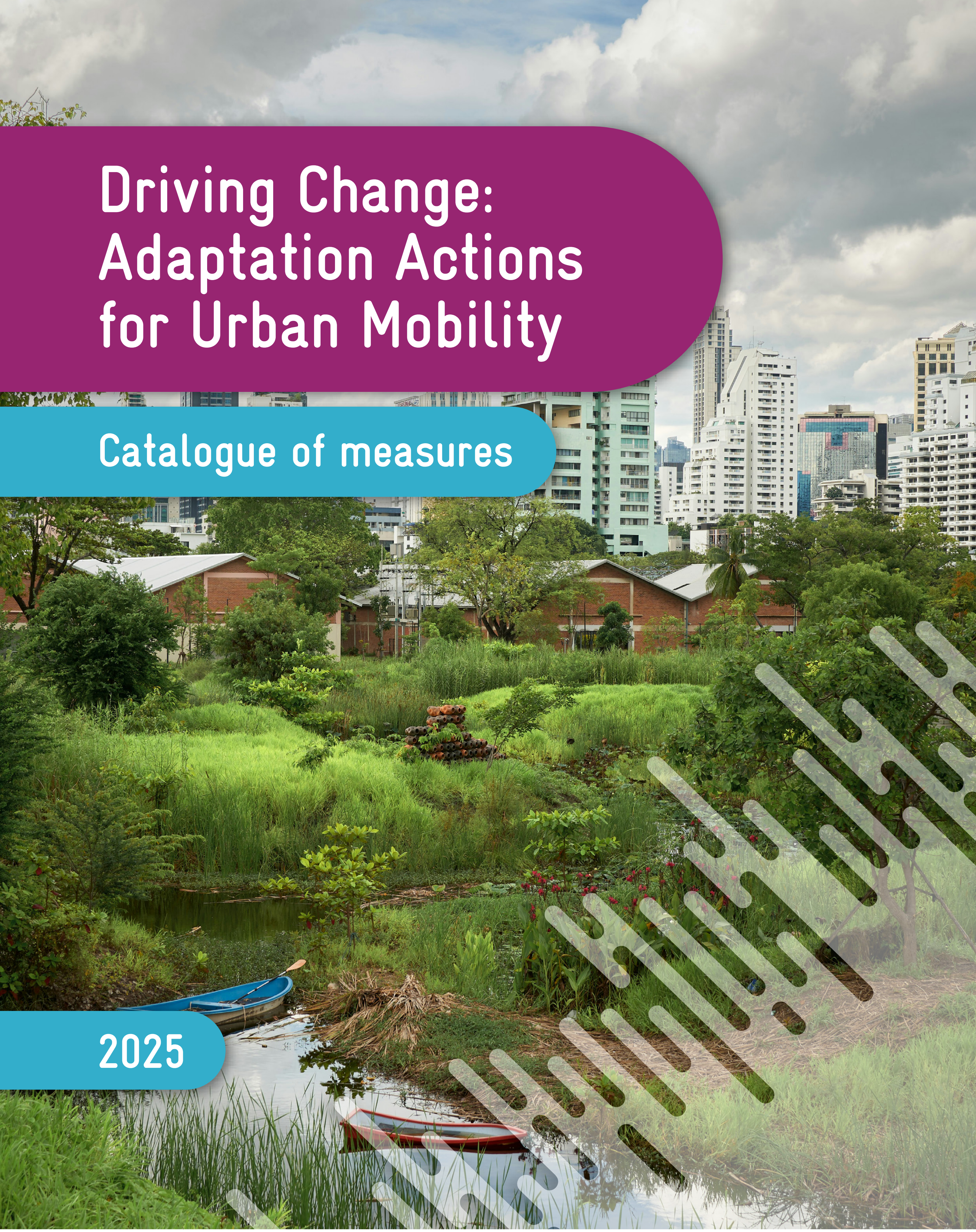

Driving Change: Adaptation Actions for Urban Mobility

Catalogue of measures

2025

Mobilise Your City

Codatu

ADEME
AGENCE DE LA TRANSITION ÉCOLOGIQUE

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1. Introduction

This publication builds upon two cornerstone MobiliseYourCity resources – the SUMP Guidelines (Cleuet & Jehanno, 2023) and the Nine Principles for Climate-Resilient Urban Mobility (ADEME, CODATU, MobiliseYourCity, RESALLIENCE, 2024). While the Guidelines describe the process for developing Sustainable Urban Mobility Plans (SUMPs) and the Principles provide a strategic framework for integrating climate adaptation into mobility planning, this report moves a step further and aims to offer a structured catalogue of measures designed to turn planning into action.

Climate change significantly impacts urban life worldwide. Rising temperatures contribute to sea-level rise, more frequent extreme weather events, and the spread of tropical diseases. These impacts pose increasing risks for critical infrastructure such as road networks, public transport systems, emergency response services, and energy supply. The Intergovernmental Panel on Climate Change (IPCC, 2022) defines adaptation as the process of adjusting to current or expected climate and its effects to reduce harm or seize beneficial opportunities. For urban mobility, adaptation strategies are essential to strengthen the resilience of transport systems and reduce socio-economic impacts, particularly for vulnerable communities in the Global South.

Despite progress in adaptation planning, significant gaps remain between the actions currently implemented and the scale required to effectively reduce risks. Most efforts are still fragmented, small-scale, and incremental, with a strong focus on planning rather than implementation. This catalogue responds to that challenge by providing cities and decision-makers with a practical toolbox to identify, prioritise, and implement adaptation measures across all phases of the SUMP cycle.

Developed within the project "Strengthening the Consideration of Climate Change Adaptation in Urban Planning through Mobility, Transport, and the Built Environment", and financed by ADEME under the MICA-2022 call for projects, this report presents:

- Key concepts and guiding principles for climate change adaptation in urban mobility,
- Links to the SUMP cycle, illustrating where adaptation measures can be embedded,
- A catalogue of "soft", "green", and "grey" measures with details on hazards addressed, transport modes benefited, cost levels, and implementation horizons,
- Recommendations for scaling up adaptation through stakeholder engagement, resource allocation, and policy support.

This project was financed by ADEME (Agence de l'Environnement et de la Maîtrise de l'Energie) as part of the MICA - 2022 call for projects to support the increased consideration of the issue of adaptation to climate change in multilateral international initiatives.

This report is structured to provide a comprehensive guide to integrating climate change adaptation into urban mobility planning. It includes chapters on key concepts and principles, the SUMP cycle, practical adaptation actions, and recommendations for practitioners and public officers. The report aims to serve as a valuable resource for stakeholders involved in urban planning and mobility, fostering a more resilient and sustainable future for cities worldwide.

This report should be cited as:

ADEME, CODATU, MobiliseYourCity, and RESALLIENCE. (2024). Driving Change: Adaptation Actions for Urban Mobility. [M. Gomez, P. Sohouenou (eds.)]. MobiliseYourCity. *Link*

2. Why considering climate change adaptation in urban mobility?

2.1. Climate risk at MobiliseYourCity geographies

Risk in urban mobility, particularly in the context of climate change, is defined as the potential for adverse consequences when valuable assets or systems are threatened. **This risk arises from the interaction of three critical components: vulnerability, exposure, and hazard** (IPCC, 2022). Vulnerability refers to the susceptibility of a community or infrastructure to climate impacts, influenced by factors such as socio-economic conditions and the quality of existing systems (C40 Cities, 2018). Exposure pertains to the **presence of people; livelihoods, ecosystems, services, resources; infrastructure; and economic, social, and cultural assets in locations that may be adversely affected** (IPCC, 2022). Hazards are the climate-related events which can disrupt urban mobility systems. The convergence of these elements determines the overall risk, underscoring the need for comprehensive adaptation strategies to mitigate potential impacts.

Countries in the Global South face higher risks due to elevated vulnerability and exposure. These regions are more susceptible to climate hazards due to their geographical locations, which may include coastal areas prone to flooding or regions experiencing significant temperature increases. Additionally, rapid urbanization and limited resources for infrastructure development exacerbate vulnerabilities, making these areas particularly at risk. The World Risk Index highlights that countries with very high risk are concentrated in North Africa, the Americas, East and Southeast Asia, and Oceania. However, when examining vulnerability and exposure separately, it becomes evident that many countries in Africa, Central and South America, and South and Southeast Asia have very high vulnerability levels. This heightened susceptibility and limited adaptive capacities underscore the critical need for targeted adaptation measures to enhance resilience and protect vulnerable communities from the adverse effects of climate change (Bündnis Entwicklung Hilft & IFHV, 2023).

2.2. Impacts on mobility infrastructure

Effective urban mobility planning is crucial in mitigating the risks associated with climate change. **By integrating adaptation strategies into SUMPs, cities can enhance their resilience and reduce the socio-economic impacts of climate hazards**. This involves addressing immediate risks and anticipating future challenges through holistic planning and stakeholder engagement. Urban mobility planning that considers climate adaptation can ensure that transportation systems remain functional and safe during extreme weather events, supporting the well-being of residents and the continuity of essential services. By fostering collaboration among stakeholders, including policymakers, urban planners, and community members, cities can create more adaptive and resilient mobility systems, contributing to broader sustainability goals and promoting equitable and inclusive urban development in the face of climate change.

Reducing climate risks to infrastructure involves two key strategies[1]:

1. **Locating assets in less exposed areas** (e.g., avoiding construction in floodplains, implement temporary constructions in vulnerable areas if required).
2. **Enhancing the resilience of assets** to withstand and respond to climate impacts. **These strategies are the focus of the actions proposed in this guide**.

[1] Reducing hazards includes reducing GHG emissions globally (mitigation actions) that can be done independently.

While climate-resilient infrastructure reduces disruptions, it cannot eliminate them entirely. Managing risk requires balancing reduction efforts with costs, particularly for high-impact events (UNEP, 2024). Resilience means assessing and managing risks to maintain acceptable performance, ensuring systems can endure and recover from shocks using available information (OECD, 2018).

3. Principles of urban planning and transport to adapt to Climate Change.

Adapting urban planning and transport systems to climate change requires a holistic approach that integrates multiple principles to enhance resilience and sustainability. ADEME, CODATU, MobiliseYourCity, and RESALLIENCE (2024) proposed nine principles for effective adaptation actions, focusing on the connection between urban mobility and the built environment. These principles serve as a foundation for developing and implementing strategies that mitigate the impacts of climate hazards on urban mobility. These principles are expected to be implemented within urban transport planning processes and measures, facilitating adaptation strategies in urban mobility at different levels.

Figure 1.The principles illustrated
Source: own elaboration

By integrating these principles into urban planning and transport systems, cities can enhance their resilience to climate change and promote sustainable and inclusive development. These principles provide a comprehensive framework for developing adaptation strategies that address the complex challenges posed by climate hazards and support the well-being of urban communities.

4. Climate change adaptation and the SUMP cycle.

MobiliseYourCity has developed guidelines for the development of Sustainable Urban Mobility Plans (SUMPs) with a focus on the Global South. The guidelines aim to support urban transport and mobility practitioners, and relevant stakeholders, in developing and implementing a SUMP. SUMP planning is described in four stages with 13 steps. Each phase concludes with a deliverable informing the decision-makers for the subsequent phase, marking the end of the previous phase. The steps and phases are presented in the figure below.

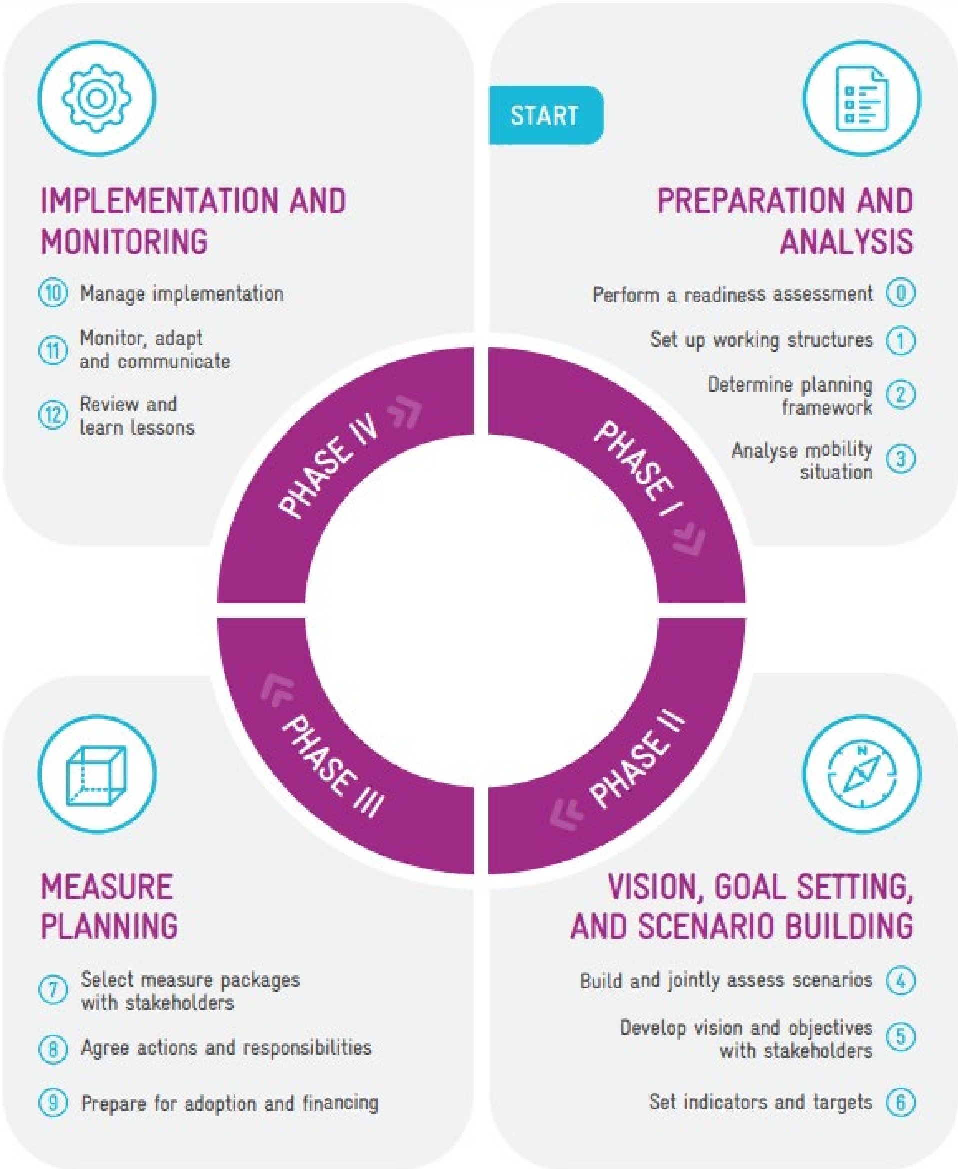


Figure 2. The SUMP Cycle – 4 Phases and 13 Steps
Source: (Cleuet & Jehanno, 2023).

The table below shows how integrating adaptation principles into the SUMP process results in specific actions aligned with each SUMP step.

Phase	Step in the SUMP cycle	Climate adaptation actions to be considered	Most relevant climate adaptation principles
Phase I: Preparation and analysis.	Step 0: Perform a readiness assessment.	Evaluate the climate adaptation context by identifying current and future climate risks threatening the city and reviewing relevant	Develop adaptation solutions informed by local vulnerabilities and capacities. Adopt adaptative governance considering future risks.

Phase	Step in the SUMP cycle	Climate adaptation actions to be considered	Most relevant climate adaptation principles
		climate adaptation policies and regulations.	
	Step 1: Set up working structures.	The Terms of Reference for contracting the consultant, the participatory process, and communication should include climate risks and solutions.	Ensure participatory decision-making. Adopt adaptative governance considering future risks.
	Step 2: Determine the planning framework.	Identify the climate framework, scenarios, horizons, and hazards relevant during the SUMP implementation period (15 to 20 years) and the lifespan of the SUMP actions (10 to 100 years).	Develop adaptation solutions informed by local vulnerabilities and capacities. Adopt a holistic approach considering other urban systems.
	Step 3: Analyse the mobility situation.	Analyse climate change impacts on urban mobility in the targeted city considering primary and secondary information gathered for the SUMP formulation.	Develop adaptation solutions informed by local vulnerabilities and capacities. Consider other sustainable development goals.
Phase II: Vision, goal setting and scenario building.	Step 4: Build and jointly assess scenarios.	Consider climate change impacts and opportunities in the definition of mobility scenarios.	Build resilient infrastructures and operations. Support response and recovery activities via infrastructures and operations. Consider other sustainable development goals. Adopt a holistic approach considering other urban systems.
	Step 5: Develop vision and objectives with stakeholders.	Explicitly mention climate adaptation of urban mobility in the SUMP vision and objectives, indicating the importance of adapting transport systems for the SUMP implementation.	Build resilient infrastructures and operations. Support response and recovery activities via infrastructures and operations. Raise climate risk awareness among decision-makers and the general public.
	Step 6: Set indicators and targets.	Include output, outcome, impact adaptation indicators, and targets supporting the SUMP. The indicators shall be crosscutting to the SUMP measures.	Build resilient infrastructures and operations. Support response and recovery activities via infrastructures and operations.
Phase III: Measure planning.	Step 7: Select measure packages with stakeholders.	Include relevant climate adaptation measures in the measure packages.	Build resilient infrastructures and operations. Ensure participatory decision-making.

Phase	Step in the SUMP cycle	Climate adaptation actions to be considered	Most relevant climate adaptation principles
			Leverage multi-level cooperation and governance.
	Step 8: Agree on actions and responsibilities.	Assess SUMP measures under adaptation scope. Consider climate adaptation funding opportunities for SUMP implementation.	Adopt adaptative governance considering future risks. Leverage multi-level cooperation and governance.
	Step 9: Prepare for adoption and financing.	Ensure the final SUMP document holistically addresses climate adaptation within all its sections.	Raise climate risk awareness among decision-makers and the general public.
Phase IV: Implementation and planning.	Step 10: Manage implementation	The approach to this step is similar to the SUMP guidelines.	
	Step 11: Monitor, adapt and communicate.	Adapt climate adaptation targets and measures based on up-to-date knowledge of climate change impacts.	Adopt adaptative governance considering future risks. Raise climate risk awareness among decision-makers and the general public.
	Step 12: Review and learn lessons	The approach to this step is similar to the SUMP guidelines. Based on the review, the adaptation actions can be modified and updated.	

Table 1. Actions and adaptation principles per SUMP step
Source: own elaboration

The next chapter highlights practical adaptation measures to be incorporated during the formulation and implementation of a SUMP, addressing the hazards and principles presented before.

5. Measures

5.1. Soft, Green and Grey measures

Three sets of adaptation measures are proposed, with their definitions outlined below.

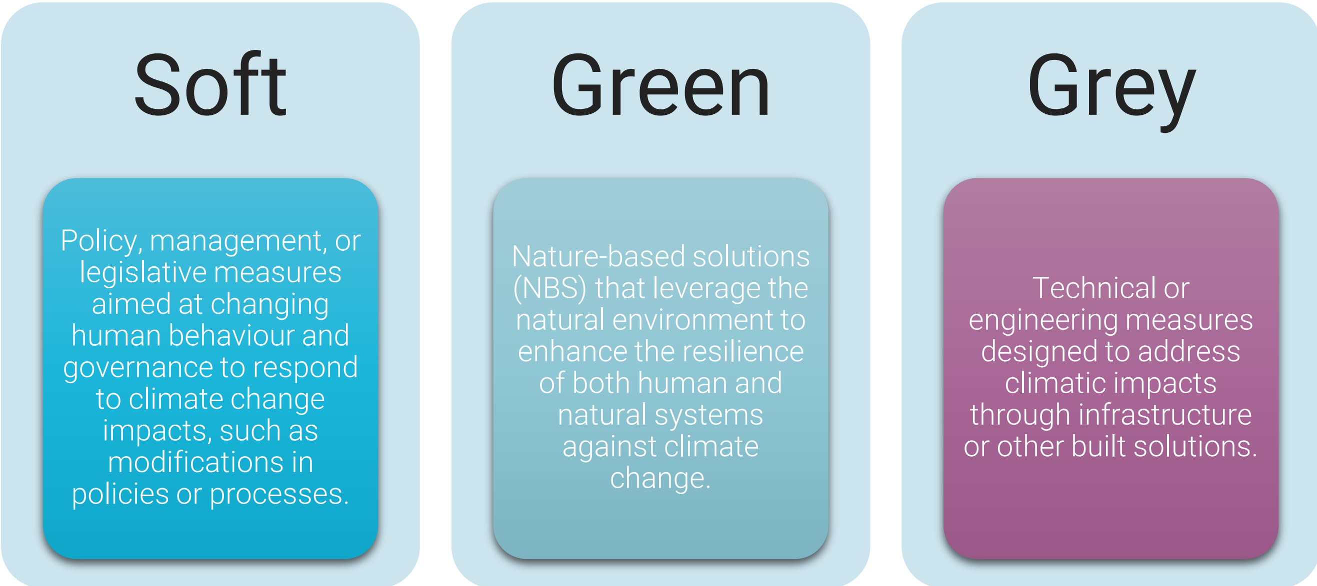


Figure 3. Types of climate adaptation measures
Source: own elaboration based on (Transport Infrastructure Ireland, 2022)

5.2. Measures proposed

The following figure presents the measures proposed divided in soft, green and grey measures.

Soft

- Risk hazard assessment and monitoring
- Assessment of interdependencies and cascading impacts with other sectors
- Include climate adaptation in transport sectorial plans
- Behavioural Adaptation for Climate-Resilient Urban Mobility
- Coordinated Emergency Mobility Response for Climatic Events
- Early warning systems for climate-resilient urban mobility

Green

- Nature-Based Solutions to enhance water retention and rainfall regulation
- Adapting to and reducing Urban Heat Islands
- Nature-Based shoreline adaptations for flood prevention
- Green corridors for active transportation
- Green roofs on transit hubs

Grey

- Engineered shoreline defences for flood mitigation
- Advanced drainage systems for enhanced rainfall management
- Urban transportation flood resilience barrier systems
- Underground tunnels and reservoirs for urban flood resilience
- Cool pavements

Figure 4. Measures considered
Source: own elaboration

5.2.1. Addressed hazards

In the context of climate adaptation, 'hazard' refers to climate-related physical trends and events and their physical impacts as defined by the IPCC (IPCC, 2022). Within MobiliseYourCity geographies, the most relevant hazards are presented below. Considering local circumstances, analysis and evaluations will contribute to assessing the impact of these hazards.

Extreme precipitation | Storm and wind | Extreme cold temperatures | Extreme hot temperatures

Figure 5. Types of climate hazards considered
Source: own elaboration

The measures proposed address the hazards outlined at Figure 5, tailored to the specificities of each measure.

5.2.2. Modes benefited

Each measure specifies the transport modes benefited from its implementation:

Figure 6. Modes considered within the measures
Source: own elaboration

5.2.3. SUMP steps

Each measure specifies the step in which it is expected to be included according to Figure 2. It is anticipated that most measures will be implemented during phases III and IV of the SUMP formulation.

5.2.4. Expected cost

The expected cost for each measure is categorised as follows:

$

- Low cost: Below €500,000
  This category includes analyses, diagnoses, plans, and feasibility studies.

$ $

- Medium cost: Between €500,000 and €5,000,000
  This category includes pilot projects, small scale initiatives, and low-cost interventions.

$ $ $

- High cost: Over €5,000,000
  This category includes major investments in specific adaptation measures, with a strong focus on infrastructure components.

5.2.5. Time horizon

Time horizons considered for the measures include:

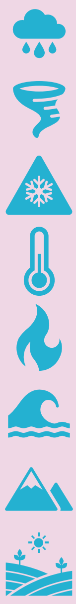
- Short term: Measures completed in less than one year after start

- Medium term: Measures completed between one and three years after start

- Long term: Measures completed in more than three years after start

5.2.6. Summary of measures

The following table presents a summary of the measures including the hazards addressed, the modes benefited, the SUMP steps, the expected costs and the time horizon.

Measure	Hazards addressed	Modes benefited	SUMP step	Expected cost	Time Horizon
Risk hazard assessment and monitoring			Steps 0 and 3	$	
Assessment of interdependencies and cascading impacts with other sectors					
Include climate adaptation in transport sectorial plans			Steps 7, 8, and 10	$	
Behavioural Adaptation for Climate-Resilient Urban Mobility					

Measure	Hazards addressed	Modes benefited	SUMP step	Expected cost	Time Horizon
Coordinated Emergency Mobility Response for Climatic Events			Steps 5, 7, 8, and 10	$	
Early warning systems for climate-resilient urban mobility					
Nature-Based Solutions to enhance water retention and rainfall regulation			Steps 7, 8, and 10	$$	

Measure	Hazards addressed	Modes benefited	SUMP step	Expected cost	Time Horizon
Nature-Based Solutions to enhance water retention and rainfall regulation			Steps 7, 8, and 10	$ $	
Adapting to and reducing Urban Heat Islands			Steps 7, 8, and 10	$ $	
Nature-Based shoreline adaptations for flood prevention			Steps 7, 8, 9, and 10	$ $ $	
Green corridors for active transportation			Steps 7, 8, and 10	$ $	

Measure	Hazards addressed	Modes benefited	SUMP step	Expected cost	Time Horizon
Green roofs on transit hubs			Steps 7, 8, and 10	$ $	
Engineered shoreline defences for flood mitigation			Steps 7, 8, and 10	$ $ $	
Advanced drainage systems for enhanced rainfall management					
Urban transportation flood resilience barrier systems			Steps 7, 8, and 10	$ $	
Underground tunnels and reservoirs for urban flood resilience			Steps 7, 8, and 10	$ $ $	
Cool pavements			Steps 7, 8, and 10	$ $	

Measure	Hazards addressed	Modes benefited	SUMP step	Expected cost	Time Horizon

Table 2. Summary of measures proposed
Source: own elaboration

5.3. Soft measures

Name	Risk hazard assessment and monitoring		
Hazards addressed			
Modes benefited			
SUMP Step	Steps 0 and 3		
Expected cost		**Time horizon**	

Description

A climate risk assessment evaluates the likelihood of future climate-related disasters and their impacts on urban areas and residents, guiding resource allocation to enhance adaptation and resilience. A Climate Action Plan (CAP), climate change diagnosis, or transportation sector analysis can provide critical inputs during the SUMP diagnosis phase. If unavailable, a basic assessment using secondary data may be required. Land-use planning policies must integrate risk assessment and monitoring as a cross-cutting strategy, evaluating risks within the city's geographical scope, including impacts on buildings, the built environment, land-use regulations, and the overall need for climate adaptation. Special attention should focus on vulnerable communities at greater risk. Additionally, planning should address climate impacts alongside mobility demand and supply in new developments, prioritising public transport and non-motorized solutions.

Expected impact

A climate risk assessment evaluates potential impacts on infrastructure, demand, and services while identifying the city's specific needs to inform proposed measures. This process considers anticipated changes in climate events in the study area and is updated regularly based on evidence and implemented measures. The assessment integrates climate trends with multi-hazard risk mapping for the city to prevent adverse effects on the transportation infrastructure, built environment and future developments. It should identify suitable locations for adaptation infrastructure, such as parks, footpaths, cycle paths, and climate shelters.

Example(s)

C40 has developed a climate change risk assessment guidance (C40 Cities, 2018) that provides methodologies and essential data requirements, supplemented by a best practice checklist for comparison. When cities face data or capacity limitations, a Rapid Climate Change Risk Assessment (C40 Cities, 2021) can be conducted, as demonstrated in Dar es Salaam, Tanzania (C40 Cities, 2022). This assessment forms part of the Climate Action Planning Framework (C40 Cities, 2023) and supports the development of CAPs for over 60 cities to align with the Paris Agreement (C40 Cities, 2022).

Surat in India faces significant climate risks, including river and creek flooding and storm surges, exacerbated by reclaimed land impacting tidal behaviour. Surat plans to conduct regular GIS-based spatial analyses of vulnerabilities and risks to enhance resilience, integrating these findings into multi-hazard risk planning. Upgrading its Early Warning System to mitigate flood risks and connecting it to an advanced Emergency Operation Centre (EOC) will ensure better management of new growth areas (Surat Climate Change Trust, 2017).

Additionally, CAF (Development Bank of Latin America and the Caribbean) and AFD (French Development Agency), with EU funding, have developed vulnerability and climate risk studies for several Latin American cities. These studies, conducted in Peru (Trujillo, Arequipa, and Piura), Brazil (Recife, Fortaleza, and São Paulo), Ecuador (Portoviejo and Guayaquil), and Bolivia (La Paz and Tarija), serve as references for replicating methodologies in other urban contexts (CAF, 2023).

Name	Assessment of interdependencies and cascading impacts with other sectors		
Hazards addressed			
Modes benefited			
SUMP Step	Steps 0 and 3		
Expected cost	$	Time horizon	

Description

Understanding the interconnectivity of urban transport with other city systems and anticipating cascading effects within these networks is essential for developing resilient SUMPs. This assessment identifies interdependencies that help integrate measures into the SUMP to minimise cascading effects on mobility and other sectors.

The process begins with an analysis by the SUMP formulation consultant and is further refined through stakeholder workshops. These workshops validate interdependencies with the transport sector and prioritise key sectors for assessment, including water (supply and drainage), ICT systems, energy (electricity and oil), healthcare, food, and solid waste.

The assessment shall be developed according to the city's specificities. For instance, a port town will be more sensible to transport disruptions with higher economic consequences on other economic sectors, such as food distribution and transport of goods required for emergency response.

Expected impact

Assessing interdependencies allows the integration of adaptive measures in the SUMP to address climate impacts on and from the transport sector. This assessment helps identify critical bottlenecks, enhance resilience, and inform other sectors to minimise their exposure to transport disruptions. Additionally, it supports coordinated cross-sectoral planning and optimises resource allocation for climate adaptation.

Example(s)

C40's report on infrastructure interdependencies and climate risks identifies impacts from climate events on transportation and sectoral relationships in food, water, energy, telecom, wastewater, and solid waste sectors. Case studies from cities like Amsterdam, Bogotá, Johannesburg, Melbourne, and Toronto illustrate the cascading effects of transportation disruptions on other sectors (C40 Cities, 2017).

A study on transport resilience explores interconnections between transport systems and critical infrastructure such as water, electricity, ICT, and petroleum. The study examines cascading effects caused by extreme heat, coastal flooding, heavy rainfall, and drought, offering insights into the vulnerabilities of interconnected systems (Markolf, Hoehne, Fraser, Chester, & Underwood, 2019) .

Name	Include climate adaptation in transport sectorial plans		
Hazards addressed			
Modes benefited			
SUMP Step	Steps 7, 8, and 10		
Expected cost	$	Time horizon	

Description

Sectoral plans, such as those for logistics, road safety, non-motorized transport, emergency response, can be integrated into the SUMP measures. These plans should embed climate adaptation into their formulation and actions through the following steps:

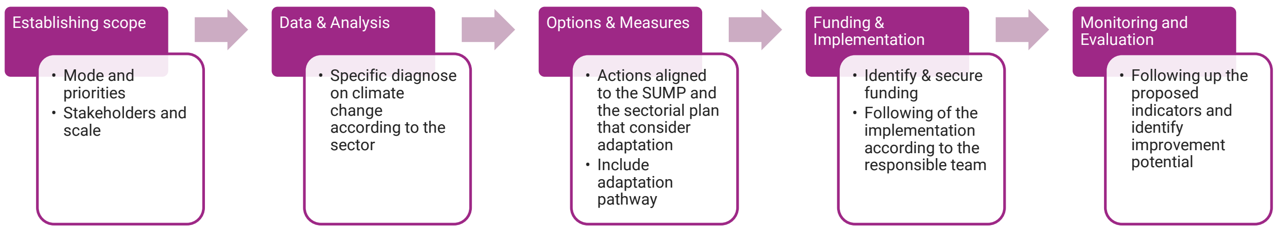


Figure 7. Steps proposed to include climate adaptation within transport sectorial plans

Source: own elaboration based on (University of Birmingham, 2022)

For instance, measures to be included in sectoral plans, with a focus on road safety during and after climatic events, include:

- **Traffic calming measures**: Design 30 km/h zones incorporating nature-based solutions (NBS) like wider, permeable pavements.
- **Climate-aware speed limits**: Implement and enforce speed restrictions during adverse climatic events to enhance system safety.
- **System functionality:** Ensure transport infrastructure maintains critical functionality during and after climate events to support effective emergency responses.

Expected impact

Incorporating climate adaptation as a cross-sectoral component enhances socio-economic benefits, prolongs the lifespan of infrastructure, and ensures resilience to climate impacts.

Example(s)

The World Bank's Guide to Integrating Safety into Road Design (World Bank, 2022):

- Proposes drainage systems managing extreme events while reducing road safety risks.
- Suggests climate-resilient road surfaces designed to absorb water and withstand heat waves.
- Highlights adaptive infrastructure interactions, ensuring safety during climatic events.
- Suggests adaptive speed limits tailored to infrastructure and climatic conditions minimising disruptions.

Name	Behavioural adaptation for climate-resilient urban mobility		
Hazards addressed			
Modes benefited			
SUMP Step	Steps 7, 8, and 10		
Expected cost	$	Time horizon	

Description

Emphasis on the role of behavioural changes in enhancing the resilience of urban transportation systems during extreme weather conditions (UITP, 2024). It aims to mitigate the impacts of heat waves and severe weather by encouraging shifts in travel patterns and promoting sustainable travel modes.

1. **Shift Pattern Adjustments**: Encourage employers and institutions to adjust work and school hours to avoid extreme temperature periods. This can reduce exposure to extreme temperatures and improve comfort and safety for commuters.
2. **Promotion of Active Travel**: Encourage walking, cycling, and other forms of active travel to reduce demand on public transport during peak times. This can be achieved through infrastructure improvements, such as dedicated bike lanes and pedestrian paths, and awareness campaigns highlighting active modes' health and environmental benefits.

Expected impact

The expected impacts include:

- **Reduced extreme temperatures exposure**: By shifting travel times away from the more extreme temperatures parts of the day, commuters can avoid temperature-related health risks, improving overall well-being and productivity.
- **Increased comfort**: Shift pattern adjustments and increased active travel modes can help manage demand for public transport, increasing comfort and improving the efficiency of urban transportation networks.

Example(s)

Spain's legislation, enacted after a record-breaking hot April, mandates employers to adjust working conditions during extreme heat, reducing work hours when weather alerts indicate significant or extreme risk. This measure, which includes financial support for drought-affected businesses, prioritises worker safety and business continuity (World Economic Forum, 2023). Spain fosters a more climate-resilient urban environment by encouraging behavioural adaptations, such as modifying work schedules. This initiative protects workers from heat-related health risks but and supports economic stability in affected regions and sectors. Spain's proactive approach serves as a model for other countries seeking to enhance climate resilience through legislative measures that address the challenges of rising temperatures (Gobierno de España, 2023).

Name	Coordinated emergency mobility response for climatic events		
Hazards addressed			
Modes benefited			
SUMP Step	Steps 5, 7, 8, and 10		
Expected cost	$	Time horizon	

Description

Develop and implement comprehensive emergency response plans to manage urban mobility during severe weather events. These plans should include:

- **Clear communication strategies:** Establish communication channels to inform the public about disruptions, alternative routes, and safety measures. Utilise platforms, including social media, mobile apps, and public announcements, to ensure widespread dissemination of information.
- **Alternative route planning:** Identify and communicate alternative routes that can be used during climatic events to maintain mobility and reduce congestion. Collaborate with local authorities and transport providers to ensure these routes are safe and accessible.
- **Emergency response protocols:** Develop protocols for emergency services to respond swiftly and effectively during severe weather events. This includes coordinating with public transport operators, emergency services, and local authorities to ensure a unified response.
- **Public awareness campaigns:** Conduct awareness campaigns to educate the public about the importance of preparedness and the steps they can take to stay safe during climatic events.

Expected impact

This measure aims to create a resilient urban mobility system that can effectively respond to climatic events, ensuring the safety and well-being of residents while maintaining the functionality of transport services. The expected impacts include:

- **Enhanced safety:** Improved safety for commuters and residents during severe weather events by providing clear guidance and support.
- **Reduced disruptions:** Minimise disruptions to urban mobility by offering alternative routes and ensuring the continuity of transport services.
- **Increased public confidence:** Build public confidence in the city's ability to manage climatic events, fostering a sense of security and preparedness.
- **Efficient resource allocation:** Optimise the use of emergency resources by coordinating efforts across different agencies and stakeholders.

Example(s)

Figure 8. Shanghai 's Advanced Information System
Source: (GIZ, 2025).

The Shanghai Flood Control Information Centre is crucial in managing flood risks in Shanghai by providing real-time data from over 400 monitoring points. This system helps mitigate risks, prevent the spread of rumours, and strengthen disaster preparedness in the city during natural disasters. (GIZ, 2025)

Name	Early warning systems for climate-resilient urban mobility		
Hazards addressed			
Modes benefited			
SUMP Step	Steps 7, 8, and 10		
Expected cost	$ $	Time horizon	

Description

Early warning systems are critical for enhancing the resilience of urban mobility infrastructure in the face of climate change. These systems integrate advanced weather forecasting, real-time data monitoring, and communication technologies to provide timely alerts about impending climate-related hazards such as floods, heatwaves, and severe storms. By enabling initiative-taking responses, early warning systems help urban authorities and communities prepare for and mitigate the impacts of extreme weather. They involve the installation of weather stations, radar systems, and communication networks, along with community engagement and training programs to ensure effective response protocols are in place (UNDRR, 2023).

Expected impact

The expected benefits of the implementation of this measure include (UNDP, 2018):

- Enhanced preparedness: Early warning systems allow for timely evacuation and safety measures, reducing the risk of injuries and fatalities during extreme weather events.
- Minimised disruption: By providing advance notice of potential disruptions, these systems help maintain continuity in transportation services, reducing economic losses and inconvenience to commuters.
- Improved resource allocation: Real-time data enables more efficient allocation of emergency resources ensuring targeted and effective response efforts.
- Community empowerment: Through education and training, early warning systems empower communities to act, fostering a culture of preparedness and resilience.
- Data-driven decision making: The data collected through these systems can inform long-term planning and infrastructure development, ensuring resilient urban mobility solutions.

Example(s)

Bangladesh: The country has implemented a comprehensive early warning system for cyclones and floods, which includes a network of weather stations and community-based alert systems. This system has significantly reduced casualties and economic losses from these frequent natural disasters (CARE, 2022).

Figure 9. SEEDS involvement of the community

Source: (SEEDS, 2025)

Delhi, India: In Delhi, the Sustainable Environment and Ecological Development Society (SEEDS), supported by Microsoft's AI for Humanitarian Action initiative, implemented an early warning system to address extreme heat in vulnerable communities. This system uses AI to identify hyperlocal risk areas and integrates heat advisories from the Indian Meteorological Department. SEEDS introduced cool roof models using recycled materials and a bamboo shelter for community use. The "Beat the Heat" campaign educated residents about heat risks and protective measures, training first responders and encouraging the use of local materials for thermal comfort. This system has significantly enhanced Delhi's preparedness during heatwaves (UN-Habitat, 2024).

5.4. Green measures

Name	Nature-Based Solutions to enhance water retention and rainfall regulation		
Hazards addressed			
Modes benefited			
SUMP Step	Steps 7, 8, and 10		
Expected cost	$ $	Time horizon	

Description

Key actions include:

- **Expanding parks and open green spaces**: Increase permeable areas to absorb rainfall from cloudbursts, reduce surface runoff, and mitigate urban heat effects.
- **Enhancing blue-green infrastructure for drainage:** Upgrade water drainage canals with natural retention areas and vegetated buffers to manage anticipated rainfall patterns, prevent overflow, and improve water quality.
- **Strengthening eco-friendly waste management:** Improve waste collection and implement nature-based filtration systems to prevent blockages, reducing pollution in rivers and drainage networks.

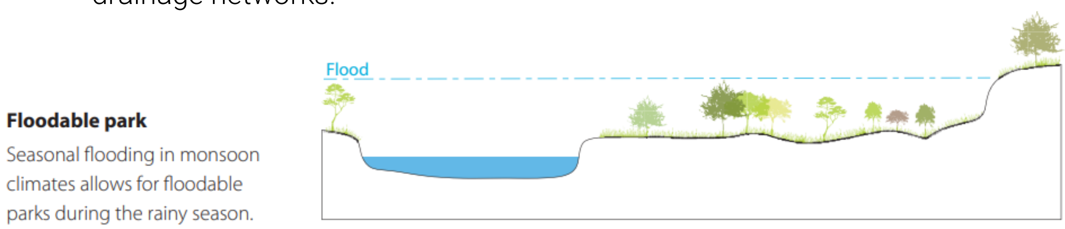


Figure 10. Schematic view floodable park

Source: (AI, 2018)

Expected impact
Implementing NBS to increase water retention capacity will reduce climate risks to the mobility system, including motorways, public transportation, and non-motorized infrastructure during flooding, storms, and heavy rain. These measures also improve urban liveability by creating green spaces that serve as recreational areas for residents and enhance pedestrian and cyclist infrastructure.
Example(s)
The **Green Urban Infrastructure project** in Beira focuses on improving living conditions in the Goto informal settlement by rehabilitating the Chiveve River and developing a sustainable urban park. This project reduced flood risk in the Goto informal settlement, designed green spaces, and provided economic and social opportunities (KFW, 2022). Copenhagen's **Cloudburst Management Plan** is a $1.63 billion, 20-year strategy with 300 projects combining surface and sewage solutions to manage extreme rainfall developed in response to extreme rainfall in 2011. The plan has resulted in direct savings of $700 million, indirect savings of $160 million, increased real estate value of $220 million, and higher municipal tax revenues (Copenhagen, 2012). The **Palmiet Catchment** project in Durban, South Africa, is a collaborative effort between the university, local community, and city government, forming a "community of innovators" to implement the project. It improved waste collection in Quarry Road and advanced flood risk communication via social media. The project reduced drain blockages, minimised flooding risks, and enhanced community preparedness (C40 Cities, 2019).

Name	Adapting to and reducing Urban Heat Islands		
Hazards addressed			
Modes benefited			
SUMP Step	Steps 7, 8, and 10		
Expected cost	$ $	Time horizon	
Description			
Citywide measures to address rising temperatures and the urban heat island (UHI) effect can mitigate impacts on citizens while encouraging increased public transport use and non-motorized travel. Examples of such measures include: • **Tree planting**: Reduces temperatures, mitigates drought effects, prevents landslides in mountainous areas, and sequesters CO2 emissions. • **Infrastructure to reduce heat stress**: Includes nature-based solutions like tree-lined walkways and shaded infrastructure, enhancing comfort for non-motorized modes of transport.			
Expected impact			
Reducing average temperatures and mitigating the heat island effect through urban tree planting can significantly benefit the local and global environment while enhancing citizens' well-being and quality of life.			
Example(s)			

Paris "Îlots de Fraîcheur": Paris has created a network of over 800 cooling islands, including parks, forests, swimming pools, and museums, connected by naturally cool walkways. This initiative relieves the summer heat and is part of the city's climate adaptation strategy, aiming to ensure all residents can reach a cooling island or walkway within seven minutes (Paris, 2024).

Figure 11. Paris water fountains

Source: (Paris, 2024)

Name	Nature-Based shoreline adaptations for flood prevention		
Hazards addressed			
Modes benefited			
SUMP Step	Steps 7, 8, 9, and 10		
Expected cost	$ $ $	Time horizon	

Description

Thanks to their higher elevation, dunes and riverbanks protect shorelines by dissipating waves and shielding against storm surges. They are stabilised with natural grasses or fencing to prevent erosion. While offering a natural alternative to seawalls and dikes, dunes and riverbanks are less stable and vulnerable to rapid erosion during storms and heavy flooding. Dune grass helps prevent erosion but is susceptible to trampling. These systems require ample sand and sediment supply and ongoing maintenance, leading to higher costs.

Design goals include preserving natural systems for storm surge protection, minimising trampling on dune grass, providing access paths, and reducing reliance on engineered infrastructure. Urban development should be limited to areas beyond a second set of dunes to protect the solution's effectiveness, requiring more space, which can be challenging in urban areas.

Figure 12. Retracted development

Source: (Al, 2018)

Expected impact

This measure reduces vulnerability to sea level rise, storms, river floods, and extreme precipitation. It benefits transport infrastructure by minimising disruptions during and after climatic events. During implementation, it is crucial to consider the transport network to ensure that the affected infrastructure is aligned with the city's mobility needs and capacity to respond to climate events.

Example(s)

Rotterdam's dunes and dikes system: Rotterdam is safeguarded by a robust flood defence system combining coastal dunes, river dikes, and flexible barriers that close during storm tides. The system's protection levels range from 1 in 4,000 years in IJsselmonde to 1 in 10,000 years on the north bank of the River Meuse. Mainly situated below sea level and facing significant flood risks, Rotterdam has established some of the highest safety standards globally to mitigate potential catastrophic consequences (City of Rotterdam, 2013).

HafenCity's flood protection concept: HafenCity employs an innovative adaptation of the traditional Dutch terp technique, building infrastructure and modern architecture atop elevated mounds to safeguard against storm surges and sea level rise (KCAP, 2020). Rather than relying on costly seawalls, the strategy integrates elevated infrastructure and buildings with water-level promenades that act as emergency water storage, preserving historical quays and port structures. This

environmentally balanced approach emphasises living with water, addressing current and future climate challenges creatively and sustainably (HafenCity, 2025).

Name	Green corridors for active transportation		
Hazards addressed			
Modes benefited			
SUMP Step	Steps 7, 8, and 10		
Expected cost	$ $	Time horizon	

Description

Green corridors are strategically designed urban pathways that integrate lush vegetation, including trees and shrubs, along major roads and transit routes. These corridors promote active transportation, such as walking and cycling, by providing shaded, comfortable, and safe routes for commuters. By enhancing the urban landscape with greenery, these corridors help mitigate climate change impacts, including urban heat islands and flooding, while improving air quality and supporting biodiversity (Net Zero Cities, 2023).

Green corridors are essential for creating a sustainable and resilient urban mobility infrastructure. They encourage people to adopt active transportation methods and contribute to the overall health and liveability of urban environments. Integrating green spaces into mobility infrastructure reduces carbon emissions by promoting non-motorized transport and enhances the aesthetic appeal of urban areas, making them more inviting for pedestrians and cyclists (Rasli, Lui Juhari, & Abdul Halim, 2025).

Expected impact

- Encourages active transportation: By providing shaded and pleasant routes, green corridors make walking and cycling more attractive, reducing reliance on cars and lowering carbon emissions.
- Improves air quality: Trees and plants along these corridors filter pollutants, contributing to cleaner air in urban environments, which benefits both commuters and residents.
- Enhances biodiversity: Green corridors support local ecosystems by providing habitats for birds, insects, and other wildlife, contributing to urban biodiversity.
- Manages stormwater: Permeable surfaces and vegetation in green corridors absorb and filter rainwater, reducing runoff and the risk of flooding in urban areas.
- Promotes health and well-being: Access to green spaces has been linked to improved mental and physical health, making urban environments more liveable and enjoyable for residents.

Example(s)

Medellín "Corredores Verdes": Since 2016, Medellín has developed 30 "Corredores Verdes", an interconnected network of green spaces enhancing urban biodiversity, reducing the urban heat island effect, and improving air quality by absorbing pollutants from busy streets (Alcaldía de Medellín, 2025). The project also sequesters CO2 through the growth of new vegetation. This initiative has reduced the city's average temperature by 2°C while further connecting existing green spaces (Global Center for Adaptation, 2019).

Figure 13. Corredor Verde in Medellín

Source: (Alcaldía de Medellín, 2025).

Name	Green roofs on transit hubs		
Hazards addressed			
Modes benefited			
SUMP Step	Steps 7, 8, and 10		
Expected cost	$ $	Time horizon	

Description

Green roofs on transit hubs involve installing vegetated roofing systems on bus stations, train depots, and other major transportation centres. These roofs support plant life, absorb rainwater, and provide insulation, contributing to the sustainability and resilience of urban mobility infrastructure. By integrating green roofs into transit hubs, cities can mitigate climate change impacts, including urban heat islands and flooding, while enhancing air quality and promoting biodiversity. Constructed with a layered system including a waterproofing membrane, drainage layer, growing medium, and vegetation, green roofs typically feature hardy, low-maintenance plants. They enhance the aesthetic appeal of transit hubs and provide functional benefits for sustainable urban development. (Barriuso & Urbano, 2021).

Expected impact

- Improved stormwater management: Green roofs absorb and retain rainwater, reducing runoff and the risk of flooding in urban areas. This is particularly important for transit hubs, which are often located in densely built environments with limited permeable surfaces.
- Reduced UHI Effect: The vegetation on green roofs helps mitigate urban heat islands by providing shade and cooling the surrounding areas through evapotranspiration. This creates a more comfortable environment for commuters and reduces the energy required for cooling buildings.
- Enhanced air quality: Green roofs filter air pollutants, contributing to cleaner air in and around transit hubs. This benefits both commuters and residents, promoting healthier urban environments.
- Energy savings: The insulating properties of green roofs help regulate the temperature inside transit hubs, reducing the need for heating and cooling, lowering energy consumption.
- Biodiversity support: Green roofs provide habitats for birds, insects, and other wildlife, supporting local biodiversity in urban areas. This contributes to the overall ecological health of the city.
- Aesthetic and recreational benefits: Green roofs enhance the visual appeal of transit hubs and can be designed to include recreational spaces for commuters, improving the overall user experience.

Example(s)

Figure 14. Utrecht Green Roof

Source: (ArchDaily, 2019)

Utrecht green roofs: In Utrecht, Netherlands, 316 bus stops were transformed with "green roofs" covered in sedum flowers and other plants, creating an oasis for bees and providing numerous environmental benefits. These green roofs absorb rainwater, capture pollutants, regulate temperatures, reduce noise pollution, and improve air quality. Additionally, the bus stops feature bamboo benches and energy-efficient LED lights. The city encourages residents to adopt similar green initiatives by offering subsidies for installing green roofs on their homes. This project supports biodiversity and urban beautification and raises awareness about the importance of protecting pollinators like bees (World Economic Forum, 2019).

5.5. Grey measures

Name	Engineered shoreline defences for flood mitigation		
Hazards addressed			
Modes benefited			
SUMP Step	Steps 7, 8, and 10		
Expected cost	$ $ $	Time horizon	
Description			
Grey infrastructure solutions like seawalls, revetments, breakwaters, floodwalls, and dikes protect urban mobility systems from climate change impacts. Seawalls and floodwalls are vertical barriers that prevent flooding and storm surges, often integrating public spaces like parks or walkways. Revetments are sloped structures made of stone or concrete that absorb wave energy and stabilise shorelines. Breakwaters reduce wave impact and erosion offshore, while dikes, often with roads or pathways, serve as embankments for flood protection (Al, 2018).			
Expected impact			
These solutions reduce vulnerability to flooding, storms, and erosion, ensuring the resilience of transportation systems. They protect critical infrastructure, minimising disruptions during extreme weather. Thoughtfully designed seawalls and floodwalls enhance urban spaces and support recreation. Breakwaters and revetments protect infrastructure and habitats, while dikes improve connectivity with integrated mobility features. These measures strengthen urban mobility systems and support broader community and ecological needs.			
Example(s)			
Ho Chi Minh Flood Protection system: Ring dikes are built to protect high-risk areas in the city, integrating with the ring road for better resilience. Redevelopment of outdated harbours will incorporate multipurpose and stepped dikes, combining floodplain parks with urban spaces. The plan also preserves Saigon River's floodplains to enhance water flow and retention capacity, reducing flood risks (World Bank, 2015).			

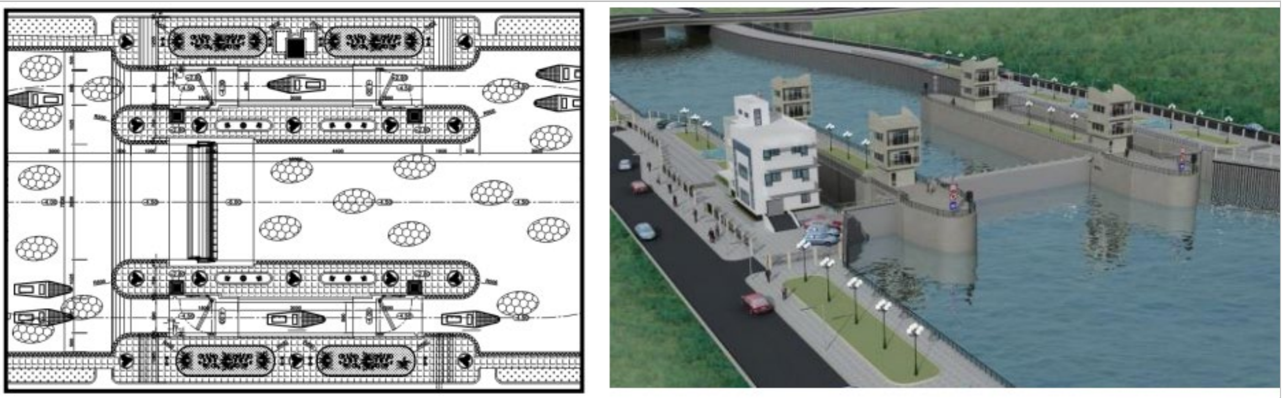


Figure 15. Perspective view of Nuoc Len tidal sluice gate

Source: (EXP, 2015)

Name	Advanced drainage systems for enhanced rainfall management
Hazards addressed	
Modes benefited	
SUMP Step	Steps 7, 8, and 10
Expected cost	$ $ $ | Time horizon

Description

Grey infrastructure built to improve water retention, regulation and drainage after storms, river floods or sea level rise including:

- **Floodable squares:** Lowered urban areas that become pools during heavy rainfall or flooding from the sea or river. They can be used for stormwater storage in inner cities and function on the river shore or seaside. As water levels change, the square becomes partially or fully flooded. A water square can also function as an urban public space as those areas can be used for sports and recreation during dry conditions.
- **Enhancing drainage capacity**: Upgrading and expanding drainage systems and pipes in roads, sidewalks, and other urban infrastructure to better handle rainfall and prevent flooding.

Expected impact

Having areas to retain and regulate water reduces maximum discharge rates and potential consequences of floods that affect the transportation system. On the other hand, enhancing drainage capacity through upgraded pipes and drainage systems increases its capacity and prevents floods in regulated areas and consequences for the transportation system and city inhabitants.

Example(s)

The **Waterplein Benthemplein** in **Rotterdam** integrates features such as a skateboard basin and basketball court, transforming an under-performing square, and addressing the rain and stormwater hazards in the ZoHo district-wide climate-proofing plan. It has a water storage capacity of 1.800 m3, an area of 5,500 m2 and was completed in 2013 at 4 million EUR (Peinhardt, 2021). The design of Waterplein Benthemplein is defined by three main stormwater management basins and their corresponding catchment areas, which double as space for public use. The basins' design addresses flooding and drought in that they store water and release it slowly into the soil and nearby Noordsingel waterway, rather than diverting it into often overwhelmed sewerage systems. (De Urbanisten, 2025)

Figure 16. Watersquare Benthemplein

Source: (De Urbanisten, 2025)

The **Climate Tile** in **Copenhagen** reintroduces the natural water circuit in the existing cities by collecting rainwater from roofs and sidewalks reducing the risk for damages coursed by the rain. The water is used as a positive supplement to the city's drainage system, the flow of water to the existing sewers is reduced significantly and thereby create savings on new facilities and expansions of the existing water management in the cities. This solution is complemented with trees planted along the sidewalk that consume part of the water captured by the tile (Tredje Natur, 2024).

<table>
<tr><th>Name</th><th colspan="3">Urban transportation flood resilience barrier systems</th></tr>
<tr><td>Hazards addressed</td><td colspan="3"></td></tr>
<tr><td>Modes benefited</td><td colspan="3"></td></tr>
<tr><td>SUMP Step</td><td colspan="3">Steps 7, 8, and 10</td></tr>
<tr><td>Expected cost</td><td>$ $</td><td>Time horizon</td><td></td></tr>
<tr><td colspan="4">Description</td></tr>
<tr><td colspan="4">Flood Barrier Systems are engineered solutions designed to protect transportation networks in vulnerable urban areas from flooding. These systems can be either temporary or permanent, tailored to the specific flood risk of the location. Temporary barriers, such as inflatable dams or modular flood walls, can be deployed during emergencies to block floodwaters, while permanent installations, like floodgates and levees, provide continuous protection for critical infrastructure. By strategically placing these barriers along roads, railways, and transit hubs, cities can prevent inundation, ensuring the continuity of transportation services and safeguarding communities from the impacts of extreme weather events.</td></tr>
<tr><td colspan="4">Expected impact</td></tr>
<tr><td colspan="4">• Infrastructure protection: Shields roads, railways, and transit hubs from flood damage, reducing repair costs and maintaining operational capacity.
• Mobility continuity: Ensures that transportation routes remain functional during flood events, minimising disruptions to daily commutes and emergency services.</td></tr>
</table>

- **Economic resilience**: Reduces the economic impact of flooding by protecting businesses and residential areas connected to transportation networks.
- **Community safety**: Protects urban populations from flood-related hazards, including health risks associated with contaminated water and displacement.
- **Environmental benefits**: Helps maintain ecological balance by preventing floodwaters from carrying pollutants into natural habitats and waterways.

Example(s)

Copenhagen Metro System: Floodgates can be deployed to protect metro stations and tunnels from water ingress during heavy rainfall. These barriers can be closed to prevent water from overwhelming the system, ensuring that metro operations remain unaffected. Other additional measures in the metro system include underground tunnels, and green infrastructure. (Climate ADAPT, 2020)

Figure 17. Flooding gates in a metro station in Copenhagen

Source: (Climate ADAPT, 2020)

Name	Underground tunnels and reservoirs for urban flood resilience		
Hazards addressed			
Modes benefited			
SUMP Step	Steps 7, 8, and 10		
Expected cost	$ $ $	Time horizon	

Description

The construction of underground tunnels and reservoirs is a strategic measure to enhance the resilience of urban transportation systems against flooding. These structures are designed to collect and manage excess rainwater, preventing it from overwhelming drainage systems and disrupting transportation networks. By diverting water away from critical infrastructure, these tunnels and reservoirs help maintain the operational integrity of metro systems, roads, and other essential services during heavy rainfall events.

Expected impact

- **Increased flood protection:** Reduces the risk of flooding in urban areas by providing additional capacity to handle excess rainwater.
- **Improved transportation reliability:** Ensures that metro systems and other transportation networks remain operational during extreme weather events.
- **Enhanced urban resilience:** Contributes to the overall resilience of the city by mitigating the impacts of climate change-related flooding.

- **Environmental benefits:** Helps manage water resources more effectively, reducing the environmental impact of flooding.

Example(s)

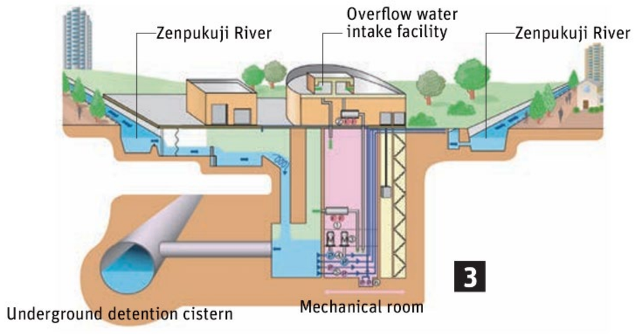


Figure 18. MAOUDC schematic view

Source: (World Bank, 2019)

Tokyo, Japan: The Metropolitan Area Outer Underground Discharge Channel (MAOUDC), also known as G-Cans, is a monumental underground flood control system in Tokyo, Japan. Completed in 2006 after 13 years of construction, it is the world's largest underground floodwater diversion facility, designed to protect the city from flooding caused by heavy rainfall and typhoons.

The system has dramatically reduced flooding in the city, showcasing Japan's advanced engineering capabilities and commitment to urban resilience. The construction of the MAOUDC involved extensive planning and collaboration among various stakeholders, ensuring that it meets the city's complex flood management needs.

Name	Cool pavements		
Hazards addressed			
Modes benefited			
SUMP Step	Steps 7, 8, and 10		
Expected cost	$ $	Time horizon	

Description

Cool pavements are innovative surfaces designed to mitigate urban heat by reflecting sunlight and reducing heat absorption. Made from materials like concrete or asphalt with high albedo or permeability, they lower surface temperatures significantly. These pavements enhance thermal comfort, reduce energy use for cooling, and manage stormwater by allowing water infiltration. Implementing cool pavements can transform urban landscapes into more resilient and sustainable environments, particularly beneficial during heatwaves.

Expected impact

- **Reduced Urban Heat Island Effect:** By reflecting more sunlight, cool pavements can lower surface and air temperatures, mitigating the urban heat island effect.
- **Improved Comfort and Health:** Lower temperatures can improve thermal comfort for pedestrians and reduce heat-related health risks, especially for vulnerable populations.
- **Energy Savings:** Reduced heat absorption can lead to lower energy consumption for cooling buildings, contributing to energy savings and reduced greenhouse gas emissions.
- **Stormwater Management:** Permeable cool pavements can help manage stormwater runoff by allowing water to infiltrate the ground, reducing the risk of flooding.

Example(s)

Figure 19. Cool pavement in Los Angeles

Source: (RIBA Journal, 2017)

Los Angeles, California: In Los Angeles' Pacoima neighbourhood, a year-long study demonstrated that reflective pavement coating significantly reduced temperatures, with over 700,000 square feet of asphalt covered, resulting in ambient air temperatures up to 1.9°C cooler during extreme heat events and surface temperatures up to 5.6°C lower. Residents noted improved thermal comfort, especially in parks. While effective, some experts argue that increasing shade remains the best protection against heat. The study highlights cool pavements as a valuable tool in mitigating urban heat islands, complementing broader strategies that include shade solutions (SmartcitiesDive, 2024). Cool pavements, designed to reflect solar energy and enhance water evaporation, contribute to improved air quality, energy savings, and pavement durability, while also managing stormwater by reducing runoff temperature (EPA, 2025).

6. The way forward

The measures proposed can contribute to upscale adaptation in urban mobility in cities in the Global South within SUMP formulation and implementation framework. To accelerate the consideration of these measures the following strategies are suggested:

Integration into SUMP Cycle

Ensure that the proposed measures are integrated into the SUMP cycle. This involves identifying the appropriate steps within the SUMP framework where each measure can be implemented. For instance, measures related to risk assessment and monitoring should be included in the early phases of the SUMP cycle, such as the readiness assessment and mobility situation analysis.

Stakeholder engagement

Engage with stakeholders, including policymakers, urban planners, and community members, to ensure participatory decision-making. This collaboration is crucial for the successful deployment of adaptation measures, as it fosters a sense of ownership and commitment among stakeholders.

Resource allocation

Allocate resources effectively by categorizing measures based on their expected costs (low, medium, high) and time horizons (short, medium, long term). This will help in prioritising measures and ensuring that funding is directed towards the most impactful initiatives.

Monitoring and evaluation

Implement a robust monitoring and evaluation framework to assess the effectiveness of the deployed measures. This includes setting clear indicators and targets for each measure and regularly reviewing progress to make necessary adjustments.

Communication and awareness

Develop clear communication strategies to inform the public about the measures being deployed, their benefits, and how they can contribute to climate resilience. Utilise various platforms, such as social media, mobile apps, and public announcements, to ensure widespread dissemination of information.

Capacity building

Build capacity among local authorities and transport providers to manage and maintain the deployed measures. This includes training on emergency response protocols, maintenance of adaptation infrastructure, and the use of new technologies for monitoring and evaluation.

Policy and regulatory support

Ensure that the deployment of measures is supported by relevant policies and regulations. This may involve advocating for policy changes or the development of new guidelines that facilitate the implementation of adaptation measures.

Leverage technology

Utilise advanced technologies, such as real-time data monitoring systems and AI-driven early warning systems, to enhance the effectiveness of the deployed measures. For example, the Shanghai Flood Control Information Centre uses real-time data to manage flood risks and strengthen disaster preparedness.

By following these recommendations, you can effectively deploy the measures proposed in section 5 and contribute to creating more resilient and sustainable urban mobility.

Abbreviations

ADEME	Agence de l'Environnement et de la Maîtrise de l'Energie
AI	Artificial Intelligence
AFD	Agence Française de Développement
CAF	Development Bank of Latin America and the Caribbean
CAP	Climate Action Plan
CODATU	(COopération pour le Développement et l'Amélioration du Transport Urbain et périurbain)
C40	C40 Cities Climate Leadership Group
EOC	Emergency Operation Centre
EU	European Union
GlobalABC	Global Alliance for Buildings and Construction
GIZ	German International Cooperation Society
ICT	Information and Telecommunication Technology
IPCC	Intergovernmental Panel on Climate Change
MAOUDC	Metropolitan Area Outer Underground Discharge Channel
NBS	Nature Based Solutions
SEDDS	Sustainable Environment and Ecological Development Society
SUMP	Sustainable Urban Mobility Plan
UHI	Urban Heat Island
UITP	Union Internationale des Transports Publics
UNDP	United Nations Development Programme
UNDRR	United Nations Office for Disaster Risk Reduction
UNEP	United Nations Environment Programme

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