ensure urban infrastructure interventions are adequately sustainable, addressing social dimension alongside environmental and economic ones.

This study identifies ten key social indicators, including health and safety, accessibility, cultural and historical heritage preservation, local community involvement in flora and fauna preservation, quality of life, transparency in decision-making, local community engagement, impact on local business activities, local employment opportunities, and houseboat relocation. These key social indicators are divided into sub-indicators such as compliance with health and safety protocols, frequency of safety incidents, duration of road closures, distance to parking spaces, damage assessment processes and compensation, community satisfaction, local community involvement in greenery efforts, disturbance frequency, local community well-being, local community support, communication frequency, local community trust, and participation in post-construction evaluation.

The impact of these social indicators varies within the projects. Project Rechtboomsloot shows both long-term positive results in terms of cultural heritage preservation and community involvement in green efforts, as well as challenges in the areas of health and safety, accessibility, and quality of life due to long construction period and lack of communication. Controversially, Project Leliegracht faced significant issues related to long-term community dissatisfaction due to the intervention method, damage to houses, and lack of effective communication regarding actions taken for green efforts. It can be concluded that the impact of social indicators on the local community depends on the specific context of each project, the intervention method, the duration of the intervention, the frequency of the intervention, different groups within the local community, and the phases of the interventions.

Integrating the social indicators into decision-making of municipality can contribute to a balanced sustainability that consider social impacts for the future infrastructure interventions. By considering both short-term and long-term social sustainability, the municipality can better understand and address the social sustainability for interventions on the quay walls. Future research is needed to effectively evaluate the social indicators.

Recommendations

It is suggested that the current decision-making approach should integrate social sustainability alongside environmental and economic aspects. This can be achieved effective evaluation of social impact through social life cycle assessment method, improvement strategies such as communication methods and strengthening community engagement. Participation can be strengthened by involving the community throughout the intervention phases with frequent meetings, surveys and regular updates. It is essential to clearly communicate and inform the community about the reasons behind certain decisions.

The municipality should pilot the suggested decision-making framework in upcoming projects, monitor and evaluate the social impacts of the interventions over time, and adjust based on community's feedback. Additionally, the new approach should be established through formal policies, standard implementation procedures, and capacity-building initiatives such as training programs for internal stakeholders regarding the implementation of social sustainability in infrastructure interventions. The continuous community engagement, regular updates, and the social impact evaluation will result in long-term social improvements.

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Appendix A – Improvement strategies

Table 14 concisely gives an overview of the municipality's efforts and recommendations across various social indicators related to the Rechtboomsloot and Leliegracht projects.

Key Social Indicator	Municipality's Efforts	Improvements strategies
Health and Safety	<ul style="list-style-type: none"> ✓ Adherence to regulations and safety protocols. ✓ Safety assessments. ✓ Following BLVC plans (Accessibility, Livability, Safety, and Communication). ✓ Supervising compliance. ✓ Assessing equipment and structures. ✓ Securing work areas. ✓ Removal of unstable quay walls 	<ul style="list-style-type: none"> ➤ Continuous Safety Assessments: Regularly assess safety even post-intervention (safety checks) ➤ Extend BLVC Plans: Enhance plans with community-specific improvements like better signage and temporary broader walkways. ➤ Communicate Clearly: Explain safety measures to mitigate community concerns. ➤ Involve Community in Evaluation: Increase trust through community participation in safety evaluation. ➤ Enhance Training: Provide additional training on safety for experts such as environmental managers. ➤ Enhance Safety Measures: Install additional barriers, especially in children's areas and for parking safety.
Accessibility	<ul style="list-style-type: none"> ✓ Implementing temporary Road closures. ✓ Scheduling interventions during non-peak hours. ✓ Complying with Autoluw Amsterdam policy. ✓ Relocating and replacing parking spaces. 	<ul style="list-style-type: none"> ➤ Provide Advance Notice and Clear Communication: Provide timely updates and alternative transport routes to Inform residents and businesses early about closures and the duration of the closure. ➤ Community-Informed Design: Involve residents in parking solutions and design multifunctional spaces for diverse community needs by considering distance. ➤ Proactive Management: Monitor and manage unauthorized parking effectively.
Local cultural and historic preservation	<ul style="list-style-type: none"> ✓ Monitoring and implementing quality standards. ✓ Conducting damage assessments and compensation 	<ul style="list-style-type: none"> ➤ Transparent Process: Improve transparency in damage assessment and compensation. ➤ Community Education: Educate residents on historical preservation and involve them in evaluations.

	<ul style="list-style-type: none"> ✓ Satisfaction with implementing renovation and renewal on quay walls. ✓ Balancing renovation and renewal preferences ✓ Ensuring stability by temporary solutions such as sheet piles 	<ul style="list-style-type: none"> ➤ Enhance aesthetic improvements in temporary structures: Consider additional improvements to enhance community satisfaction. For example, hold workshops within community to gather input on design and appearance.
Community Involvement in Flora and Fauna Preservation	<ul style="list-style-type: none"> ✓ Consulting tree experts when removing trees, replacing them with smaller ones, avoiding work during bird breeding seasons, installing bat boxes, and creating new habitats for fish. ✓ Community engagement in creating mini gardens. ✓ Addressing conflicts over tree preservation and safety 	<ul style="list-style-type: none"> ➤ Enhanced local community engagement: Increase transparency and enhance involvement of community in preservation efforts to reduce conflicts. ➤ Evaluation and Feedback Sessions: Hold sessions to gather community feedback.
Quality of Life	<ul style="list-style-type: none"> ✓ Currently, implementing noise reduction and innovative construction methods such as grout injection where possible, working from water to minimize disturbances. 	<ul style="list-style-type: none"> ➤ Community Support Services: Offer assistance for residents affected by intervention disturbances. ➤ Community Engagement: Involve community in decisions affecting their quality of life.
Transparency in Decision-Making Process	<ul style="list-style-type: none"> ✓ Using multiple communication channels. ✓ Engaging residents in meetings during implementation phase. 	<ul style="list-style-type: none"> ➤ Improve Communication Channels: Enhance digital and in-person communication by frequent meetings. ➤ Ongoing local community engagement: Continue involving residents throughout all intervention phases including post-construction to sustain trust and transparency by gathering feedback through surveys.

		<ul style="list-style-type: none"> ➤ Timely Responses: Establish feedback mechanisms for addressing local community concerns immediately. ➤ These decrease community concerns and increase awareness
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Table 14: : Municipality's efforts and improvements (Asomani-Boateng et al., 2015; Bagnall et al., 2018; Melanie van der Horst, 2023; Sierra et al., 2016; Sierra, Pellicer, et al., 2017; Vijayakumar et al., 2022) and from interviews.

Appendix B – Interview guide experts

Introductie

Allereerst, hartelijk dank voor je deelname aan mijn onderzoek naar sociale duurzaamheid bij onderhoudswerkzaamheden / ingrepen aan kademuren in Amsterdam. Jouw tijd wordt zeer gewaardeerd, en het gesprek wordt naar verwachting ongeveer 45 minuten in beslag nemen.

Een korte introductie over mezelf: Ik studeer Construction Management and Engineering aan de Universiteit Twente, en ik doe sinds juli 2023 doe mijn afstudeerstage bij het ingenieursbureau van de Gemeente Amsterdam, waar ik hoop af te studeren eind april 2024 af te studeren.

Inleiding Sociale Duurzaamheid

Sociale Duurzaamheid is een vrij breed begrip. In tegenstelling tot de milieu- en economische aspecten is het moeilijk te kwantificeren. Er zijn veel verschillende definities.

In deze context omvat mijn definitie van sociale duurzaamheid het strategisch plannen en verantwoord wijze beheren van historische kademuren om aan de huidige en toekomstige behoeften en verwachtingen van de gemeenschap te voldoen, met actieve betrokkenheid van relevante belanghebbenden. Het onderzoek heeft tot doel de belangrijkste sociale indicatoren te identificeren die verband houden met de bescherming van gezondheid en veiligheid, het behoud van welzijn, het behoud van cultureel erfgoed en de algehele levenskwaliteit van de gemeenschap. Het houdt rekening met de plannings-, bouw- en exploitatiefasen. In het bijzonder richt het zich zowel op tijdens als na de uitvoering van de onderhoudswerkzaamheden zoals renovatie (levensverlenging) en vernieuwing van de historische kademuren in Amsterdam.

Met 'sociale indicatoren' bedoelen we specifieke parameters of elementen die gericht zijn op het meten van de sociale impact van renovatie en vernieuwing van historische kademuren op de gemeenschap. Deze indicatoren zijn ontworpen om niet alleen de onmiddellijke effecten te evalueren die ontstaan tijdens de onderhoudswerkzaamheden, maar ook de langetermijneffecten op de lokale gemeenschap na de uitvoering van de onderhoudswerkzaamheden aan de kademuren. Dit is bedoeld om de directe zorgen van de gemeenschap te beoordelen en te prioriteren en om een positieve sociale impact op lange termijn te behouden en te versterken.

Definities in het Kader van Sociale Duurzaamheid

Veiligheid en Gezondheid: Focus op het beschermen en bevorderen van de menselijke gezondheid via een veilige en gezonde werkomgeving. Het omvat het plannen en beheren van werkzaamheden om het risico op ongevallen te verminderen en de zorgvuldige omgang met stoffen die schadelijk zijn voor de menselijke gezondheid (Valentin & Bogus, 2020) and (Hill & Bowen, 1997). Aspecten ter bescherming van gezondheid en veiligheid kunnen onder meer ongevalspreventie, de implementatie van veiligheidsprotocollen en toegankelijkheidsmaatregelen betreffen voor de veiligheid van voetgangers, fietsers en voertuigen.

Cultureel Erfgoed: Moet worden overwogen bij het plannen van lokale tradities en culturele diversiteit (Valentin & Bogus, 2020); (Hill & Bowen, 1997). Het idee is dat projecten niet alleen fysiek passen, maar ook cultureel bij wat de lokale gemeenschap waardeert en behoudt, zelfs lang nadat de werkzaamheden zijn uitgevoerd.

Welzijn: Het zorgt ervoor dat iedereen toegang heeft tot essentiële behoeften zoals voedsel, onderdak en schoon water (Valentin & Bogus, 2020) and (Hill & Bowen, 1997). Op korte termijn worden onmiddellijke

behoefden aangepakt, terwijl op de lange termijn wordt gestreefd naar een verbeterde levenskwaliteit door ervoor te zorgen dat deze basisbehoeften continu worden vervuld en mentale gezondheid in stand blijft.

De onderhoudswerkzaamheden aan de kademuren kunnen ook invloed hebben op lokale bedrijven. Dit kan de lokale werkgelegenheid omvatten, tijdelijke verstoringen van de dagelijkse activiteiten van lokale bedrijven, een afname van klanten en kan economische uitdagingen meebrengen, die ook op lange termijn gevolgen kunnen hebben.

De geïdentificeerde sociale indicatoren kunnen vervolgens in overweging worden genomen bij het nemen van beslissingen binnen het Programma Bruggen en Kademuren van de Gemeente Amsterdam. Het is belangrijk om het besluitvormingsproces te onderzoeken, het niveau van transparantie met betrekking tot genomen beslissingen, de verantwoordelijkheid van besluitvormers voor hun keuzes, en de tevredenheid en betrokkenheid van de lokale gemeenschap tijdens dit besluitvormingsproces. Dit draagt bij aan het nemen van beslissingen die de lasten van de onderhoudswerkzaamheden eerlijk verdelen en ervoor zorgen dat degenen die nadelige gevolgen ondervinden, rechtvaardige compensatie ontvangen (Valentin & Bogus, 2020) and (Hill & Bowen, 1997). Het doel is om de gevolgen van de onderhoudswerkzaamheden aan de kademuren eerlijk te verdelen, zodat ze niet onrechtvaardig worden doorgegeven aan toekomstige generaties.

Vragen en Verzoek

De vragen zijn verdeeld in twee groepen: één voor experts en één voor de lokale gemeenschap. Dit is bedoeld om de perspectieven van experts te verkrijgen en de ervaringen en zorgen van de lokale gemeenschap bloot te leggen. De vragen draaien om sociale indicatoren die een impact kunnen hebben tijdens en na de uitvoering van onderhoudswerkzaamheden aan kademuren. Het doel is om deze sociale indicatoren te identificeren en te prioriteren op basis van de beoordeling van de geïnterviewden. Daarom wordt een lijst met mogelijke sociale indicatoren verstrekt om te beoordelen tussen 1 en 5 (UNEP, 2020); (Blaauw, Maina, & Grobler, 2021). Bijvoorbeeld, 1 betekent 'niet belangrijk,' 2 betekent 'licht belangrijk,' 3 betekent 'matig belangrijk,' 4 betekent 'belangrijk,' en 5 betekent 'zeer belangrijk.' Ik wil graag weten hoe u deze sociale indicatoren waardeert en/of ervaart.

Verzoek om opname

Ik wil graag jouw toestemming vragen om het gesprek op te nemen om de antwoorden nauwkeurig te verwerken. De opnames worden vertrouwelijk behandeld en alleen op verzoek en met goedkeuring gedeeld. Je kunt op elk moment aangeven als je niet langer wilt worden opgenomen.

Voor het publiceren van resultaten zullen de bevindingen worden besproken met begeleiders. In principe zijn verwerkte resultaten generiek (dat wil zeggen, niet herleidbaar tot specifieke individuen), tenzij citaten worden gebruikt. In dat geval zal ik altijd om toestemming vragen voordat ik dat specifieke citaat in mijn resultaten gebruik.

Dank je wel voor je deelname!

1. Kun je jezelf kort introduceren of je rol binnen het Programma Bruggen en Kademuren van de Gemeente?
2. Hoe waardeert u de volgende sociale indicatoren met betrekking tot de veiligheid en gezondheid van de lokale gemeenschap, zowel tijdens als na de onderhoudswerkzaamheden aan de kademuren?

Sociale indicator	Beschrijving	Toelichting	Score (1-5)
			Tijdens
Risico's op ongevallen	<p>Tijdens het onderhoud: Evaluatie van mogelijke ongevallen die verband houden met werkzaamheden, zoals het risico om te vallen door veranderingen in trottoirs en verkeerspatronen.</p> <p>Na het onderhoud: Evaluatie van aanhoudende risico's, zoals veranderingen in het verkeerspatroon of gewijzigde routes (ook op de waterwegen) die op de lange termijn de veiligheid van de lokale gemeenschap beïnvloeden.</p>		
Aanwezigheid en implementatie van veiligheidsprotocollen	<p>Tijdens het onderhoud: Evaluatie van hoe goed veiligheidsprotocollen worden geïmplementeerd om bewoners en bezoekers te beschermen tijdens de onderhoudswerkzaamheden.</p> <p>Na het onderhoud: De evaluatie omvat een onderzoek naar de voortdurende relevantie van specifieke veiligheidsmaatregelen na de werkzaamheden. Hieronder vallen voortdurende inspecties, waarschuwingsborden of noodplannen, enz.</p>		
Bereikbaarheid	<p>Tijdens het onderhoud: Evaluatie van verstoringen van gebruikelijke routes, potentiële congestie en uitdagingen voor bewoners en bezoekers om alternatieve parkeergelegenheid te vinden.</p> <p>Na het onderhoud: Evaluatie van blijvende veranderingen in toegankelijkheid, zoals gewijzigde verkeersstromen of verbeterde voetgangers- en fietspaden.</p>		
Verstoring/vervuiling	<p>Tijdens onderhoud: Evaluatie van onmiddellijke verstoringen die mensen ervaren, zoals geluid, trillingen en mogelijke problemen met de luchtkwaliteit.</p> <p>Na onderhoud: Evaluatie van mogelijke voortdurende effecten op de luchtkwaliteit en geluidsoverlast als gevolg van aspecten zoals stof, emissies van bouw equipments of veranderingen in lokale verkeerspatronen.</p>		

1. Hoe waardeert u de volgende sociale indicatoren met betrekking tot het behoud van cultureel erfgoed, die mogelijk worden beïnvloed door onderhoudswerkzaamheden aan de kademuren?

Sociale indicator	Beschrijving	Toelichting
Verandering of verlies van culturele bezienswaardigheden	<p>Evaluatie van mogelijke schade aan historische en culturele elementen die aanwezig zijn in het gebied rondom de kademuren.</p> <p>Tijdens onderhoud: Evaluatie van wijzigingen of schade die worden aangebracht om eventuele negatieve invloed op historische of culturele elementen in de buurt te minimaliseren.</p> <p>Na onderhoud: Evaluatie van de onvermijdelijke verandering die nodig was om de kademuren te behouden.</p>	
Renovatie van kademuren	<p>De gemeente overweegt de kademuren te renoveren, met als doel hun levensduur te verlengen tot ongeveer 30 jaar. Dit kan leiden tot periodieke overlast elke ongeveer 2- 2 keer per eeuw als gevolg van onderhoudswerkzaamheden. De bedoeling is om frequentie van onderhoud, tijdelijke verstoringen, bescherming van culturele elementen en historische aspecten, zoals het gebruik van traditionele materialen, en langetermijnoverlast veroorzaakt door de renovatie te evalueren. <i>Meningen van experts over hoe deze gekozen ingreep de gemeenschap zou kunnen beïnvloeden.</i></p>	
Vernieuwing van kades	<p>Een andere overweging is de vernieuwing van de kademuren, waarbij een volledige reconstructie wordt uitgevoerd die tot 100 jaar meegaat. Hoewel dit misschien slechts eenmaal overlast veroorzaakt, kan vernieuwing langetermijnstabiliteit bieden. Evaluatie van de onderhoudsmethode van de nieuwe kademuren en hoe deze bijdragen aan het behoud van cultureel erfgoed en de frequentie van het werk om te begrijpen hoe het de gemeenschap beïnvloedt. <i>Ik ben geïnteresseerd in de gedachten over de mogelijke impact op mensen door renovatie en vernieuwing. Dit kan waardevol zijn om te weten wat het verschil in hinder is tussen renovatie en vernieuwing.</i></p>	
Behoud van de vegetatie: bescherming van lokale planten en bomen in de buurt	<p>Tijdens onderhoud: Evaluatie van maatregelen die worden genomen om de vegetatie te beschermen, zoals het plaatsen van tijdelijke barrières om boomwortels te beschermen, het gebruik van milieuvriendelijke bouwmaterialen en het instellen van bouwvrije zones rond gevoelige plantgebieden.</p> <p>Na onderhoud: Evaluatie van de blijvende verandering in behouden vegetatie die bijdraagt aan de esthetische en ecologische waarde van het gebied.</p>	

1. Hoe waardeert u de volgende sociale indicatoren voor het behoud van het welzijn van de lokale gemeenschap, zowel tijdens als na het onderhoudswerk aan de kademuren?

Sociale indicator	Beschrijving	Toelichting
Levenskwaliteit	<p>Evaluatie van het algehele welzijn, inclusief mentale gezondheid en sociale relaties.</p> <p>Tijdens onderhoud: verstoringen kunnen invloed hebben op het dagelijks leven van bewoners, zoals toegang tot essentiële diensten (school, kerk). Dit gaat verder dan fysieke toegankelijkheid, zoals verstoringen van voedsel, schoon water, geluid dat van invloed is op het mentale welzijn, of veranderingen in sociale relaties als gevolg van het onderhoudswerk.</p> <p>Na onderhoud: Evaluatie van de kwaliteit van leven dat wordt verwacht te verbeteren, omdat het gebied toegankelijker en esthetisch aantrekkelijker zou moeten worden.</p>	
Steun aan de lokale gemeenschap	<p>Evaluatie van hulp voor bewoners.</p> <p>Tijdens onderhoud: gemeenschapsondersteuningsprogramma's/platfms worden verwacht bewoners te helpen omgaan met verstoringen. Dit kan informatiesessies, gemeenschapsbijeenkomsten, bewonersavonden omvatten.</p> <p>Na onderhoud: Evaluatie van voortdurende gemeenschapsondersteuning die een soepele overgang terug naar het normale leven voor bewoners kan garanderen, dat bevordert een gevoel van verbondenheid. Voorbeelden zijn voortdurende communicatiekanalen voor updates, hulp bij het aanpakken van aanhoudende problemen en gemeenschapsevenementen om de verbinding tussen bewoners te helpen herstellen.</p>	
Woonboot Verhuizing / verplaatsing	<p>Perceptie van mogelijke gedwongen verhuizing.</p> <p>Tijdens onderhoud: Evaluatie van communicatie- en betrokkenheidsinspanningen, die moeten prioriteit krijgen om zorgen over mogelijke verplaatsing aan te pakken. Dit houdt in dat de woonbootbewoners actief worden betrokken bij discussies die duidelijke informatie geven over de onderhoudsplannen.</p> <p>Na onderhoud: Evaluatie van terugkeer. Woonboten worden verwacht terug te keren naar hun plaatsen, waarbij gedwongen verhuizingen worden geminimaliseerd. Bewoners zouden zich veilig moeten voelen om terug te komen. Evaluatie van niet terugkeer van woonboten. Als een scenario zich voordoet waarin ze niet naar hun oorspronkelijke locatie kunnen terugkeren, moet er transparantie en duidelijkheid zijn in het communicatieproces tussen de gemeente en bewoners.</p>	

1. Hoe waardeert u de volgende sociale indicator die gerelateerd is aan het zorgen dat beslissingen duidelijk en verantwoord worden genomen?

Sociale indicator	Beschrijving	Toelichting
Transparantie inclusief vertrouwen, bewustzijn en acceptatie	<p>Evaluatie van het besluitvormingsproces voor ingrepen aan de kade muren omvat het beoordelen van de duidelijkheid van beslissingen, het vertrouwensniveau dat lokale bewoners hebben in het besluitvormingsproces, en hoe goed de gemeenschap de beslissingen begrijpt. Evaluatie van de duidelijkheid van beslissingen voor kademuren voor de gemeenschap.</p> <p>Tijdens onderhoud: regelmatige updates en communicatiekanalen die ervoor zorgen dat de gemeenschap op de hoogte is van beslissingen en voortgang.</p> <p>Na onderhoud: blijf transparantie behouden door voortdurende communicatie en informatie over de voltooiing van het onderhoudswerk en toekomstige plannen. Dit zal de bewustwording van de gemeenschap handhaven, het vertrouwen versterken en ervoor zorgen dat de gemeenschap de beslissingen blijft accepteren en begrijpen.</p>	.
Verantwoordelijkheid van besluitvormers	<p>Evaluatie van besluitvormers die verantwoordelijkheid nemen voor gemaakte keuzes en ervoor zorgen dat er rekening wordt gehouden met de toekomstige generaties.</p> <p>Tijdens onderhoud: Besluitvormers actief in gesprek met de gemeenschap, nemen verantwoordelijkheid voor eventuele verstoringen veroorzaakt door het onderhoud. Zo zouden ze regelmatig vergaderingen met bewoners kunnen houden, onmiddellijk op zorgen reageren en maatregelen nemen om ongemak tijdens de werkzaamheden te minimaliseren.</p> <p>Na onderhoud: Evaluatie van besluitvormers die blijven de langetermijneffecten van hun keuzes beoordelen. Dit kan voortdurende communicatie met de gemeenschap omvatten, monitoring van eventuele problemen in de postconstructiefase en het implementeren van maatregelen om eventuele onvoorziene gevolgen na voltooiing van het onderhoudswerk te verzachten.</p>	
Betrokkenheid en tevredenheid van de gemeenschap	<p>Evaluatie van de mate van betrokkenheid van de gemeenschap en tevredenheid tijdens planning, uitvoering en na voltooiing.</p> <p>Tijdens onderhoud: gemeenschapsinbreng is belangrijk, met beslissingen gebaseerd op het aanpakken van zorgen die door bewoners naar voren zijn gebracht. Bijvoorbeeld, er kunnen stadvergaderingen/ bewonersavonden worden gehouden, enquêtes worden verspreid om input te verzamelen. Tevredenheid wordt gemonitord via feedback, en aanpassingen als reactie op gemeenschapszorgen. Dit kan bijvoorbeeld werkschema's zijn om verstoringen te minimaliseren op basis van feedback van bewoners.</p> <p>Na onderhoud: Evaluatie van voortdurende betrokkenheid en tevredenheid moeten prioriteit hebben, met open feedbackkanalen voor continue verbetering en gemeenschapstevredenheid zoals eerder aangegeven.</p>	

1. Hoe waardeert u de impact van de onderhoudswerkzaamheden aan de kademuren op lokale bedrijven?

Sociale indicator	Beschrijving	Toelichting
Veranderingen in lokale bedrijfsactiviteiten	<p>Evaluatie van veranderingen in bedrijfsactiviteit als gevolg van onderhoud aan kademuren.</p> <p>Tijdens onderhoud: er kunnen veranderingen zijn in bedrijfsactiviteiten, zoals een afname van klanten en economische uitdagingen, waaronder moeilijkheden bij vrachtwagetoegang voor laden en lossen. Lokale bedrijven kunnen tijdelijke verstoringen ervaren als gevolg van logistieke activiteiten, wat leidt tot economische uitdagingen als gevolg van verminderde klantenstroom.</p> <p>Na onderhoud: Evaluatie langetermijn effecten. de lokale bedrijvigheid wordt verwacht weer normaal te worden. Er is potentieel voor een verhoogde klantenstroom na voltooiing van het onderhoud aan de kademuren. Aan ander kant, moet ook worden overwogen dat dingen misschien niet precies volgens plan verlopen. Er kunnen onverwachte uitdagingen zijn, lange termijn veranderingen in de economie of andere factoren die lokale bedrijven negatief kunnen beïnvloeden. Daarvoor zou moeten maatregelen worden genomen, zoals financiële bijstandsprogramma's die lokale bedrijven ondersteunen, samenwerking met bedrijfsverenigingen en gemeenschapsbetrokkenheid en feedback, of trainingsprogramma's of workshops om hen te helpen zich aan te passen aan veranderende omstandigheden.</p>	
Lokale werkgelegenheid	<p>Evaluatie van arbeidsmogelijkheden voor de lokale gemeenschap.</p> <p>Tijdens onderhoud: er kunnen lokale arbeidsmogelijkheden beschikbaar zijn, met potentiële kortetermijnbanen als logistieke ondersteuningsrollen.</p> <p>Na onderhoud: Er kan kans zijn op stabiele lokale arbeidsmogelijkheden door lopende projecten, afwisseling van de lokale economie, verbeterde infrastructuur, gemeenschapsbetrokkenheid en ondersteunende initiatieven van de gemeente.</p>	

7. Zijn er andere sociale indicatoren/ effecten die niet zijn opgenomen in de lijst? Zo ja, hoe evalueert u deze effecten?
8. Kunt u enkele positieve/negatieve veranderingen noemen die u hebt waargenomen sinds de onderhoudswerkzaamheden? (indien nodig: overweeg verbeteringen in de leefomgeving, toegenomen betrokkenheid van de gemeenschap, ontwikkeling van nieuwe faciliteiten of lokale bedrijven)

Appendix C- Interview guide Local community

Vragen voor lokale gemeenschap**Introductie**

Mijn naam is Varshalie Paragh, en ik ben een master student aan de Universiteit Twente. Momenteel doe ik mijn afstudeerstage bij de Gemeente Amsterdam. Mijn onderzoek richt zich op het identificeren van sociale aspecten die gericht zijn op hoe onderhoudswerkzaamheden aan de kademuren onze gemeenschap beïnvloedt.

Waar gaat het over?

Wanneer er werkzaamheden aan de kademuren wordt verricht, kan dit invloed hebben op ons dagelijks leven. Mijn onderzoek draait allemaal om het begrijpen van hoe deze veranderingen jullie beïnvloeden, zoals veiligheid, welzijn en de dingen die we waarderen aan onze buurt, zowel tijdens als na het onderhoudswerk.

Waarom is het belangrijk?

Ik wil ervoor zorgen dat de beslissingen die tijdens deze projecten worden genomen, rekening houden met jullie behoeften en ervaringen. Het gaat niet alleen om het fysieke werk; het gaat ook om hoe het ons als gemeenschap beïnvloedt. Dit kan naast veiligheid, het behoud van ons cultureel erfgoed omvatten, het ondersteunen van lokale bedrijven en ervoor zorgen dat aan de behoeften van iedereen wordt voldaan.

Wat zijn de sociale aspecten precies?**1. Veiligheid:**

- a. **Wat het betekent:** Zorgen dat iedereen beschermd is en zich veilig voelt.
- b. **Tijdens Onderhoud:** We willen ongelukken vermijden en ervoor zorgen dat het onderhoudswerk geen risico's creëert voor mensen die rondlopen, fietsen of rijden.
- c. **Na Onderhoud:** Zorgen dat de veranderingen aan de kademuren geen doorlopende veiligheidsproblemen voor de gemeenschap veroorzaken.

2. Behoud van Cultureel Erfgoed:

- a. **Wat het betekent:** Zorgen voor de dingen die onze buurt speciaal en uniek maken beschermd blijven.
- b. **Tijdens Onderhoud:** Ervoor zorgen dat het werk onze lokale tradities en diverse cultuur respecteert en aansluit. We willen dat de veranderingen hier zowel fysiek als cultureel thuishoren.
- c. **Na Onderhoud:** Zorgen dat wat de gemeenschap uniek maakt, wordt beschermd, zelfs lang nadat het onderhoudswerk is voltooid.

3. Welzijn:

- a. **Wat het betekent:** Zorgen voor het algehele geluk en comfort van iedereen.

- a. **Tijdens Onderhoud:** Directe behoeften aanpakken zoals toegang tot school, voedsel en schoon water terwijl het werk bezig is en verminderen van frustraties die te maken heeft met mentale gezondheid.
- b. **Na Onderhoud:** Zorgen dat het leven in onze buurt nog beter wordt door continu aan deze basisbehoeften voor iedereen te voldoen.

2. Lokale Bedrijven:

- a. **Wat het betekent:** De winkels en diensten hier in de buurt.
- b. **Tijdens Onderhoud:** Sommige lokale bedrijven kunnen uitdagingen tegenkomen zoals tijdelijke verstoringen, minder klanten of veranderingen in hun dagelijkse activiteiten als gevolg van het onderhoudswerk.
- c. **Na Onderhoud:** We willen begrijpen hoe deze veranderingen de lokale bedrijven op de lange termijn kunnen beïnvloeden. Dit kan dingen omvatten zoals of ze weer normaal worden, of er nieuwe banenkansen zijn voor de lokale gemeenschap, en hoe het gesteld is met de lokale economie.

Hoe kun je helpen?

Ik zou graag met u willen praten over u ervaringen en wat u het belangrijkste vindt door middel van scores. Uw ervaring zal ons helpen begrijpen wat er tijdens deze tijden het meest toe doet. Het interview duurt ongeveer 15 minuten, en de vragen hebben betrekking op de sociale aspecten die u kunt beoordelen tussen 1 en 5. Bijvoorbeeld, 1 betekent 'niet belangrijk,' 2 betekent 'licht belangrijk,' 3 betekent 'gematigd belangrijk,' 4 betekent 'belangrijk,' en 5 betekent 'zeer belangrijk.' Uw gedachten zijn zeer waardevol voor mij.

Dank u wel voor uw deelname!

1. Kunt u zich kort voorstellen?
2. Hoe ervaart u of voelt u zich met betrekking tot uw eigen veiligheid tijdens en na het onderhoudswerk aan de kademuren, met name met betrekking tot ongevallen en de bereikbaarheid van voetgangers, fietsers en voertuigen? En hoe belangrijk vindt u deze aspecten?

Sociale Indicator	Beschrijving	Toelichting
Risico's op ongevallen	<p>Tijdens onderhoud: Evaluatie van zaken tijdens het onderhoudswerk die ongelukken kunnen veroorzaken, zoals veranderingen in trottoirs of verkeersbewegingen.</p> <p>Na onderhoud: Evaluatie van nog aanwezige elementen die risico's met zich mee kunnen brengen, zoals nieuwe verkeerspatronen of veranderingen in routes (vooral op de waterwegen) die op de lange termijn van invloed kunnen zijn op de veiligheid.</p>	
Bereikbaarheid voor voetgangers, fietsers en voertuigen: bewegingsvrijheid	<p>Tijdens onderhoud: Evaluatie van problemen met de gebruikelijke routes, zoals verkeersopstoppingen of problemen met het vinden van parkeerplaatsen.</p> <p>Na onderhoud: Evaluatie van blijvende veranderingen in hoe mensen zich verplaatsen, zoals verschillende verkeerspatronen of betere paden voor wandelen en fietsen.</p>	

3. Hoe ervaart u de volgende sociale aspecten die verband houden met het behoud van het cultureel erfgoed van uw buurt tijdens en na het onderhoudswerk aan de kademuren? En hoe belangrijk vindt u deze aspecten?

Sociale indicator	Beschrijving	Toelichting
Verandering of verlies van cultureel erfgoed, waaronder renovatie en vernieuwing aan kademuren.	<p>Tijdens onderhoud: Evaluatie van gebeurtenissen tijdens het onderhoud die schadelijk zouden kunnen zijn voor de historische of culturele elementen in het gebied rondom de kademuren.</p> <p>Na onderhoud: Evaluatie van eventuele veranderingen om de geschiedenis en cultuur te beschermen. En als er onvermijdelijke veranderingen zijn, hoe ervaren mensen dat.</p>	

Behoud van de vegetatie	<p>Tijdens onderhoud: Evaluatie van hoe mensen de genomen maatregelen ervaren om lokale planten tijdens de werkzaamheden te beschermen. Dit omvat het gebruik van milieuvriendelijke materialen, het opzetten van barrières en ervoor zorgen dat bepaalde gebieden vrij blijven van onderhoudswerkzaamheden.</p> <p>Na onderhoud: Evaluatie of mensen veranderingen hebben opgemerkt in de planten die bijdragen aan de esthetiek en milieubehoud van de buurt.</p>	
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1. Hoe ervaart u de volgende sociale aspecten met betrekking tot uw welzijn tijdens en na het onderhoudswerk aan de kademuren? Kunt u uw ervaring delen, en hoe belangrijk vindt u deze aspecten?

Sociale indicator	Beschrijving	Toelicht
Levenskwaliteit	Tijdens onderhoud: Evaluatie van hoe het onderhoudswerk van invloed is op het dagelijks leven van mensen. Onderbrekingen kunnen invloed hebben op de dagelijkse routine van mensen, zoals het bereiken van belangrijke plaatsen (school /kerkn, en omvatten ook zaken als toegang tot voedsel, schoonwater en zelfs hoe je je mentaal voelt vanwege geluid, enz.	
Verstoring/vervuiling	<p>Tijdens onderhoud: Evaluatie van directe verstoringen die mensen ervaren, zoals geluid, trillingen en mogelijke problemen met de luchtkwaliteit.</p> <p>Na onderhoud: Evaluatie van mogelijke voortdurende effecten op de luchtkwaliteit en geluid als gevolg van aspecten zoals stof, emissies van bouwapparatuur</p>	
Steun voor de lokale gemeenschap	Evaluatie of er voldoende ondersteuningsprogramma's en bijeenkomsten zijn om iedereen te helpen omgaan met de veranderingen. En zelfs nadat het onderhoudswerk is voltooid, doorlopende ondersteuning is belangrijk om mensen bij te werken over het onderhoudswerk en hen onmiddellijk te helpen als ze problemen hebben die verband houden met deze onderhoudswerkzaamheden	
Verplaatsing van woonboten	Evaluatie van hoe mensen zich voelen over het verplaatsen van woonboten, zoals onrustig, onveilig, zorgen. Tijdens onderhoud: Er moet duidelijke communicatie zijn tussen bewoners van woonboten en	

Verplaatsing van woonboten	<p>Evaluatie van hoe mensen zich voelen over het verplaatsen van woonboten, zoals onrustig, onveilig, zorgen. Tijdens onderhoud: Er moet duidelijke communicatie zijn tussen bewoners van woonboten en de gemeente over de plannen om eventuele zorgen te verlichten.</p> <p>Na het onderhoudswerk: Evaluatie of de woonboten worden verwacht terug te keren naar hun oorspronkelijke locatie of dat ze gedwongen worden te verhuizen.</p>	
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1. Hoe ervaart u de besluitvorming van de gemeente met betrekking tot onderhoudswerkzaamheden aan de kademuren? Kunt u uw ervaring delen met betrekking tot de manier waarop de gemeente besluiten communiceert, en hoe belangrijk vindt u deze communicatie-aspecten?

Sociale indicator	Beschrijving	Toelichting
Transparantie die vertrouwen, bewustzijn en acceptatie omvat	<p>Evaluatie van hoe duidelijk de beslissingen van de gemeente zijn voor de lokale gemeenschap, het niveau van vertrouwen dat zij hebben in het besluitvormingsproces, en hoe goed de gemeenschap de beslissingen begrijpt.</p> <p>Tijdens onderhoud: Regelmatige updates en communicatiekanalen om ervoor te zorgen dat de gemeenschap op de hoogte is van beslissingen en voortgang.</p> <p>Na onderhoud: Voortdurende transparantie door lopende communicatie en informatie over de voltooiing van het onderhoudswerk en toekomstige plannen. Dit zal gemeenschapsbewustzijn handhaven, vertrouwen waarborgen en voortdurende acceptatie en begrip door de gemeenschap waarborgen.</p>	
Betrokkenheid en tevredenheid van de gemeenschap	<p>Evaluatie van de mate van betrokkenheid en tevredenheid van de gemeenschap tijdens planning, uitvoering en na voltooiing.</p> <p>Tijdens onderhoud: Gemeenschapsinput is belangrijk, waarbij beslissingen worden genomen op basis van het aanpakken van zorgen die door bewoners worden geuit. Bijvoorbeeld, er kunnen bewonersavonden worden gehouden, enquêtes worden verspreid om input te verzamelen. Tevredenheid wordt gecontroleerd via feedback en aanpassingen in reactie op zorgen van de gemeenschap. Dit kan bijvoorbeeld werkschema's</p>	

Betrokkenheid en tevredenheid van de gemeenschap	<p>Evaluatie van de mate van betrokkenheid en tevredenheid van de gemeenschap tijdens planning, uitvoering en na voltooiing.</p> <p>Tijdens onderhoud: Gemeenschapsinput is belangrijk, waarbij beslissingen worden genomen op basis van het aanpakken van zorgen die door bewoners worden geuit. Bijvoorbeeld, er kunnen bewonersavonden worden gehouden, enquêtes worden verspreid om input te verzamelen. Tevredenheid wordt gecontroleerd via feedback en aanpassingen in reactie op zorgen van de gemeenschap. Dit kan bijvoorbeeld werkschema's omvatten om verstoringen te minimaliseren op basis van feedback van bewoners.</p> <p>Na onderhoud: Voortdurende betrokkenheid en tevredenheid moeten worden geprioriteerd, met open feedbackkanalen voor continue verbetering en gemeenschapstevredenheid.</p>	
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1. Hoe ervaart u de impact van de onderhoudswerkzaamheden aan de kademuur op lokale bedrijven in uw buurt, vooral wat betreft veranderingen in de bedrijfsactiviteiten?

Sociale indicator	Beschrijving	Toelichting
Veranderingen in lokale bedrijfsactiviteiten, zoals verminderde klanten en economische uitdagingen	<p>Evaluatie of lokale bedrijven veranderingen ervaren als gevolg van het onderhoud aan de kademuren, zoals een afname van klanten en economische uitdagingen, waaronder moeilijkheden bij vrachtwagenverkeer voor laden en lossen. Lokale bedrijven kunnen tijdelijke verstoringen ervaren als gevolg van logistieke activiteiten, wat leidt tot economische uitdagingen als gevolg van verminderde klantenstroom.</p> <p>Na onderhoud: Het wordt verwacht dat de lokale bedrijvigheid weer normaal zal worden. Er is potentieel voor een toename van de klantenstroom na afronding van het onderhoud aan de kademuren. Het moet ook worden overwogen dat dingen misschien niet precies volgens plan verlopen. Er kunnen onverwachte uitdagingen zijn, veranderingen</p>	