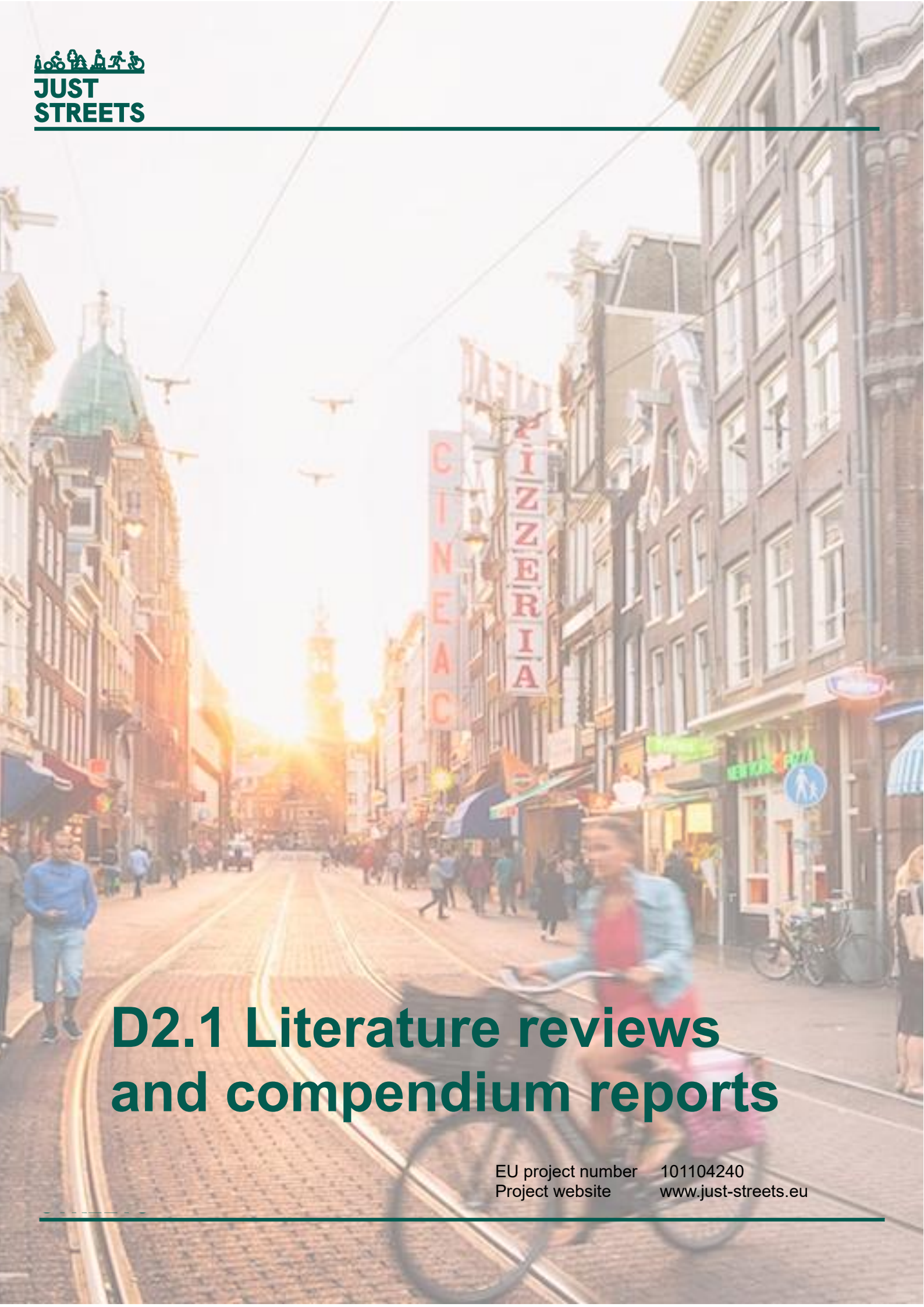




D2.1 Literature reviews and compendium reports

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Authorship and Contributions

This deliverable was authored collaboratively. Enrica Papa (University of Westminster) and Sabina Cioboata (University of Westminster) are the authors of Chapters 1, 2, 3, 4, and 9, as well as the overall coordination of the report. Wendy Tan (Hogeschool van Amsterdam) and Dipanjan Nag (Hogeschool van Amsterdam) authored Chapter 5. Stefania Mauro, Federica Raiti and Andrea Rosso (LINKS Foundation) authored Chapter 6. Jonne Silonsaari (University of Amsterdam) and Marco te Brömmelstroet (University of Amsterdam) are the authors of Chapter 7. António Ferreira, Silvia Spolaor, and Cecilia Silva (Universidade do Porto) authored Chapter 8.



About JUST STREETS

The JUST STREETS project focuses on developing streets shaped by active mobility that are both sustainable and inclusive for all citizens. This shift from the use of cars towards more active modes of mobility will be led by prioritizing the needs and visions of marginalized social groups often not involved in the planning processes, particularly women, migrants, the elderly, LGBTQI+ individuals, and people with disabilities.

Goal of the strong international consortium is to support 12 cities in revolutionizing public spaces and streets by putting all of its citizens first. The project addresses the pressing need to transform our streets both from an infrastructural as well as behavioural perspective, shifting away from car-centric environments towards streets that cater to the needs of all citizens.

JUST STREETS is a 32-partner international Horizon Europe project coordinated by the Future Cities and Communities division of Turin-based LINKS Foundation and scheduled from January 2024 to June 2027. Partner cities include the cities of Amsterdam (Netherlands), Braga (Portugal), Cugir (Romania), Haifa (Israel), Kozani (Greece), Milan (Italy), Riga (Latvia), Southwark (UK), Vilnius (Lithuania), Vratsa (Bulgaria), Westminster (UK), and Zaragoza (Spain).

Expert partners of the JUST STREETS consortium are Fondazione LINKS (Italy), Agenzia TPL (Italy), Centro Studi Pim (Italy), Climate Alliance (Germany), European Cyclists' Federation (Belgium), Fundación CIRCE (Spain), International Federation of Pedestrians (Belgium), IT University of Copenhagen (Denmark), Politecnico di Torino (Italy), RINA Consulting (Italy), SocialFare (Italy), Southeast European Technological Company – SETECHCO (Bulgaria), Technical University of Cluj-Napoca (Romania), TECHNION – Israel Institute of Technology (Israel), TREDIT (Greece), University of Amsterdam (Netherlands), University of Porto (Portugal), University of Westminster (UK), Urban Future (Austria), and Western Norway University of Applied Sciences (Norway).

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Executive Summary

Across Europe and beyond, cities are being called to transform their streets, not only to meet sustainability and climate goals, but to create safer, healthier, more inclusive public spaces for all. Yet despite growing commitments to “equitable” or “people-centred” mobility, translating these ambitions into practice remains a challenge. How can justice be meaningfully embedded into the design, planning, governance, and everyday experience of urban streets? How can street transformations address (not reproduce) the inequalities that shape who moves, who stays, who belongs, and who is heard?

This deliverable seeks to answer these questions by offering a set of actionable ideas, frameworks, and strategies for achieving just streets. It builds on the central premise that justice must be understood not only as a desirable outcome, but as a process, a practice, and a pathway for transformation. Street justice is not something achieved at the end of a project; it must be embedded in every phase, from identifying needs and setting priorities to designing interventions, experimenting with alternatives, and institutionalising change.

Drawing on examples from European countries, a review of good practices, and insights from behavioural science, participatory design, intersectional analysis, and transition studies, this deliverable translates complex concepts into practical tools for urban and transport planners, city officials, community organisations, and decision-makers. Rather than offering a one-size-fits-all blueprint, it provides a flexible, adaptable approach that can be tailored to different contexts while guided by shared justice principles.

The report is structured around five key dimensions of street justice:

1. **Participation and Co-Creation:** Exploring participatory processes as a justice mechanism, moving beyond consultation to empower communities as co-creators of change.
2. **Understanding Needs, Behaviours, and Habits:** Mapping diverse and intersectional user needs as the foundation for inclusive design and policy.
3. **Enabling Behaviour Change:** Applying behavioural science frameworks (COM-B and the Behaviour Change Wheel) to design interventions that address structural, social, and psychological barriers to active mobility.
4. **Prefigurative Planning and Design:** Using experimental, temporary, and imaginative interventions to prototype and experience alternative street futures in the here and now.
5. **People-Friendly Technology:** Harnessing digital tools and smart systems to support, rather than undermine, more equitable and inclusive street environments.

At its core, this deliverable invites practitioners and policymakers to view street transformation as a collective, iterative, and reflective journey, one that requires courage to question the status quo, creativity to imagine new possibilities, and commitment to act in ways consistent with the values of justice. It argues that just streets emerge not only from what is built, but from how we build, with whom, and for whom.



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List of Acronyms

BCW	Behaviour Change Wheel
COM-B	Capability, Opportunity, Motivation – Behaviour (model)
DIBIS	Dimensions of Inclusion, Balance, Integration, and Sustainability (framework)
EU	European Union
GIS	Geographic Information Systems
LGBTQIA+	Lesbian, Gay, Bisexual, Transgender, Queer/Questioning, Intersex, Asexual and others
NGO	Non-Governmental Organization
SDG	Sustainable Development Goal
STARS	Sustainable Travel Accreditation and Recognition for Schools
UN	United Nations
WHO	World Health Organization

Glossary

Actionable Ideas Actionable ideas are concrete, practical strategies that can be directly implemented to achieve specific goals. In the context of street transformations, actionable ideas translate abstract principles — such as justice, participation, or inclusion — into tangible steps, methods, or interventions that planners, city officials, and communities can apply in real-world projects. They bridge the gap between theory and practice, offering clear guidance on how to activate change through engagement, co-creation, and collaboration.

Active Mobility Forms of human-powered transport such as walking, cycling, and wheeling (including wheelchairs and other mobility devices), often promoted as sustainable, healthy alternatives to motorised travel.

Behaviour Change Wheel (BCW) A framework developed by Michie et al. (2011) to design effective behaviour change interventions. It integrates the COM-B model (Capability, Opportunity, Motivation – Behaviour) with intervention strategies such as education, persuasion, enablement, and environmental restructuring.

Capability Approach A theoretical framework developed by Amartya Sen and Martha Nussbaum that focuses on what people are actually able to do and be, rather than just the resources they have. In mobility, it highlights whether people have real opportunities to move and access the city.

Care Mobilities A concept recognising that travel related to caregiving (e.g. escorting children, helping the elderly) is often undervalued in transport planning, despite being essential to everyday life and disproportionately carried out by women.

COM-B Model A behaviour change framework that explains human action through three components: Capability (physical and psychological), Opportunity (physical and social), and Motivation (reflective and automatic).



Co-creation A participatory process in which citizens, stakeholders, and professionals collaborate equally to design, plan, and implement urban interventions. It goes beyond consultation by sharing power and responsibility.

Distributive Justice A principle of justice concerned with the fair allocation of resources, space, risks, and benefits. In the context of streets, this refers to who gets access to safe, comfortable, and convenient infrastructure.

DIBIS Framework A tool to evaluate digital mobility technologies based on Dimensions of Inclusion, Balance, Integration, and Sustainability. It encourages ethical, people-centered technological innovation (te Brömmelstroet et al., 2023).

Epistemic Justice The fair recognition and inclusion of different types of knowledge, including local and experiential knowledge, in planning processes and decision-making.

Equity vs Equality Equality treats everyone the same, whereas equity recognises different needs and allocates resources accordingly to achieve fair outcomes.

Intersectionality An analytical framework for understanding how multiple aspects of identity—such as race, gender, class, age, and disability—intersect and compound to shape experiences of (in)justice and exclusion in urban mobility.

Just Streets An approach to street transformation that prioritises equity, inclusivity, and community empowerment. It incorporates four justice principles: distributive, procedural, recognition, and restorative.

Living Lab A real-world testing environment in which users, researchers, and public institutions co-develop and evaluate innovations. In the mobility context, this often involves street experiments or pop-up interventions.

Mobility Justice A framework that examines how mobility systems reinforce or challenge social inequalities. It includes concerns about access, safety, recognition, historical injustices, and participation in decision-making (Sheller, 2018; Martens, 2016).

Pedibus / Bike Bus (Bicibús) A group of children walking or cycling to school together along a fixed route, often accompanied by adults. These are safe, social, and environmentally friendly alternatives to car school runs.

People-friendly Digital Technologies Digital tools designed to support inclusive and equitable mobility—such as participatory GIS, real-time information systems, and accessibility apps—while avoiding exclusionary or surveillance-based practices.

Placemaking A planning and design approach that focuses on creating vibrant, inclusive public spaces where people want to spend time. Often involves community participation and temporary or tactical interventions.

Prefigurative Planning A forward-looking design approach that uses temporary or symbolic projects (e.g. pop-up parks, PARK(ing) days) to prototype and demonstrate alternative futures for streets and public space.

Procedural Justice Fairness in the decision-making process. This includes transparency, participation, and the opportunity for all groups—especially those most affected—to have a meaningful voice.

Recognition Justice The acknowledgement and valuing of diverse identities, needs, and ways of moving through urban space, especially those that have historically been ignored or marginalised.



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Restorative Justice (Urban) An approach that seeks to repair historical and systemic injustices—such as planning decisions that harmed specific communities—through targeted investments, reparative design, or participatory redevelopment.

Tactical Urbanism

Low-cost, temporary changes to the built environment (e.g. pop-up bike lanes, parklets) intended to catalyse long-term transformation and engage community input.

Targeted Universalism A policy approach that sets universal goals (e.g. safe access to transport) but uses targeted strategies to help different groups reach that goal, ensuring no one is left behind.

Universal Design A design philosophy that ensures environments are accessible to all people, regardless of age, ability, or background. Examples include step-free access, tactile paving, and audible signals.



1. Introduction

Across European cities, streets are undergoing a moment of critical transformation. No longer seen only as conduits for traffic or technical corridors for infrastructure, they are increasingly recognised as public spaces where health, social interaction, climate resilience, and liveability converge. From the climate crisis and air pollution to inequality and exclusion, some of the most urgent urban challenges play out on our streets, and this is where many of the solutions must begin. Deliverable D2.1 responds to this evolving understanding of streets by offering a practical and evidence-based resource for practitioners. It compiles actionable ideas, emerging methods, and illustrative cases to support cities in creating more inclusive, vibrant, and people-centred street environments. Drawing from a wide range of disciplines (urban planning, mobility studies, behavioural science, social innovation, and technology) this report is intended to bridge the gap between theory and practice. While the concept of justice in mobility and public space has received growing academic attention in recent years, most work remains highly theoretical, focusing on normative frameworks, ethical debates, and high-level policy critiques (Lucas, 2012; Sheller, 2018). There is a significant gap in studies that explore how justice is implemented in practice - especially at the scale of streets, where every day experiences of inclusion, exclusion, risk, and opportunity are most visible. Similarly, in the field of planning, justice principles lack concrete guidance on how to shape design choices, engagement methods, and institutional processes. In practice questions such as who benefits, who is left out, and whose voices shape street transformations are still rarely integrated into project development or evaluation tools. Moreover, while promising practices exist across Europe, they are fragmented and not yet part of a shared knowledge base accessible to practitioners.

This deliverable helps fill these gaps by offering a grounded, practice-oriented contribution to the field of street justice. It seeks to address the following problem:

How can the concept of justice, often theorised but rarely operationalised, be translated into practical frameworks, methods, and tools for the planning, design, and governance of urban streets?

This research question is especially urgent because it addresses a critical blind spot in current street transformation agendas: while many initiatives aim to reclaim street space for environmental and social goals, few offer pathways for embedding justice in the everyday practices, decisions, and institutional routines that govern these changes. Furthermore, this work contributes to the literature not simply by applying justice concepts to a new domain, but by interrogating how justice can be co-produced, negotiated, and sustained through iterative, participatory, and experimental processes at the street level.

Why focus on streets?

In this report, **streets are defined as multifunctional urban spaces** that simultaneously operate as mobility corridors and public places, structuring the spatial, social, and economic life of cities, towns, and suburban settlements. This definition encompasses a diverse range of street typologies, including residential streets, local connectors, commercial high streets, and major arterial roads, each shaped by overlapping transport, land use, and social functions. Drawing on the 'Link and Place' framework (Jones et al. 2007), we emphasise streets as spaces where the intrinsic tension between movement functions (links) and place functions (destinations of social interaction and activity) is most pronounced and consequential for urban equity, accessibility, and everyday experience. The dual role of streets, as transport arteries and as public spaces, creates inherent conflicts, particularly over the allocation of space, time, and priority among different users and uses.



It is precisely on streets that these contradictions manifest most clearly and most frequently: every day, decisions are made (both formally through planning and informally through use) about whose needs streets serve, whose movements are facilitated or hindered, and whose presence is legitimised or marginalised.

By focusing on streets, we address the material and symbolic spaces where mobility and spatial justice are continuously negotiated and contested. In that sense, streets are not neutral infrastructures; they are political spaces where issues of access, recognition, safety, exclusion, and belonging play out daily. Reimagining streets therefore offers a strategic and visible entry point to address broader urban injustices, making visible, tangible changes that impact people's everyday experiences of the city.

Who is this report for?

This report is intended for all those involved in shaping, governing, using, or contesting the everyday life of streets, where questions of access, safety, visibility, and justice are constantly negotiated. As such, professionals and organisations that influence street environments have a direct responsibility: they can either reinforce existing inequalities or actively work to challenge them. Specifically, this report speaks to:

- **Urban and transport planners and designers** who seek to move beyond traditional traffic-focused models towards practices that embed inclusivity, recognition, and care into the physical and functional design of streets;
- **City administrations, technical officers, and public agencies** who require adaptable frameworks and tools to ensure that street transformation projects serve diverse communities and avoid reinforcing patterns of exclusion;
- **NGOs, grassroots organisations, and civic groups** who advocate for equitable access to public space and wish to co-create street interventions that reflect the lived experiences of all residents, especially those historically marginalised;
- **Researchers, students, and educators** in urban studies, transport, and mobility fields who aim to translate critical theories of justice into actionable, community-responsive strategies;
- **European and international institutions, networks, and funders** who are scaling up initiatives on sustainable mobility transitions and recognise that mobility justice must be a core pillar of transformative urban policy.

What does this report focus on?

These deliverables bridge the gap between conceptual frameworks of street justice and the practical realities of urban transformation. Structured around six critical domains, this report translates mobility justice principles into actionable strategies that practitioners can implement to reshape streets as fairer, more inclusive public spaces.

The six thematic areas, each responding to a key question for achieving just street transformations, are as follows:

- **Understanding justice for streets:** *What does justice mean in the context of streets, and how can it guide fairer, more inclusive street transformations?* This addresses the need to clarify key justice principles—distributive, procedural, recognition, and restorative—and how they can reshape the way we design and govern streets. (Chapter 2)
- **Advancing justice through participation and co-creation:** *How can participatory and co-creation strategies embed justice into all stages of street transformation, from*



design to governance? This explores how moving beyond consultation to genuine co-creation can redistribute power, amplify diverse voices, and foster more inclusive decision-making. (Chapter 3).

- **Understanding behaviours, needs, and habits:** *How can we better understand and integrate the diverse mobility needs, behaviours, and habits of different groups to design streets that promote equity and inclusion?* This highlights the importance of recognising and addressing the differentiated experiences, needs, and barriers of various user groups, especially marginalised communities. (Chapter 4)
- **Behavioural strategies for change:** *What behavioural strategies can effectively promote fair, active, and sustainable mobility choices on streets?* This focuses on tools and interventions from behavioural science that can help shift everyday mobility patterns and overcome social and structural barriers to change. (Chapter 5)
- **Change through Prefigurative Planning and Design:** *How can temporary, experimental, and imaginative planning and design approaches support justice outcomes on streets?* This examines how prefigurative planning, tactical interventions, and street experiments create opportunities to test alternative street futures, foster public dialogue, and support more inclusive and equitable change. (Chapter 6).
- **Navigating Digital Tools for Just Streets:** *How can digital tools and mobility technologies be used to support street justice without reinforcing inequalities?* This examines how digital tools can be applied in people-centred and inclusive ways, helping to identify local needs, expand access, and guide fair decisions—while addressing risks such as exclusion, bias, and lack of accountability in data use and governance. (Chapter 7)

Each chapter follows a consistent structure designed for practical use: beginning with a framing of the issue, it then offers a series of actionable ideas: concrete, adaptable strategies that practitioners, public authorities, NGOs, communities and advocates can apply to real-world projects. These ideas are illustrated through examples drawn from diverse European contexts and are supported by detailed annexed compendia for further exploration.

What are the tools and compendium reports?

This handbook is supported by five compendium reports that accompany each chapter. These compendia provide more detailed guidance on the concepts, tools, methods, and case studies referenced in the main text. They include practical examples of mobility justice in action, engagement strategies, behavioural interventions, planning experiments, and inclusive digital solutions implemented across Europe. The compendium reports are titled as follows:

- Compendium Report 1. Participation, Co-Creation and Justice for Streets Change.
- Compendium Report 2. Understanding Needs, Behaviours, Patterns, Habits.
- Compendium Report 3. Behavioural Strategies for Achieving Just Active Mobility.
- Compendium Report 4. Prefigurative Planning and Design Approaches.
- Compendium Report 5. Navigating Technology and Innovation: The techno-practical wisdom approach for Just Streets.



2. Justice for Street Transformations

Injustice in streets appears through overlapping patterns that affect the distribution of space and resources, the inclusiveness of design, the exposure to harm, and the right to participate in shaping public environments. These injustices are not isolated incidents; they reflect broader urban structures and power dynamics that must be actively challenged to create more equitable cities.

Key patterns of injustice observed on streets include:

- **Unequal distribution of infrastructure and amenities:** The quality and functionality of street environments (such as safe crossings, accessible sidewalks, greenery, lighting, and spaces for social life) are unevenly distributed across urban areas. Wealthier or more central neighbourhoods tend to benefit from higher-quality streetscapes, while lower-income or marginalised communities often face neglected, deteriorating, or inadequate street conditions. This disparity is not only the result of uneven public investment, but also shaped by market-driven development patterns and power imbalances.
- **Exclusionary design standards:** Street design practices often reproduce normative assumptions about the "default" user, typically conceptualised as able-bodied, neurotypical, adult, and male. As a result, the mobility needs, rhythms, and spatial practices of many more groups, including children, older adults, people with disabilities, caregivers, and neurodivergent individuals, are systematically overlooked or marginalised. Design standards prioritising uniform movement efficiency and physical conformity can restrict access, compromise safety, and diminish the right to comfortably and meaningfully inhabit public space.
- **Disproportionate exposure to harm and health risks:** In many urban areas, exposure to traffic danger, air pollution, and unsafe walking conditions are unevenly distributed. Streets carrying high traffic volumes, lacking pedestrian protections, and facing environmental degradation are often found in areas with lower land values, fragmented public investment, and reduced political visibility. These spatial patterns of exposure are not random but reflect how urban infrastructures have historically been planned and governed. As a result, certain populations, particularly children, older adults, low-income residents, and racialised groups, face greater cumulative health risks and reduced access to safe, supportive street environments.
- **Limited rights to use public space:** Access to, and enjoyment of, urban streets is often unevenly distributed. Certain groups such as young people, informal workers, and unhoused residents face both formal and informal barriers that limit their ability to use streets as spaces for rest, expression, commerce, or social life. In addition to social policing and criminalisation, the physical absence of supportive infrastructure such as shading, seating, or accessible amenities, restricts who can comfortably occupy public space. Through both design and regulation, the right to inhabit and shape street life is often constrained along lines of class, race, age, and economic status.
- **Invisibility of everyday and informal mobility:** Conventional street design tends to prioritise formal, predictable trip patterns such as commuting during weekday peak hours, while overlooking the diverse and irregular mobility practices that sustain daily life. Essential journeys like accompanying children or carrying goods are frequently disregarded in design standards. These forms of mobility, often undertaken by women, caregivers or older adults, remain underrepresented in planning models and infrastructure provision. In addition, street designs typically reflect daytime usage, marginalising those who rely on streets at night or on weekends, such as shift workers, informal traders, and young people.



- **Gentrification and displacement:** Street upgrades can increase property values and trigger displacement if not paired with housing protections or affordability measures. Without safeguards, improvements intended to promote equity may end up pushing out the very residents they aimed to benefit.
- **Exclusion from decision-making:** Key decisions regarding the use, design, and transformation of streets are frequently concentrated in the hands of technical experts, political elites, or dominant interest groups, with limited or superficial community involvement. Even when public consultation processes are initiated, they are often inaccessible due to technical language, limited outreach, or resources and time constraints, serving more to legitimise pre-decided plans than to genuinely redistribute power.
- **Technological exclusion and digital injustices:** The growing reliance on digital mobility technologies risks reinforcing inequalities in access, control, and representation. Many tools assume universal digital access and literacy, excluding low-income, older, disabled, and undocumented users. Private tech platforms often prioritise profit over public interest, while surveillance and data collection practices can disproportionately target marginalised groups. Automated planning tools may replicate existing biases, overlooking everyday, informal, or community-based mobility practices essential to street life.

These patterns of street-based injustice are rooted in broader structural and theoretical contexts. To support a more reflective and strategic response, it is helpful to link these observed injustices with academic theories that can help practitioners understand not just *what* is happening, but *why*. The table below offers a conceptual mapping that connects each identified form of street injustice with relevant theoretical frameworks and key scholars. It provides a bridge between empirical observations and justice-oriented planning theory, offering planners, policymakers, and advocates a structured way to interpret injustice in urban streetscapes.

Dimension of Injustice	Related Theories / Frameworks	Main References
Spatial and Resource Inequality	Distributive Justice, Urban Political Ecology, Egalitarianism Rawlsian Justice	Rawls (1971); Martens (2016); Heynen (2006)
Design and Access Inequality	Recognition Justice, Capabilities Approach, Feminist Urbanism, Universal Design	Fraser (1996); Young (1990); Fainstein (2010); Sen (1999)
Social and Cultural Exclusion	Recognition Justice, Right to the City	Fraser (1996); Lefebvre (1968); Harvey (2008); The Untokening (2016)
Procedural and Political Injustice	Procedural & Epistemic Justice, Critique of Utilitarianism in Transport Planning	Fraser (1996); Beebejaun (2017); Fricker (2007); Lam (2021); Pereira et al. (2019)
Digital and Technological Exclusion	Digital Justice, Infrastructural Justice	Graham & Marvin (2001); Eubanks (2017)



Temporal Injustice	Rhythmanalysis, Feminist Time Use Theories	Lefebvre (1992); Power (2004); England (1993)
Historical and Structural Inequalities	Transport Justice and Just Transitions	Schwanen (2020)
Cross-Cutting and Systemic Injustice	Mobility Justice, Relational Mobility	Sheller (2018); Cresswell (2013)

Table 1 Mapping of Street Injustices and Link to Justice Theories

2.1 Framing: Just Streets and Mobility Justice

Justice for streets means ensuring that individuals and communities are able to access, use, and shape public space as a site of political agency, collective expression, and social innovation. It recognises that streets are not just infrastructures for movement but critical arenas for enacting rights, contesting exclusions, and co-creating more equitable urban futures. Achieving justice involves removing barriers that constrain the ability of marginalised groups to participate meaningfully in shaping street transformations and empowering communities to act as agents of change. Achieving this also requires a multifaceted approach, drawing from the fields of spatial justice, transport justice and mobility justice. In this sense, four interconnected dimensions of mobility justice can provide a comprehensive framework for better understanding fairness and inclusivity on streets:

Distributive Justice (fair allocation of space & resources): This dimension focuses on the fair allocation of transport resources and the reduction of inequalities in access (Pereira, Schwanen & Banister, 2016). Rather than prioritising speed or the movement of vehicles, it shifts attention to how easily people can reach essential destinations like jobs, schools, and healthcare (Martens, 2016). In the context of street design, distributive justice challenges the historical dominance of car infrastructure and supports the reallocation of space away from private cars toward active and public transport to ensure that all users benefit from healthier, safer, and more sustainable streets. It also calls for prioritising investment in areas that have been underserved (often low-income or marginalised neighbourhoods) by improving access to safe sidewalks and cycling infrastructure – and importantly highlights how some communities have disproportionately borne the burdens of past mobility policies, such as air pollution, unsafe walking environments, or limited connectivity. Finally, distributive justice also recognises that interventions must avoid unintended consequences such as displacement, where street improvements or mobility policies drive up housing costs and push out existing residents.

Procedural Justice (inclusive and democratic processes): Procedural justice is about how decisions are made and who gets a say. Traditionally, transport planning has been technocratic and top-down, often sidelining the voices of those most affected by changes. Mobility justice is also linked to just processes, means creating opportunities for public participation at every stage, from initial vision through design to evaluation. This could involve co-design workshops, neighbourhood forums, citizen assemblies, or participatory budgeting – any method that gives residents, including marginalised groups, real influence over street decisions. Effective procedural justice requires moving up from token consultation to true power-sharing with the community. In practice, this might mean residents helping decide project priorities or having

veto power over designs that don't meet their needs. The goal is to build co-creation: planners and citizens working as partners to identify problems and craft solutions together. Such collaborative processes also advance epistemic justice, by valuing local “non-expert” knowledge as much as technical expertise (Young, 1990; Fricker, 2007).

Recognition Justice (acknowledging difference in needs): Recognition justice broadens the focus to who we are planning for. It highlights that streets must serve the diverse identities, cultures, and abilities present in the community. Historically, many streets and transport systems were designed with a one-size-fits-all user in mind (often an able-bodied, male, adult commuter), neglecting the needs of others. A recognition justice lens asks whose mobility needs have been undervalued (for example, women juggling childcare trips, elderly people, wheelchair users, children, minority ethnic groups, neurodivergent individuals, etc.) and calls for those needs to be explicitly addressed in street design (Hamraie, 2017). In practical terms, this means applying universal design principles from the start: ensuring infrastructure works for people of all ages and abilities (e.g. smooth curbs and ramps, tactile paving for the visually impaired, benches for rest, safe lighting at night, etc.). It also means tailoring mobility services to different groups: for instance, providing information in multiple languages, or offering cycle training for those who may not have had the chance to learn. Recognition is cultural as well: cities should celebrate diverse uses of street space (street markets, play streets, community gatherings) rather than enforcing a narrow view of ‘proper’ street behaviour and use.

Restorative Justice (repairing past inequities): This dimension looks backward to address historical and structural injustices that have shaped our cities. Many European (and global) cities still bear the scars of past transport planning decisions – highways driven through low-income districts, public transport lines removed leaving certain areas isolated, or decades of disinvestment in certain neighbourhoods. Restorative mobility justice calls for actively remedying these harms (Forsyth, Pali & Tepper, 2022). In street projects, this could mean reconnecting communities split by big roads (e.g. by pedestrianising an overbuilt arterial), investing in long-neglected areas for better transit and sidewalks, or prioritising upgrades in areas with high need rather than those that have already benefited before. It also aligns with the idea of a “just transition” in transport – ensuring that efforts to create greener, low-carbon mobility also improve social equity instead of leaving vulnerable groups behind. Importantly, intergenerational fairness is part of this dimension as well: today’s street designs should not create new burdens for future residents. For example, making climate resilience a priority (more trees, cooler materials, flood mitigation) in street improvements can be seen as a restorative step critical for addressing the climate crisis which will affect not only present but also future generations (Mattioli, 2016).

Building on the breakdown above, the table below goes into more detail on urban street transformation examples in order to illustrate the different dimensions of mobility justice: distributive, procedural, recognition, and restorative. Drawing on real-world examples from London, Ghent, Stockholm, and Madrid, the table outlines the context, intervention strategies, justice framing, and key lessons learned in each case:

Justice Dimension	Example	Context	Intervention	Justice Addressed	Lessons Learned
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JUST STREETS

Distributive	School Streets in London	Concerns about air pollution, safety, and inequitable access to street space, especially around schools and affecting primarily children.	Temporary and permanent closures of streets around schools to traffic during key hours, co-designed with communities to create safe, child-friendly spaces.	Initiative redistributes street space to pedestrians and cyclists, especially benefiting children and families, addressing health and spatial inequalities. Interventions are located in most school across London.	Prioritising underserved groups in street planning leads to better health and equity outcomes; reclaiming space improves social wellbeing.
Procedural	"Living Streets" Programme in Ghent	Resistance to top-down mobility changes led to experimentation with bottom-up approaches amidst broader car-reduction strategies.	Residents decide on street changes, and temporarily take over streets for community activities and active mobility, supported by local organisations and city facilitation.	Programme fosters inclusive decision-making through bottom-up planning, empowering residents to co-create their street environments.	Bottom-up, inclusive processes enhance legitimacy and community acceptance; local ownership supports policy sustainability.
Recognition	"Easy Access" Programme in Stockholm	Stockholm's long-standing commitment to accessibility culminated in a major city-led initiative to promote inclusive design.	A citywide effort to implement accessibility improvements including tactile paving, curb cuts, and guidance paths through the "Easy Access" project.	Programme recognises the rights and lived experiences of people with disabilities by embedding accessibility into standard street design.	Accessibility is justice-driven, not technical; embedding it in governance ensures long-term impact for all street users.
Restorative	Madrid Río project in Madrid	The M-30 motorway caused social fragmentation and environmental harm along the Manzanares River, prompting the need for ecological and social repair.	M-30 was tunnelled underground and the riverfront transformed into a linear park with promenades, bike paths, and public amenities through citizen input.	Addresses historical harms of car infrastructure by restoring the riverbed, reconnecting neighbourhoods, and regenerating ecological and cultural value.	Ambitious interventions can repair past planning harms; integrating environmental and social restoration supports intergenerational justice.

Table 2 Justice dimensions illustrated with European case studies

Importantly, the four justice dimensions outlined here are interrelated and should be pursued together. A project that only redistributes space (distributive justice) but ignores community input may fail on procedural fairness, while an inclusive process that doesn't consider historical exclusion may not fully deliver justice. Thus, just street practice demands an integrated approach. Planners are encouraged to ask of every project: Are we allocating resources fairly? Are we empowering the public in decision-making processes? Are we designing for all users? Are we correcting past injustices? Using this framing can help ensure that new street designs truly advance equity and inclusion on all fronts.



2.2 Key Areas of Intervention to Tackle Street-Based Injustices

The four dimensions of justice outlined above establish not only what just streets should achieve, but also expose the systemic barriers that hinder their realisation. Moving from principles to practice requires identifying specific levers for intervention. The following five areas of intervention can each play a powerful role in addressing different dimensions of injustice in the public realm, and will be addressed in this report as well as in the supporting compendium documents.

Advancing Justice through Participation and Co-Creation (Chapters 3): Achieving just streets requires recognising that mobility is not simply a technical issue. Justice involves addressing who has access to safe, inclusive street environments, who participates in shaping them, and whose experiences are valued. Advancing participation and co-creation means redistributing power in decision-making and moving beyond tokenistic consultation to genuine collaboration. By engaging those typically excluded (such as children, caregivers, disabled people, or racialised communities) co-creation processes help surface diverse needs, lived experiences, and invisible barriers that traditional planning often ignores. More than a method, co-creation is a pathway to restoring democratic control over public space, building local ownership, strengthening trust, and laying foundations for long-term care, equity, and resilience in urban streetscapes.

Understanding Behaviours and Habits (Chapter 4): Planning that recognises how people actually use and experience streets (rather than relying solely on technical models) helps correct biases in mobility data and decision-making. By accounting for informal trips, caregiving responsibilities, safety concerns, or cultural norms, planners can design streets that work for those whose needs are most often ignored. This approach ensures that interventions are context-sensitive and responsive, rather than imposing standardised solutions that may unintentionally reinforce inequalities.

Behavioural Change (Chapter 5): Changing infrastructure alone does not guarantee more just outcomes: deeply embedded habits, social norms, and perceptions often act as barriers to equitable street use. Targeted behavioural interventions, such as awareness campaigns promoting inclusive mobility, community-led safety initiatives, or incentives for reducing car use, can help shift behaviours in ways that open up street space to more people. These efforts support justice by creating enabling conditions for fairer, safer, and more sustainable mobility choices, especially for those historically marginalised.

Prefigurative Planning Approaches (Chapter 6): Prefigurative planning uses experimentation to model just and inclusive street futures in the present. It allows communities to test alternative uses of space (such as play streets or community-led designs) beyond traditional planning constraints. By shifting existing practices, challenging dominant norms, and imagining different futures, experimental approaches can create space for innovation, learning, and reimagination. Crucially, prefiguration and experimentation link means with ends: the planning process itself should reflect values of equity, care, and inclusion.

People-Centred Use of Technology (Chapter 7): Technology can support street justice when it is designed and deployed with equity at its core, as well as when it is governed responsibly. Community-driven digital tools like participatory mapping or real-time accessibility platforms can help identify needs and guide inclusive decisions. However, to avoid reinforcing existing inequalities, cities must regulate tech use, ensure fair access, prevent monopolisation and ensure transparency and accountability in data collection – as well as also consider low-tech, cost-effective solutions.



JUST STREETS

These five areas of intervention were selected because they directly target the key mechanisms through which injustice is produced and reproduced in street transformations. Each addresses a critical dimension of justice: participation tackles exclusion from decision-making; behavioural approaches challenge unequal access and use; prefigurative opens space to question dominant norms; and technology shapes who benefits from innovation.



Figure 1 Pedestrian-priority street in Paris, reflecting efforts to reclaim urban space for people and promote safer, more inclusive environments for all generations



3. Participation, Co-Creation and Justice for Street Change

3.1 Introduction: co-creation for streets change

How can participation and co-creation be mobilised to embed justice into every phase of street change? This chapter explores the critical role of participatory processes in building fairer, more inclusive streets. It argues that participation and co-creation are not simply a method for gathering input but transformative practices that redistribute power, amplify underrepresented voices, surfaces diverse knowledge systems, and builds collective stewardship over public space. Historically, participation in street planning has been limited, tokenistic, or confined to consultation after key decisions were made. In contrast, co-creation centres communities as active agents of change, recognising residents as experts in their own experiences and as co-producers of knowledge and solutions.

Co-creation advances justice across multiple dimensions: it supports distributive justice by aligning resources and space with community-defined needs; reinforces procedural justice by making decision-making processes open, inclusive, and responsive; promotes recognition justice by valuing diverse identities and lived realities; and contributes to restorative justice by ensuring that those most affected by historical harms are actively involved in shaping repair and redress.

By focusing on participatory strategies for street justice, this chapter offers a conceptual framework for co-creation (Section 3.2) and a set of actionable strategies (Section 3.3) for practitioners, planners, and community organisations seeking to translate justice principles into everyday practice. Drawing on examples from across Europe, it shows how participatory innovation can make streets more inclusive, equitable, and resilient, not only in their outcomes, but throughout the processes that shape them. For more insights, definitions and practical examples, see the Compendium Report 1.

3.2 Conceptual Framework: Participation and Co-Creation for Just Street Change

Achieving street justice requires more than addressing isolated dimensions of fairness: it demands recognising the interdependence between different types of justice and embedding meaningful participation across all of them. In this report we bring together two interrelated pillars that define a just street (see more in Compendium report 1):

- **Street Justice** – Understanding street justice requires bridging transport, mobility justice and spatial justice, recognising that streets function as links for movement and as vital public spaces (Jones, Boujenko & Marshall, 2007). Traditional approaches to transport and spatial justice have focused largely on improving access and distributing resources more equitably but often fall short in addressing the underlying political, social, and structural forces that shape who benefits from urban mobility and public space (Sheller, 2018; Soja, 2010). A street justice perspective expands these frameworks by asking not only who has access, but also who participates in decision-making and whose needs, knowledges, and identities are valued in street planning and governance. It highlights how intersecting forms of inequality shape everyday experiences of exclusion, insecurity, and marginalisation in urban streetscapes. This approach draws attention to the ways streets can reproduce social and environmental



injustices, such as the disproportionate exposure of marginalised communities to air pollution and displacement from car-dominated planning. Ultimately, street justice calls for transforming streets into inclusive, liveable spaces that support care work, community-building, health, and democratic participation.

- **Participation, Knowledge Co-Production & Experiential Learning** – Participatory planning seeks to democratise urban governance by ensuring that communities have meaningful influence over decisions shaping their environments (Healey, 1997). This pillar integrated insights from participatory planning theory, highlighting that genuine engagement requires moving beyond tokenistic consultation to processes (Arnstein, 1969; Healey, 2010). In street transformations, this means recognising the everyday expertise of users—such as pedestrians, caregivers, and children—who understand challenges and opportunities that may be overlooked by top-down, expert-driven approaches. Co-creation builds on this by fostering collaboration between residents, planners, and other stakeholders to jointly identify problems and co-develop solutions, integrating technical and experiential knowledge (Kolb, 2014). Knowledge co-production and experiential learning are crucial in this process, ensuring that interventions are not only technically effective but also socially relevant, inclusive, and just.

In this framework, the two pillars are mutually reinforcing. Mobility, transport and spatial justice provide the normative grounding by diagnosing structural inequalities and articulating goals for equitable streets; while participation, co-production and experiential learning offer the processes and practices necessary to democratise knowledge, redistribute power, and build shared ownership over street transformation. Together, they position co-creation as not only a method, but a justice-oriented pathway of collective learning, negotiation, and transformation: embedding justice both in the outcomes and the process of change. Rather than viewing justice as a static goal, this approach frames it as an iterative, dynamic process.

3.3 Actionable ideas for participation and co-creation in just streets

Building on the concepts outlined above, we propose a set of phases -that could be combined in different pathways (see Deliverable D2.2 The Just Streets Pathways) - as a practical framework for operationalising street justice. This model emphasises that achieving just street transformations is not a one-off intervention but a dynamic, iterative process.

A crucial start consists by recognising that **injustices are not always visible** through technical assessments alone and by prioritising dialogue with marginalised voices to uncover everyday inequalities and needs, addressing recognition and distributive justice by surfacing who has been excluded from access, safety, or representation and grounding the process in local knowledge and experiences (Fraser, 2008; Young, 1990). Another key phase focuses on the **collective reimagining of possible futures**, where diverse aspirations and lived experiences inform a shared vision for more just streets. This stage embodies procedural and recognition justice by ensuring that different imaginaries are included and that influence over visions is distributed fairly across stakeholders. Building from this, the framework advances into **co-design practices** that bring technical and experiential knowledges (Healey, 2010) into dialogue. Rather than treating residents as passive informants, the process elevates their lived experience and knowledge into the development of street interventions. This approach addresses epistemic injustice (Fricker, 2007) by legitimising non-expert, embodied, and local forms of knowledge alongside professional expertise. Another block emphasises the **experimenting as a mode of learning and governance**. Temporary pilots, living labs, and iterative trials create opportunities for communities to test and experience alternative street



futures in real time, while generating situated knowledge about their effects (Bertolini, 2020). Experimentation is not simply a technical tool but a justice-oriented practice: it distributes opportunity to shape outcomes, enables collective dialogue and reflection, and opens space for adaptation. Crucially, the framework embeds **ongoing evaluation and learning as collective activities**. Justice is not presumed to be achieved once an intervention is implemented; instead, affected communities are invited to assess, critique, and refine interventions based on their lived experiences (Sheller, 2018). This reflexive practice sustains procedural and epistemic justice by maintaining community voice and agency throughout. Finally, rather than treating co-creation as a one-time project, the framework aims to establish **lasting institutional mechanisms** that integrate recognition, participation, and knowledge diversity into routine decision-making.

To support practitioners in applying the different phases described, the table below translates each stage into a **set of concrete, actionable ideas and tools**. These examples demonstrate how participatory methods can operationalise justice principles at different points in the transformation process—providing practical entry points for embedding recognition, procedural, distributive, and epistemic justice into street change.

Co-Creation phase	Actionable Ideas	Justice Dimension	Concrete Tools
Co-Identify Needs	Conduct community listening sessions and walking audits	RJ, DJ	Community Needs Mapping
	Map underserved areas collaboratively	RJ, DJ	Participatory Mapping
	Deploy Street Ambassadors to build trust and gather diverse input	RJ, PJ	Street Ambassadors Programmes
Co-Vision Futures	Facilitate inclusive visioning workshops	RJ, PJ	Visioning Charrettes
	Develop future street scenarios with diverse groups	RJ, PJ	Scenario Planning Exercises
Co-Design Solutions	Organise co-design studios where residents collaborate with planners	PJ, RJ	Co-Design Workshops
	Conduct Universal Design Audits to ensure accessibility	RJ	Universal Design Audits
	Implement Participatory Budgeting for streets	PJ, DJ	Participatory Budgeting
Experiment	Implement street experiments (such as pop-up cycle lanes, parklets, and temporary street closures)	DJ	Street Experiment Initiatives and Temporary Pilots
	Create Living Labs for real-time feedback	PJ	Living Labs



Co-Evaluate and Learn	Host participatory evaluation forums	PJ	Participatory Evaluation Forums
	Use resident-led audits and feedback surveys	PJ, RJ	Resident-Led Audits, Community Surveys
	Apply Feedback and Evaluation Tools for continuous learning	PJ, RJ	Feedback and Evaluation Tools
Shift Existing Institutions	Institutionalise Mobility Advisory Councils	RJ, PJ, DJ, ReJ	Mobility Advisory Councils
	Integrate Justice-Focused Investment Targeting	DJ, ReJ	Justice Budgeting Tools

DJ = Distributive Justice; PJ = Procedural Justice; RJ = Recognition Justice; ReJ = Restorative Justice

Table 3 Actionable ideas and tools for engagement and co-creation in just streets

The following section unpacks these phases in more detail, showing how they embody the intertwined goals of mobility justice, participation, and experiential learning—transforming engagement from isolated activities into an integrated, justice-oriented process.

Co-Identify Needs

- **Community Listening Sessions and Walking Audits** Community listening sessions and walking audits are participatory methods designed to centre residents' lived experiences in urban planning. Rather than relying solely on technical assessments, these practices invite people to articulate everyday challenges and opportunities while moving through the space together. In **Dublin**, [walking audits](#) were key tools in shaping the Active Travel Action Plans by enabling communities to directly highlight unsafe crossings, poor accessibility, and missing facilities.
- **Map Underserved Areas Collaboratively** Collaborative mapping engages residents, especially from marginalised communities, in identifying areas of disinvestment, poor infrastructure, or barriers to mobility. Unlike top-down data mapping, this method captures lived realities and community-specific needs. In Barcelona, the [Pla de Barris](#) programme combined participatory mapping workshops with social data to target funding towards the city's most vulnerable districts.
- **Deploy Street Ambassadors to Build Trust and Gather Diverse Input** Street Ambassador initiatives send trained representatives—often from within the local community—out into streets, markets, parks, and transit hubs to gather everyday feedback and build trust. This approach is critical for reaching groups that might not participate in formal consultations. In Vienna, the Wiener Kinder- und Jugendbüro supports youth ambassadors who work directly with young people to inform urban mobility planning from a generational perspective.

Co-Vision futures

- **Facilitate Inclusive Visioning Workshops** Inclusive visioning workshops create accessible spaces where diverse communities co-create shared future goals for their streets and public spaces. Rather than consultants presenting finished ideas, residents generate the visions themselves through drawing, storytelling, and model-building. In Bristol, inclusive co-design sessions within the City Centre and High Streets Recovery Programme engaged residents in imagining greener, more walkable high streets post-COVID. Similarly, in Rotterdam, citizen visioning was central to the transformation plans



for post-industrial areas under the City Lounge project, prioritising walkability, play, and green space.

- **Develop Future Street Scenarios with Diverse Groups** Future street scenario planning involves co-developing different possible visions for how streets might function, offering residents opportunities to explore trade-offs and innovations before decisions are finalised. This builds agency, creativity, and resilience into planning processes. Rotterdam's Highway and City programme developed multiple street futures for reconnecting communities separated by major motorways, combining professional expertise with local knowledge through structured workshops. In Helsinki, the Urban Futures project has used scenario building as part of participatory design for climate-resilient and people-centred streets, inviting residents to imagine different mobility futures based on sustainability priorities.

Co-Design Solutions

- **Organise Co-Design Studios Where Residents Collaborate with Planners** Co-design studios are hands-on workshops where residents and planners work together as equals to shape public space projects. This collaborative method fosters ownership and surfaces local expertise. In London's Peckham Co-Design project, residents worked directly with architects and council staff to rethink public spaces like Rye Lane (Peckham Co-Design). Similarly, Brussels' Living Labs within the Innoviris Co-create Programme have fostered co-design processes on issues ranging from shared mobility hubs to safer streets.
- **Conduct Universal Design Audits to Ensure Accessibility** Universal Design Audits assess public spaces to ensure they are accessible to all, regardless of age, ability, or circumstance. Going beyond minimum standards, these audits focus on usability and dignity for every user. Copenhagen is a leader in embedding accessibility systematically, conducting audits that include wheelchair users, elderly citizens, and families with prams as part of the City of Copenhagen's Mobility Strategy. Likewise, Vienna's "Barrier-free City" programme audits streets and transport infrastructure, working toward a fully inclusive urban environment.
- **Implement Participatory Budgeting for Street** Participatory budgeting (PB) lets residents directly decide how to allocate part of the city's budget, typically voting on projects that matter to them. In Europe, Paris runs one of the largest PB programmes in the world — "Budget Participatif" — with many funded projects related to local street improvements, like greening sidewalks, creating safe crossings, and new cycle lanes. Lisbon was the first European capital to introduce PB citywide in 2008, leading to community-led investments in pedestrian infrastructure and traffic calming projects (Lisbon Participatory Budget).

Experimenting

- **Implement Street Experiments (Pop-Up Cycle Lanes, Parklets, Temporary Street Closures)** Street experiment refers to low-cost, temporary interventions that allow cities to experiment with street transformations before permanent investments. These pilots are fast, flexible, and highly visible, offering proof of concept. After COVID-19, **Milan** launched the Piazze Aperte ("Open Squares") initiative, reallocating street space from cars. Similarly, **Paris** expanded hundreds of kilometres of "coronapistes" (temporary cycle lanes) during the pandemic, many of which have since been made permanent after strong public support. In **Ghent's** Living Streets programme residents had a chance to apply for transforming their street into a car-free space for a summer, creating pop-up playgrounds, gardens, or social spaces. These pilots allowed people to experience a different street reality and provide feedback through direct participation



and initiative, help city officials test ideas and gather data before making permanent changes – while also generating new governance mechanisms. Such iterative, experiment-driven processes embody co-creation: residents and officials learn together what works, what can be improved, how it can be scaled up.

- **Create Living Labs for Real-Time Feedback** Living Labs are experimental spaces within cities where new mobility, public space, or street concepts are tested in real conditions, with direct input from users. Rather than waiting for formal evaluations, cities gather continuous feedback and adapt interventions dynamically. **Barcelona's** famous Superblocks started as Living Labs, transforming traffic-dominated neighbourhoods into pedestrian-focused zones with real-time community involvement. Similarly, Amsterdam's Smart Mobility Living Labs invite residents to co-test solutions like shared mobility hubs and flexible public space designs before permanent rollout.

Co-Evaluate and Learn

- **Host Participatory Evaluation Forums** Participatory evaluation forums create structured opportunities for residents to assess and comment on street projects collectively. Rather than relying only on expert audits, community members come together to reflect on what worked, what didn't, and what should happen next. In **Vienna**, regular "Grätzl" meetings (neighbourhood assemblies) allow citizens to evaluate urban interventions at the district level, influencing updates to local planning priorities. **Madrid** has also experimented with participatory evaluations during its "Decide Madrid" platform, where users evaluate the outcomes of citizen-initiated projects
- **Use Resident-Led Audits and Feedback Surveys** Resident-led audits put evaluation tools directly into the hands of the people most affected by street design. Community members assess accessibility, safety, and livability, often documenting issues overlooked by professionals. In **Bristol**, the "Bristol Walking Alliance" supports citizen-led walkability audits across the city to advocate for pedestrian-friendly improvements. Similarly, Barcelona's civic audit initiatives encourage local organisations to survey conditions for walking and cycling, integrating findings into district mobility plans (Ajuntament de Barcelona).
- **Apply Feedback and Evaluation Tools for Continuous Learning** Modern feedback tools—like QR codes, SMS polls, and mobile apps—allow cities to gather continuous user insights during and after implementation. This ongoing learning model ensures street transformations remain adaptive and user-centred. **Helsinki's Agile Piloting Programme** (Forum Virium Helsinki) places lightweight pilots (e.g., street experiments, micromobility hubs) and gathers real-time resident feedback via digital platforms, iterating quickly based on community responses. **Ghent** has similarly deployed simple online tools to crowdsource public input on street redesign pilots as part of its sustainable mobility plan.

Shifting Existing Institutions

- **Institutionalise Mobility Advisory Councils** Mobility Advisory Councils formalise community participation by establishing standing groups of diverse residents who advise city agencies on transport and street issues over time. These councils ensure that feedback is consistent, representative, and integrated into institutional decision-making. In **Oslo**, the "Universal Design Advisory Council" includes people with disabilities advising on mobility policies to guarantee accessibility is systematically prioritised. **Vienna's** Senior Citizens Advisory Council also plays an active role in shaping pedestrian environments, transit services, and street improvements for older residents (City of Vienna).



- **Integrate Justice-Focused Investment Targeting** Justice-focused investment targeting ensures that public spending prioritises historically underserved, disinvested, or vulnerable communities rather than being distributed equally across all areas. Investment is guided by data and community input to correct historical inequities. **Amsterdam's** "Right to the City" Framework (Amsterdam Plan 2025) explicitly targets public space improvements in lower-income districts. **Paris** uses equity-weighted criteria in its Participatory Budget to channel more funding to peripheral arrondissements historically neglected by central investment patterns.

3.4 Conclusions: Embedding Justice through Co-Creation in Street Change

Streets are not neutral infrastructures, but social and political spaces where access, safety, and belonging are either enabled or denied. Justice offers a lens to reimagine how they are planned, governed, and shared for the benefit of all. While concepts like distributive, procedural, recognition, and restorative justice provide a powerful framework, this chapter has shown that justice must be enacted through practice and not just theorised on.

Advancing justice in street transformations demands more than fair outcomes; it requires fundamentally rethinking how change is designed, implemented, and institutionalised. As this section has shown, engagement and co-creation are not simply participatory tools: they are justice practices in themselves. By centring lived experiences, diversifying decision-making processes, and valuing different forms of knowledge, co-creation processes help to realise distributive, procedural, recognition, epistemic, and restorative justice.

Distributive, procedural, recognition, epistemic, and restorative justice must be addressed in an integrated way, not in isolation. Justice should be embedded across every phase of the co-creation cycle — from identifying needs, to visioning, designing, experimenting, evaluating, and institutionalising change. Co-creation processes help navigate the interdependencies between different justice dimensions at each stage, ensuring that fairness is both material and procedural, and that street transformations remain inclusive, responsive, and equitable over time.

The examples and actionable ideas presented demonstrate that just street transformations are both possible and practical when power is shared, when processes are transparent and inclusive, and when communities are treated as co-authors of urban futures rather than passive recipients of pre-designed solutions. Across Europe, cities are already pioneering these practices, showing that meaningful engagement leads not only to better streets but also to stronger, more resilient and equitable communities.

Ultimately, embedding justice in street transformations means embedding it into everyday governance: into how needs are identified, visions are built, designs are developed, experiments are tested, outcomes are evaluated, and institutions evolve. Justice is not an endpoint but an ongoing practice of reflection, negotiation, and collective learning. Co-creation is the engine that drives this practice forward — making street change not only more just, but also more sustainable, more innovative, and more deeply connected to the communities it serves.



KEY TAKEAWAYS

Understanding people's needs, behaviour, and habits can be a vast task but some of the important highlights to bear in mind are:

1. **Justice is a Process, Not Just an Outcome:** Achieving just streets requires embedding justice principles into every stage of street transformation — from identifying needs to evaluating impacts — not merely aiming for fair end results.
2. **Co-Creation is Essential for Justice:** Engagement and co-creation are not optional extras; they are critical mechanisms for redistributing power, surfacing invisible needs, valuing diverse knowledges, and ensuring that street transformations genuinely serve all communities.
3. **Addressing Multiple Justice Dimensions Across All Phases:** Distributive, procedural, recognition, epistemic, and restorative justice must be embedded throughout every phase of the co-creation cycle. Co-creation ensures these justice dimensions are addressed together.
4. **Participation Strengthens Planning Quality:** Participatory processes enrich the planning and design of streets by incorporating lived experience, practical knowledge, and diverse imaginaries — leading to solutions that are more inclusive, legitimate, and effective.
5. **Experimentation and Learning Are Core Components:** Justice-driven street change is dynamic. Iterative experimentation, resident-led evaluation, and continuous learning are essential for adapting designs and processes to better meet community needs over time.
6. **Institutional Change is Necessary:** Embedding justice in street transformations also requires shifting institutions — establishing permanent participatory structures, adopting justice-focused investment frameworks, and changing governance norms to support long-term equity.



Figure 2 Community street walk in Islington, London, engaging residents to reflect on justice in street transformations and highlight local needs, priorities, and experiences



4. Understanding needs, behaviours and habits for just streets

4.1 Introduction: understanding needs for just streets

Mobility enables individuals to meet their needs, access opportunities, and participate fully in society. In urban contexts, ensuring equitable and inclusive mobility is a critical responsibility for planners, policymakers, and other stakeholders. However, understanding urban mobility requires more than simply observing movement patterns; it demands recognising the diversity of the people who move and the unequal conditions that shape their everyday journeys.

It is inaccurate to treat urban travellers as a homogeneous group with identical needs, behaviours, and experiences. Different user groups, defined by factors such as age, gender, ability, or socio-economic status, interact with streets and transport systems in distinct ways. These differences are not simply personal preferences but reflect structural inequalities embedded in urban environments, policies, and social norms. Without actively uncovering how different people experience exclusion, risk, or constraint in their mobility, street transformations risk reproducing the very injustices they seek to address. To plan more just and effective mobility systems and streets, practitioners must use appropriate tools and frameworks to ask critical, cross-cutting questions: How do different groups experience mobility and use the streets? Where do gaps in safety and accessibility emerge? How do habits, constraints, and cultural norms shape everyday movement? By approaching mobility and street design and planning with this nuanced understanding, cities can better design interventions that reflect the real, varied needs of their populations. Understanding mobility needs, behaviours, and habits is therefore a critical intervention point for achieving just streets: it directly addresses recognition justice by surfacing the overlooked realities and mobility struggles of diverse groups; it advances distributive justice by revealing disparities in access, safety, and comfort; and it supports epistemic justice by valuing lived experience as legitimate knowledge for shaping interventions. By mapping these differentiated experiences, practitioners can challenge the assumptions embedded in dominant planning models and design interventions that respond to actual, diverse needs rather than idealised, universal users.

This chapter explores methods for assessing mobility needs (including narrative approaches, ethnography, and spatial analysis) across different modes such as walking, cycling, and public transport. It focuses on understanding the experiences of diverse, intersectional user groups, including children, young adults, women, older adults, people with disabilities, LGBTQI+ individuals, migrants, and others. The goal is to support practitioners in designing streets that are guided by principles of justice, perceived safety, universal design, and equity.

What is more, this chapter section builds on insights from D3.1, which focuses on methods for understanding user needs and behaviours in urban mobility. Here, we translate those insights into actionable ideas to support needs assessment across different modes and among diverse, intersectional user groups. In addition to offering practical approaches, this section aims to stimulate critical questions among readers, encouraging deeper reflection on how needs, habits, and behaviours intersect with broader issues of mobility justice. It summarises key points from ‘Compendium 2.2. Understanding Needs, Behaviours, Patterns, Habits’, highlighting strategies that community stakeholders, urban and transport planners, city-level professionals, and NGOs can use to better integrate equity considerations into their everyday practices.



4.2 Conceptual framework: understanding needs for just streets

Human behaviours and habits are shaped by underlying needs, yet these needs are not always directly visible. They must be interpreted through a deeper understanding of personal, social, and structural factors that influence how people experience and navigate urban mobility. Understanding needs is therefore crucial for achieving just streets: it reveals not only what people do, but why certain groups face persistent barriers, exclusions, or unmet needs within mobility systems. Maslow's hierarchy of needs (1943) provides one way to conceptualise human needs, positioning mobility-related needs such as safety, access to opportunities, and participation in community life within the middle tiers. To explore these needs in mobility systems, we draw on three complementary perspectives (psychology, economics, and geography) each offering different insights into how needs, behaviours, and habits are shaped (see Figure 3).

Psychology/Sociology: This perspective focuses on the individual experience of need fulfilment, expectation, and satisfaction. Mobility behaviours are influenced not only by rational decision-making but also by perceived barriers, past experiences, and social norms. Individuals' travel choices are shaped by what they have access to, what they expect from their environment, and their subjective evaluations of safety, comfort, and dignity. Critically, these perceptions are mediated by intersecting identities such as gender, age, race, and disability, highlighting the importance of intersectionality in analysing mobility needs.

Economics: From an economic perspective, mobility behaviours are often framed as rational choices, where individuals weigh costs, benefits, and trade-offs. While useful, this model risks ignoring the constraints that limit real choice for many groups—whether due to affordability, time poverty, or structural exclusion. The capability approach (Sen, 1999) offers a corrective: it shifts attention from theoretical access to what people are actually able to do, recognising that material resources alone do not guarantee meaningful mobility if social, environmental, or personal factors block access.

Geography: This perspective draws attention to the spatial distribution of needs and the role of distance, location, and connectivity. Where people live, work, and access services fundamentally shapes their mobility patterns and opportunities. Urban inequalities are spatially embedded: people in marginalised neighbourhoods often face longer journeys, fewer transport options, or more dangerous routes. Understanding these geographic disparities is essential for addressing distributive and recognition justice in street transformation.

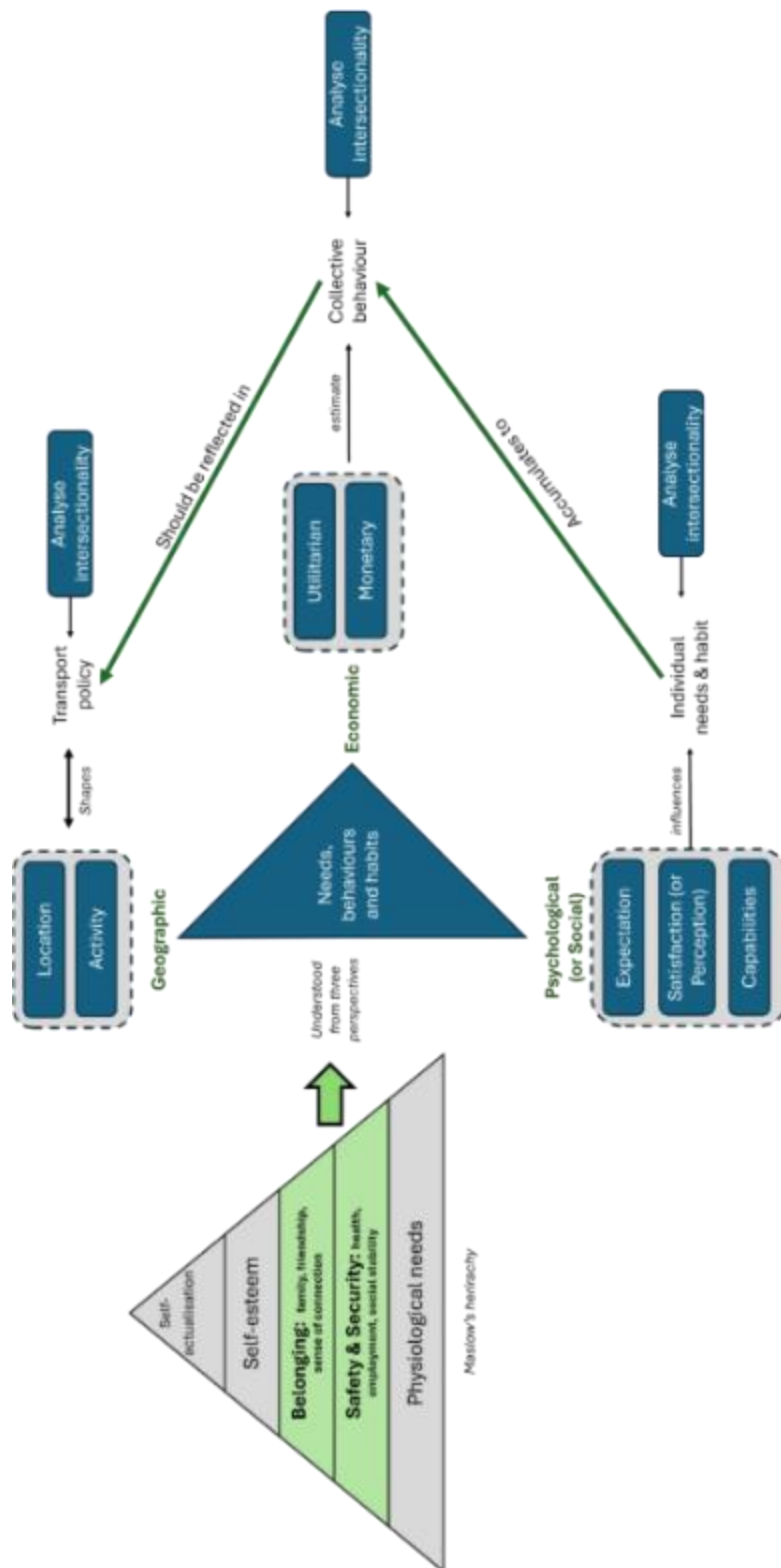


Figure 3 Understanding needs, behaviours and habits framework



To operationalise these insights, we propose a three-level approach to needs assessment: individual, collective, and policy. At the individual level, needs assessment focuses on the specific preferences, constraints, and experiences of individuals—examining how factors like age, disability, gender, and cultural background shape their interaction with streets and transport. This level enables practitioners to surface granular insights into safety, accessibility, and comfort. At the collective level, patterns emerge across individuals who share similar social or spatial positions. This level enables identification of common issues faced by communities or demographic groups for example, the clustering of accessibility barriers in low-income neighbourhoods, or gendered patterns of trip-chaining related to caregiving responsibilities. At the policy level, insights from individual and collective assessments are synthesised to inform system-wide responses. Policies must respond not only to aggregate patterns but to the differentiated needs of diverse groups, embedding justice principles into investment decisions, design standards, and governance structures. Aligning policy with distributive, recognition, and procedural justice ensures that street transformation does not merely improve averages, but targets systemic inequalities in access and experience.

Importantly, intersectionality must be considered at all three levels of assessment. People's mobility needs cannot be understood through single categories; rather, their experiences are shaped by the interaction of multiple identities and systems of power (Crenshaw, 1991). Intersectional analysis enables practitioners to identify compounded disadvantages and design interventions that address overlapping forms of exclusion.

Mobility often involves a trade-off between individual benefits and collective disadvantages, creating a social dilemma. This means that what benefits one person might not be the best for the community. People make travel decisions based on personal convenience, time-saving, comfort, and cost-efficiency. These individual choices can sometimes harm the community by causing traffic congestion, pollution, and increased wear on infrastructure. When most people choose to drive cars for convenience, it benefits them individually by saving time. However, this collective behaviour can lead to traffic jams, air pollution, and fewer resources for public transportation. Against this backdrop, our work aims to present various actionable ideas to highlight the above-described 'trip as an instrument' angle so that future transport planning may shift from solely focusing on maximising individual benefits towards minimising collective disbenefits.

4.3 Actionable ideas: understanding needs for just streets

Our review of the state of the art, drawing on literature reviews, expert interviews, and desk research, reveals a wide range of concepts, approaches, and methods for understanding mobility needs. To present these findings coherently and in ways that support actionable steps, we organise the discussion around three core perspectives: safety, accessibility, and connectivity. Each is viewed through the lens of mobility justice, enabling us to account for intersectionality and the multiple, overlapping forms of disadvantage faced by different user groups. While other perspectives could be explored, this chapter focuses on those most directly linked to the practical challenges of inclusive street transformation. The methods and approaches described here are intended to support needs assessment for all user groups, particularly those historically marginalised or underserved. To operationalise intersectionality and highlight the differentiated needs of vulnerable groups, we present profiles of key demographic groups often excluded from mobility planning. Addressing these needs through inclusive design and policy is essential for creating equitable, accessible, and just urban transport systems.

Needs of vulnerable user groups through intersectionality analyses: Certain demographic groups often face significant challenges and disadvantages in urban mobility and



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streets environment. These groups may have limited access to transport options, encounter safety issues, or face socioeconomic barriers. Here are some instances of specific challenges for the vulnerable groups:

- **Low-Income Communities:** Residents in low-income areas often face limited transport options, longer travel times, and higher relative costs. Public transport routes may be less frequent or absent in these areas, forcing reliance on costly or unreliable alternatives. High transport costs can constrain access to employment, healthcare, and education, reinforcing cycles of disadvantage. In addition to transport access, low-income communities often inhabit streets with poor pedestrian infrastructure, inadequate lighting, or high traffic volumes, which further reduce safe and comfortable access to opportunities.
- **Elderly people:** Many elderly commuters face mobility issues, which can lead to difficulty accessing transit. Elderly individuals also have a higher risk of falls or injuries in poorly maintained infrastructure, leading to significant safety concerns for this group. Accessibility concerns include a lack of services that cater to the needs of the elderly, such as low-floor buses or adequate seating. Similarly, streets may lack resting places, safe crossings, and clear signage, reducing older adults' ability to navigate public spaces independently and confidently.
- **People with Disabilities:** People with disabilities encounter physical, sensory, and cognitive barriers in mobility systems. Infrastructure may lack ramps, tactile paving, elevators, or accessible vehicles, limiting independent travel. Inaccessible design can result in social isolation, reduced participation, and exclusion from public space. Street design itself may also fail to accommodate accessibility needs—such as uneven pavements, narrow pathways, or missing tactile guidance—compounding mobility challenges and limiting safe access to public streets.
- **Women:** Women face gendered risks of harassment, violence, and insecurity, particularly during night-time travel or in poorly monitored environments. Travel patterns among women often reflect trip-chaining linked to caregiving and household responsibilities, leading to more frequent, multi-stop, short trips across fragmented networks. Women's use of streets is also shaped by perceived safety, visibility, and access to amenities; poorly lit, isolated, or heavily trafficked streets may discourage walking or lingering, restricting their mobility choices.
- **Children and Youth:** Children require safe, accessible routes to schools, play spaces, and services. However, traffic danger, lack of safe crossings, and poor cycling infrastructure reduce their independent mobility. Reliable, child-friendly public transport options are often lacking, limiting access to education and leisure opportunities. Street environments without traffic calming, safe pedestrian crossings, or protected play areas also restrict children's ability to safely navigate and use public space independently.
- **Immigrant and Minority Ethnic Groups:** Immigrants may face challenges in navigating transport systems due to language barriers, unfamiliarity, or exclusionary practices. Limited financial resources can restrict access to higher-cost transport modes. Discrimination or profiling can deter use of certain routes or modes, reinforcing marginalisation. Streetscapes may also reflect cultural exclusion—through signage, policing practices, or lack of culturally responsive design—affecting immigrants' comfort and perceived belonging in public space.
- **LGBTQ+ Individuals:** LGBTQ+ passengers experience higher rates of harassment on buses and trains, making public transport a less viable option for commuting. Feeling unsafe can lead to avoiding public transport, thereby limiting mobility options. From an accessibility perspective, a lack of gender-neutral restrooms and appropriate facilities can make transit systems uncomfortable and unwelcoming. Similarly, LGBTQ+



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individuals may experience harassment or exclusion in street spaces, affecting their sense of safety, visibility, and inclusion in public environments.

Recognising the unique challenges faced by intersectional groups is essential for developing strategies that reduce marginalisation and ensure these communities are not left behind in street and mobility transformations. Applying an intersectional lens reveals how overlapping social identities (such as age, gender, income, disability, ethnicity, or sexual orientation) combine to create compounded barriers to accessibility, safety, and connectivity. Intersectionality helps planners and policymakers see not just isolated categories of disadvantage but how these categories interact to produce specific vulnerabilities in mobility and street environments. For example, low-income LGBTQ+ individuals may face heightened risks of harassment, discrimination, and hate crimes, particularly in under-policed or socioeconomically deprived neighbourhoods, affecting both their willingness and ability to move safely through public streets and transit systems. As shown in Figure 4, some social categories (such as low-income status and disability) commonly overlap in patterns of mobility disadvantage reported in the literature and confirmed by expert interviews and policy reviews. However, the literature also reveals gaps in systematic intersectional analysis for certain overlapping groups. While intersections between income and disability are well-documented, less attention has been given to overlapping disadvantages faced by children and other identities, such as gender, migration background, or poverty. This represents an important area for further research. Emerging studies, for example, explore how gender and age intersect to shape independent mobility and cycling rates among teenage girls (Orsini & O'Brien, 2006), or how youth living in deprived areas face compounded barriers to mobility access, safety, and participation (Ricci, 2016). Research on migrant children and youth also points to cultural, linguistic, and institutional barriers that intersect with age to restrict independent navigation of public transport and street environments (Sime, 2007).

These studies suggest that intersectional disadvantages in street and mobility access for children, girls, and young migrants remain underexplored in policy and practice, despite growing evidence of their unique challenges. Addressing this research gap is crucial for advancing both recognition and distributive justice in street design, mobility planning, and accessibility interventions. Intersectional approaches can help uncover invisible or compounded barriers and ensure that mobility systems respond to the diverse realities of urban residents.

	Low-income	Elderly	Children	Women	Disability	LGBTQ+	Migrants
Low-income							
Elderly	++						
Children							
Women	++						
Disability	+++	+	+	++			
LGBTQ+	+				+		



	Low-income	Elderly	Children	Women	Disability	LGBTQ+	Migrants
Migrants	++	+					

Figure 4 Overlap in intersectionality - Understanding needs, behaviours and habits

Concepts, methods, and tools that incorporate intersectionality: Designing streets and mobility systems that serve everyone requires recognising that barriers to access, safety, and comfort vary across social groups. Concepts like universal design, safety, and connectivity provide critical foundations for inclusive mobility, but must be approached through an intersectional lens that accounts for overlapping identities and inequalities.

Universal design aims to create streets, public spaces, and transport systems that are accessible to people of all ages and abilities. The principle is that designing for those with disabilities often benefits everyone—a phenomenon known as the “curb-cut effect,” referring to sidewalk ramps initially designed for wheelchair users but also helpful for parents with strollers or travellers with luggage. Modern urban design guidelines integrate features such as step-free access, tactile paving, clear signage, and smooth, continuous pathways, improving street usability for a wide range of users. Similarly, low-floor buses and level boarding increase access for elderly and disabled passengers while making travel easier for families, migrants with luggage, and low-income residents who rely on walking and transit. By embedding accessibility at every stage—from street design to vehicle procurement—cities move closer to recognising and addressing intersectional mobility needs through design.

Safety: understanding objective and perceived risks Safety in mobility and streets has both objective and subjective dimensions. Objective safety refers to measurable risks of harm (e.g., traffic crashes, crime incidents), while subjective safety reflects how safe people feel when using streets or transport systems. Research shows that perceptions of safety vary significantly across groups. For example, women may avoid walking alone at night due to harassment fears, or parents may restrict children’s independent travel even when crime rates are low. Therefore, planners must combine objective data (such as injury rates) with community-reported perceptions of safety, ensuring that vulnerable groups, including elderly people, women, ethnic minorities, and youth, are heard and prioritised in street safety interventions.

Connectivity measures how well different parts of the city are linked by walking routes, cycling paths, and transit lines. High connectivity enables people (especially those without cars) to reach essential destinations easily. Planners use tools such as Space Syntax to analyse how street networks support or hinder pedestrian movement, identifying isolated areas versus highly connected routes. GIS-based indicators, such as intersection density or walkable catchment areas, further map accessibility patterns. Crucially, overlaying these spatial measures with demographic data can reveal where connectivity gaps disproportionately affect certain groups: for example, an older adult living in a low-density neighbourhood may face long distances between crossings or a lack of benches, discouraging walking.

While quantitative measures provide useful benchmarks, understanding intersectional mobility needs requires listening to people lived experiences. Participatory methods, including surveys, focus groups, interactive workshops, and co-design sessions, are now standard practice in equitable mobility planning. Ethnographic techniques, such as travel diaries, ride-along, and in-depth interviews, add richer insights into how and why mobility patterns emerge. These methods help uncover barriers that data alone cannot capture, such as feelings of exclusion or cultural discomfort in public streets.



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At a policy level, frameworks like targeted universalism guide inclusive mobility strategies. This approach sets a universal goal (e.g., mobility access for all) but uses targeted strategies for different groups to achieve that goal. For example, agencies may define minimum accessibility thresholds while prioritising improvements in underserved areas. This aligns with global goals such as SDG 11.2, which tracks “convenient access to public transport” disaggregated by gender, age, and disability.

Analytic tools have also evolved to assess mobility equity intersectionally. Segregated transport models allow planners to estimate how different demographic groups will benefit from interventions—such as comparing the impact of a new transit line on low-income women versus higher-income men. Multi-criteria assessment tools with equity weighting prioritise projects benefiting historically marginalised groups. Equity audits, using structured checklists, help ensure that planners assess impacts across diverse user groups systematically.

In sum, achieving equitable streets and mobility systems requires integrating multiple approaches: universal design that builds accessibility into infrastructure; safety measures responsive to both real and perceived risks; connectivity analyses that reveal structural exclusions; participatory processes that centre lived experiences; and policy tools that operationalise fairness. These methods, when combined, support an intersectional approach that recognises overlapping forms of disadvantage and targets interventions accordingly. In that sense, assessing the mobility and street needs of diverse user groups requires a combination of concepts, methods, and tools that can be applied across multiple dimensions of justice and across different social groups. Rather than assigning specific methods to specific groups in isolation, an intersectional approach recognises that many concepts and tools are relevant across groups but may be emphasised or adapted differently depending on their specific experiences and barriers.

For safety, both objective safety (measurable risks of harm, such as traffic accidents or crime) and subjective safety (people’s perceptions of safety) are critical for all groups, including women, children, elderly people, disabled people, LGBTQ+ individuals, and ethnic minorities. Participatory methods, such as community workshops or focus groups, and ethnographic approaches (like travel diaries and ride-alongs) are especially valuable for uncovering safety concerns that are not captured by official statistics—particularly for those who experience harassment, fear, or exclusion in public streets.

For accessibility, core concepts like universal design and wayfinding benefit multiple groups, including disabled people, elderly people, women with caregiving responsibilities, migrants unfamiliar with local systems, and low-income communities. Universal design features—such as step-free access, tactile paving, and clear signage—improve usability for everyone. In addition, frameworks like targeted universalism can help ensure that accessibility improvements address the needs of those facing the most barriers while benefiting the broader population.

For connectivity, spatial methods such as Space Syntax analysis, geospatial mapping, and network accessibility indicators can reveal patterns of exclusion in the built environment, identifying which neighbourhoods or groups face disconnection from services, jobs, and opportunities. Tools like equity mapping, audit checklists, and multi-criteria assessments can help planners evaluate how well street networks and transport systems serve diverse populations. Quantitative models, including segregated transport models that estimate the impacts of interventions by demographic group, can further highlight inequities and guide resource allocation.

Choosing appropriate tools: Given the breadth of available implements in a practitioner’s toolbox, the selection of proper instruments impacts how mobility justice is addressed.



Measuring the success of mobility initiatives from an equity perspective requires a mix of quantitative and qualitative measures. On the quantitative side, numerous indices and indicators have been developed to capture different facets of mobility. For example, walkability indices (such as Walk Score or the Global Walkability Index) utilise metrics like intersection density, sidewalk availability, and land-use mix to assess the friendliness of an area for walking. These can be further refined to consider rollability (for wheelchair users or strollers). Accessibility metrics are another key quantitative tool; planners often calculate how many important destinations (such as jobs, hospitals, schools, and grocery stores) are reachable within a certain travel time by walking, cycling, or transit. This can be expressed as, say, “% of the population that can access a supermarket within 15 minutes without a car,” and crucially, broken down by neighbourhood or demographic. Agencies also track service quality indicators, such as transit frequency, reliability, and crowding levels, since these factors affect different riders in various ways. For instance, a crowded bus might be a mild inconvenience for some but a significant barrier for an elderly or autistic rider who cannot stand for long or handle dense crowds. Safety indicators, such as accident rates for pedestrians and cyclists or the number of crimes on public transit, are disaggregated to identify which groups or areas bear the brunt of unsafe conditions. In many places, new composite indices are emerging that encompass safety, accessibility, connectivity and other perspectives.

Qualitative and subjective assessment measures complement the numbers by providing context and depth. User satisfaction surveys are commonly used; transit agencies often survey riders on their feelings of safety, comfort, affordability, and convenience, ensuring that they collect demographics to identify, for example, whether women rate safety lower than men or if disabled riders are less satisfied with service frequency. Focus groups and interviews can be an ongoing evaluative tool: a city might convene a panel of residents from diverse backgrounds to provide regular feedback on mobility conditions. In some cases, community scorecards are used, where residents score various aspects (e.g., sidewalk maintenance in their area or the respectfulness of drivers toward pedestrians) and discuss them in workshops; this process both educates the community on standards and informs officials about on-the-ground realities. The assessment also extends to the qualitative stories behind the metrics. Case studies and personal narratives are often included in evaluations to illustrate the numbers. For instance, an annual mobility report might feature the story of a disabled commuter’s improved journey after station upgrades or, conversely, a collection of citizen complaints on a new transit service highlights problems not shown in ridership statistics.

Finally, a successful needs assessment requires an effective way to communicate with the user groups. Practitioners must adopt an inclusive, participatory, and tailored communication strategy that recognises overlapping identities. Intersectionality must be central, with communication reflecting the lived realities of groups like low-income women, migrant parents, LGBTQI+ individuals, and people with disabilities. Strategies may be co-created with these communities using participatory storytelling, multilingual and culturally relevant materials, and visuals that affirm representation and dignity.

4.4 Conclusions

Understanding people’s mobility needs, behaviours, and habits is a complex task, but several key principles can guide this process. A shift from a ‘potential-based’ to a ‘needs-based’ analysis (rooted in the capabilities approach) places individual well-being and lived realities at the centre. Core dimensions such as accessibility, safety, and connectivity should be examined through a justice lens to uncover structural inequalities. Crucially, an intersectional approach is essential, as the overlapping experiences of low-income groups, elderly, children, women,



disabled individuals, LGBTQ+ people, and migrants reveal how mobility barriers are often compounded. These overlaps also indicate that cross-cutting solutions can benefit multiple groups simultaneously. To effectively assess needs and behaviours, researchers and practitioners should adopt mixed methods, combining the depth of qualitative insights with the rigour of quantitative analysis (see D3.1). While qualitative methods are more intuitive and flexible, and quantitative ones more data-driven but technical, mixed approaches offer a balanced path toward inclusive and evidence-based mobility planning.

KEY TAKEAWAYS

Understanding people's needs, behaviour, and habits can be a vast task but some of the important highlights to bear in mind are:

1. Shifting focus to '**Needs-based**' (capabilities approach) analysis away from the 'potential-based' approach.
2. Needs, habits and behaviour can be analysed from different angles; some of the major ones are—accessibility, safety, and connectivity, viewed from the lens of justice.
3. Intersectionality analysis is crucial in understanding the needs, behaviour, and habits of vulnerable user groups. These are some of the groups that may require focus—Low-income residents, elderly, children, women, disabled individuals, LGBTQ+, and migrants.
4. A powerful insight from **intersectional analysis** is that many inequities overlap, suggesting that solutions can be cross-cutting.
5. Three approaches to understanding needs, behaviour and habits—quantitative, qualitative and mixed:
6. Qualitative are more easily adopted but open to interpretations
7. Quantitative is less easily adopted due to the steep learning curve
8. Mixed approaches combine the advantages of both approaches and suggested as the way forward



5. Behavioural Strategies for Achieving Just Active Mobility

5.1 Introduction

Behaviour change is central to shifting our streets towards justice and sustainability, with human behaviour being shaped by a complex and interconnected interplay of individual beliefs, social norms, cultural context, and environmental cues. In that sense, changing how people move through cities is not only about redesigning physical infrastructure: it is about reshaping habits, social norms, emotions, and lived experiences.

This chapter, developed under Task 2.3 “Nudging Behavioural Change”, explores how targeted behavioural interventions can support more inclusive forms of active mobility such as walking, wheeling and cycling, particularly amongst vulnerable groups. It highlights a selection of relevant good practices drawn from the analysis of 92 examples across more than 22 countries (see the attached Compendium 2.3. Behavioural Strategies for Achieving Just Active Mobility).

To guide this analysis, we draw on the COM-B model (Capability, Opportunity, Motivation – Behaviour) and the Behaviour Change Wheel (BCW) (Michie et al., 2011), two well-established frameworks in behavioural science. These models propose that Capability, Opportunity, and Motivation interact to drive behaviour, and have been widely used to design effective interventions. The COM-B model (Capability, Opportunity, Motivation – Behaviour) and the Behaviour Change Wheel (BCW) offer a robust, evidence-based framework for designing, implementing, and evaluating interventions aimed at behaviour change. Their relevance to understanding behavioural change for active mobility and street justice lies in their ability to:

- Bridge theory and practice: They translate complex behavioural insights into clear intervention types, allowing for the development of context-specific strategies.
- Address multiple layers of behaviour: COM-B helps understand both internal (e.g., motivation, knowledge) and external (e.g., environmental, social) barriers to behaviour change.
- Support co-creation and adaptability: The BCW's structured approach can guide collaborative work with communities, allowing co-designed interventions to be mapped and adjusted over time.

5.2 Methodological approach: applying behavioural science to promote justice in street mobility

This section outlines the methodological approach used to identify actionable behavioural interventions aimed at promoting just, inclusive active mobility, with a focus on walking, cycling, and wheeling among groups historically excluded or disadvantaged. Rather than viewing behaviour change as an individual choice isolated from structural conditions, this approach integrates insights from behavioural science with a justice lens, recognising how physical, social, and economic barriers intersect to constrain or enable mobility. The following steps are outlined to explain the process:

1. Defining target groups

The starting point was identifying the groups most affected by inequalities in active mobility. These include people facing physical, cognitive, socio-economic, or social barriers to walking, cycling, or wheeling: older adults, people with disabilities, low-income individuals, ethnic minorities, migrants, LGBTQIA+ individuals, women, children, and youth.

2: Understanding intersectional mobility needs

To ground interventions in real needs, six core active mobility needs were identified:

- **Accessibility:** Infrastructure and physical factors (e.g., ramps, appropriate sidewalks) enabling active mobility, plus accessible public information.
- **Safety & security:** Feeling protected from accidents (safety) and crime/harassment (security).
- **Reachability:** Having essential services (e.g., schools, healthcare, shops) within a reasonable distance/time on foot, wheelchair, or bike.
- **Affordability:** Financial accessibility of necessary equipment (e.g., cargo bikes, e-bikes) for individuals with specific needs or limited resources.
- **Reliability:** Safe and convenient active travel options across varying conditions (e.g., weather, infrastructural disruptions).
- **Pleasantness & comfort:** Enjoyable, user-friendly environments (e.g., well-maintained paths, seating, shade) that encourage regular active mobility and accommodate additional needs for rest.

These needs are experienced differently across groups and often intersect, compounding disadvantage as already stated in Chapter 2.

3: Applying the COM-B model and the Behaviour Change Wheel

To translate these needs into actionable strategies, we applied the COM-B model (Capability, Opportunity, Motivation—Behaviour). The COM-B model explains behaviour through the interaction of Capability, Opportunity, and Motivation, each of which includes specific sub-elements. When applied to the context of active mobility, this framework helps identify the psychological, physical, social, and emotional factors that can either enable or hinder walking, cycling, or wheeling. The table below provides a breakdown of each COM-B component as it relates to active mobility choices.

COM-B	
Key elements	Key sub-elements
Capability	Psychological <i>Refers to internal cognitive abilities required for active mobility, such as understanding routes, navigating urban spaces safely, knowledge of traffic rules, and mental resilience to handle challenges in the environment.</i>
	Physical <i>Involves the physical capacity to engage in active mobility, including body mechanics, strength, endurance, balance, and overall physical readiness.</i>
Opportunity	Physical <i>Encompasses external, tangible factors that enable or hinder active mobility, such as the availability and quality of infrastructure, resources, tools, and environmental conditions.</i>
	Social <i>Involves the influence of social norms, community dynamics, interpersonal relationships, and social support systems that shape active mobility behaviours.</i>
Motivation	Reflective <i>Relates to conscious decision-making processes, including planning, evaluating</i>



	outcomes, and setting goals. Reflective motivation drives individuals to choose active mobility based on personal values, knowledge, and perceived benefits.
	Automatic <i>Refers to habitual behaviours and emotional responses that influence active mobility. This includes ingrained habits, routines, or impulses (such as routinely choosing to walk or cycle) that occur without deliberate decision-making.</i>

Table 4 COM-B model for active mobility choices.

The COM-B model is used alongside the BCW to identify suitable intervention strategies. While COM-B helps explain why behaviours occur the BCW focuses on how to address them through specific interventions which are: 1) **Education** (Increasing knowledge or understanding linked to psychological capability and reflective motivation); 2) **Persuasion** (Using communication to induce positive or negative feelings or stimulate action linked to reflective and automatic motivation); 3) **Incentivization** (Creating expectation of reward linked to reflective and automatic motivation); 4) **Coercion** (Creating expectation of punishment or cost linked to reflective and automatic motivation); 5) **Training** (Imparting skills linked to psychological and physical capability and reflective and automatic motivation); 6) **Enablement** (Increasing means or reducing barriers to enhance capability beyond education/training or opportunity beyond environmental restructuring linked to psychological and physical capability and reflective and automatic motivation); 7) **Modelling** (Providing an example for people to aspire to or imitate linked to social opportunity); 8) **Environmental Restructuring** (Changing the physical or social context linked to psychological and physical capability, physical and social opportunity and reflective and automatic motivation); 9) **Restriction** (Using rules to reduce the opportunity for the target behaviour or to increase it by limiting competing behaviours linked to physical and social opportunity).

4: Mapping good practices against intervention types

The review of good practices led to the identification of five overarching categories of behavioural interventions, each comprising specific sub-groups of actions targeting different behavioural levers. These categories reflect diverse strategies for promoting just, inclusive active mobility, from direct engagement and empowerment to environmental design and economic incentives. Together, they illustrate the range of intervention types that can be applied across contexts, user groups, and justice dimensions. A total of 92 good practices from over 22 countries were analysed. All were mapped to a BCW intervention type, then further grouped into five main categories and 16 sub-categories, each reflecting a distinct approach to influencing mobility behaviour.

Categories	Sub-groups
A - Coaching, empowerment and community engagement	A.1 - Coaching and training
	A.2 - Community initiatives
	A.3 - School mobility
B - Informational, educational and awareness-raising initiatives	B.1 - Personalised guidance and information services
	B.2 - Storytelling and awareness initiatives
C - Digital and smart systems	C.1 - Route planning Apps
	C.2 - Walking/Cycling smart systems



D - Economic levers and incentives	D.1 - Challenge/game-based initiatives
	D.2 - Support for bike/e-bikes ownership and use
	D.3 - Economic incentives and pricing strategies
E - Walking and cycling environment	E.1 - Streetscape design (visual cues)
	E.2 - Bike supporting infrastructures
	E.3 - Placemaking initiatives
	E.4 - Car-free areas
	E.5 - Climate-proof walking/cycling streets

Table 5 Active mobility intervention types and related subgroups.

5.3 Actionable ideas: behavioural change

Coaching, empowerment and community engagement

A - COACHING, EMPOWERMENT AND COMMUNITY ENGAGEMENT						
Intervention types	A.1 - Coaching and training A.2 - Community initiatives A.3 - School mobility					
COM-B components	Capability		Opportunity		Motivation	
	<i>psychological</i>	<i>physical</i>	<i>physical</i>	<i>social</i>	<i>automatic</i>	<i>reflective</i>
Vulnerable groups	Older people, Women, Youth, Children, Families, LGBTQIA+, Migrants, People with disabilities					

A.1 – Coaching and training

These initiatives promote active mobility by building confidence, capability, and motivation, especially for those unfamiliar or uncomfortable with cycling or walking. Training fosters independence, empowers marginalised groups, and strengthens community ties, while building long-term behavioural change through skill development and community-based support.

Spotlight Good Practice: Paths for All - Training for Health Walks

- **Location:** Scotland, United Kingdom
- **Description:** A national programme that trains volunteers to lead short and accessible group walks designed for individuals facing barriers to physical activity, such as older adults, people with long-term health conditions, and those experiencing social isolation.
- **Key Features:** volunteer-led health walks, focus on accessibility and inclusion, social connection and mental/physical well-being, capacity-building through structured volunteer training.



- Impact: over 800 volunteers trained annually, more than 600 Health Walks conducted weekly, reaches 20,000+ participants per year, recognised model for combining health, social inclusion, and active mobility.
- COM-B Components: physical capability, social opportunity, reflective motivation.

A.2 – Community initiatives

These initiatives leverage local knowledge and empowerment to reimagine public spaces through audits, reporting platforms, and co-creation addressing ownership and local needs. They help ensure that interventions are inclusive, context-sensitive, and rooted in lived experience.

Spotlight Good Practice: Safety Walks

- Location: Gothenburg and other Swedish cities
- Description: A long-standing initiative where residents collaborate with local authorities to assess and improve public space safety through participatory neighbourhood audits. Using structured protocols, communities identify risks such as poor lighting or overgrown vegetation.
- Key Features: participatory safety audits, resident–authority collaboration, structured data collection on urban safety, focus on visibility, lighting, and environmental hazards.
- Impact: widespread adoption across multiple cities since the early 2000s, tangible improvements to urban safety infrastructure, increased resident perception of safety and trust in local governance, enhanced community involvement in urban planning.
- COM-B Components: social opportunity, reflective motivation.

A.3 – School mobility

These initiatives target school-aged children and families to embed active mobility habits early. Methods include bike buses, pedibuses, educational campaigns, and digital route management tools.

Spotlight Good Practice: STARS - Sustainable Travel Accreditation for Schools

- Location: Zaragoza, Spain
- Description: A multi-tiered school mobility programme encouraging walking and cycling to school through accreditation schemes, peer education, and infrastructure improvements.
- Key Features: behavioural tracking, student ambassador programmes, school community engagement.
- Impact: involved over 12,000 students across 31 schools, reinforcing a culture of active mobility and safety around schools.
- COM-B Components: reflective motivation, social opportunity

Informational, educational and awareness-raising initiatives

B - INFORMATIONAL, EDUCATIONAL AND AWARENESS-RAISING INITIATIVES



Intervention types	B.1 - Personalised guidance and information services B.2 - Storytelling and awareness initiatives					
COM-B components	Capability		Opportunity		Motivation	
	<i>psychological</i>	<i>physical</i>	<i>physical</i>	<i>social</i>	<i>automatic</i>	<i>reflective</i>
Vulnerable groups	Older people, Youth, Children, Older people, Women, LGBTQ+ individuals					

B.1 – Personalised guidance and information services

These initiatives provide clear, targeted, and user-friendly information to promote sustainable transport choices. Through maps, signage, and digital tools, they enhance understanding and accessibility, encourage walking and cycling, and reduce car dependency.

Spotlight Good Practice: Metrominuto

- Location: Pontevedra, Spain
- Description: A pedestrian map initiative launched in 2011 that shows walking distances and times across city points, modelled after metro maps.
- Key Features: visually clear maps, citywide distribution, locally adapted designs, part of active ageing and urban accessibility policies.
- Impact: Inspired replication in over 10 cities across Europe; improved pedestrian awareness; contributed to a shift in modal share in Pontevedra toward walking.
- COM-B Components: psychological capability, reflective motivation.

B.2 – Storytelling and awareness initiatives

These campaigns use emotional narratives, identity framing, and social storytelling to promote walking and cycling as aspirational, inclusive, and normative behaviours. Such efforts help reshape public perception and support systemic cultural change.

Spotlight Good Practice: I Bike CPH

- Location: Copenhagen, Denmark
- Description: A branding and identity campaign launched in 2017 as part of the city's goal to be the world's best cycling city, using the slogan "I bike CPH" to replace "I ♥ NY" with a bicycle.
- Key Features: emotional branding, integration with cycling policies, citywide visibility, alignment with modal shift strategies.
- Impact: contributed to making cycling a core part of Copenhagen's identity.
- COM-B Components: automatic motivation, social opportunity

Digital and smart systems

C - DIGITAL AND SMART SYSTEMS	
Intervention types	C.1 - Route planning Apps C.2 - Walking/Cycling smart systems



COM-B components	Capability		Opportunity		Motivation	
	<i>psychological</i>	<i>physical</i>	<i>physical</i>	<i>social</i>	<i>automatic</i>	<i>reflective</i>
Vulnerable groups	Youth, Children, People with disabilities.					

C.1 – Route planning Apps

These tools promote sustainable and inclusive mobility by offering real-time, personalised, and accessible information for planning walking and cycling routes. They reduce psychological barriers and foster autonomy, especially for people with reduced mobility or lower digital literacy.

Spotlight Good Practice: FOLLOW

- Location: Brest (France) and Dublin (Ireland)
- Description: An inclusive route planner designed for people with reduced mobility, identifying the safest and most accessible walking routes using AI and user-reported data.
- Key Features: Crowd-sourced obstacle detection, AI-driven route optimisation, co-design with mobility-impaired users, integration into city planning.
- Impact: Offers inclusive navigation, raises awareness of infrastructure issues, informs municipal improvements, and supports behavioural change among vulnerable pedestrians.
- COM-B Components: Psychological capability, physical opportunity, automatic motivation

C.2 – Walking/cycling smart systems

These interventions use sensors, data, and connectivity to support real-time decision-making, prioritise active travellers, and create engaging, responsive environments for walking and cycling. They reinforce behavioural change through visibility, gamification, and feedback loops.

Spotlight Good Practice: Smart Bicycle Counters

- Location: Copenhagen, Denmark
- Description: Real-time counters that track and publicly display the number of cyclists passing key city points each day and year.
- Key Features: Public-facing LED counters, integrated data collection, motivational displays, alignment with Copenhagen's cycling targets.
- Impact: Enhances visibility of cycling culture, provides feedback to users, informs urban planning, and reinforces the city's commitment to active mobility.
- COM-B Components: physical opportunity, automatic motivation

Economic levers and incentives

D - ECONOMIC LEVERS AND INCENTIVES	
Intervention types	D.1 - Challenge/game-based initiatives



	D.2 - Support for bike/e-bikes ownership and use D.3 - Economic incentives and pricing strategies					
COM-B components	Capability		Opportunity		Motivation	
	<i>psychological</i>	<i>physical</i>	<i>physical</i>	<i>social</i>	<i>automatic</i>	<i>reflective</i>
Vulnerable groups	General, Youth, Children, Families, Migrants, Low-income, Employees					

D.1 - Challenge/game-based initiatives

These initiatives use gamification and competitive elements to make active travel engaging and socially rewarding. These initiatives often incorporate tracking tools, point systems, and community-based goals to encourage participation and habit formation.

Spotlight Good Practices: Beat the Street

- **Location:** United Kingdom (multiple cities)
- **Description:** A gamified walking and cycling challenge that transforms towns into real-life games using digital “Beat Boxes” where participants earn points by tapping cards or fobs at locations across the city.
- **Key Features:** community challenges, real-time feedback, digital leaderboards, team and individual incentives, donation-linked rewards.
- **Impact:** reached over 1.9 million people in 170+ areas. In Burnley alone, participants walked/cycled 155,121 miles. Demonstrated success in increasing physical activity and community engagement.
- **COM-B Components:** reflective motivation, automatic motivation, social opportunity

D.2 - Support for bike/e-bikes ownership and use

These initiatives focus on improving access to cycling through donation, sharing, or low-cost acquisition of bikes and e-bikes (especially for low-income or marginalised groups). Often includes training, maintenance, or co-design components to build ownership and confidence.

Spotlight Good Practices: Bota pra Rodar

- **Location:** Recife, Brazil
- **Description:** A community-based bike-sharing and refurbishment initiative aimed at low-income residents. It collects and redistributes donated bikes, while fostering skills and community ownership.
- **Key Features:** Free access to bikes, mechanics training, entrepreneurship workshops, co-management model, weekly community meetings.
- **Impact:** Empowered underserved communities through mobility access and employment skills. Strengthened civic participation and environmental consciousness.
- **COM-B Components:** physical opportunity, automatic motivation, reflective motivation



D.3 - Economic incentives and pricing strategies

Employs fiscal measures like subsidies, bonuses, tax benefits, or disincentives (e.g., parking fees, congestion charges) to shift travel choices. These interventions aim to influence cost-benefit perceptions and align personal behaviour with environmental goals.

Spotlight Good Practices: Be-Cyclist

- Location: Belgium (nationwide)
- Description: Launched in 2021, Belgium's first federal cycling action plan includes 52 measures to boost everyday cycling, including fiscal incentives for commuters.
- Key Features: Fiscal incentives (e.g. potential expansion of €0.24/km tax-free allowance), integration with railways, anti-theft bicycle registry, support for cycle highways.
- Impact: Aims to raise cycling rates, cut transport emissions by 55% by 2030, and reduce traffic congestion costing €2 billion annually.
- COM-B Components: physical opportunity, reflective motivation.

Walking and cycling environment

E - WALKING AND CYCLING ENVIRONMENT						
Intervention types	E.1 - Streetscape design (visual cues)					
	E.2 - Bike supporting infrastructures					
	E.3 - Placemaking initiatives					
	E.4 - Car-free areas					
	E.5 - Climate-proof walking/cycling streets					
COM-B components	Capability		Opportunity		Motivation	
	<i>psychological</i>	<i>physical</i>	<i>physical</i>	<i>social</i>	<i>automatic</i>	<i>reflective</i>
Vulnerable groups	Older people, people with disabilities, Families, Children, Street Workers, Low-income, Migrants.					

E.1 – Streetscape design (visual cues)

This intervention focuses on visual and spatial cues in the streetscape such as signage, markings, surface textures to influence perceptions of safety, guide behaviour, and make walking and cycling environments more intuitive and inclusive. These low-cost but high-impact design solutions can significantly improve both actual and perceived safety, particularly for vulnerable groups.

Spotlight Good Practices: 3d Zebra Crossing

- Location: Ísafjörður, Iceland (replicated globally)
- Description: Pedestrian crossings painted in a 3D optical illusion style to appear raised above the street surface.
- Key Features: Visually striking design that naturally slows down drivers, increases crosswalk visibility, and enhances pedestrian priority.



- Impact: Widely adopted for its simplicity and effectiveness, especially near schools and areas with vulnerable pedestrians.
- COM-B Components: Physical opportunity, Automatic motivation.

E.2 – Bike Supporting Infrastructures

These infrastructures (for example secure, accessible bike parking, but also bike racks and repair stations) can enhance perceived safety, prevent theft, support multimodal travel. These interventions are a form of environmental restructuring, enabling behaviour change across all user groups by making cycling more convenient and reliable.

Spotlight Good Practices: Secure Bike Shelters

- Location: Paris, France
- Description: Paris has introduced secure bike shelters across the city to promote everyday cycling. These structures offer weather protection and anti-theft features, addressing major deterrents to bike use, and are positioned in high-demand locations to support regular and multimodal travel.
- Key Features: Weather protection, theft reduction, located in high-demand areas.
- Impact: Encouraged broader adoption of cycling by removing key barriers; enhanced sense of safety and convenience for users.
- COM-B Components: physical opportunity, reflective motivation.

E.3 – Placemaking initiatives

These initiatives activate and transform public spaces to make them more inclusive, welcoming, and functional, especially for people who are often excluded from traditional urban design. Through public seating, creative design, and community participation, these interventions promote environmental restructuring, encouraging people to walk, meet and socially engage.

Spotlight Good Practices: Citizen Bench

- Location: Munich, Germany
- Description: The Citizen Bench project enhanced urban seating by involving residents in the design and placement process using the hogga.me web application. It empowered citizens to share preferences on form, material, and location.
- Key Features: Digital participation via hogga.me, customizable bench design, citizen feedback integration, transferable toolbox for other cities.
- Impact: Improved the quality and inclusivity of public seating; increased civic engagement and environmental awareness; informed urban planning with real community input.
- COM-B Components: physical opportunity, psychological capability, reflective motivation.

E.4 – Car-free areas

These interventions limit or eliminate motorised traffic in targeted urban zones to create healthier, safer, and more accessible environments. These areas can take many forms (like temporary closures, low-traffic neighbourhoods, or repurposed parking spots for example) and



often serve as platforms for community events and cultural engagement, especially benefiting vulnerable groups.

Spotlight Good Practices: Parklets

- Location: Munich, Germany
- Description: The Parklets initiative transforms car parking spaces into small community-oriented public areas featuring seating, plants, and bike racks. Initiated as a pilot in 2021, it invites residents and local groups to design and manage these temporary installations, aiming to foster social interaction and environmental awareness.
- Key Features: Temporary transformation of parking spaces, community co-design, seasonal recurrence, green infrastructure.
- Impact: Improved community interaction, promoted sustainable mobility, increased urban greenery, and inspired similar interventions.
- COM-B Components: physical opportunity, social opportunity, reflective motivation.

E.5 – Climate-Proof Walking/Cycling Streets

These interventions ensure thermal comfort for citizens walking and cycling even under adverse weather conditions, such as extreme heat events. By integrating green and blue infrastructure, they reduce heat exposure, enhance walkability, and provide shelter—particularly benefiting vulnerable populations.

Spotlight Good Practices: Climate Shelters Network

- Location: Barcelona, Spain
- Description: The Climate Shelters Network provides residents with thermally comfortable public spaces (such as parks, libraries, and schools) that double as refuges during extreme heat. Launched in 2020, it is central to Barcelona's climate adaptation and public health strategies.
- Key Features: Indoor/outdoor shelters, integrated into everyday public infrastructure, widespread accessibility, tailored for heat-vulnerable populations.
- Impact: Expanded from 70 to 350+ shelters by 2024, ensuring 97% of residents are within a 10-minute walk of a climate refuge; enhanced urban resilience and promoted safe, climate-adapted active mobility.
- COM-B Components: physical opportunity, psychological capability, reflective motivation.

5.4 Conclusions

This chapter highlights that behaviour change is not simply an individual matter of choice, but a social and structural process deeply entangled with justice, inclusion, and equity. By using the COM-B model and the Behaviour Change Wheel as guiding frameworks, we were able to identify how interventions can target not only personal motivation and skills, but also the broader opportunities and barriers that shape people's ability to walk, cycle, or wheel safely and comfortably.

A key insight from this work is that behavioural interventions for just streets must address multiple, intersecting layers of inequality—including physical access, safety, affordability, social norms, and cultural perceptions. The review of 92 good practices across 22 countries shows



that interventions work best when they are context-sensitive, co-created with communities, and explicitly designed to empower groups historically excluded from active mobility.

Five broad intervention strategies emerged—coaching and community empowerment, informational and educational campaigns, digital tools, economic incentives, and environmental restructuring—each offering complementary entry points to support behavioural change. These interventions are not neutral technical fixes: they are political acts that redistribute power, resources, and visibility within urban spaces.

In summary, promoting behaviour change for just streets requires more than encouraging modal shift: it demands transforming the conditions under which people can safely, confidently, and joyfully move through their cities. It calls for an integrated approach that connects behavioural insights with structural change, participatory methods, and a commitment to recognising and redressing exclusion.

Future applications of this framework should continue to embed participatory evaluation and iterative learning, ensuring interventions remain adaptable, accountable, and responsive to the lived experiences of diverse urban communities.

KEY TAKEAWAYS

1. **Behavioural interventions must address structural barriers**—justice in mobility requires not only changing individual habits, but transforming the social, economic, and physical conditions that enable or constrain behaviour.
2. **The COM-B model and Behaviour Change Wheel** provide practical tools to align behavioural strategies with justice goals, by linking individual, social, and environmental factors to targeted interventions.
3. Interventions work best when **co-created with communities**, ensuring that strategies reflect lived experiences, local knowledge, and the diverse needs of historically excluded groups.
4. Five complementary intervention types—**coaching, information, digital tools, economic incentives, and environmental design**—offer multiple entry points to support behavioural change and promote equitable active mobility.
5. Behaviour change is a **political process**: behavioural strategies must be designed to redistribute power, increase visibility for marginalised users, and embed justice into both the outcomes and processes of street transformation.



6. 'What if we had just streets?' – Change through prefigurative planning and design

6.1 Introduction

An increasing number of cities across Europe have recently adopted progressive mobility plans. These plans are often a policy response to the myriad societal and environmental problems that are connected to decades of developing car dominated mobility systems. Making policy claims to do things differently is of course important, but when they are implemented, these ideas often run into fierce –sometimes even violent– resistance. These dynamics are already quite well understood; resistance is often most severe before implementation, but subsides in time or even turns into support (Goodwin, 2006; Van Wee et al. 2023).

The difficulties of transformation can be explained by various social and societal mechanisms. For example, *pluralistic ignorance* (Miller & McFarland, 1987) means that people often wrongly perceive a minority position on a given topic as being the majority position. Strong negative sentiments about changes to streets receive disproportional attention, pushing majority support into silence. Moreover, often used imaginative stated preference questions are not challenging people to discuss *real experiences* of living and moving differently. This means that opportunities of change are dismissed based on speculation, not on practical experimenting and shared experiences.

In addition to the dynamics of pluralistic ignorance, our inability to imagine is explained by well-established *motonormativity* that transgresses most modern societies (Walker et al. 2023; Walker & te Brömmelstroet, 2025). This means that we unconsciously apply double standards to the car-dominated status quo in the face of potential change. The point is that people and decision makers have unconscious biases in their reasoning that stems from a strong cultural assumptions about the role of private cars in (late)modern societies. To illustrate this bias Walker and colleagues (2023) compared people's views on how car driving compares to other social practices that harm other street users (e.g. "*People shouldn't drive in highly populated areas where other people have to breathe in the car fumes*" vs "*People shouldn't smoke in highly populated areas where other people have to breathe in the cigarette fumes*"). They found that people are much more prone to accepting the harms of driving than other practices (e.g. only 17% agreed with "*People shouldn't drive...*", but 75% agreed with "*People shouldn't smoke...*").

But instead of being held back by the *fear* of resistance and biased thinking against change, our cities need to start moving forward with *courage* and *curiosity*. This chapter discusses planning approaches and tools that can help cities to enact changes in their street planning and public space use *here and now*. By imagining radically different realities through asking "What if..." we can figure out what kinds of planning and design can nurture desirable urban realities – and start enacting and living today those realities that don't yet exist. These approaches are discussed under the concept of prefigurative planning.

6.2 Conceptual framework: Prefigurative planning

Prefigurative planning entails that we should not wait for new planning and design approaches to be approved by existing structures and institutions but to start doing something today



(Davoudi, 2023). The power of prefiguration lies in acting here and now, "as if" inclusive urban mobility was really a norm across European cities.

Generally, prefigurative action stems from two core principles (Yates, 2015). First, prefiguration means building alternatives to the prevalent practices and institutions that dominate urban planning. This means for example street designs but also the practices and processes that lead to these designs (e.g. software, organisational processes, hierarchies of knowledge etc.). Secondly, prefiguration often seeks to establish a means-ends equivalence, meaning that the desired end-results should dictate how they are pursued. For example, this principle can mean that if we want to create spaces for marginalised people, those people should be able to attend the design processes. Moreover, their participation should be facilitated in a way that is accessible and meaningful for them (e.g. think for example what could be a meaningful way to involve children in planning processes).

Prefigurative planning is not confined to a specific group of actors (e.g. transport planning experts) – it can be both bottom up (stemming from grass roots activism) but also top down (implemented by the state or public authorities). But in either case it should identify and resource groups and communities that might have been previously marginalised from street design and planning. The idea that "whatever the nature of the present, situations can change, and even the most marginalised might participate in effecting that transformation" (Jeffrey & Dyson, 2021, 653), is an organic part of prefigurative planning.

Importantly, prefiguration means enacting futures in an open-ended fashion where the end results are not predetermined but learned together in the course of planning, design and implementation. In other words, it demands experimenting, failing, succeeding and learning with new street designs, planning processes and governance measures. But this is not to say that "anything goes" and experimenting has its own quality criteria. A successful experiment is often defined as (Roorda et al. 2014, 31):

- radical (substantially and holistically changes how streets are used);
- feasible (we are able to practically do conduct the experiment) ;
- linked to a concrete challenge (e.g. traffic danger, air quality, liveability);
- leads to strategic learning for all relevant stakeholders and;
- mobilises wider society (meaning people out and organisations outside of planning processes).

All these features are relevant for prefigurative planning but to get the ball rolling towards transformative change, the first step requires to focus optimizing *feasibility*, without losing too much on *radicality*. Here the point is, again, to achieve something here and now without long-winding planning for action. Even though prefiguration is not interested on the status quo – how things are and what is "possible" or "impossible" in the current regime – too radical initiatives are *practically* very difficult to implement. Despite the often experimental and local nature of prefigurative planning, its long term goal should always be the holistic and systemic transformation in how streets are planned and used.

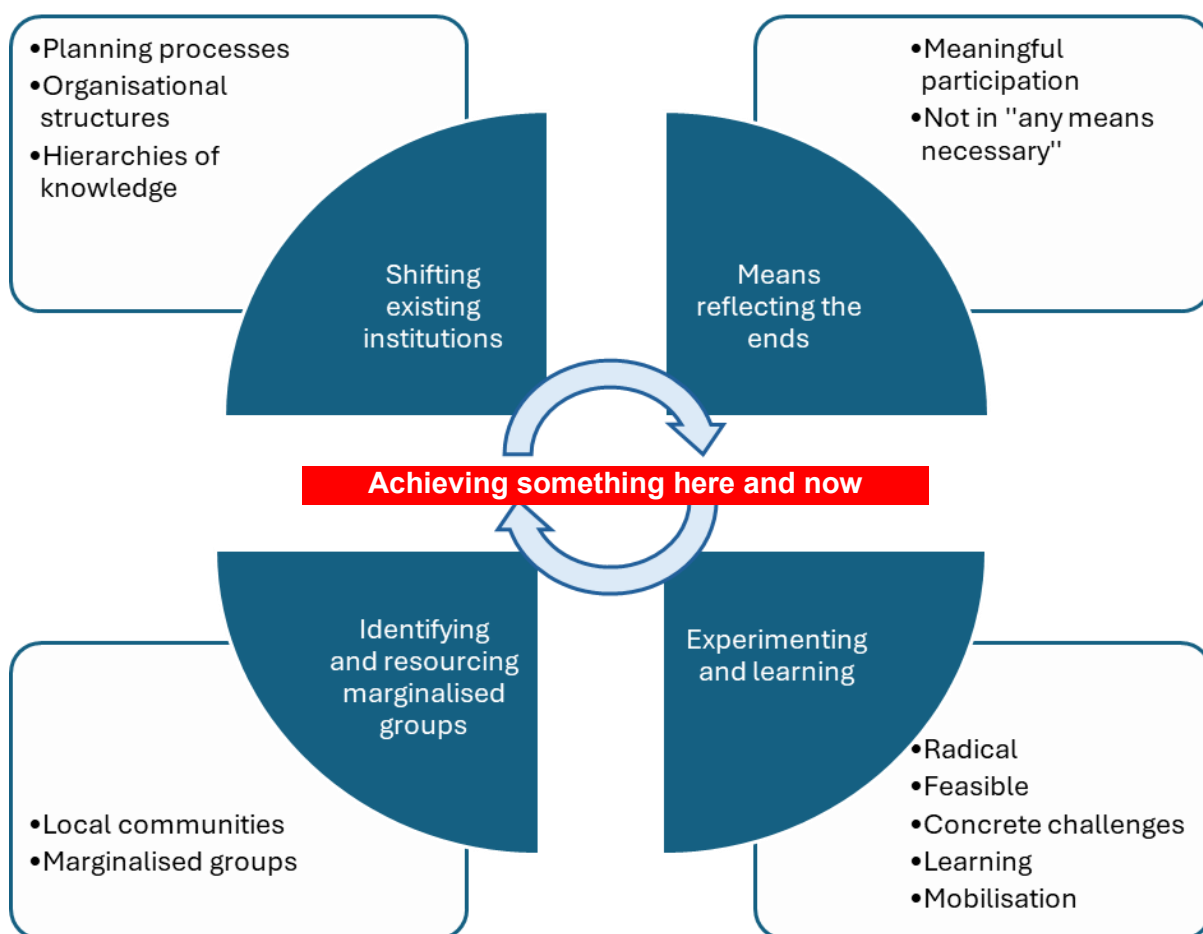


Figure 5 Elements of prefigurative action (Yates, 2021)



6.3 Actionable ideas for innovative planning and design approaches

The following sections showcase actionable planning approaches by explaining their prefigurative powers by asking and answering the question of “What if...”. Additionally, in the end of each section there is a concise call to action explaining what can your city do NOW.

School streets – What if all children could walk or cycle to school?

BASIC IDEA AND BACKGROUND: The basic rationale of school streets is that streets and neighbourhoods outside of schools are extensively used by children and families (especially in the beginning and after the school day), which is why these spaces should be allocated for the mobility modes and various other uses that are important for these groups. School streets seek to diversify how streets are used, often combined with monitoring the effects of change on the local community. This can be for example in terms of levels of children’s physical activity and health (e.g. Thompson, 2024); air quality around schools (e.g. Gellatly & Marner, 2021); transition towards more active and sustainable mobility (e.g. Bernardino et al., 2023).

While different cities and neighbourhoods do this in their own way, there are a few clear steps that are often followed. First, a school street may mean temporarily closing a street during peak drop off and pick up times. Here, many practitioners emphasise that it is also important to enforce these closures for them to work. Cities can use temporary objects such as movable gates and bollards, ask school community members to act as volunteers to redirect traffic, or even install cameras that catch and fine vehicles who should not be there.

Some school streets schemes take it a step further. They partially redesign part of the street to slow down traffic. These measures include lowering speed limits or altering the street layout with speed bumps, planters, and other creative street furniture. Furthermore, some schemes even close the street down all together to car traffic allowing for a radically new uses of public space outside of schools.

PREFIGURATION: From the prefigurative planning perspective the crucial question is what kinds of life realities school streets are allowing for children and families. School streets are often implemented in an agile way and are immediately instilling alternative uses of the streets but also creating a modal shift of school trips towards walking and cycling. While school streets are often praised for promoting better air quality and children’s physical activity, these rationalities are not the only reasons why school streets should be created. By experimenting and learning we can learn totally new reasons for advocating the implementation of school streets.

School streets are essentially street experiments, that can be defined as ‘intentional, temporary change of the street use, regulation and/or form, aimed at exploring systemic change in urban mobility’ (Bertolini, 2020, 735). Here the idea of street experiments is not to get answers to predefined questions but also to allow the local community, decisionmakers and planners to learn together what works in certain contexts and why different children and adults think school streets are valuable. For example, regarding children’s autonomous and active mobility, the instrumental and functional rationalities of mobility (such as physical activity and environmentalism), might be actually secondary to the social community benefits and children’s autonomy, when you ask children and parents (Silonsaari et al., 2022; 2023).



JUST STREETS

The point is that school streets should allow for social learning where various stakeholders can together discuss the meaning of street designs and used. As such they prefigure new everyday mobilities, social relations and spatial configurations, challenging prevalent ideas around how streets should be used and what they are for. Importantly, they propose that planning practice should attend to the local community dynamics – schools are spaces where certain populations with certain needs are prioritised over other street uses. Schools, families and children to plan and implement are not conventionally involved in street design processes but there are several ways to empower them. In order to be truly prefigurative the design processes should involve children in ways that are natural to them – through play and exploration.

WHAT CAN YOUR CITY DO NOW: Start a school street experiment in a few local schools and plan it with school staff, parents and children. There is an abundance of resources online and check for example the Just Streets knowledge clip on school streets. Ask the involved actors to share their experiences with other schools and cities and make sure to measure and document the perceived benefits – especially those of children!

- Just Streets knowledge clip on School Streets
- [School Streets How to -guide of Active Travel England](#)
- [Information on Paris School Street schemes](#)



Figure 6 Paris has implemented hundreds of school streets during the past years (Picture: Ville de Paris).

Superblocks – What if streets were designed for people and not just for traffic?



BASIC IDEA AND BACKGROUND: A Superblock is a neighbourhood transformation strategy combining multiple urban blocks, forbidding or severely limiting drive-through traffic through built means, thereby pacifying its streets and giving priority to active modes of transport (walking, cycling) and multiple uses. It limits any traffic not coming from or to the neighbourhood. Consequently, the roads are safer and more welcoming for people. As the borders of a Superblock are still driveable for cut-through traffic, a city could consist of Superblocks adjacent one to another: a main network of thoroughfares intended to support cut-through traffic, and all the meshes of this network redesigned as superblocks to support non-motorised mobility and multiple street use.

By designing streets for people and not just for traffic, streets become more inclusive. They are less hazardous, both directly by a reduction of cars, and indirectly by a reduction of air and noise pollution. Taking space and freedom of movement away from the most harmful actors – cars – and redesigning local streets, the superblock approach makes local streets more inviting, increasing the vitality in the neighbourhood. This empowers citizens to reclaim streets as shared social spaces for a more inclusive city.

The most famous example of superblock's development are Barcelona's Supermanzanas. The original idea of superblocks in Barcelona, formulated by Rueda (2019), envisaged the creation of highly restricted traffic zones within areas composed of several blocks, keeping the circulation of motor vehicles on the outer perimeter and severely restricting it on the inside. The first superblock experiment was developed starting in 2016 in the Poblenou neighborhood, originating controversial reactions and resistance also due to its top-down nature (Nello Deakin, 2024). Later, between 2017 and 2020, the superblock model was replicated, in a more flexible way, and with greater citizen participation, in other neighborhoods of Barcelona.

PREFIGURATION: A key objective of superblocks is to change the urban imaginary concerning mobility and the use, or rather the different uses, of streets. The development of superblocks is related to a different idea of the city and the street, in which the use and presence of cars is limited to favour other types of (active) mobility, and people are invited to use and experience the street. This also implies the creation or re-appropriation of the street as a public space. In this sense, the superblocks are an example of prefigurative planning, which, on the one hand, creates the material conditions that make it possible to use and experience the street in different ways and for a plurality of actors/users, and on the other hand makes it possible to reimagine streetscapes.

Moreover, superblocks can be considered as an approach that creates spaces for experimentation and, especially when they are developed on a temporary basis, for trial-and-error experiments of tactical urbanism, which can also foster reflexive practices (reflection in action) along with the participation and involvement of interested communities. By creating a different form of mobility and fostering the presence of a multiplicity of actors in the street, superblocks can promote a process of 'empowerment' and 'awareness' for subjects who are traditionally not considered central to planning and mobility. This depends largely on how the reimagined space is lived and how much room for institutionalisation of transformative participatory practices is given in planning processes.

In its most bare bone version, one can enforce a Superblock with very light material or structural changes, only some planters or bollards. A more radical transformation can remove curbs or implement additional street furniture such as benches, tables, playgrounds, etc. Superblocks can be implemented both as a temporary, and eventually reversible experiments of tactical urbanism, but also as a permanent reform and redesign of the streets and neighbourhoods involved. As such they allow for a gradual change through experimentation but also can achieve something immediately (*here and now*).



The ways in which the means-ends equivalence is reflected in the superblocks model can be very relevant as well as complex, especially because often implies at least some degree of institutional intervention. Some of the main issues linked to the implementation of the superblocks are linked to the degree of participation and involvement of the communities (residents, streets users, owners of local shops, etc.) in the different steps of the superblock's development (from design to implementation). In this sense it is important that the whole process is not perceived as too top-down to avoid resistance and protests. Another issue is related to the potential resistance to the implementation of the superblocks model promoted by lobbies or organized groups that oppose this model of mobility which can organize mediatic, political and even legal campaigns against the superblocks model. Another micropolitical issue is related to the necessity of counter, or at least mitigate as much as possible, the side and negative effects linked to the implementation of the superblocks model (gentrification and increase in housing costs in the neighbourhoods involved, "winner-losers" effect (Nello Deakin 2024), creation of "isles/oasis" in which alternative mobility and streets uses are created in a general urban context in which traditional, car-centred forms of mobility remain.

By designing or enhancing a neighbourhood, a Superblock can both foster and be fostered by community engagement. Place planters, large rocks, or bollards strategically on streets at the entrance of a new Superblock, or inside, slowing or blocking motorized traffic. Now people can meet, and children can play again in the streets without the hazard of cars, reconnecting the local social tissue. Avoiding complex infrastructural change, Superblocks can be quickly tested as a safe-to-fail experiment and implemented. This allows to spread agency and responsibility. Citizens can own again the streets here and now, not relying on expensive and drastic technological or infrastructural changes.

WHAT CAN YOUR CITY DO NOW: Your city could use the "Superblockify" software to visualize a scenario in which the city is covered by Superblocks. The software returns a coherent partitioning of any city into neighbourhoods and the impact on several KPIs, such as the share of streets that is then available for people instead of for traffic, or the increase in car trips caused by the created detours. This first vision can be refined by stakeholders' local expertise and knowledge. Superblockify is a Python package designed to assist in planning future Superblock implementations by partitioning an urban street network into Superblock-like neighbourhoods and providing tools for visualizing and analysing these partition results. It is designed to be modular, allowing new partitioner to be added to the method. This is done to ensure flexibility and adaptivity to a local context, either based on the local knowledge, or on the local desire and goal.

PARK(ing) days and car free days – What would happen to public space if there were no cars?

BASIC IDEA AND BACKGROUND: "Car-free days" happen in a variety of ways, but all share one feature: cars are restricted from accessing certain spaces in the city for a fixed period. In Europe, cities often implement car-free days during European Mobility Week which occurs during mid-September. Cities will often restrict cars from accessing the city centre, for example, allowing other forms of traffic such as pedestrian, cyclist and public transport traffic. This restriction might last from anywhere from several hours to an entire day. PARK(ing) Day, as a similar initiative, involves temporarily transforming (metered or not) parking spaces into "parklets" that are creatively used for social or artistic purposes. Participants might pay a parking meter to "rent" the space and then use it for activities like socializing, reading, or creating art, often with items like chairs, plants, and tables.



Citizen-led active mobility groups use car-free days to generate activities with citizens. Many other citizens groups use the opportunity to pursue their own outdoor interests. Citizens immediately see what a car-free city can be like. Citizens who see the difference a car-free day brings then ask themselves and others the question, “why couldn’t this happen more often?” and “what would it take for this to happen more often?” These questions immediately enable citizens to engage in a dialogue with their politicians, and in local political discussions with the people around them.

The Brussels Capital Region is known for implementing a regional-wide car-free day in September, Europe’s largest. In this case, motor vehicles are not allowed to circulate within the entire region from 09h00 to 19h00. Exceptions are permitted: taxis, public transport and emergency vehicles can circulate, as can drivers who obtain and pay for a special permission prior to the car-free day.

PREFIGURATION: Car-free days give a city’s inhabitants an extraordinary chance to witness how a city’s mobility system can change overnight. The sudden restriction of cars from the city frees up space for people to use the space as they like: to walk, cycle, to play, to draw or to meet with neighbours. The sudden freeing up of space for people enables citizens, planners and decisionmakers to *learn* how the public space usually reserved for cars can be used for other means that bring more benefits. Importantly, this learning happens without any predefined need to understand complex city planning documents and processes.

The sensory experience of living in the city changes drastically: people remark how they can hear birdsong and ordinary sounds of city life that are normally covered by car noise pollution. It allows people to realise just how much public space cars occupy. Inhabitants can explore the city at their pace, discovering new places within the city or perhaps rediscovering places they usually quickly drive by. Car-free days get inhabitants to ask, “what if ... we had more space on our streets?”, and enable them to immediately see the results.

Similarly, PARK(ing) Day serves as a prefigurative model by demonstrating how urban spaces can be repurposed for community benefit, showcasing potential permanent changes to urban landscapes, inspiring policy changes and long-term urban transformation, and challenging the status quo of car-centric urban design.

On the long term, lessons from Car-free days and PARK(ing) Days can help shape urban planning policies, leading to introducing permanent parklet zones, expanded pedestrian areas, and more green spaces—fostering a more people-centred urban environment.

WHAT CAN YOUR CITY DO NOW: Your city can start organising a recurring car-free day or alternatively begin by issuing easy-to-obtain permits for community groups to self-organize a PARK(ing) Days. Beyond permits and regulations, municipalities can further support local people by offering shared resources, such as a lending library for materials, and providing toolkits on how to create a successful parklets and other initiatives in the empty street spaces.



Figure 7 Park(ing) Day intervention transforming car parking spaces into temporary public spaces, demonstrating creative street reclamation and highlighting the potential for more just, people-centred urban environments

Rewilding – What if our streets were biodiverse and climate adaptive?

BASIC IDEA AND BACKGROUND: Cities face great challenges in rewilding their public spaces. This is seen as solution for a range of societal challenges, such as urban heat islands (Brandsma et al. 2024), the biodiversity crisis (Lehmann, 2021), air pollution, water retention, and physical, mental and social health problems (Nieuwenhuyzen, 2021). But how to get there when public space (and the underground) is already highly contested and for 60% filled with concrete, asphalt and bricks? And which many people take for granted. With temporary interventions, we can let people experience the effects of greening.

'If a forest can walk through a city, anything is possible.' With this in mind, Bruno Doedens proposed an artistic project when the city of Leeuwarden (NL) was the European Cultural Capital in 2022. In 'Bosk' he placed over 1.000 trees in movable street furniture that turned a street or square into a temporary forest. Volunteers take care of the forest and, after a week with exhibitions, shows, performances and meetings, move the trees to the next location in a theatrical procession.

PREFIGURATION: The radical changes in feeling, ambiance and comfort can have profound learning effects on how people perceive urban green and can increase support for rewilding plans. Rewilding initiatives often aim to communicate the urgency of urban greening, and to enchant and inspire the conversation about streets by giving nature a voice. Often the initiatives face little resistance beforehand and a lot of requests for the return of the trees afterwards.



Powerful performative initiatives can have impacts beyond their local contexts by spreading to new places. For example in the Netherlands, several cities have been replicating the temporary forest of BOSK, but all on a much smaller scale: Dordrecht (NL) has 150 trees ([see](#)), Arnhem (NL) 50 ([see](#)). From the experimental perspective this has made the initiatives more *feasible*, but also significantly reduced the impacts of the experience.

Prefiguring urban green can also happen by empowering citizens. This happened for example in the city of Lund, Sweden. The city offered citizens a climbing rose, a structure and a hole in the pavement in front of their house. The only promise that they had to make was to take good care of the rose. Through these small presents, the citizens significantly rewilded their streets without any resistance and turned urban greening into a very feasible public-civic partnership.

When no institutional actors are involved, prefigurative action happens through guerilla gardening, in which citizens just take actions themselves by claiming spaces for urban green. This can of course be also –implicitly – supported by local governments.

Prefigurative powers can also be supported by creating meaningful links between certain citizen groups and urban green. This has been experimented for example by creating Tree Nurseries at local elementary schools. This literally makes rewilding root in society by giving children the responsibility to take care of their trees. After nurturing them for a couple of years, the bigger trees can be planted somewhere in the city ([see](#)). This establishes meaningful relations between rewilding and future generations. You could even start to do this with existing trees and have them adopted by elementary schools or neighborhoods.

WHAT CAN YOUR CITY DO NOW: As the above shows, prefigurative planning for rewilding your city can start through creative experimentation and by involving actors and events that are not conventionally involved in such processes. The BOSK project in the Netherlands was possible due to a window of opportunity in the Cultural Capital program. Paris used the dynamics of organising the Olympic Games to realize significant rewilding projects (less temporary) in their bigger program to plant a total of 170.000 trees. Start by engaging with established cultural events and interest groups to put urban rewilding on your city's agenda!

- [The BOSK project](#)
- [On urban greening in Paris](#)



Figure 8 Temporary urban forest installation engaging citizens in reclaiming public space, fostering environmental awareness, and demonstrating collective action for greener, more just cities



Figure 9 Streets in the city centre of Lund (Sweden) with gifted climbing roses (Picture: Travel Monkey).



6.4 Conclusions

This chapter highlighted how prefigurative planning and design can be a transformative force in the pursuit of just streets, creating space for immediate, tangible change. By asking “what if?” and acting on the answer, this mode of planning demonstrates the power of prototyping alternative futures: making them visible, felt, and experienced in the here and now. It challenges traditional planning timelines and processes, instead inviting communities and institutions alike to model justice through experimental, iterative, and inclusive interventions.

From school streets that prioritise children’s safety and autonomy, to superblocks that reclaim space for people and community life, to PARK(ing) days and rewilding projects that reimagine the ecological potential of streets, each example cited here illustrates how temporary, experimental, tactical, or symbolic actions can spark new ways of thinking and acting. These interventions are not just physical; they are social and political acts that question dominant norms and reveal new possibilities. Importantly, they offer a form of learning-by-doing, where planners, residents, and policymakers co-create knowledge and build momentum for more structural change.

Prefigurative planning embodies the principle of “means-ends equivalence,” ensuring that the methods used to shape urban change are consistent with the values being promoted: such as equity, participation, and care. This requires centring community voices, especially those often excluded from formal planning processes, and designing not just for but with diverse users. At its core, this approach is hopeful and empowering: it recognises that more just, sustainable, and inclusive streets are not only possible, but they can begin now, through deliberate, creative, and collective action.

In doing so, prefigurative planning can become a vital strategy for cities striving to align their street transformations with mobility justice. It is both a mindset and a methodology - one that links vision with practice, imagination with implementation, and aspiration with accountability. As this chapter shows, by experimenting boldly and inclusively in the present, cities can lay the groundwork for the just futures they seek.



KEY TAKEAWAYS

Here are some important lessons on prefigurative planning

1. Prefigurative planning turns **visions into action** by testing just street futures here and now, enabling learning, adaptation, and social imagination beyond policy promises.
2. **Temporary, experimental, and community-led interventions**—like school streets, superblocks, car-free days, and rewilding—show how small-scale actions can challenge dominant norms and inspire systemic change.
3. Prefigurative approaches centre “**means-ends equivalence**”: the way we plan and design must reflect the just, inclusive outcomes we seek—requiring participation, equity, and care in every step.
4. These interventions are not only spatial changes but **political acts**, redistributing power and visibility to groups often excluded from planning processes.
5. **Prefigurative planning empowers cities and communities** to learn by doing, building collective confidence, knowledge, and agency to push toward more just, sustainable, and inclusive street systems.



7. Navigating Technology and Innovation for Just Streets

7.1 Introduction

In contemporary mobility planning, a range of approaches is available to address the evolving demands of urban systems. However, the increasing influence of pro-digital stakeholders has led to a growing reliance on digital mobility tools in many planning processes. This trend can be attributed to the rising prominence of market-driven and high-tech normative visions, which prioritize technology-intensive solutions. This scenario poses a significant threat to street justice, as these tools come with inherent limitations, biases, and drawbacks. This chapter critically examines the deployment of Digital Mobile Technologies (DMT). DMTs encompass a wide variety of digital technologies ranging from those used by transport and mobility planners, to those used by people to get around and to facilitate their mobility choices. They have in common heavy reliance on digital functions to fulfil their role. Their growing dominance and protagonism represent an important socio-technological transition, often (but not always) resulting from adding extra digital functions to existing technologies.

Digital Mobile Technologies (DMTs) can be used to support Mobility Planning Tools (MPT). These tools entail software packages and devices used in decision-making at various stages of the planning process. The trend in contemporary mobility planning is to implement a growing number of *DMT-MPT assemblages*, so that Digital Mobile Technologies (DMT) are used to inform Mobility Planning Tools (MPT) in an increasingly responsive, automated, fast, and efficient way. Conversely, the Mobility Planning Tools are supposed to operate as high-level managers of the DMTs operating across the city (see Figure 6). The assumption is that these assemblages will lead to extremely positive outcomes, as data, innovation, technology, highly skilled professionals, mobility and urban areas become increasingly synergistic and capable of serving the public interest. However, a series of drawbacks can be associated to them.

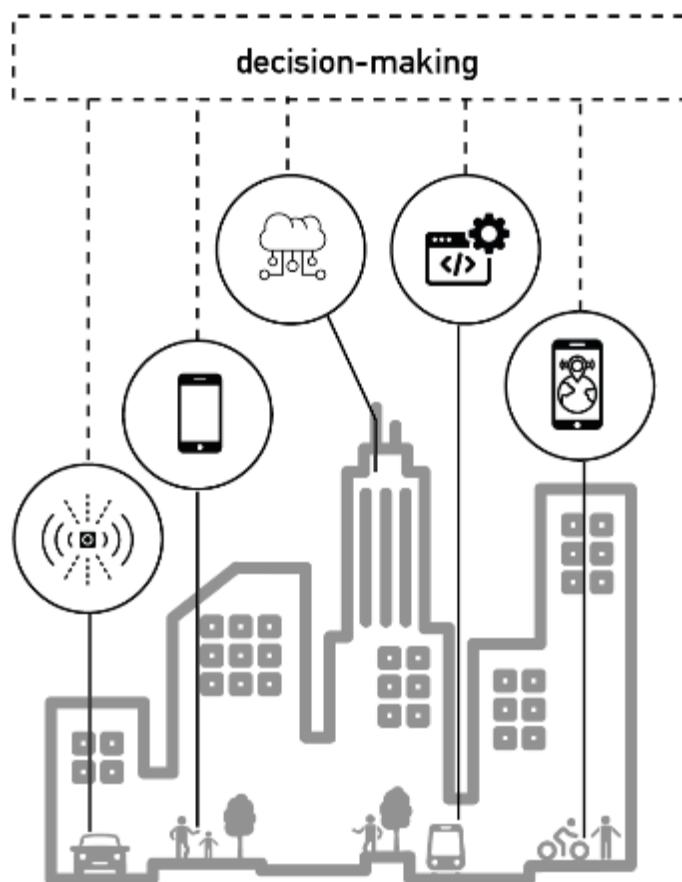


Figure 10 Representative scheme of DMT-MPT assemblages

Moving beyond “smart solutions”, this chapter proposes the notion of **techno-practical wisdom** as an approach to support decision-making. The Diverse and Balanced Intervention Spectrum (DIBIS) is presented as a framework that advocates for a proportional and balanced perspective, encouraging planners to consider different polarisations – such as low-tech and high-tech – in the pursuit of environmentally and socially sustainable mobility solutions. Moreover, we outline the operationalisation of the DIBIS framework as an approach to address other types of planning polarisations that might emerge in a decision-making process.

We employed a multi-stage methodology that integrates academic rigour and practical insights. The process combined a literature review, expert feedback and validation through a workshop to ensure the robustness of the recommendations offered. The literature review focuses on three topics: i. key publications on DMT concerning environmental sustainability, social equity, health impacts and cybersecurity, ii. technological intensity levels used in mobility planning tools, iii. the concept of “wisdom”.

This chapter is structured into four parts. This introduction sets the stage by outlining the concerns that motivated this research, introducing key concepts and ideas, and describing the methodology adopted. The second section **presents the Diverse and Balanced Intervention Spectrum (DIBIS) framework and the articulation of the techno-practical wisdom, introducing the three dimensions of wisdom: reflective, cognitive and affective.** The third section discusses actionable ideas including: strategies to deal with the risks and



drawbacks of using DMTs, a practical example of DIBIS framework to assess tools and methods used in mobility planning and the operationalisation of the DIBIS as a procedural approach. The fourth and final part is the conclusion, summarizing key insights for mobility planning practitioners.

7.2 Conceptual Framework: Navigating Technology and Innovation for Just Streets

The DIBIS Framework and the notion of techno-practical wisdom

The widespread adoption of Digital Mobile Technologies (DMT) in the transport sector is often framed as transformative, but it also brings significant social, environmental, and ethical challenges. Over-reliance on technology-intensive mobility solutions risks exacerbating inequalities, environmental degradation, monopolistic control by large tech corporations, and exposure to hackers and terrorists. Drawing on a literature review and expert feedback, this section argues that balancing low-tech and high-tech alternatives is constructive, ensuring that solutions are sustainable, equitable, and resilient. In addition, it advocates for an approach that considers the social dynamics, proposing citizen engagement in the development and deployment of mobility solutions.

The Diverse and Balanced Intervention Spectrum (DIBIS) framework is presented as a guide for creating equitable, sustainable and adaptable transport systems. It proposes that mobility planning tools are analysed through polarisations of significant relevance when considering the design and implementation of a given intervention. In this section we explain how the DIBIS was thought of and structured and how the concept of “wisdom” can help us move beyond smart solutions.

It is necessary that decision-makers in general, and mobility planners in particular, are offered means to cultivate what we have designated here as *techno-practical wisdom*. It is a form of practice-oriented understanding that enables making sound choices when facing fracturing situations in highly complex techno-social environments that can be problematic and destructive. Considering how people frame (and reframe) such situations can be very effective in moving forward in a constructive way (Schön and Rein, 1994).

Building on such approach and engaging as well with Ardel’s work on wisdom (Ardelt, 2003), we argue that techno-practical wisdom should embrace three dimensions, namely the reflective, cognitive and affective. According to Aldert, the cognitive dimension refers to our ability to understand the significance and deeper meaning of events. A better understanding of the behaviours of people around us and assessing the presence of positive emotions should improve our affective dimension. The reflective dimension requires that we perceive reality looking at different perspectives to develop self-awareness. The reflective is the foundational dimension, from which the other two emerge. The three elements are not independent however they are not the same. The conditions of “being wise” only exist when the three elements can be observed at the same time.

Following this concept, we structure a practical and adaptable framework for policymakers, planners and communities to manage the complexity of integrating technologies into mobility planning practice. Given the rapid development of DMTs, we emphasise the importance of developing adaptive, diverse and balanced strategies that respond to the changing technological landscapes and social dynamics. The following section presents actionable ideas on how to address the risks and drawbacks of deploying DMTs in mobility planning.



7.3 Actionable ideas: Technology and Innovation for Just Streets

Addressing the Risks and Drawbacks of DMT-MPT assemblages: high-tech solutions and low-tech alternatives

While DMTs are often praised for their capacity to optimise mobility, increase efficiency, and reduce emissions, their widespread adoption also brings significant issues that cannot be ignored. The intention is to highlight the extent to which exclusively seeking solutions in technological intensification is not necessarily a good idea and can be, in some cases, highly detrimental as it prevents policymakers from approaching the challenges they face with all the available resources. The adopted framework for the identification of DMT-related risks and drawbacks is composed of six elements: 1) Environmental sustainability, 2) Health and Well-being, 3) Equity and Social Justice, 4) Monopolization and Power Dynamics, 5) Data Governance and Privacy, and 6) Hacking and Terrorism. We provide a range of possible solutions to help policymakers understand how they could move forward in six cards presented below.

Card 1. Environmental sustainability

Although DMTs are often associated with efficiency gains, environmental benefits and reduced carbon footprints, there are hidden environmental costs associated with these technologies.

Risks and possible solutions:

Increased energy demand

- High-tech: implement AI-driven energy optimisation systems that intelligently manage data centres' energy usage, adjusting power consumption based on workload demand.
- Low-tech: adopt energy-efficient building designs and natural cooling systems in data centres.

Carbon footprint of digital infrastructure

- High-tech: develop and implement green computing technologies, such as liquid-cooled servers and energy-efficient chips, which reduce energy consumption during data processing.
- Low tech: policy solutions should encourage the location of data centres closer to the users or services they support, reducing the need for data transmission and excessive data load.

Technological obsolescence

- High-tech: Invest in modular, upgradable hardware designs allowing component replacement.
- Low tech: promote hardware refurbishing and recycling programs, in which consumers can return old or obsolete devices for refurbishment or recycling.

Card 2. Health and well-being

The increasing integration of digital technologies in the transport sector has the potential to improve comfort and safety among travellers, however, this approach can also lead to various health and well-being concerns.



Risks and possible solutions:

Cognitive overload and fatigue

- High-tech: develop AI-based user interfaces that can adapt to the user's cognitive load by presenting information incrementally and reducing unnecessary alerts.
- Low-tech: implement more intuitive and basic interfaces for drivers and operators without unnecessary distractions.

Social isolation

- High-tech: utilise social engagement features in ride-hailing and ride-sharing apps that encourage shared rides and conversations between passengers.
- Low-tech: develop design ideas for public spaces, such as community-based transport hubs, where people using transport services can interact. These hubs can host events, provide communal seating areas, and allow people to engage while waiting for or using transport.

Card 3. Equity and social justice

As DMTs become increasingly embedded in society, they are often seen as tools to enhance equity and social justice. However, a digital-intensive approach risks exacerbating existing social inequalities and creating new forms of exclusion.

Risks and possible solutions:

Digital divide: the unequal access to digital technologies such as the internet, computers and smartphones can affect low-income, elderly and people in rural areas.

- High-tech: develop inclusive digital platforms that work on low-cost devices and require minimal data usage.
- Low-tech: ensure that non-digital transport alternatives remain available, such as cash payment options for public transport, printed timetables and analogue route maps.

Economic exclusion

- High-tech: introduce dynamic pricing systems that adjust the cost of digital mobility services based on income, ensuring that low-income users pay less for essential transport.
- Low-tech: introduce tiered fares for public transport could be an idea.

Gentrification: displace of low-income residents

- High-tech: use geospatial data and AI models to identify areas at risk of gentrification.
- Low-tech: prioritise community involvement in urban planning to ensure that residents have a say in implementing digital transport solutions.

Card 4. Monopolisation and power dynamics

In the rapidly expanding DMT landscape, the concentration of power in the hands of a few global tech giants is an increasingly pressing concern. As tech monopolies consolidate their influence over transport platforms, they dictate the terms of innovation, data use, and pricing strategies often with little transparency or oversight.

Risks and possible solutions:

Concentration of control in global tech companies



- High-tech: develop open-source digital public transport platforms that allow local governments or communities to manage their transport systems independently.
- Low-tech: introduce local or regional government transport services that reduce reliance on private digital platforms.

Lack of local governance and influence

- High-tech: use blockchain to create decentralised governance models for transport systems
- Low-tech: establish local transport committees of officials, community members and transport experts.

Card 5. Data Governance and privacy

In the digital age, data has become one of the most valuable assets, particularly in the transport sector, where DMT heavily rely on vast amounts of personal and operational data. However, data collection, use, and governance present significant privacy challenges that, if left unchecked, could undermine user trust and security.

Risks and possible solutions:

Data security and data breaches

- High-tech: develop end-to-end encryption protocols for all data transmitted and stored by DMT systems.
- Low-tech: apply mandatory security audits for DMT providers, requiring them to regularly test their systems for vulnerabilities.

Data governance and accountability

- High-tech: set up AI-powered data governance platforms that automatically track and report all data processing activities in DMT systems to ensure accountability.
- Low-tech: establish independent data oversight committees to monitor how organisations collect, store and use personal data.

Card 6. Hacking and Terrorism

As DMTs increasingly become integral to transport systems, they open new vulnerabilities, particularly hacking and terrorism. These technologies manage critical infrastructure such as traffic controls, public transport networks and autonomous vehicles, making them attractive cyberattack targets.

Risks and possible solutions:

Cyber-attacks on critical infrastructures

- High-tech: use AI-driven cybersecurity systems monitor transport infrastructure in real time, detect anomalies, and automatically neutralise potential threats.
- Low-tech: implement manual bridging systems and offline backups for critical transport infrastructure, allowing human intervention during a cyber-attack.

Risk of terrorism

- High-tech: use AI-based predictive analytics to identify potential terrorist threats by monitoring traffic system usage patterns and detecting unusual behaviour that could indicate malicious intent.



- Low-tech: increase physical security measures at key transport hubs such as railway stations and airports through additional checks, patrols and spot checks to prevent cyber-attacks and other forms of terrorism.

The cards show that while advanced technologies can lead to significant improvements, they should not overshadow the importance of simpler, cost-effective alternatives that meet immediate needs in ways that can be significantly more resilient and less prone to hacking, technical failure, and corporate take-over. Planners should adopt the following rule of thumb: for every investment in a high-tech solution, there should be an equivalent investment in a low-tech approach to maintain balance. Adopting this balanced approach with some preference towards low-tech, planners can create resilient, adaptable and equitable transport systems that meet the needs of all users while making reasonable use of DMTs. The next section dives further into this discussion, presenting the DIBIS (Diverse and Balanced Intervention Spectrum) framework for discussing the use of different types of mobility tools and methods.

Using wisely your mobility tools: finding balance

This section presents one application of the Diverse and Balanced Intervention Spectrum (DIBIS) framework to assess tools and methods applied to mobility planning. Even though the DIBIS framework might be used to address different issues, here we focus on two planning polarisations. The first polarisation concerns the intensity of technological deployment (low-tech versus high-tech). Low-tech solutions are more accessible and easier to implement from a technical point of view. However, they represent a very intense human workload and are unsuitable for generalised application and scalability. In contrast, high-tech solutions leverage advanced digital innovations, often including sophisticated technologies.

The second polarisation concerns the intensity of markets in the governance of the mobility sector (market-oriented versus community-oriented). Private companies, global innovation networks and other capital-driven institutions are the ones driving market-oriented solutions. These solutions tend to focus on achieving efficiency, low cost-benefit ratios, competitive advantages, and profitability. However, they tend to come at high social and environmental costs. Conversely, commons-oriented approaches are led by communities, neighbourhoods, small local businesses, non-profit organisations, and collaborative initiatives that emphasise shared resources, collective action, and meeting local needs. From a social point of view, commons-oriented approaches are nearly ideal. However, implementing and maintaining such approaches is often very difficult since the public sector must dedicate substantial efforts to them, which can have significant costs.

This section looks at examples of tools and methods used in mobility planning framed in three groups: i. information, adaptation, participation; ii. data integration, storage and analysis and iii. simulation, monitoring and evaluation within four defined quadrants of the DIBIS framework. In the next pages, the different tools are presented in three tables according to their application. Examples and a brief characterisation are provided according to their framing in four categories: high-tech commons-oriented, high-tech market-oriented, low-tech commons-oriented and low-tech-market oriented. For a broader collection of examples of mobility planning tools, [Deliverable D3.1](#) can be consulted.

Tools for information, customisation and participation

Informative, customised and participatory tools are crucial to empower individuals and communities to engage in mobility planning and promote transparency, education and inclusion. These tools aim to inform the public while offering customised mobility services, responding to the diverse needs of users, promoting sustainable practices, and encouraging



active participation in mobility planning (Gil et. Al, 2011; Giuffrida et al., 2019). Table 2 shows examples and presents the characteristics of tools for information, customisation and participation in four quadrants of the DIBIS framework.

TOOLS FOR INFORMATION, CUSTOMISATION AND PARTICIPATION	
High-tech commons-oriented tools <i>Examples: Open Street Maps (OSM)</i>	Low-tech commons-oriented tools <i>Examples: Community-led mobility forums, bulletin boards for transport updates, and face-to-face meetings</i>
•developed based on advanced technologies but guided by commons-oriented and inclusive approaches. •focus on customisation to the needs of specific groups or individuals to promote co-ownership, inclusivity, and shared decision-making. •empower communities by integrating sophisticated digital solutions shaped by local stakeholders' preferences and inputs. •use open-source software and shared digital infrastructure to promote transparency and encourage collective responsibility. •provide real-time data and allow users to give feedback, creating a two-way flow of information. •apply customisation to ensure that technological advances are aligned with local values, making tools accessible and relevant to different groups in the community.	•use minimal technological infrastructure prioritising collective management, active community participation, and customisation to local needs. •focus on human-centred, participatory processes that promote local agency, shared governance, and inclusive dialogue in every step of the process. •ensure that transportation services are not only accessible but also responsive to the distinct realities of different neighbourhoods. •stimulate transportation cooperatives where members collaborate on shared transport services voluntarily or to provide travels free of charge. •based on community collectively decision on transportation services and infrastructure. •designed to be flexible and adaptable, allowing communities to modify or expand them as local needs evolve.
High-tech market-oriented tools <i>Examples: Navigation apps used in mobile phones</i>	Low-tech market-oriented tools <i>Examples: SMS-based notifications, printed timetables, or public information boards.</i>
•driven by advanced digital technologies developed by private companies to offer customisation options for user needs. •protected by proprietary software and hardware systems to preserve the company's intellectual property. •employ state-of-the-art digital infrastructures such as real-time data analytics, connectivity solutions, and advanced user interfaces to optimise urban mobility conditions.	•emphasis on simplicity and accessibility while remaining commercially viable. •include customisation capabilities. •designed to be affordable and scalable, ensuring that key transport-related services are accessible. •transport information is accessible to all, including those who do not have access to digital infrastructure or the know-how to use high-tech tools.



•enable users to make real-time informed transport decisions based on personalised preferences and individual travel patterns. •participation is limited to utilisation providing innovative, customisable interfaces that empower individual agency. •Interaction is fundamentally transactional: user data is collected and analysed to improve services (often from a cost-benefit perspective) and maximise the provider's profitability and scalability.	•commercial interests remain front and central as companies seek to profit by providing widespread, basic urban mobility services. •achieve public participation via simple and traditional means such as market surveys and interviews. •employ dedicated staff to regularly engage with the users to understand which changes are most needed or requested to obtain larger scale public feedback.
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Table 6 Tools for information, customisation and participation represented in four DIBIS quadrants.

Tools for data integration, storage and analysis

The effective management of data is a fundamental aspect of modern mobility planning. Integrating, storing, and analysing data from different sources enables planners and policymakers to understand mobility patterns, identify issues, establish priorities, and make decisions. Data-driven tools provide the necessary basis to collect and interpret large amounts of information to improve transport systems, promote sustainability, and enhance the overall mobility experience. Table 3 shows examples and the characteristics of such tools according to four DIBIS quadrants.

Table 3. Tools for data integration, storage and analysis represented in four DIBIS quadrants.

TOOLS FOR DATA INTEGRATION, STORAGE AND ANALYSIS	
<i>High-tech commons-oriented tools</i> <i>Examples: Big Data analytics, Artificial Intelligence (AI), cloud computing, Internet of Things (IoT)</i>	<i>Low-tech commons-oriented tools</i> <i>Examples: Participatory mapping, workshops, guided meeting, memory wall, analogue data storage systems (facilitated by local authorities), community data circles, storytelling</i>
•based on advanced digital technologies usually developed and used by private companies. •designed to handle extensive data collection, storage and analysis processes. •offer scalable and efficient solutions emphasising real-time performance, precision and comprehensive data integration. •integrate data from various digital platforms into centralised databases.	•local authorities facilitate participatory processes and manage data integration. •development of internal resources, building local staff's capacity to engage with the community through workshops, participatory mapping and public discussions. •emphasise ongoing engagement and a stronger, long-term relationship between planners and the community. •more informed and better-customised decisions as planners gain a deeper understanding of mobility challenges.



•focus on cost efficiency and optimising mobility systems to improve its performance. •reliance on proprietary technologies lead to data silos where information is spread, limiting the ability of public authorities to fully utilise data. •closed-source nature reduces transparency. •privacy and security concerns arise (personal data collected through apps and digital platforms linked to commercial interests)	•involve initial costs but bring long-term benefits by ensuring continuity. •storytelling events can provide a platform for residents to share personal stories about their transport experiences, focusing on how mobility (or the lack of it) impacts their daily lives.
High-tech market-oriented tools <i>Examples: Citizen science, collaborative GIS platforms and community-operated data portals</i>	Low-tech market-oriented tools <i>Examples: Participatory mapping, workshops, guided meeting, memory wall, analogue data storage systems (facilitated by consultants, artists)</i>
•based on advanced digital technologies while emphasising inclusivity, transparency and de-commodification. •designed to be open, collaborative and community-focused. •enable local communities, non-profits and grassroots organisations to actively participate in data collection, sharing, and analysis. •ensure that the data collected is accessible and usable by all stakeholders (equitable access). •operated with simple digital devices to monitor traffic patterns enabling citizens to actively participate in data collection. •Challenges: the need for ongoing community engagement, capacity building and sustained public sector support. •combine advanced technology with inclusive governance models and ensure that data is a public good, not a commercial commodity.	•rely on tangible, accessible methods that integrate and analyse data without advanced technologies. •represent a commercially viable way for service providers to support agencies with limited resources and smaller scales. •enable valuable data integration through manual visualisation techniques such as hand-drawn charts, graphs, and whiteboards. •interactive and collaborative sessions provide unique market opportunities for skilled group facilitators. •facilitators can collect insights from community members, which are manually analysed to identify recurring themes. •using simple methods, data collected can inform strategic documents and policy recommendations. •commercial services can focus on creating efficient filing systems and providing regular updates or enhancements. •might involve visual artists in producing artworks.

Tools for mobility simulation, monitoring and assessment

Tools are needed to help predict, envision or simulate future traffic scenarios and evaluate the impact of the measures implemented in planning and managing urban mobility systems. Mobility simulation, monitoring and evaluation tools serve these two purposes. They enable planners to predict potential outcomes, test interventions in controlled environments and



evaluate real-world performance to make adaptive decisions. Examples and the characterisation of those tools can be seen in Table 4.

TOOLS FOR MOBILITY SIMULATION, MONITORING AND ASSESSMENT	
High-tech commons-oriented tools <i>Examples: Big Data analytics, Artificial Intelligence (AI), Internet of Things (IoT), digital twins, open-source smartphone apps, open data dashboards, civic tech platforms</i> • emphasise openness, transparency and public collaboration while using advanced technologies. • utilise sophisticated digital infrastructures but with a clear focus on collective ownership. • based on open-source platforms ensuring transparency and inclusiveness. • simulate urban transport systems while flexibly adapting the models to specific local needs. • enable community participation in tracking and evaluating transport measures. • visualise transport data and results in user-friendly formats, making the data accessible to a wider audience. • requires considerable investment in technical training and capacity building for communities. • depends on the willingness of public institutions to prioritise commoning over proprietary solutions.	Low-tech commons-oriented tools <i>Examples: Community mapping, counter cartography, storytelling, community walks, subversive cartography, role-playing games</i> • radically different approach drawing from critical and radical feminist perspective. • create shared, decommodified spaces, resources and services collectively managed by communities. • using tools is transformed into an act of resistance, challenging the patriarchal, racist, and class-based hierarchies. • contribution from underrepresented groups guide planners recounting their mobility experiences from the perspective of safety, pain, and exclusion. • planners are no longer the experts, they are learners, absorbing the rich, qualitative insights that traditional metrics and simulations cannot capture. • use role-playing games that invite planners to step into the shoes of different community members (e.g. migrants, senior citizens or single mothers)
High-tech market-oriented tools <i>Examples: Big Data analytics, Artificial Intelligence (AI), Internet of Things (IoT), digital twins, microsimulation models</i> • based on advanced technologies developed and offered by private companies. • integrate cutting-edge computational modelling, data analytics, artificial intelligence (AI) and Internet of Things (IoT) devices to simulate, predict and evaluate the performance of transport systems. • enable authorities to forecast mobility patterns, optimise traffic flows and test	Low-tech market-oriented tools <i>Examples: Serious games, street experiments, hand-drawn diagrams, pinboard displays, physical models</i> • offer practical alternatives to high-tech solutions using simpler methods. • valuable for resource-limited environments or situations where digital scepticism is predominant. • use games as physical, board-based simulations to help planners, policymakers, and stakeholders explore mobility scenarios interactively.

infrastructure changes in virtual environments before implementation. •allow continuous monitoring and real-time assessment of impacts as changes are implemented. •simulations allow detailed modelling of traffic flows, pedestrian behaviour, and urban dynamics and give considerable precision in testing changes and new regulations. •prioritise optimisation for market-driven goals over the common good.	•street experiments offer cities the opportunity to test the real-world impact of traffic reconfigurations. •physical simulations provide planners with immediate, tangible insights, using low-cost materials such as cones, paint and barriers to create temporary changes in street design. •communicate complex ideas in a way that is more accessible to decision-makers and the public, especially in situations where digital literacy is low or digital scepticism is high. •may not capture the full complexity of urban mobility challenges.
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Table 7 Tools for mobility simulation, monitoring and assessment represented in four quadrants

Figure 11 represents the axes and the possibilities of combining different solutions to achieve a balanced societal configuration when addressing mobility planning. Achieving balance requires finding a solution combining high-tech/market-oriented and low-tech/community-oriented approaches. This combination leverages the benefits of DMT usage while effectively mitigating its risks. The scheme presented interprets three societal configuration models related to DMT development and usage, ranging from a less desirable for a more desirable configuration, achieving not only balance but also diversity.

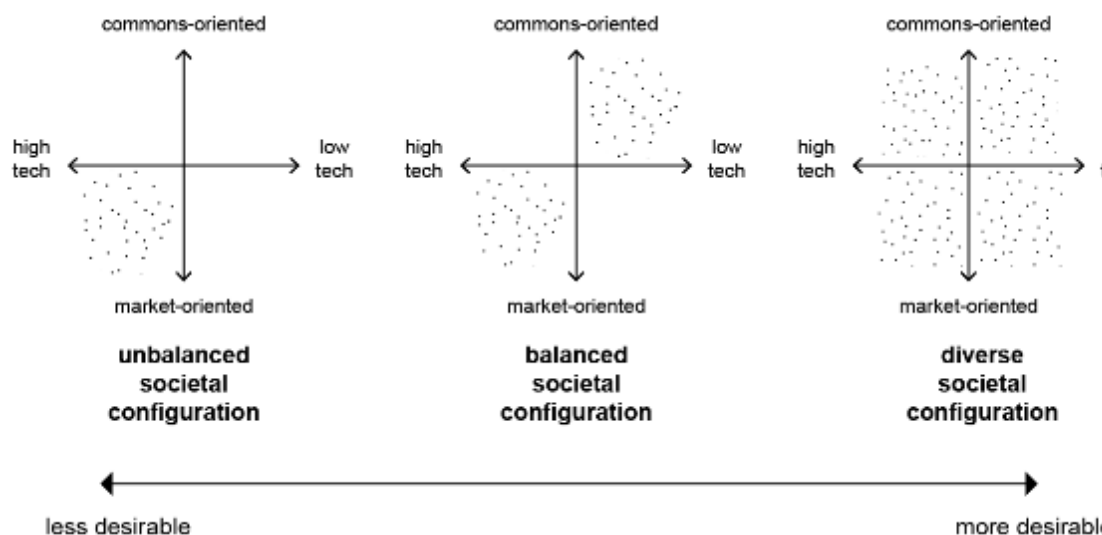


Figure 11 Three societal configurations for DMT development and usage

In this example using two polarised situations, the DIBIS framework guides the selection and deployment of DMT solutions to ensure that transport systems are resilient, inclusive, safe, and adaptable. DIBIS aims to encourage planners and policymakers to avoid monocultural dependence on any one quadrant and instead promote a diverse mix of strategies that leverage the strengths of each quadrant in different contexts while mitigating risks, limitations,



and drawbacks. By contextualising DMT strategies within this framework, we propose that adopted solutions should neither be exclusively high-tech nor low-tech. They should also balance business and citizen engagement in ways capable of promoting a holistic and dynamic approach to mobility planning.

Operationalising techno-practical wisdom with DIBIS: addressing planning polarisations

In this section we outline the operationalisation of the DIBIS framework as an approach to address planning polarisations. This section aims at making meaningful steps in the direction of establishing a framework capable of helping mobility planners to develop actionable techno-practical wisdom capabilities. The DIBIS is proposed to achieve the establishment of non-polarised interventions in a given time and place, as well as non-polarised intervention mixes across various time and places. Ultimately, it can be seen as a heuristic to cultivate and deploy wisdom to address complex situations.

A flowchart to systematise the reasoning behind the DIBIS framework in the face of polarisations is presented. In this format, the DIBIS is proposed as a procedural approach, yet not a robotic one, but instead as an iterative and learning process for planners to reach better decision-making. DIBIS can be used not just to inform the final result, but also to integrate the notion of techno-practical wisdom in the entire process. The approach proposes moments for reviewing the practice and considering other paths for mobility planners and innovators to stay informed throughout the decision-making procedure.

Drawing from the idea of wisdom, we argue that decision-making approaches should be supported by three key capacities – reflective, cognitive and affective. Especially navigating a polarised scenario, wisdom might be fundamental to smooth tensions, anticipate and solve conflicts. Beyond methods and tools that can be instrumental to support decisions as presented in previous subsection, we argue that it is useful developing a procedural approach to navigate polarisation. In this way, the three dimensions of wisdom could be incorporated in the process to facilitate more efficient and equitable outcomes of urban interventions.

As part of the DIBIS, we outline how the three dimensions of wisdom may contribute to a more structured thinking process. The reflective dimension should help us assess if shifts occurred because people became more aware of their own beliefs, assumptions and thought process. The cognitive dimension helps us consider if changes in technical knowledge, or the adoption of enhanced technical approaches influenced the situation. Finally, the affective dimension contributes with the capacity to examine the emotional aspects of navigating those polarised debates.

The procedural approach offers a way to address polarisations and move beyond the original idea by identifying additional challenges and conflicts within a given decision problem. Despite the availability of advanced technology, decision-making processes should remain human-centred. The purpose of the DIBIS is to look beyond technological solutions, considering their potential drawbacks and future challenges and searching for alternative solutions to our mobility problems. Overall, DIBIS intends to improve decision-making, fostering a learning-based process. In this process, planners are invited to find a balance between identified polarisations, emerging conflicts, and possible solutions within this spectrum. As demonstrated, it can be used to address technological intensity and governance levels. Identifying controversies and exploring possible solutions are essential steps towards delivering more just interventions.

For a better illustration of this DIBIS process, a flowchart is presented in figure 9. The flowchart illustrates the structure and decision-making process operated within the **DIBIS as a** systematic approach to addressing polarised issues by assessing potential solutions and

guiding urban intervention strategies. The process begins with sorting possible solutions to a given issue. As a first step, acknowledging polarisation is central. Planners should evaluate whether it should be taken into consideration. If polarisation is ignored, the process does not proceed further, and the next step is to consider the intervention, even though the chosen solution could potentially create conflicts between social groups. However, if it is acknowledged, the framework explores strategies to manage it.

DIBIS FRAMEWORK

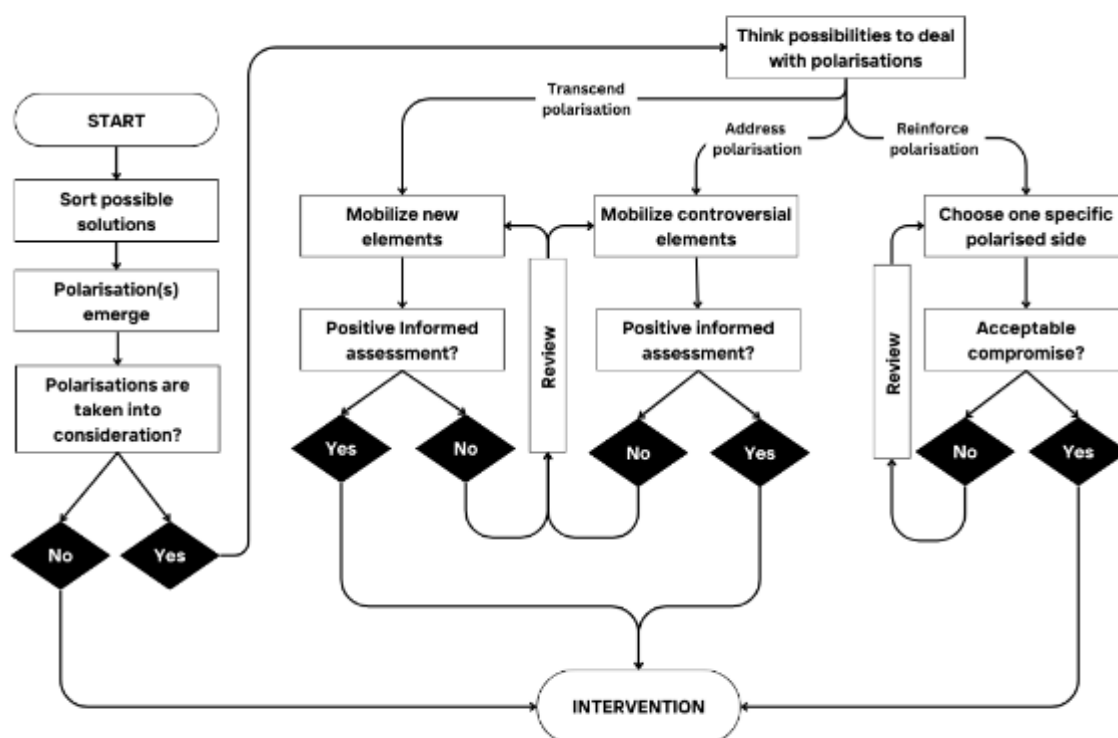


Figure 12 DIBIS framework flowchart

To address polarisation, the framework considers three primary approaches. The first approach is to transcend polarisation by mobilising new elements. This mobilisation refers to identifying other types of polarisations that might be addressed – for instance promoting public debates and participation. The second approach involves addressing polarisation by mobilising controversial elements. Mobilising controversial elements means identifying two antagonistic elements, such as two different social groups. The third approach reinforces polarisation by choosing a specific polarised side. Once an approach is selected, an assessment process follows.

If new elements are mobilised, a positive informed assessment is conducted. If the assessment is favourable, the intervention proceeds. If it is unfavourable, the process undergoes review and may reattempt mobilisation. Similarly, if controversial elements are mobilised, a positive informed assessment is performed, and depending on the result, the process either moves forward or returns for further review. When a specific polarised side is chosen, an acceptable compromise is evaluated. This means that, even though polarisation is acknowledged, a counterpart was not consulted or taken into consideration. However, if the compromise is deemed acceptable, the intervention proceeds; otherwise, the review process is initiated again.



Ultimately, once an appropriate pathway is identified and validated, the final step leads to intervention, ensuring that the most suitable solution is implemented. The DIBIS framework provides a structured approach to handling polarisation in decision-making by evaluating possible solutions, assessing informed perspectives, and guiding interventions that either transcend, address, or reinforce polarisation informed by wisdom. Through iterative reviews, the process ensures that the chosen intervention is well-assessed and balanced.

Acknowledging polarisations towards more informed decision-making

Previous section presented the functioning of the DIBIS as a procedural approach, simplifying its application. An important focus was given to acknowledging polarisations. However, recognising antagonistic reactions is not always a simple task. Therefore, this section addresses some search engines to help identify relevant polarisations. Acknowledging polarisations is essential to anticipate conflicts and to help us situate ourselves in a broader debate. This step is an invitation to think “outside our bubble”.

To ensure a well-informed and balanced approach to decision-making, it is essential to promote public participation, particularly among those who are most directly affected by the problem or the proposed solution. In the context of school streets, for instance, this means actively engaging members of the school community, including students, teachers, parents, and staff, in discussions and decision-making processes. Their perspectives and experiences provide valuable insights that can lead to more effective and inclusive solutions.

Additionally, maintaining an ongoing engagement with public information sources that do not necessarily align with one’s political views is crucial for developing a well-rounded understanding of different perspectives. This includes regularly checking what opposing viewpoints are arguing, reading newspapers and media outlets that may challenge personal beliefs, and considering alternative sources of information. Such engagement fosters critical thinking and helps counteract biases that can emerge from selective exposure to information.

Another important aspect is the analysis of policy frameworks established by various governing bodies, including state and local authorities, as well as supranational organizations such as the European Union. Understanding the regulatory landscape and the funding opportunities made available by these institutions can significantly impact the feasibility and sustainability of proposed solutions. By examining these frameworks, individuals and organizations can align their initiatives with existing policies and leverage available resources effectively.

Lastly, continuous engagement with scientific and academic literature is essential for ensuring that decisions are informed by the latest research and empirical evidence. Academic studies provide valuable data, theoretical insights, and methodological approaches that can enhance policy development and implementation. By staying informed about current research, stakeholders can make evidence-based decisions that are more likely to result in meaningful and lasting improvements.

7.4 Conclusions: navigating Technology and Innovation for Just Streets

The DIBIS framework is offered to support the cities that are part of the JUST STREETS consortium – Amsterdam, Braga, Cugir, Kozani, London, Milano, Riga, Vilnius, Haifa, The London borough of Southwark and Zaragoza – in achieving successful transformation in their urban spaces. The framework is open, simple and adaptable to address the issues raised in their living labs experiences. Many of the challenges identified are related to polarisations that emerge in their territories and become barriers to enhance active mobility and provide safer, just and equitable streets. For instance, the necessities of children, elderly and people with disabilities, the need of space for cars vs. pedestrians and bicycles, challenges to accommodate the needs of public transport of different groups, among many others.



The DIBIS framework can be used as an approach to ponder and consider multiple viewpoints during various moments of decision-making. DIBIS can also be used to understand and evaluate the possible solutions available to propose an urban intervention. We propose that wisdom should be incorporated to decision-making to consider tools, methods and interventions that move beyond high-tech solutions.

Below some key suggestions from this document are presented for practitioners:

- **Embrace the diversity of available solutions:** Mobility challenges vary widely between cities, communities and contexts, and the tools used to address them should reflect this diversity. The compendium shows that each approach has strengths and limitations, from high-tech AI-powered predictive modelling to low-tech community mapping and storytelling techniques. By pondering a mix of solutions, planners can create more resilient and adaptable transport systems.
- **Promote Adaptability:** Mobility planning cannot be static in a rapidly changing world. The emergence of digital mobile technologies (DMTs), environmental concerns and shifts in social dynamics require transport systems to remain adaptable. Planners must continually evaluate and adapt their strategies based on new data, feedback and technological developments. Remember that the emergence of a new technology should not directly represent the need to implement it while excluding well-tested alternatives.
- **Balance technological innovation with social equity:** While market-based high-tech tools offer precision, scalability and efficiency, they also carry risks related to cost, accessibility and privacy. In contrast, commons-oriented approaches emphasise inclusivity, transparency and shared ownership but often struggle with scalability and resource allocation. Planners need to be aware of these trade-offs and actively work to balance their choices, ensuring that mobility solutions do not exclude vulnerable groups or contribute to widening social inequalities.
- **Promote community engagement:** This compendium emphasises the role of community-led initiatives. Tools such as community data circles, participatory mapping and subversive mapping provide planners with a more nuanced understanding of local needs and preferences. By involving local communities in designing and evaluating transport solutions, planners democratise the planning process and build stronger relationships between citizens and local authorities.
- **Use mobility planning as a tool for social change:** This compendium challenges planners to think beyond technical and operational concerns, adopting the notion of techno-practical wisdom. Mobility systems are deeply embedded in the social fabric of cities, and their design influences broader societal dynamics, from accessibility to social equity. Considering wider perspectives and promoting wisdom, planners can address long-standing inequalities, empower marginalised groups and promote more inclusive urban spaces. Mobility planning can thus become a vehicle for social change that challenges entrenched power dynamics and promotes equity among us all.
- **Acknowledge and face polarisations:** Cities are a place of diversity and possible conflicts. Addressing wisely possible polarisation that can emerge during decision-making processes is essential to make sure diversity is not only represented in participatory processes but also reflected in mobility planning choices implemented.

In conclusion, this compendium calls for a mobility planning approach that combines technological innovation, community inclusion, and social justice. The Diverse and Balanced Intervention Spectrum is a versatile framework for practitioners to select and integrate



solutions that address the unique needs of their cities and communities. As planners look to the future, the focus should be on flexibility, collaboration and a commitment to serving the public good in an inclusive, sustainable and equitable way.

KEY TAKEAWAYS

- Prioritise community-driven approaches to ensure that technological innovations address diverse local needs.
- Invest in low-tech solutions that are cost-effective, inclusive, and resilient.
- Regulate technology deployment to prevent monopolistic practices and ensure equitable access.
- Foster transparency and accountability in data governance and decision-making processes.



8. Conclusions

Deliverable D2.1 has sought to bridge the persistent gap between theoretical frameworks of street justice and the practical realities of transforming urban streets. Across its five thematic pillars - participation and co-creation, understanding needs and behaviours, behavioural change strategies, prefigurative planning, and people-friendly technology - this report has highlighted that achieving justice is not merely about redistributing physical space or delivering equitable outcomes, but about fundamentally transforming the processes, relationships, and power dynamics that shape how streets are imagined, designed, governed, and experienced.

A central insight from this work is that justice is a process, not an endpoint. True street justice must be embedded throughout every stage of transformation: from the earliest identification of needs, to the selection of tools and methods, to collaborative visioning, to co-design, experimentation, learning, and institutionalisation. This iterative, cyclical, and reflective process is not linear or static; rather, it demands ongoing adaptation, negotiation, and responsiveness to changing conditions, emerging knowledge, and diverse community voices.

At the heart of this approach is participation and co-creation, reframed not as tokenistic consultation, but as a justice practice in its own right. By centring communities, especially those historically excluded from planning, as co-producers of knowledge and decision-making partners, co-creation rebalances power, elevates lived expertise, and advances recognition, procedural, epistemic, and restorative justice simultaneously. This participatory ethos must also be grounded in a deeper understanding of how needs, experiences, and constraints are shaped by intersecting identities such as gender, age, race, disability, and socio-economic status. An intersectional lens not only ensures that street transformations respond to the full diversity of urban life, but also informs behaviour change strategies that promote more inclusive and sustainable mobility habits over time.

Equally important is the report's advocacy for experimentation and learning as core justice mechanisms. Tactical urbanism, living labs, pop-up interventions, and temporary pilots serve not just to test technical feasibility, but to open collective spaces for imagining, experiencing, and negotiating alternative street futures in real time. These experimental practices are political acts: they make visible the "what if" possibilities, challenge dominant assumptions, redistribute visibility to marginalised groups, and allow for learning-by-doing in ways that challenge the status quo.

Finally, the report also reflects on the opportunities and risks posed by digital mobility technologies, offering reflection and action tools that can help with navigating polarised planning logics and mitigate the harms of tech-driven inequality. In that sense, this deliverable calls for a "wise", people-centred, balanced, and ethically governed approach to technology—one that enhances rather than undermines justice.

Looking ahead, Deliverable D2.1 offers a fertile platform for further innovation, application, and research. Key future directions include:

- Embedding co-creation cycles into institutional routines: Cities can adopt the co-creation stages outlined here (needs identification, visioning, co-design, experimentation, evaluation, institutionalisation) as standard planning procedures rather than project-based exceptions—ensuring justice is not a one-off achievement but a continuous practice.
- Scaling experimental interventions into broader urban strategies: Temporary pilots and tactical interventions can inform, inspire, and justify more permanent, systemic shifts in



street design and policy. Cities should develop pathways to “scale up” successful experiments while retaining local specificity and community ownership.

- Building cross-sectoral alliances for just streets: The findings highlight the need for collaboration across planning, transport, public health, environment, education, and cultural sectors to integrate diverse goals (e.g. climate resilience, public health, equity) into street transformation agendas. Future applications should foster stronger cross-sectoral governance models.
- Investing in capacity building for inclusive practice: Deliverable D2.1 identifies knowledge gaps and capacity challenges in facilitating meaningful co-creation and justice practices. Future actions should include training programmes, peer-learning networks, and resource hubs to equip practitioners, policymakers, and communities with the skills, tools, and confidence to embed justice in everyday planning.
- Developing justice-based evaluation and monitoring frameworks: Beyond technical KPIs, cities need new metrics to evaluate whether street transformations are delivering distributive, procedural, recognition, and restorative justice. Future work could focus on co-developing participatory evaluation tools that capture both material and experiential impacts.
- Leveraging culture, art, and storytelling for transformation: The examples of prefigurative planning show the potential of cultural and artistic interventions (e.g. BOSK, PARK(ing) Day) in shifting imaginaries and fostering public engagement. Future applications could explore partnerships with artists, cultural institutions, and grassroots movements to expand the emotional, aesthetic, and narrative dimensions of just street transformations.



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10. Appendices

- **Compendium Report 1. Participation, Co-Creation and Justice for Streets Change**
- **Compendium Report 2. Understanding Needs, Behaviours, Patterns and Habits**
- **Compendium Report 3. Behavioural Strategies for Achieving Just Active Mobility**
- **Compendium Report 4. Prefigurative Design and Planning Approaches**
- **Compendium Report 5. Navigating Technology and Innovation: the Techno-Practical Wisdom Approach for Just Streets**

D2.1 Literature reviews and compendium reports

**Compendium 1 - Participation, Co-Creation and Justice for
Streets Change**

EU project number 101104240
Project website www.just-streets.eu



Deliverable Details

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¹ Delivery type: **R**: Document, report; **DEM**: Demonstrator, pilot, prototype; **DEC**: Websites, patent filings, videos, etc; **OTHER**; **ETHICS**: Ethics requirement; **ORDP**: Open Research Data Pilot.

² Dissemination Level: **PU**: Public; **CO**: Confidential, only for members of the consortium (including the Commission Services); **EU-RES** Classified Information - restraint UE; **EU-CON**: Classified Information - confidential UE; **EU-SEC**: Classified Information - secret UE



Authorship and Contributions

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About JUST STREETS

The JUST STREETS project focuses on developing streets shaped by active mobility that are both sustainable and inclusive for all citizens. This shift from the use of cars towards more active modes of mobility will be led by prioritizing the needs and visions of marginalized social groups often not involved in the planning processes, particularly women, migrants, the elderly, LGBTQI+ individuals, and people with disabilities.

Goal of the strong international consortium is to support 12 cities in revolutionizing public spaces and streets by putting all of its citizens first. The project addresses the pressing need to transform our streets both from an infrastructural as well as behavioural perspective, shifting away from car-centric environments towards streets that cater to the needs of all citizens.

JUST STREETS is a 32-partner international Horizon Europe project coordinated by the Future Cities and Communities division of Turin-based LINKS Foundation and scheduled from January 2024 to June 2027. Partner cities include the cities of Amsterdam (Netherlands), Braga (Portugal), Cugir (Romania), Haifa (Israel), Kozani (Greece), Milan (Italy), Riga (Latvia), Southwark (UK), Vilnius (Lithuania), Vratsa (Bulgaria), Westminster (UK), and Zaragoza (Spain).

Expert partners of the JUST STREETS consortium are Fondazione LINKS (Italy), Agenzia TPL (Italy), Centro Studi Pim (Italy), Climate Alliance (Germany), European Cyclists' Federation (Belgium), Fundación CIRCE (Spain), International Federation of Pedestrians (Belgium), IT University of Copenhagen (Denmark), Politecnico di Torino (Italy), RINA Consulting (Italy), SocialFare (Italy), Southeast European Technological Company – SETECHCO (Bulgaria), Technical University of Cluj-Napoca (Romania), TECHNION – Israel Institute of Technology (Israel), TREDIT (Greece), University of Amsterdam (Netherlands), University of Porto (Portugal), University of Westminster (UK), Urban Future (Austria), and Western Norway University of Applied Sciences (Norway).

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www.just-streets.eu



Executive Summary

This Compendium Report provides a comprehensive framework to guide the operationalisation of justice in urban street transformations. Grounded in the principles of distributive, procedural, recognition, and restorative justice, the Deliverable offers a robust foundation for policymakers, practitioners, and communities seeking to create more equitable, inclusive, and sustainable streets. At its core, the Deliverable introduces the Just Streets Co-Creation Framework, which integrates both a conceptual understanding of justice dimensions and a practical cycle of co-creation. It addresses the need to move beyond abstract commitments to justice by providing clear, actionable pathways that can reshape how street change is imagined, designed, implemented, and institutionalised. The framework combines three essential components:

The Justice Dimensions: Distributive, procedural, recognition, and restorative justice are outlined as interconnected pillars that should inform all phases of street transformation. This multidimensional perspective helps ensure that justice is understood not merely as the fair distribution of resources, but also as a matter of participation, respect for difference, and historical repair.

The Just Streets Pathways: A set of phases that translate justice principles into practice (co-identify needs, co-vision futures, co-design solutions, experiment, co-evaluate and learn, and shift institutions), providing dynamic pathways for embedding justice as an ongoing process, not a one-off intervention.

Tools and Methods: A curated set of participatory tools, methods, and examples is provided for each phase. These include community mapping, participatory budgeting, living labs, visioning workshops, universal design audits, and justice-focused investment instruments.

This work not only contributes to scholarly debates on mobility justice but also equips cities with practical strategies to deliver fairer and more inclusive urban futures.



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List of Acronyms

EU – European Union
LEZ – Low Emission Zone
LTA – Local Transport Authority
NGO – Non-Governmental Organization
PT – Public Transport
SUMP – Sustainable Urban Mobility Plan
TfL – Transport for London
TOD – Transit-Oriented Development
UN – United Nations
UNECE – United Nations Economic Commission for Europe
WHO – World Health Organization

Glossary

Accessibility The ease with which people can reach key destinations such as jobs, schools, and healthcare facilities, often measured in terms of time, cost, and availability of transport options.

Active Mobility Non-motorized forms of transport such as walking, cycling, and the use of micro-mobility devices (e.g., scooters, e-bikes) that contribute to health and sustainability in urban mobility.



Co-Creation A participatory planning approach where diverse stakeholders, including local communities, actively contribute to decision-making and design processes for urban transformations.

Distributive Justice A principle of fairness focused on ensuring that mobility benefits (such as access to transport services and safe street space) and burdens (such as air pollution and road danger) are equitably distributed across social groups.

Epistemic Justice The recognition and inclusion of diverse forms of knowledge, including lived experiences and local expertise, in urban mobility decision-making processes.

Equity Audit A systematic assessment of how mobility policies and projects impact different demographic groups, ensuring that planning decisions do not disproportionately disadvantage marginalized populations.

Gender-Responsive Planning An approach that considers gender-specific travel needs and barriers in transport planning, ensuring equitable access and safety for all genders.

Low-Emission Zone (LEZ) A designated area where access to polluting vehicles is restricted to improve air quality and protect public health.

Mobility Commons The shared, collectively managed spaces and services that enable equitable access to mobility, such as public transport, walking infrastructure, and community-led mobility initiatives.

Mobility Justice A framework for addressing inequalities in movement and access, recognizing that transport systems are shaped by power dynamics and structural discrimination.

Participatory Budgeting A democratic process where residents help decide how to allocate a portion of public funds to mobility and urban infrastructure projects.

Placemaking A community-driven approach to shaping public spaces that enhance local identity, social interaction, and urban liveability.

Procedural Justice Ensuring fair and inclusive decision-making processes in mobility planning, where all affected stakeholders have a meaningful say.

Recognition Justice The acknowledgment and incorporation of diverse mobility needs and experiences in urban planning, particularly for underrepresented groups such as women, children, elderly people, and people with disabilities.

Restorative Justice (Urban Context) The process of addressing historical injustices in urban mobility by repairing harm, restoring access to underserved communities, and reversing discriminatory transport policies.

Right to the City The idea that all urban residents should have equal access to public spaces, decision-making processes, and the benefits of city life.

Sustainable Urban Mobility Plan (SUMP) A strategic framework that integrates sustainability, equity, and public participation into transport planning, promoting environmentally and socially just mobility solutions.

Tactical Urbanism A method of implementing low-cost, temporary interventions (such as pop-up bike lanes and pedestrian plazas) to test and refine street transformation projects.

Transport Poverty The condition where individuals or communities lack adequate access to affordable, reliable, and safe transport options, limiting their participation in social and economic life.



JUST STREETS

Urban Freight and Logistics Justice The equitable planning and regulation of goods movement in cities, ensuring that the negative impacts of freight transport (e.g., congestion, pollution) do not disproportionately affect marginalized communities.



1. Introduction

1.1 Purpose and Scope

This Compendium Report builds directly on the theoretical foundations presented in Deliverable 2.1 Chapters 2 and 3, expanding them with practical guidance and real-world examples. Its purpose is to bridge the gap between concepts of mobility justice and the participation and co-creation practices needed to embed these principles meaningfully into street transformation projects across Europe. Rather than treating justice and participation as separate concerns, this report approaches them as fundamentally interconnected: participation and co-creation are understood as the critical mechanism through which mobility justice — distributive, procedural, recognition, and restorative — can be achieved in the design, governance, and use of urban streets. The central research question guiding this report is:

How can the principles of mobility justice be effectively operationalised through co-creation practices within street transformation projects in European urban contexts, and what practical tools and strategies best support practitioners in achieving equitable and inclusive outcomes?

Three interrelated sub-questions structure the analysis:

- **Operationalising Justice through Participation & Co-Creation:** How can distributive, procedural, recognition, and restorative justice be systematically embedded across all phases of street change — from needs identification to evaluation — through participatory and co-creation methods?
- **Tools and Methods for Justice-Based Street Change:** Which practical tools, participatory frameworks, and design methods can best support cities and communities in advancing justice in street transformations?
- **Actionable Lessons from Practice:** What challenges, and lessons emerge from European case studies, and how can these experiences guide future actions and policy-making to institutionalise just and participatory street transformation practices?

Through addressing these questions, the report offers:

- **Expanded reflections** on the dynamic relationship between justice and participation;
- **Concrete examples** of how European cities are turning justice principles into action on the ground;
- **Practical resources** (actionable ideas, methods, and case-based insights) for practitioners seeking to embed justice at the heart of street change initiatives.

By linking conceptual frameworks, participatory strategies, and applied examples, this Compendium aims to inspire and equip those leading Europe's transition towards streets that are not only more accessible and sustainable, but also more just and democratically shaped.

Why does justice matter, and why justice for streets?

Justice matters in the context of both mobility and street space because access to movement and the right to use public space are not merely technical issues of transport efficiency or speed — they are fundamental conditions for participation in social, economic, and political life. Streets function not only as corridors for mobility but also as vital public spaces where people interact, express themselves, and build community. Ensuring just access to both



movement and space is essential for reaching jobs, education, healthcare, public services, and social networks, making it a basic social right rather than simply a matter of infrastructure provision. As Sheller (2018) has argued, mobility is deeply intertwined with relations of power, recognition, and exclusion — shaping who can participate fully in society and who is left at its margins — and the same applies to the ways street space is allocated, designed, and governed.

Urban streets, in particular, are critical sites for advancing mobility justice. Streets are not just conduits for traffic flow; they are highly contested public spaces where different forms of mobility (walking, cycling, driving, public transport) compete for space, where rights of access are negotiated, and where public resources are allocated. Moreover, streets sit at the intersection of multiple crises and policy agendas: climate adaptation, air quality, safety, liveability, and social inclusion, all of which disproportionately affect marginalised communities. Streets are, in short, where the everyday experience of justice and injustice is made visible and tangible.

Despite a rapidly expanding body of research on mobility and space justice, significant gaps remain, particularly when it comes to the application of justice concepts in practice. Much of the academic literature has focused on critiquing transport inequalities or analysing structural forms of exclusion, but has offered relatively little guidance on how to translate these insights into actionable strategies for access planning, street design, or governance reform. While the principles of distributive, procedural, and recognition justice are well established in theory, they have often failed to penetrate the professional cultures and institutional frameworks of urban planning. This gap is due in part to the multidimensional and contested nature of justice itself, but also to the persistence of deeply rooted paradigms in transport and urban policy that privilege efficiency, technical rationality, and economic growth over questions of equity, voice, and historical redress.

Applying Justice to Streets Change

This report response to the question of why justice matters, and why streets are a crucial arena for advancing it. Its purpose is not simply to restate theoretical arguments, but to develop a body of actionable ideas, methods, and tools that can help practitioners embed justice principles into the concrete work of transforming streets.

In the report, by **street change** we refer to the **intentional transformation of the physical, functional, social, and regulatory characteristics of streets**, aimed at reshaping how public space is used, accessed, and experienced by different individuals. This encompasses interventions in street design, mobility systems, governance, and use patterns, with the goal of improving safety, accessibility, sustainability, equity, social inclusion, and overall liveability. Street changes can include permanent infrastructural redesign (such as pedestrianisation, cycling lanes, or green infrastructure), temporary or tactical interventions (such as pop-up parklets or street experiments), or policy or regulatory shifts (such as speed reductions or traffic restrictions).

By drawing on the lens of mobility and spatial justice and integrating insights from practice across Europe, the report aims to bridge the gap between critique and implementation, offering cities new ways to make their streets more inclusive, participatory, and fair. In this report we define and break down the concept of mobility and spatial justice, illustrating how its various dimensions (distributive, procedural, recognition and restorative) apply, in practice, to urban streets – and how they can be operationalised for cities and their residents to take action towards just street changes. Through hands-on examples of street transformations in several European cities, the report highlights the ways in which mobility and spatial justice



can be advanced through the redesign of streets, the reallocation of space, and more inclusive decision-making processes – while also discussing some of the challenges with moving from theory to practice. To support with operationalising mobility and spatial justice in urban street transformations, this report also examines a series of concrete strategies and tools that can embed equity into planning and practice. These focus primarily around strategies that place participation and co-creation at the centre of efforts to advance mobility justice.

1.2 Who Is This Report For?

This report is designed for a diverse audience of stakeholders who are invested in making urban streets more just and inclusive and committed to rethinking streets through a justice-oriented lens. It serves as a resource for urban planners, (transport) practitioners, policymakers and urban change-makers who seek to integrate mobility justice principles into their work - but also for those who are interested in gaining a more comprehensive understanding of what (mobility) justice for streets may look like in practice.

Beyond technical experts, this report is also aimed at community organisations, activists, and residents and streets stakeholders who play a crucial role in advocating for fairer mobility and spatial policies. By outlining how mobility and spatial justice can be operationalised, this report also seeks to empower these groups with the language, concepts, and case studies needed to push for meaningful change - whether it is advocating for streets that support better public transport access, walking- and cycling- friendly infrastructure, good quality public space, more inclusive planning processes, or support for grassroots action.

Additionally, this report can also be useful for researchers and academics studying the intersections of justice and street space. It offers a synthesis of theoretical perspectives and real-world applications, helping to bridge academic discussions with on-the-ground practices. By grounding mobility and spatial justice in tangible street interventions, the report could provide a foundation for further research and explorations of how theorisations around justice can be operationalised into solutions for policy and practice.

Ultimately, this report is intended for anyone who wishes to understand and engage with the concept of mobility and spatial justice, learn from street transformations across Europe, and move from theory to action in making their city's streets more fair, accessible, and inclusive.



Figure 1 Paris school street intervention, transforming the streetscape with bold markings and planters to prioritise pedestrians, improve safety, and enhance the local urban environment



2. Theoretical Framework: Justice and Participation for Streets Change

2.1 Justice for Streets Change: Literature Overview

Streets are more than just physical infrastructures for movement: they are inherently political spaces where justice, competing interests and values, power structures and inequalities converge. They constitute sites where access, inclusion and control over space are constantly negotiated and contested. In that sense, decisions about the way streets are designed, governed, and used are rarely neutral – they instead reflect existing power dynamics and structural issues which shape who can move freely, who faces barriers, whose needs are prioritised, and whose voice is included. In many cities and in particular since the rise of the automobile age, streets have been planned in ways that reinforce social and spatial hierarchies and exacerbate inequalities, inequities and injustice. This has meant designing and planning streets that privilege certain forms of mobility such as private car travel while marginalising others (particularly walking, cycling and public transport), and taming the public life functions of streets for the sake of efficiency and economic productivity.

The challenges of mobility injustice are sharply visible on urban streets, where inequalities in infrastructure, design, safety, and public life converge. High-quality streetscapes, safe crossings, and amenities are typically concentrated in affluent areas, while marginalised neighbourhoods face neglect and poor conditions. Street design often reflects narrow assumptions about users, privileging able-bodied, adult, male commuters and overlooking the needs of children, older adults, disabled people, and caregivers. Low-income and racialised communities disproportionately bear the health risks of traffic danger and pollution. Access to public space is also uneven, as unhoused people, informal workers, and youth face formal restrictions, social policing, or lack of supportive infrastructure. Beyond physical design, everyday forms of mobility, such as caregiving trips or informal work, are often invisible in planning models. Efforts to improve streets can unintentionally trigger gentrification and displacement if not paired with affordability protections. Meanwhile, decision-making on street transformation frequently excludes affected communities, and growing reliance on digital platforms risks reinforcing inequalities through assumptions of universal access and embedded technological bias.

In recent decades, street change has emerged as a prominent strategy within urban mobility transitions, driven by goals of sustainability, liveability, and multimodal transport integration. Although contemporary interest has surged, scholarly and policy engagement dates back to at least the 1980s, when early research explored the topic of streets space reallocation interventions like pedestrianisation, traffic calming, cycling infrastructure, and travel demand management (Tolley, 1990; Pharoah, 1992; Pharoah & Apel, 1995). Key investigations assessed impacts on economic activity, particularly retail viability (Hass-Klau, 1993), and shifts in travel behaviour following reductions in road capacity (Cairns, Atkins & Goodwin, 2002).

Parallel to transport-focused research, urban design scholarship contributed insights into the qualities of public streets, from sociability and public life to human-centred environments (Whyte, 1980; Jacobs, 1993; Gehl & Gemzøe, 2003; Carmona, 2003; Gehl, 2010). This body of work shaped emerging practices like shared space schemes (Hamilton-Baillie, 2008; Hickman, Hamilton-Baillie & Purkiss, 2009) and informed policy guidelines (DfT & DCLG, 2007; CABE, 2007, 2008). More recent studies have extended these foundations to revisit pedestrianisation (Hass-Klau, 2015), promote walkability (Ewing & Handy, 2009; Adkins et



al., 2012), advocate for cycling infrastructure (Pucher & Buehler, 2008; Forsyth & Krizek, 2011; Colville-Andersen, 2018), and examine interventions reducing car dominance (Carmona et al., 2018). The 'Link and Place' framework (Jones, Boujenko & Marshall, 2007) has been especially influential, positing streets as simultaneously movement corridors and public spaces, and offering a conceptual model to balance these roles within design and planning.

Yet despite this substantial body of technical and design-oriented research, critical perspectives have only more recently interrogated who benefits from street change and who remains excluded. Equity and justice have gained attention in both transport and urban geography fields, through debates on transport justice (Martens, 2017), mobility justice (Sheller, 2018), and socio-spatial justice (Soja, 2010). These literatures highlight that street interventions, whether framed as pedestrianisation, traffic calming, or modal shifts, may reproduce or even exacerbate inequalities if underlying power structures and participatory deficits are left unaddressed (Lucas, 2012; Verlinghieri & Schwanen, 2020). Critical scholarship highlights that justice is not solely a matter of spatial redistribution (e.g., reallocating road space from cars to bikes), but also procedural: it concerns who participates, whose knowledge is recognised, and how decisions are legitimised (Forester, 1989; Healey, 1998). Accordingly, transforming streets into more inclusive and sustainable urban spaces requires acknowledging that mobility is not a purely technical issue, but a deeply political one, with street transformations often revealing deep-seated tensions in how public spaces are perceived and used. Conflicts emerge from competing priorities, needs, and perspectives, particularly between maintaining car access and promoting pedestrian-friendly, socially inclusive designs, turning streets into sites of contestation and negotiation (Verlinghieri, Vitale Brovarone & Staricco, 2024). What is more, these tensions also reveal deeper struggles over the right to the city: who has the power to shape urban environments, whose voices are included in decision-making, and whose mobility and use of the space needs are prioritised. Beyond their function as transport corridors, streets also serve as spaces of political expression and social interaction (Lees, 1998). They can often be sites of protest, politics, informal economies, and everyday encounters that shape urban culture and identity. In that sense, the governance of street space (through policing, surveillance, and regulatory frameworks) determines who feels safe and welcome on city streets, and who experiences exclusion or marginalisation. As cities increasingly seek to reimagine their streets, these transformations become not solely just about redesigning infrastructure but also about redefining power relations in urban space.

Empirical research exploring the governance and negotiation processes underpinning street reallocation remains relatively limited. Much of the existing literature privileges infrastructural, behavioural, or economic outcomes, while offering less insight into the institutional dynamics, political contestation, and power asymmetries that shape project trajectories (Curtis & Low, 2012; Legacy, 2015; Spotswood et al., 2015). What is more, the planning field has long engaged with the politicisation of public space (Flyvbjerg, 1998; Forester, 1989), yet these perspectives are inconsistently translated into transport planning and street design practices, which often retain a technocratic orientation (Freund & Martin, 1993; Paterson, 2007; Geels, 2011). Furthermore, while innovative pilots and experimental interventions have proliferated across European cities (Bertolini, 2020), evidence on their long-term institutionalisation, transferability, or inclusivity remains fragmented. Important questions persist regarding how divergent stakeholder views are mediated, whose priorities prevail, and how participatory processes influence project legitimacy and outcomes.

In sum, although the literature has advanced understanding of street design, modal rebalancing, and the experiential qualities of streets, it remains underdeveloped in explaining



how justice is enacted, or sidelined, within the political, institutional, and participatory processes of streets change.

2.2 Justice for Street Transformations: Key Concepts

2.2.1 Transport and Spatial Justice

While streets serve as highly visible sites where struggles over justice unfold, the conditions that shape access, mobility, and public space are embedded in broader socio-political, economic, and spatial structures. The concept of transport justice provides a critical theoretical foundation for evaluating fairness and equity in mobility systems, while spatial justice offers complementary insights into how urban space is organised, contested, and governed. Understanding justice in the context of street transformations thus requires engagement with both bodies of thought and their underlying debates. The following section traces key developments in transport and spatial justice scholarship, and critically assesses their limitations in addressing the complexities of street-level change.

While transport justice foregrounds questions of mobility, accessibility, and resource distribution, **spatial justice** highlights the ways in which urban form, land use, and spatial arrangements shape everyday life and reinforce social inequalities (Soja, 2010; Marcuse, 2009). Spatial justice asks not only about access but about how space is produced, controlled, and contested. It focuses on the uneven distribution of valued urban resources (from housing and green space to public facilities and infrastructure) and interrogates who has voice and power in shaping these distributions (Fainstein, 2010).

The roots of socio-spatial justice theory can be traced to critical urban thinkers from the left such as Henri Lefebvre, David Harvey, Peter Marcuse, Edward Soja and others. In 1968, the seminal work of Henri Lefebvre (1968), *Le Droit à la Ville* (The Right to the City) argued that urban space is socially produced and inherently political. Lefebvre emphasised that the right to participate in the production of space is a fundamental human right, particularly in the context of capitalist urbanisation, which tends to prioritise commodified and elite-controlled spaces. This claim laid the groundwork for later discussions of spatial justice by asserting that access to urban space is tied to deeper struggles over power, exclusion, and participation.

In the 1970s and 1980s, radical geographers such as David Harvey (1973) further advanced the study of space and justice by linking it to Marxist political economy. Harvey's *Social Justice and the City* (1973) argued that capitalist urbanisation produces spatial inequalities, such as uneven development, gentrification, and segregation, that cannot be separated from broader class relations. Harvey shifted the discussion from distributive concerns (who gets what) to structural concerns about how urban space is governed and produced under capitalism.

In the early 2000s, Edward Soja's *Seeking Spatial Justice* (2010) argued that space matters as both an outcome and a medium of justice struggles. Soja built on Lefebvre and Harvey but broadened the framework that space is a socially produced, dynamic force central to understanding and addressing social injustice. In this sense, Soja critiqued the traditional dominance of historical and sociological perspectives in urban studies, arguing for a "spatial turn" that places space and geography at the heart of justice struggles. He contends that spatial justice, distinct yet complementary to social and environmental justice, reveals how inequalities are embedded and reproduced through urban geographies of exclusion and access.



In parallel, at the heart of discussions on **transport justice** are interlinked ideas of efficiency, individual freedom, fairness, accessibility, and the spatial distribution of transport resources. While some transport justice scholars draw from theories that prioritise maximising overall benefits (utilitarianism), others emphasise individual rights and market mechanisms (libertarianism), context-dependent solutions (intuitionism), or correcting social inequalities (egalitarianism) (Pereira, Schwanen & Banister, 2017).

Many contemporary transport and urban planning practices are strongly influenced by **utilitarian principles**, which emphasise maximising overall societal benefits (Mill, 1861). In both transport and urban planning, this often translates into cost-benefit analyses that favour projects with the highest economic return or efficiency gains. Large infrastructure projects, congestion pricing, and transport modelling all draw on this logic, seeking to optimise the movement of people and goods. While maximising societal welfare can lead to large-scale improvements, it tends to remain blind to social and spatial inequalities and overlooks who benefits most. A project that improves commuting times for high-income professionals but does little for underserved or peripheral communities may still be justified under a utilitarian framework, even if it worsens transport and spatial exclusion for marginalised groups. Similarly, evictions and relocations for new road or rail projects may be justified as serving the public good, despite the spatial injustices they produce in terms of displacement and dispossession (Soja, 2010).

Libertarianism, as articulated by Robert Nozick (2003), foregrounds individual freedom and minimal state intervention, arguing that mobility and space-use choices should primarily be governed by market mechanisms and personal responsibility. From this perspective, transport and urban systems are assumed to operate fairly if they allow individuals to make unfettered choices, irrespective of structural inequalities. Examples such as ride-hailing platforms, private toll roads, or deregulated public transit align with libertarian ideals, as do market-driven patterns of urban development. However, libertarian approaches have been widely critiqued. Scholars have shown that they fail to address the deeply embedded structural and spatial inequalities that shape mobility opportunities and spatial access (Sheller, 2018; Verlinghieri & Schwanen, 2020). Libertarianism presumes an equal starting point, ignoring how race, gender, income, disability, and geography fundamentally shape individuals' capacities to exercise "free" choices in both mobility and spatial terms. Without public intervention, market-driven systems risk reinforcing social and spatial injustices, prioritising profitable routes, areas, and infrastructures over equitable accessibility and fair distribution of space and mobility benefits (Pereira et al., 2017). Furthermore, libertarianism overlooks procedural and recognitional aspects of justice, focusing narrowly on distribution without questioning who participates in decisions, whose spatial needs are recognised, and which knowledges are valued in shaping urban and transport systems (Fraser, 1996; Soja, 2010; Sheller, 2018).

A more structured normative framework is offered by John Rawls' (1971) theory of justice, grounded in **egalitarian principles**. Rawls argues that inequalities in the distribution of social goods are acceptable only if they benefit the least advantaged members of society — the so-called "difference principle." Applied to transport and spatial contexts, this principle would prioritise investments and interventions that improve mobility, accessibility, and spatial inclusion for marginalised groups: for example, expanding public transport and public space in low-income areas, enhancing pedestrian and cycling infrastructure in underserved neighbourhoods, or subsidising housing and mobility for those facing structural barriers. Rawls' approach shifts the focus from absolute equality to the fair distribution of opportunities and resources, seeking to maximise the position of the worst-off. Despite its appeal, Rawlsian egalitarianism faces challenges when applied to urban and transport justice. It struggles to adequately distinguish between inequalities arising from systemic disadvantages



and those from personal choices, and it raises difficult questions about how to identify, spatialise, and measure disadvantage (Pereira et al., 2017; Verlinghieri & Schwanen, 2020). Moreover, its focus on distributive justice often overlooks procedural and recognitional dimensions, including who shapes the production of urban space and whose everyday spatial practices are legitimised or marginalised (Soja, 2010).

Amartya Sen's **Capabilities Approach** (1999) offers another important lens by shifting attention from the provision of resources to what individuals can actually do and be. In transport and spatial terms, this means that justice is not only about offering mobility or spatial options, but about ensuring that people have the real freedom to use these options to improve their well-being and fully participate in social life. This perspective underscores that access alone is insufficient: meaningful opportunities depend on factors such as affordability, safety, reliability, location, proximity, and individual capacities. Unlike egalitarian frameworks focused on redistribution, the Capabilities Approach emphasises the substantive freedoms individuals have to convert spatial and mobility resources into valuable life outcomes. While offering a holistic and context-sensitive account of justice, the approach faces practical challenges, including defining universal entitlements and measuring whether urban and transport systems effectively expand people's capabilities (Pereira et al., 2017; Martens, 2016; Sheller, 2018).

2.2.2 Toward a Framework of Street Justice

With streets functioning both as a link and as a place (Jones, Boujenko & Marshall, 2007), any discussion of justice must bridge the concerns of mobility justice and spatial justice together. In this sense, we propose the notion of street justice as an integrated framework that combines the distributional, procedural, epistemic and recognitional dimensions of both mobility and spatial justice.

Existing transport and spatial justice frameworks have laid important groundwork but also show clear limitations. Utilitarian approaches prioritise efficiency and economic productivity, often benefiting wealthier groups and overlooking inequality. Libertarianism promotes individual choice and market-driven solutions, assuming equal starting conditions and neglecting structural disadvantage. Even egalitarian and capabilities-based approaches, while moving toward more comprehensive frameworks, often reduce justice to issues of distribution and accessibility, without addressing the political and social forces that shape everyday access to space and mobility. Traditional transport and spatial justice frameworks have largely focused on improving access to destinations and enhancing infrastructure.

Mobility justice thus emerges as a response to these limits, reframing justice beyond technical access to highlight questions of power, rights, and the politics of movement (Sheller, 2018). It shifts the debate toward who has the right to move, who faces restrictions, and how mobility is shaped by race, class, gender, ability, age, and environmental conditions. This lens reveals how marginalised populations (such as migrants, racialised minorities, disabled people, women, and children) face layered barriers not only from inadequate infrastructure but from legal, economic, and social constraints. Importantly, mobility justice links local street and transport interventions to global struggles around climate change, displacement, and the right to the city (Lefebvre, 1996; Sheller, 2018). It challenges the idea of transport systems as merely technical, revealing their role in reproducing social and environmental injustice. As Sheller (2018) argues, this involves reclaiming the street as a mobile commons: a space not only for circulation but for gathering, protest, care, and community-building.



Spatial justice complements these insights by foregrounding the unequal distribution of space, resources, and urban opportunities (Soja, 2010). It examines who has access to parks, sidewalks, housing, and public amenities, and how the built environment and unequal governance structures reinforce or disrupt patterns of privilege and marginalisation. While spatial justice has often focused on the allocation of material resources, it also discusses about the social and political processes (displacement, gentrification, segregation) that shape how space is produced and contested (Marcuse, 2009; Fainstein, 2010).

The concept of street justice builds on these strands of thought to offer an integrated framework. It asks not only how we distribute space and mobility fairly but also how we create streets that serve as inclusive, liveable, and empowering environments for diverse urban residents. This means considering distributive issues (who has access), procedural concerns (who participates in decisions), and recognitional dimensions (whose needs, knowledges, and identities are valued) in street design and governance.

For example, addressing gendered mobility requires rethinking how streets accommodate caregiving trips, address safety concerns, and enable meaningful participation by women and LGBTQ+ groups in planning. Addressing environmental injustice means recognising how car-dominated streets disproportionately harm marginalised communities through air pollution and climate vulnerability. Complementarily, tackling racialised spatial inequality requires acknowledging the historic displacement of minority communities through highway construction and urban renewal projects.

2.2.3 Dimensions of Streets Justice

This section introduces a multidimensional framework to understand justice in street transformations. By dimensions, we refer to distinct yet interconnected aspects of justice that help unpack how fairness operates across material, political, and social domains. Building on recent theoretical developments in transport and mobility justice (Verlinghieri & Schwanen, 2020; Sheller, 2018), we propose the concept of street justice as an integrated approach that brings together insights from both mobility and spatial justice (Kębłowski, Van Criekingen & Bassens, 2019). By thinking in terms of dimensions, we are able to move beyond narrow, single-issue framings of justice that often dominate urban and transport debates.

Distributive justice: Fair Allocation of Space and Resources

Distributive justice is one of the most extensively examined dimensions in transport and urban planning, focusing on the fair allocation of resources, opportunities, and burdens. Drawing on the work of Martens (2012), this perspective centres on people's capability to access key destinations such as jobs, education, and healthcare. It reframes equity from a focus on movement speed (mobility) to the ability to reach essential opportunities (accessibility), proposing minimum accessibility standards and prioritised improvements for disadvantaged groups (Martens, 2012). In the context of street transformations, distributive justice challenges the historical prioritisation of car travel and the unequal distribution of safe, affordable, and accessible options for walking, cycling, and public transport (Pereira, Schwanen & Banister, 2017). It calls for a critical examination of how infrastructure investments are allocated across cities, advocating that underserved, low-income, or marginalised areas be prioritised for improvements to public transport, sidewalks, and cycling infrastructure (Lucas et al., 2016). An example includes London's widespread School Streets



scheme, whose core objective is explicitly distributive: reallocating urban street space away from motorised vehicles towards children and families.

Distributive justice also extends to recognising the unequal distribution of environmental burdens: marginalised communities often face disproportionate exposure to air pollution, traffic danger, and infrastructural neglect, compounding health and social inequalities. A distributive justice approach to street change thus goes beyond equal investment; it calls for equity-oriented redistribution that corrects past and present imbalances. It argues for reallocating street space away from car-dominated uses toward active and public transport modes, ensuring all users—particularly the most disadvantaged—benefit from safe, efficient, and sustainable streets (Martens, 2017).

Importantly, the distributive mobility justice must also consider intergenerational fairness (Skillington, 2019). Many of today's mobility challenges, from climate change to car dependency, are the result of past planning decisions. Following the same logic, the burden of current unsustainable transport systems will (and to some extent is already), disproportionately affect future generations (Mattioli, 2016). A distributive mobility justice framework must therefore call for current decisions around transport and mobility to not create new forms of harm for future inhabitants. This includes designing and planning streets that safeguard long-term environmental sustainability and generational well-being by addressing current climate challenges.

What is more, distributive justice must also address the unintended consequences of street improvements. Enhancements such as pedestrianisation, cycling infrastructure, and urban greening can increase neighbourhood attractiveness, potentially driving gentrification and displacing lower-income residents (Lucas et al., 2016). Without accompanying anti-displacement measures—such as affordable housing protections, rent control, or community land trusts—the very populations meant to benefit from mobility justice interventions may be pushed out of their neighbourhoods. To prevent this, distributive justice requires integrated policies that link public realm improvements with measures safeguarding against exclusion and displacement.

Procedural Justice: Inclusive and Democratic Processes

Procedural justice concerns the fairness of decision-making in street planning, emphasising that inclusion and participation are as important as outcomes (Young, 1990). Scholarship on participatory and environmental justice highlights the need to meaningfully involve marginalised groups and ensure their voices influence decisions (Arnstein, 1969; Blue, Rosol & Fast, 2019; Chu, Anguelovski & Carmin, 2015). Transport and urban planning have long been expert-driven and top-down, often excluding low-income residents, people with disabilities, or racialised groups – and while a paradigm shift is underway toward more participatory mobility planning, research finds gaps between the ideal of procedural justice and on-the-ground practice (Schwanen, 2020).

Addressing this requires creating processes that allow diverse groups to shape street transformations in meaningful ways. Effective strategies involve deepening participation and engagement beyond standard consultation, using workshops, arts-based methods, or pop-up trials, and adopting digital platforms such as interactive mapping tools – for instance, programmes like Ghent's Living Streets and multi-stakeholder mobility labs show how local knowledge and experimentation can produce innovative, widely supported solutions. Reducing barriers to participation, for example through translation, childcare, or holding events in accessible local spaces, ensures input is not limited to already privileged groups. Transparency is also key, with fair decision-making including advisory committees with broad



representation, participatory budgeting processes, and mechanisms like citizens' assemblies, which would allow diverse voices to deliberate on policy. Applying procedural equity criteria can also help ensure that engagement is both wide-reaching and representative, while making the links between public input and final decisions explicit helps build legitimacy and trust. Finally, empowering local initiatives through grants, technical support, and toolkits enables communities to design and implement their own pilots or improvements.

Overall, procedural justice requires shifting power and valuing lived experience alongside professional expertise. This is also linked to an additional dimension, **epistemic justice**, which refers to the need of recognising and integrating diverse forms of knowledge in decision-making processes (Fricker, 2007). In this sense, ensuring procedural and epistemic justice in street transformations means creating participatory mechanisms where local communities have real influence and agency over decision-making, whether through co-design processes, citizen assemblies, or supporting grassroots, community-led planning and street transformation initiatives.

Recognition Justice: Acknowledging Difference

Recognition justice extends the concerns of mobility and spatial justice by focusing on whose needs, identities, and mobility cultures are acknowledged in transport planning (Verlinghieri & Schwanen, 2020). Feminist and intersectional scholars highlight that transport systems have historically been designed around a narrow user profile (e.g. an able-bodied, neurotypical male commuter), often overlooking others such as women, children, the elderly, people with disabilities, ethnic minorities etc. (Levy, 2013^[4]), while also overlooking a more nuanced inter-sectional understanding of mobile subjects (that is rejecting fixed single categories such as race, gender or economic status when considering diversity). Recognition justice thus calls for valuing different mobility experiences and social identities. This includes, for example, understanding how gender roles affect travel (such as women's trip for care work).

When it comes to street transformations, these often fail to acknowledge the diverse ways in which different groups use public space, reinforcing exclusionary designs. For example, street designs and plans that prioritise efficiency and car use may overlook the importance of spaces for social interaction, play, or informal economies, important to the livelihood and wellbeing of many. Similarly, authors highlight how existing infrastructures (such as streets without resting spaces, bike lanes requiring sustained physical exertion, or "open streets" events assuming ease of movement) fail to accommodate the full spectrum of human diversity in mobility needs (Hamraie, 2021). This exclusion is compounded by policing and surveillance, which disproportionately affect Black, Indigenous, and other people of colour, making public space unsafe regardless of transportation mode (Golub, Marcantonio & Sanchez, 2013). Another example includes the exclusion of neurodivergent individuals in street design considerations, for whom streets often create sensory overload, unpredictability, and navigation difficulties, with inadequate signage, lack of resting spaces, and overwhelming noise, light, and crowding making urban mobility stressful and inaccessible (Pau, Gaudion & Phillips, 2023).

Beyond human actors, recognition justice should also extend to non-human entities such as trees, plants, and urban biodiversity, which are often overlooked in street transformations. Urban greening initiatives must go beyond aesthetic considerations and be rooted in ecological justice, recognising that trees, green spaces, and biodiversity contribute to climate resilience but also have a right to exist safely and flourish as integral members of the urban ecosystem – with numerous scholars and indigenous epistemologies arguing that non-human entities such as plants and trees should not be merely understood as resources but



as kin deserving of kin and reciprocity (Stone, 1972). For street transformation contexts, this implies that greening initiatives must prioritise the well-being and self-sustaining capacities of non-human entities, ensuring that trees and biodiversity are not merely ornamental but protected as rightful urban inhabitants.

Restorative Justice: Repairing Past Inequities

Restorative justice in mobility seeks to address historical injustices embedded in transport and urban infrastructure, drawing conceptually from environmental justice frameworks (Forsyth, Pali & Tepper, 2022). This perspective recognises that many marginalised and lower-income communities have borne the costs of past planning decisions prioritising road expansion, automobile use, and car-centric urban development, often resulting in displacement, environmental degradation, and neighbourhood fragmentation (Golub, Marcantonio & Sanchez, 2013). For instance, major roads and highways have frequently been routed through vulnerable neighbourhoods, dividing communities and creating long-term social, economic, and environmental harms (Martens, 2017).

Within the context of street transformations, restorative justice entails redressing these harms through reinvestment in neglected areas, the restoration of walkability and connectivity, and the prioritisation of projects that repair past damage. This may involve reclaiming road space for pedestrians, introducing traffic-calming measures in historically marginalised areas, or reallocating space to better serve communities that have been excluded from past investments (Pereira, Schwanen & Banister, 2017). For example, several European cities have begun mapping transport investment equity and targeting resources toward under-served districts, implementing measures such as new sidewalks, cycling infrastructure, and traffic calming in low-income or peripheral areas.

Improving public transport in these neighbourhoods through enhanced routes, stations, and last-mile connections can also help address past investment imbalances. Restorative justice further involves dismantling physical barriers and remediating environmental damage caused by prior infrastructure decisions. This may include removing or redesigning highways and flyovers that have divided neighbourhoods, as seen in the Madrid Río project, or smaller interventions such as installing green buffers, noise barriers, and restoring public transit where service has been withdrawn (Bertolini, 2020).

In addition to physical interventions, policy-based reparations are a growing dimension of restorative justice. An illustrative case is the Coventry Mobility Credits scheme in the United Kingdom, which allowed residents to exchange old, polluting vehicles for £3,000 worth of credits usable on public transport, car-sharing, or cycling-related purchases. This type of initiative addresses both environmental and social equity concerns, offering compensation while supporting a just transition toward sustainable mobility (European Environment Agency, 2024).

2.3 Participation and Co-Creation for Just Streets Change

The preceding section established a multidimensional framework for mobility justice, encompassing distributive, procedural, recognition, epistemic and restorative dimensions. This section turns its attention to the central role of participatory processes and co-creation in operationalising these dimensions in practice. Rather than treating participation as an optional or supplementary element of justice, this section argues that participation should be the fundamental mechanism through which different dimensions of justice are addressed and brought together.



While transport justice has traditionally been framed through a distributive lens (Pereira, Schwanen & Banister, 2017; Martens, 2017), ensuring equitable outcomes cannot be achieved through redistribution alone. Distributive goals must be grounded in participatory processes that define what is fair, for whom, and in which contexts. Similarly, procedural and epistemic justice, concerned with transparency, accountability, and inclusion, rely fundamentally on the design and quality of participation processes. Recognition justice, too, depends on participatory approaches that validate diverse needs, experiences, knowledges, and cultural perspectives often marginalised in traditional planning. Finally, restorative justice, which addresses historical harm and structural exclusion, demands active involvement from those affected in shaping the terms of redress. Participation, then, is not simply one component of justice: it is the mechanism through which all forms of justice are negotiated, made visible, and enacted.

2.3.1 Participatory Planning & Justice

Participatory planning has increasingly been seen as a way to democratise urban governance, challenge power imbalances, and include diverse voices in shaping urban space. Below is an overview of key strands of theorising that have shaped this field, highlighting how they reflect evolving ideas about governance, democracy, and the right to the city (Lefebvre, 1968). This will help set the stage for understanding how community participation and co-creation can advance just mobility and street transformations.

Seminal works such as Arnstein's (1969) *Ladder of Citizen Participation* laid the foundation for much of the work that followed, framing participation as fundamentally about the redistribution of power. Arnstein used the analogy of a ladder to distinguish between non-participation (manipulation), tokenistic consultation (community engagement as a tick box exercise), and genuine citizen power (meaningful participation). She argued that without shifting decision-making authority to citizens, engagement risks becoming exploitative and purely performative. This foundational framing remains crucial for mobility justice, where procedural justice depends on ensuring that affected communities have meaningful influence over decisions. Currently, numerous mobility planning processes still operate at low levels of the ladder, where communities are consulted but lack real decision-making authority - a justice-based approach to engagement, however, would seek to climb this ladder.

Building on Arnstein's work, through the 1970s and 1980s, participation became increasingly embedded in not only urban planning scholarship but also planning practice, shifting from elite-driven visions toward models rooted in more community consensus. The 1990s saw a renewed focus on participation, linked to the rise of civil society organisations, collaborative planning, and debates on social justice. Thinkers like Patsy Healey (1996) and Edward Soja (1996) emphasised the value of local experience, equity, and access to space. This emphasis is part of Healey's broader argument that planning should be a collaborative process where local, experiential knowledge is valued alongside technical expertise, as this would lead to more just, inclusive, and context-sensitive outcomes. In that sense, central to Healey's theory of collaborative planning is the importance of experiential knowledge, or the insights, values, and understandings that arise from people's everyday lives and local contexts (Healey, 2010). This may include how people use and navigate streets in their daily life, what challenges they face in terms of access, safety, or inclusion, their sense of place or belonging tied to streets, as well as cultural, social, or informal practices that shape how public space is used and valued.

Importantly, Healey sees this kind of knowledge not just as useful input but as essential to both the justice and the effectiveness of planning and policy-making. For her, incorporating experiential knowledge into planning processes is both a normative imperative (it enhances



fairness, recognition, and inclusivity) and a functional necessity (it leads to more responsive, context-sensitive solutions) (Healey, 2006). This work was also aligned with Edward Soja (see above), who put forward the idea that inequality and injustice are experienced not just economically but also spatially, and that addressing them requires paying attention to the voices and experiences of those most affected on the ground (Soja, 2010) - as well as with the concept of epistemic justice as put forward by Miranda Fricker (2007), emphasising the value of non-expert knowledge in shaping participatory planning practices.

Such discussions are directly relevant when it comes to streets, which are transforming into more people-centred spaces, an ambition which is inspiring numerous placemaking and street regeneration efforts. However, these projects often take a designed-led approach, where expert opinions, aesthetic preferences, and numerical data are prioritised over the lived experiences of local residents (Smeds et al., 2023). At the same time, streets have historically been shaped by state-led perspectives (Scott, 1998), treating them mainly as transport infrastructures designed for efficiency and movement rather than as complex social and cultural spaces. These dominant ways of thinking (whether from designers or policymakers) tend to sideline local knowledge and citizen perspectives, which creates two major problems, as Healey (2010) also highlights: first, it ignores the deep, place-specific understanding that residents have about their streets and how these function in everyday life; second, it fails to recognise the diverse needs, identities, and experiences within communities, leading to interventions that can feel detached, exclusive, or even harmful. Acknowledging these challenges calls for a shift away from top-down interventions, advocating instead for collaborative, participatory frameworks where local expertise, lived experiences, and the voices of marginalised communities play a central role in driving street transformations. The real challenge, as Beebejaun (2017) points out, isn't just gathering input from diverse groups but ensuring that their insights are valued, amplified, and acted upon in meaningful ways.

Recent discussions have introduced co-creation as a more dynamic and innovation-driven alternative to traditional participation. While participation, as outlined by Arnstein (1969) and subsequent scholars, has historically focused on redistributing power and ensuring inclusivity in decision-making, co-creation moves beyond rights and representation to emphasise collaborative problem-solving and knowledge integration (Lund 2018). Earlier participatory models aimed to empower communities and counter expert dominance, but many efforts remained tokenistic, failing to give citizens real decision-making power. Co-creation, in contrast, seeks to leverage diverse types of knowledge (practical, lived, and expert) to generate socially innovative solutions to complex urban challenges. This approach draws on social and experiential learning (von Schönfeld et al., 2020), where different stakeholders collectively experiment, refine, and adapt urban policies and projects through an iterative process.

2.3.2 Knowledge Co-Production & Experiential Learning

Scholars focusing on urban transformations consistently highlight learning as a central mechanism through which urban interventions such as street experiments can contribute to broader systemic change (Beukers & Bertolini, 2021; Stam, Ewijk & Chan, 2023). Learning, understood as the process through which knowledge is created by transforming experience (Kolb, 2014), enables actors to develop new perspectives, behaviors, and institutional arrangements. Kolb (2014) refers specifically to the concept of experiential learning, which emphasizes four iterative stages: concrete experience, reflective observation, abstract conceptualisation, and active experimentation. This model has been applied in recent research to interpret how urban actors, especially local governments, engage with and learn



from temporary urban interventions (Beukers & Bertolini, 2021). Importantly, learning does not happen automatically through mere participation; it requires deliberate structuring of interactions and reflection processes to avoid superficial outcomes (von Schönfeld et al., 2020).

In this sense, knowledge co-production emerges as a critical component of this process, understood as the collaborative creation of knowledge across different stakeholders, including local governments, community actors, and other partners- which can lead to shared understandings and innovative solutions. This approach recognises that no single actor or type of knowledge can adequately address the complex challenges facing cities today (Verdini, Woltjer & Cioboata, 2025). Knowledge co-production moves beyond the traditional separation between expert and lay knowledge by creating spaces where diverse actors can jointly define problems, identify solutions, and shape interventions. In this view, local communities are not merely data providers or stakeholders to be consulted; they are active contributors whose lived experiences, practical expertise, and social insights are essential to the design and governance of just urban environments.

This perspective is particularly relevant to street transformations, where everyday users (pedestrians, cyclists, children, caregivers, informal workers, disabled persons) have situated knowledge about how streets function and what challenges they pose. Such knowledge often remains invisible in traditional planning frameworks, which privilege technical data and standardised indicators over context-specific insights. Integrating experiential knowledge is thus not only a matter of epistemic justice (Fricker, 2007) but also of improving the relevance, legitimacy, and effectiveness of planning outcomes (Healey, 2010).

Importantly, co-production and experiential learning challenge the hierarchies of expertise that have historically shaped transport and urban planning. As Smeds et al. (2023) argue, by foregrounding lived experience and non-expert knowledge, these approaches can help counter the technocratic biases embedded in dominant planning cultures, making space for more just, inclusive, and adaptive street transformations. Nevertheless, despite the potential of centring knowledge co-production and experiential learning in urban transitions, challenges remain. Much of the learning in street transformation projects tends to be focused on instrumental knowledge, such as traffic impacts or air quality improvements, while less attention is paid to transformative knowledge that questions deep-seated norms, values, and power structures in urban mobility (VanHoose, Bertolini, & Straatemeier, 2025). In this sense, for co-production and learning to fulfil their transformative potential, they must be approached as a political practice attentive to issues of representation, accountability, and power-sharing.

Ultimately, embedding co-production and experiential learning in street transformation processes provides a way to operationalise the principles of mobility and spatial justice outlined earlier. It offers a path toward interventions that are not only technically sound but socially meaningful—built through collaboration, reflection, and continuous learning alongside the communities they affect.



Figure 2 Community workshop on parklets and street interventions, where participants discuss global examples and share ideas for reimagining local public space, London, 2022

2.4 Existing Gaps & Challenges

Despite the recent expansion and growing academic interest in spatial and mobility justice as a comprehensive framework for understanding and addressing inequalities in street transformations, important gaps remain. Firstly, while the theoretical foundations of mobility and spatial justice have been extensively developed, empirical research applying these principles in real-world cases remains limited (Verlinghieri & Schwanen, 2020). Many studies offer conceptual or normative accounts but provide little insight into how distributive, procedural, recognition, and restorative justice dimensions are operationalised in practice, particularly in street-level interventions.

Secondly, there is a persistent gap between theoretical advances and the practical tools required to implement justice frameworks in planning and design processes. Integrating different knowledge systems, including technical expertise, local experience, and lived realities, demands new methodological approaches that address disciplinary silos, institutional inertia, and entrenched power asymmetries. This is often why existing participatory processes fall short of these ambitions, relying on extractive or tokenistic forms of consultation that gather input without meaningfully embedding it in decision-making (Beebejaun, 2017).



Furthermore, although the literature increasingly recognises the importance of procedural and epistemic justice, there is little critical examination of how co-creation and participatory practices reshape power relations on the ground. Questions remain about under what conditions community engagement genuinely influences outcomes and how processes can be designed to avoid reinforcing existing exclusions. This is particularly salient for engaging historically marginalised groups (such as neurodivergent individuals, children, older adults, immigrants, and informal workers) whose mobility needs and everyday practices are often neglected in dominant planning paradigms.

Finally, while knowledge co-production and experiential learning have emerged as critical components of street transitions, research has yet to systematically evaluate how these approaches enhance justice outcomes and translate on the ground. In this sense, we know relatively little about how such practices redistribute expertise, or shift institutional cultures, and under what conditions they contribute to more equitable and context-sensitive street transformations.



3. Methodology

3.1 Data Collection: Survey on Tools for Operationalising Street Justice

As part of this research, we conducted a survey aimed at identifying and assessing tools, methods, and indicators that can help operationalise the concept of justice in street transformation processes. The survey targeted a diverse group of stakeholders, including urban planners, policymakers, community organisations, advocacy groups, and researchers across different national contexts. Respondents were asked to report on the tools they use to capture distributive, procedural, recognition, and restorative dimensions of justice in their work, as well as on the challenges and gaps they encounter in practice. The collected data provided valuable insights into current practices, highlighting both promising approaches and persistent shortcomings in applying justice frameworks on the ground. These findings informed the development of the Just Streets Pathways (see below and Deliverable 2.2) by grounding its stages not only in theory but also in practical tools and real-world experience, ensuring its relevance and usability for practitioners.

Data collection occurred through an online survey using Qualtrics, aimed at collecting case studies and practical approaches from diverse urban contexts. The questionnaire was carefully structured to capture detailed, context-specific insights on how mobility justice principles are being applied, ensuring a comprehensive understanding of challenges, strategies, and best practices in street transformation initiatives.

The mobility justice tools & approaches survey was structured into several thematic sections, each addressing specific aspects related to mobility justice and practical applications. Respondents were guided through targeted questions designed to capture comprehensive and detailed information. The thematic sections were as follows:

1. **Tool Basic Information:** The purpose of this initial section was to collect basic information about the submitted tool including the name, source, year of development, a weblink for further exploration, and key words to describe it.
2. **Tool Description:** The purpose of this section was to describe each submitted tool comprehensively. Respondents provided the detailed description of the tool they were submitting, the main category the tool belonged to (participatory planning tool, implementation strategy tool etc.), the type of tool (exploratory, descriptive, explanatory, evaluative etc.), and intended users and target audiences.
3. **Tool Application and Implementation:** This part of the survey inquired about the tool application process how easily accessible and user-friendly each tool is, examining practical considerations like language requirements and necessary technical skills. Additionally, it explored geographical applicability.
4. **Tool Impact & Effectiveness:** This section gathered information on the real-world impacts of these tools, particularly how they have practically influenced street transformation projects. Respondents were also prompted to provide concrete case studies or examples illustrating the tool's implementation in real urban contexts. This section also sought to identify specific metrics or criteria used to assess and measure the success and effectiveness of the tools in achieving desired outcomes.
5. **Integration with Street Justice Principles:** Here, respondents explained how the tools specifically contributed to advancing street justice (specifically how the tool promotes principles of equity, safety, accessibility and sustainable urban mobility). The section also captured insights into the specific mobility and accessibility challenges addressed by the tools.

6. **References and Additional Resources:** This part of the survey invited respondents to share additional references, literature, or resources related to the tools they described. This facilitated the enrichment of the dataset and provided valuable context and supporting documentation.
7. **General Information:** The final section aimed to collect data about the respondents, their name, affiliated institution, and contact email, ensuring the credibility and context of each submission.

The survey employed a qualitative approach to data collection, emphasising respondents' experiential knowledge and practical insights. Open-ended questions were utilised to allow respondents flexibility in detailing specific cases, providing rich, qualitative narratives suitable for deeper analysis. The survey distribution targeted a wide range of stakeholders involved in street transformation projects across Europe, including academics as well as urban planners, policymakers, and other practitioners.

The survey instrument was piloted with a small group of experts in July 2024 and refined based on their feedback to improve clarity, relevance, and accessibility.

Section	Focus Area	Example Question Type
1. Respondent profile	Background information (sector, role, country, experience with street change)	Multiple choice, drop-down list
2. Distributive justice	Perceptions of resource allocation, fairness in space distribution, prioritised user groups	Likert scale, ranking, open text
3. Procedural justice	Experiences with participation, governance processes, inclusion of diverse voices	Likert scale, multiple choice, open text
4. Recognition justice	Attention to diverse needs, identities, knowledge systems in street projects	Likert scale, yes/no, open text
5. Restorative justice	Addressing historical harms, displacement, and long-term impacts	Likert scale, open text
6. Barriers and enablers	Challenges and factors supporting just street change	Multiple choice, open text
7. Recommendations	Suggestions for improving fairness and inclusivity in street transformations	Open text

Table 1. Table summarising the survey sections and question types



The survey was distributed in September 2024 through multiple channels (direct emails to professional networks, mailing lists, social media platforms) to ensure broad and diverse participation. The survey targeted practitioners and stakeholders with practical experience in street transformation initiatives, including public officials, transport professionals, urban designers, local activists, NGO representatives, and academic researchers, with the objective to gain cross-sectoral insights.

3.2 Data analysis

Data from open-ended responses were subjected to thematic analysis, with responses coded inductively to capture recurring themes, insights, and examples provided by respondents. This allowed the research team to explore not only general perceptions of justice dimensions but also the contextual and experiential factors shaping how these principles are understood and applied in practice.

By synthesising these theoretical and empirical strands, we constructed an integrative framework that links justice theory with practical action. Our goal was to translate the abstract dimensions of justice into a set of concrete, actionable phases that could guide street transformation processes on the ground.

From the theoretical side, the justice literature provided essential insights into what matters for just street change — from the need to redistribute resources and space (distributive justice), to ensuring fair and inclusive decision-making (procedural justice), to valuing the diverse needs, identities, and knowledges of different users (recognition and epistemic justice), and to repairing historical harms (restorative justice). However, the theory alone provided limited guidance on how to translate these values into everyday practice.

To address this gap, we turned to the empirical material collected through our survey, which gathered examples of tools, methods, and practices from multiple local contexts. These empirical inputs offered grounded insights into how practitioners are already experimenting with operationalising justice in real-world street projects. The survey data revealed the importance of practical methods such as participatory mapping, walking interviews, co-design workshops, tactical urbanism trials, community-led audits, and evaluation frameworks. Crucially, the survey results helped us map specific tools to each of these stages, offering concrete mechanisms for operationalising justice.



4. The Just Streets Process

4.1 Framing the Just Streets Process

Building on the concepts outlined above, we propose a set of phases as a practical framework for operationalising street justice. This set of phases emphasises that achieving just street transformations is not a one-off intervention but a dynamic, iterative process. The process is designed to foster continuous learning, negotiation, and responsiveness to diverse community needs and local contexts. By integrating justice principles into each stage, the pathways supports practitioners, policymakers, and communities in translating high-level justice ideals into actionable, participatory strategies that are both context-sensitive and adaptive over time.

At its foundation, the process begins by **recognising that injustices are not always visible** through technical assessments alone. It prioritises dialogue with marginalised voices to uncover everyday inequalities, addressing recognition and distributive justice by surfacing who has been excluded from access, safety, or representation and grounding the process in local knowledge and experiences.

From this starting point, the process moves into a **collective reimagining of possible futures**, where diverse aspirations and lived experiences inform a shared vision for more just streets. This stage embodies procedural and recognition justice by ensuring that different imaginaries are included and that influence over visions is distributed fairly across stakeholders.

Building from this, the process advances into **co-design practices** that bring technical and experiential knowledges (Healey, 2010) into dialogue. Rather than treating residents as passive informants, the process elevates their practical expertise - into the development of street interventions. This approach addresses epistemic injustice (Fricker, 2007) by legitimising non-expert, embodied, and local forms of knowledge alongside professional expertise.

A key innovation of the process is its emphasis on **experimenting as a mode of learning** and governance. Temporary pilots, living labs, and iterative trials create opportunities for communities to test and experience alternative street futures in real time, while generating situated knowledge about their effects (Bertolini, 2020; Verlinghieri & Schwanen, 2020). Experimentation is seen here as not simply a technical tool but a justice-oriented practice: it distributes opportunity to shape outcomes, enables collective dialogue and reflection, and opens space for adaptation.

Crucially, the cycle also embeds ongoing **evaluation and learning** as collaborative activities. Justice is not presumed to be achieved once an intervention is implemented; instead, affected communities are invited to assess, critique, and refine interventions based on their lived experiences. This reflexive practice sustains procedural and epistemic justice by maintaining community voice and agency throughout.

Finally, the cycle culminates in efforts to **institutionalise new norms and practices**, embedding justice into the governing structures that shape street space over the long term (Cornwall, 2017). Rather than treating co-creation as a one-time project, the cycle aims to establish lasting mechanisms that integrate recognition, participation, and knowledge diversity into routine decision-making.

The process described by the Just Streets Pathways (see Deliverable 2.2) is designed not only to achieve just outcomes, but to enact justice throughout the journey itself, framing street transformation as an ongoing, relational, and contested practice of negotiating more



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equitable urban futures. A key lesson here is that processes matter as much as outcomes: how we create change on our streets can determine whether the change is truly just. Thus, many of the strategies which will be outlined below emphasise engagement, power-sharing, and innovation in collaboration, while also referencing other dimensions of justice elaborated on in previous sections.



Figure 3 - Playful street redesign in Bologna, using colourful markings and urban furniture to reclaim public space

4.2 Key Phases and Actionable Ideas for Just Streets

To support practitioners in applying the co-creation cycle, the table below translates each stage into a set of concrete, actionable ideas. These examples demonstrate how participatory and experiential methods can operationalise justice principles at different points in the street transformation process.

Co-Creation Phase	Actionable Idea	Objective	Justice Dimension (Code)
Co-Identify Needs	Conduct community listening sessions and walking audits	Reveal lived experiences, local challenges, and overlooked needs	RJ, DJ



Co-Creation Phase	Actionable Idea	Objective	Justice Dimension (Code)
	Map underserved areas collaboratively	Identify spatial inequalities and resource gaps in street conditions	RJ, DJ
Co-Vision Futures	Facilitate inclusive visioning workshops	Co-create shared visions and priorities for fairer streets	RJ, PJ
	Develop future street scenarios with diverse groups	Explore and visualise multiple futures, balancing needs and trade-offs	RJ, PJ
Co-Design Solutions	Organise co-design studios with residents and planners	Co-develop solutions combining local knowledge and expert input	PJ, RJ
	Conduct Universal Design Audits to ensure accessibility	Ensure inclusive, accessible street environments for all users	RJ
	Implement Participatory Budgeting for streets	Allocate public resources transparently with direct community input	PJ, DJ, RVJ
Experiment	Implement street experiments (pop-up lanes, parklets, closures)	Test and demonstrate street changes in real-life settings	EJ, DJ
	Create Living Labs for real-time feedback	Foster continuous learning and adaptation through hands-on trials	EJ, PJ
Co-Evaluate and Learn	Host participatory evaluation forums	Enable collective reflection on outcomes and impacts	PJ, EJ
	Use resident-led audits and feedback surveys	Collect community-generated assessments to inform improvements	PJ, RJ
	Apply feedback and evaluation tools for continuous learning	Support iterative adaptation and ongoing improvement	PJ, RJ
Shift Institutions	Institutionalise Streets Advisory Councils	Embed diverse community voices into long-term governance structures	SJ, PJ, DJ, ReJ
	Integrate Justice-Focused Investment Targeting	Direct resources toward historically marginalised or underserved areas	DJ, ReJ

DJ = Distributive Justice PJ = Procedural Justice RJ = Recognition Justice EJ = Epistemic Justice, Restorative Justice = ReJ



Table 2. Co-Creation Phases, Actionable Ideas, Objectives, and Justice Dimensions

The following section unpacks these and actionable ideas in more detail, showing how they embody the intertwined goals of mobility justice, participation, and experiential learning, transforming engagement from isolated activities into an integrated, justice-oriented process.

Co-Identify Needs

- **Community Listening Sessions and Walking Audits:** Community listening sessions and walking audits are participatory methods designed to centre residents' lived experiences in urban planning. Rather than relying solely on technical assessments, these practices invite people to articulate everyday challenges and opportunities while moving through the space together. In **Dublin**, [walking audits](#) were key tools in shaping the Active Travel Action Plans by enabling communities to directly highlight unsafe crossings, poor accessibility, and missing facilities.
- **Map Underserved Areas Collaboratively:** Collaborative mapping engages residents, especially from marginalised communities, in identifying areas of disinvestment, poor infrastructure, or barriers to mobility. Unlike top-down data mapping, this method captures lived realities and community-specific needs. In Barcelona, the [Pla de Barris](#) programme combined participatory mapping workshops with social data to target funding towards the city's most vulnerable districts.

Co-Vision Futures

- **Facilitate Inclusive Visioning Workshops:** Inclusive visioning workshops create accessible spaces where diverse communities co-create shared future goals for their streets and public spaces. Rather than consultants presenting finished ideas, residents generate the visions themselves through drawing, storytelling, and model-building. The [Tomorrow's Cities Initiative](#), led by University of Edinburgh alongside UCL, provides interesting examples of urban visioning exercises conducted throughout the world.
- **Develop Future Street Scenarios with Diverse Groups:** Future street scenario planning involves co-developing different possible visions for how streets might function, offering residents and other stakeholders opportunities to explore trade-offs and innovations before decisions are finalised. This builds agency, creativity, and resilience into planning processes. The UK often uses scenario planning to co-vision futures for its cities – more details about processes and results from one such exercise conducted by Innovate UK & Urban Foresight can be found [here](#).

Co-Design Solutions

- **Organise Co-Design Studios Where Residents Collaborate with Planners:** Co-design studios are hands-on workshops where residents and planners work together as equals to shape public space projects. This collaborative method fosters ownership and surfaces local expertise. In [London's Peckham Co-Design](#) project, residents worked directly with architects and council staff to rethink public spaces like Rye Lane. Similarly, the [Innoviris Co-create Programme](#) supports Brussels residents who wish to engage in research and explore new ways for a sustainable city.
- **Conduct Universal Design Audits to Ensure Accessibility:** Universal Design Audits assess public spaces to ensure they are accessible to all, regardless of age, ability, or circumstance. Going beyond minimum standards, these audits focus on usability and dignity for every user. Copenhagen is a leader in embedding



accessibility systematically, conducting audits that include wheelchair users, elderly citizens, and families with prams as part of the City of Copenhagen's Mobility Strategy. Likewise, Vienna's "Barrier-free City" programme audits streets and transport infrastructure, working toward a fully inclusive urban environment.

- **Implement Participatory Budgeting for Streets:** Participatory budgeting (PB) lets residents directly decide how to allocate part of the city's budget, typically voting on projects that matter to them. Paris runs one of the largest PB programmes in Europe — ["Budget Participatif"](#) — with many funded projects related to local street improvements, like greening sidewalks, creating safe crossings, and new cycle lanes. Lisbon was the first European capital to introduce PB citywide in 2008, leading to community-led investments in pedestrian infrastructure and traffic calming projects ([Lisbon Participatory Budget](#)).

Experimenting

- **Implement Street Experiments (Pop-Up Cycle Lanes, Parklets, Temporary Street Closures):** Street experiments refers to low-cost, temporary interventions that allow cities to experiment with street transformations before permanent investments. These pilots are fast, flexible, and highly visible, offering proof of concept. After COVID-19, Milan launched the Strade Aperte ("Open Streets") initiative, creating pop-up bike lanes and widened pavements overnight to reclaim street space from cars. Similarly, Paris expanded hundreds of kilometres of "coronapistes" (temporary cycle lanes) during the pandemic, many of which have since been made permanent after strong public support. In Ghent's "Living Streets" programme residents had a chance to apply for transforming their street into a car-free space for the summer, creating pop-up playgrounds, gardens, or social spaces. These pilots allowed people to experience a different street reality and provide feedback through direct participation and initiative, help city officials test ideas and gather data before making permanent changes – while also generating new governance mechanisms. Such iterative, experiment-driven processes embody co-creation: residents and officials learn together what works, what can be improved, how it can be scaled up.
- **Create Living Labs for Real-Time Feedback:** Living Labs are experimental spaces within cities where new mobility, public space, or street concepts are tested in real conditions, with direct input from users. Rather than waiting for formal evaluations, cities gather continuous feedback and adapt interventions dynamically. Barcelona's famous Superblocks started as Living Labs, transforming traffic-dominated neighbourhoods into pedestrian-focused zones with real-time community involvement.

Co-Evaluate and Learn

- **Host Participatory Evaluation Forums:** Participatory evaluation forums create structured opportunities for residents to assess and comment on street projects collectively. Rather than relying only on expert audits, community members come together to reflect on what worked, what didn't, and what should happen next. Madrid experiments with participatory evaluations on its ["Decide Madrid"](#) platform, where users evaluate the outcomes of public projects.
- **Use Resident-Led Audits and Feedback Surveys:** Resident-led audits put evaluation tools directly into the hands of the people most affected by street design. Community members assess accessibility, safety, and livability, often documenting issues overlooked by professionals. In Bristol, the ["Bristol Walking Alliance"](#) supports citizen-led walkability audits across the city to advocate for pedestrian-friendly improvements.



- **Apply Feedback and Evaluation Tools for Continuous Learning:** Modern feedback tools, like using mobile apps - allow cities to gather continuous user insights during and after implementation. This ongoing learning model ensures street transformations remain adaptive and user-centred. For instance, the UK-based [FixMyStreet](#) is a mobile app and web platform that enables residents to report local street issues and support municipalities gather real-time input and address problems effectively.

Shifting Existing Institutions

- **Institutionalise Mobility Advisory Councils:** Mobility Advisory Councils formalise community participation by establishing standing groups of diverse residents who advise city agencies on transport and street issues over time. These councils ensure that feedback is consistent, representative, and integrated into institutional decision-making.
- **Integrate Justice-Focused Investment Targeting:** Justice-focused investment targeting ensures that public spending prioritises historically underserved, disinvested, or vulnerable communities rather than being distributed equally across all areas. Investment is guided by data and community input to correct historical inequities.

4.3 Tools for Operationalising Mobility Justice

Results to the survey revealed a variety of different tools and methodologies for operationalising mobility justice - from analytical instruments to participatory models. A more comprehensive list is provided in Deliverable 2.2.

Co-Creation Phase	Tool Name	Description & Scope	Example / Link
Co-Identify Needs	Community Needs Mapping	Mapping process to identify local challenges, gaps in access, and underserved groups; combines quantitative data and qualitative local insights.	Community Mapping Toolkit (Maptionnaire)
	Participatory Mapping	Collaborative workshops where residents map barriers, assets, and opportunities; supports spatial justice by surfacing local knowledge.	Participatory Mapping Guide (IIED)
	Street Ambassadors Programmes	Program employing local ambassadors to build trust, gather insights, and engage hard-to-reach groups; often youth, elders, or community leaders.	Better Block Ambassadors Program
Co-Vision Futures	Visioning Charrettes	Intensive design sessions bringing stakeholders together to	National Charrette Institute



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Co-Creation Phase	Tool Name	Description & Scope	Example / Link
		co-create street visions; uses sketches, models, or storyboards.	
	Scenario Planning Exercises	Collaborative workshops to explore future options and test trade-offs; uses scenarios to anticipate outcomes of street changes.	Urban Futures Method
Co-Design Solutions	Co-Design Workshops	Residents and experts work side-by-side to co-develop interventions; integrates professional and local expertise.	CoDesign Studio Toolkit
	Universal Design Audits	Accessibility-focused audits evaluating streets for usability by all ages, abilities, and conditions; often includes people with disabilities in the team.	World Enabled Accessibility Toolkit
	Participatory Budgeting	Democratic process where residents vote on how to allocate a portion of the public budget for local street improvements.	Participatory Budgeting Project
Experiment	Street Experiment Initiatives & Temporary Pilots	Short-term, low-cost interventions to test new street uses (e.g., pop-up bike lanes, parklets); evaluates impacts before permanent changes.	Tactical Urbanism Guide (NACTO)
	Living Labs	Collaborative spaces where multiple stakeholders co-create, test, and iterate solutions in real-life settings; includes ongoing feedback loops.	European Network of Living Labs
Co-Evaluate & Learn	Participatory Evaluation Forums	Community-led spaces to reflect on project outcomes; residents assess successes, failures, and future needs.	Participatory Evaluation Toolkit (Clear Horizon)
	Resident-Led Audits & Community Surveys	Audits and surveys conducted by local residents to assess safety, accessibility, and satisfaction; often leads to actionable improvements.	Living Streets Community Street Review
	Feedback and Evaluation Tools	Digital tools (e.g., QR codes, SMS polls, mobile apps) to collect	Streetwyze Community Engagement App



Co-Creation Phase	Tool Name	Description & Scope	Example / Link
		real-time feedback from the public on interventions.	
Shift Institutions	Mobility Advisory Councils	Standing bodies composed of diverse residents advising on mobility and street issues; institutionalises continuous participation.	Vienna Senior Citizens Council
	Justice Budgeting Tools	Budgeting tools that apply social equity criteria to public investments; directs resources to historically excluded communities.	Gender Budgeting in Vienna

Table 3 Tools for Just Streets Pathways

4.4 Inspirational Examples

School Streets Initiative in London. Redistributing Street Space for Child-Friendly Mobility

Over recent decades, London has faced escalating concerns surrounding air pollution, road safety, and inequitable access to safe street spaces, disproportionately impacting lower-income neighborhoods and children (Aldred et al. 2021). Areas surrounding schools, particularly those situated in socio-economically disadvantaged neighborhoods, frequently experience elevated levels of traffic congestion, increased exposure to air pollution, and limited safe pedestrian infrastructure. Such conditions exacerbate inequalities by restricting children's independent mobility and autonomy, negatively impacting physical and mental health, and perpetuating spatial disparities (Marzi and Reimers, 2018).

In response, School Streets were introduced by various London boroughs, aiming to create safer, healthier, and more equitable street environments for children by temporarily restricting motorised vehicle access during school drop-off and pick-up times; more recently, ambitions also include plans for permanently closing streets around schools to cars through complete redesign and public realm improvements that create spaces for play, socialising and lingering (Thomas, Furlong & Aldred, 2022). Streets thus become fully open to walking and cycling only, prioritising the safety and comfort of children and families. Such interventions are now widespread across London and involve designated school streets managers and teams within local authority bodies, as well as collaborative governance, actively engaging schools, children, community organisations, and residents in the planning and implementation phases.

The core objective of School Streets is explicitly distributive: reallocating urban street space away from motorised vehicles toward pedestrians and cyclists, thus improving access to public space. The initiative directly addresses historical inequities by prioritising traditionally underserved user groups, particularly children and families. By physically reclaiming space previously dominated by vehicular traffic, school streets interventions redistribute environmental and health benefits, including improved air quality, reduced exposure to road injuries, and enhanced freedom of movement for children and families.



Figure 4 – An example of School Street in the Borough of Lambeth, London

Evaluations of the School Streets schemes indicate several positive distributive outcomes. Empirical studies report significant reductions in traffic volumes, air pollution, and collision rates near participating schools, particularly during closure times. Additionally, qualitative research highlights increased parental confidence in allowing children's independent mobility, improved perceptions of neighbourhood safety, and strengthened community cohesion around school sites – alongside growing community support for school streets (BYCS & Clean Cities Campaign, 2022).

Key takeaways:

- School Streets explicitly redistribute urban space from motorised vehicles to pedestrians and cyclists, directly addressing inequalities by prioritising previously underserved groups, notably children and families.
- By reclaiming street spaces from vehicular traffic, School Streets enhance air quality, decrease collision risks, and promote physical and mental well-being, effectively redistributing these benefits toward groups disproportionately affected by pollution and unsafe infrastructure, such as children.



- School streets have the potential to foster greater autonomy and freedom of movement among children, can improve parental confidence in children's independent mobility, and can strengthen neighbourhood safety perceptions and community ties, indicating a broader social redistribution that enhances communal resilience and well-being.

"Leefstraten" (Living Streets) in Ghent. Community-led Street Transformation through Participatory Urbanism

Since 1997, Ghent has predominantly prioritised walking and cycling, starting with the pedestrianisation of 35 acres of the city center (Van de Velde & Holemans, 2020). Despite these early efforts, urban mobility issues persisted, prompting more ambitious actions such as the 2017 "Circulation Plan," which drastically reshaped mobility by creating pedestrian districts around the city center, forcing through-traffic onto peripheral ring roads. The success of these strategies is exemplified by Ghent achieving its ambitious target of a 35% cycling modal share by 2019, significantly ahead of its 2030 goal. While these measures successfully improved mobility, they initially met significant resistance from the community, who were concerned about the potential impact on their daily routines and the top-down nature of measures.

Between 2012 and 2017 the "Leefstraten" ([Living Streets](#)) initiative was launched as an experimental approach explicitly rooted in testing out bottom-up approaches and helping to counter resident oppositions to city-wide changes. The initiative allowed residents to take initiative and temporarily redesign their streets, reclaiming public space for community activities, social interaction, and active mobility. Typically organised during the summer months, residents collaboratively chose to close their streets to vehicular traffic, repurposing them for communal activities including shared meals, children's play areas, pop-up cafés, and green installations. Local associations such as Lab van Troje, played a crucial facilitation role, supporting residents in translating their visions into actionable urban designs and logistics solutions through structured participatory workshops, dialogue sessions, and co-creation events.

The focus of Ghent's Living Streets on democratic dialogue, inclusive deliberation and bottom-up approaches is directly linked to addressing procedural justice. Central to this approach is fostering an environment where diverse and potentially conflicting community perspectives can openly engage in dialogue. The process actively facilitates opportunities for democratic debate, striving to move beyond merely technical or expert-driven planning decisions to genuinely incorporate the lived experiences, concerns, and aspirations of local residents. While the process aims for consensus through inclusive dialogue, the initiative also acknowledges and accommodates disagreement as an essential component of democratic participation. Furthermore, procedural justice here is not only about equitable participation but also about empowering residents to redefine their own roles and identities in street transformation processes - allowing citizens to transition from passive recipients of top-down decisions to active co-creators of their urban environments.



Figure 5- An example of Living Streets in Ghent

The Living Streets initiative in Ghent has grown significantly since its inception, beginning with just 2 streets in 2013 and rapidly scaling up to 18 streets by 2016, with a total of 46 streets organized between 2013 and 2017 (Van Wymeersch, Oosterlynck & Vanoutrive, 2018). The initiative's success and widespread community acceptance led the City of Ghent to officially adopt and embed it into municipal policy from 2018 onward. The project has also gained international recognition, inspiring similar experiments in cities such as Amsterdam, Brussels, Utrecht, and Rotterdam, with additional interest from cities like Turin and Milton Keynes (Van Wymeersch, Oosterlynck & Vanoutrive, 2018). Locally, residents have praised Living Streets for significantly enhancing neighborhood cohesion, deepening local democracy through active citizen participation, increasing urban greenery, and providing visions for a different way of inhabiting and using streets.

Key takeaways:



- The success of Ghent's Living Streets highlights the importance of genuinely inclusive and democratic participation, where open dialogue and meaningful consultation enable communities (including initially skeptical or marginalised groups) to actively shape urban initiatives, enhancing procedural justice.
- Empowering local residents to lead the design and implementation of urban interventions significantly improves project outcomes by aligning initiatives closely with community needs and values.
- Bottom-up, community-led approaches can foster stronger neighbourhood cohesion, strengthen a sense of ownership for different interventions, and increase public acceptance of transformative urban policies.

Inclusive Street Design in Stockholm. Recognising Diverse Mobility Needs

Stockholm, the capital of Sweden, has long been recognised for prioritising the creation of an inclusive urban environment that accommodates all residents and visitors, regardless of physical ability. In December 1998, the Stockholm City Council initiated a comprehensive accessibility strategy designed to improve the quality of life for all residents by removing physical barriers across public spaces and city-operated venues. The city's drive towards enhanced accessibility was significantly informed by international standards, particularly the UN Convention on the Rights of Persons with Disabilities, mandating the development of accessible physical environments. Between 1999 and 2010, Stockholm systematically implemented the "Easy Access" project, with the explicit ambition of positioning Stockholm as the "most accessible capital in the world" by 2010 (European Union 2015).

Stockholm's "Easy Access" project consisted of dedicating an annual budget of 100 million SEK specifically to accessibility improvements in the city, particularly for people with disabilities. The project was coordinated by the City Council in partnership with all City District administrations and disability organisations. Key interventions included the introduction of the "Stockholm model" for pedestrian crossings, which combined tactile paving, auditory signals, and high-contrast markings to support visually impaired users. Curb cuts and lowered pavements improved wheelchair accessibility, while tactile guide paths were installed along sidewalks to aid navigation. Street furniture was repositioned to reduce obstacles, and non-slip surfaces were used to enhance safety. Additionally, the first and last steps of 1,500 stairways were marked with contrasting colors, and handrails were installed or upgraded along stairs and sloping paths to support users with mobility limitations. These interventions were applied systematically across the city, supported by staff training and maintenance guidelines to ensure long-term consistency and effectiveness. As of 2012, the work on accessibility is no longer conducted through the "Easy Access" project, but is instead embedded in the political and the executive functioning of the city. The work on accessibility is nowadays directed through the Participation Programme for People with Disabilities 2011-2016, which sets out priority political goals for persons with disabilities.

The "Easy Access" project in Stockholm reflects a strong commitment to recognition justice by acknowledging the right of all individuals (regardless of physical ability) to move safely, independently, and with dignity through public space. Rather than treating accessibility as a technical add-on, the project recognised the lived experiences of people with disabilities and actively included them in shaping the urban environment. The redesign of street infrastructure, particularly through features like tactile paving and audible signals addressing the needs of all, was guided by an understanding that mobility is not just a matter of convenience but of justice and equal participation in public life.



The "Easy Access" project led to substantial, measurable improvements in Stockholm's urban mobility and safety, particularly for people with disabilities – earning Stockholm the 2013 Access City award for disabled-friendly cities (Ceccato, 2015). A total of 65% of pedestrian crossings in the inner city and 25% in suburban areas were rebuilt to meet higher accessibility standards. Such street improvements have supported greater social participation among people with disabilities, enabling more independent movement through public spaces and broader engagement in cultural, economic, and civic life. The long-term success of the Easy Access project also contributed to deeper institutional change: since 2011, accessibility has been mainstreamed into city governance through the Participation Programme for People with Disabilities, with accessibility investments continuing well beyond the initial project phase (European Union 2015).

Key takeaways:

- Stockholm's approach to street design demonstrates that accessibility is fundamentally about recognition justice: acknowledging the rights, identities, and lived experiences of people with disabilities. By embedding inclusive features like tactile paving, curb ramps, and audible signals into standard urban design, the city affirms that dignified, independent mobility is essential to full civic participation.
- The transition from project-based interventions to a city-wide strategy highlights the importance of embedding accessibility for recognition justice into governance structures. Sustained political commitment and integration into long-term urban planning ensure that accessibility remains a consistent priority rather than a temporary initiative.
- The systematic redesign of streets (such as marked stairways, smoother crossings, and safer walkways) not only improves safety and mobility for people with disabilities but also enhances usability for the broader population, including older adults, children, and caregivers.

Madrid Río Project . Restoring Connectivity and Reclaiming Urban Space

Madrid, Spain, experienced decades of urban fragmentation due to car-oriented infrastructure, most notably through the M-30 urban highway, which severely divided neighbourhoods along the Manzanares River. Constructed throughout the 20th century, the 6-lane ring road not only fragmented the city but also led to significant environmental degradation, particularly of the adjacent river bed (Abajo et al., 2020).

The Madrid Río Project, initiated by the City of Madrid in 2003 and completed in 2011, represents an ambitious urban regeneration and ecological restoration initiative. The intervention involved a monumental engineering effort to relocate significant sections of the elevated M-30 underground, thereby eliminating the barrier that had long separated surrounding neighborhoods from the river. Simultaneously, the city undertook a process of public consultation, inviting citizens to participate in envisioning how the recovered riverfront should be used. This participatory process drew on collective memory and cultural identity, as the river had historically been a site of festivals and featured prominently in representations of old Madrid. From 2007 to 2011, after the tunneling was completed, the land above the former highway was transformed into a 6-mile linear park, featuring pine-lined promenades, bicycle paths, playgrounds, water features, and extensive landscaping. The project also integrated both restored historic bridges and newly designed footbridges to reconnect previously divided urban spaces and facilitate movement across the river.

Madrid Río reflects a restorative justice approach by addressing the long-term social and environmental harms caused by the construction of the M-30 motorway along the



Manzanares River. By removing the surface-level highway and restoring the original riverbed, the project reversed decades of ecological degradation and re-established access to the river as a shared public space. The transformation repaired the fragmentation of the urban fabric created by car-centric planning, reconnected neighborhoods that had been physically divided, and returned walkability, greenery, and cultural meaning to the river corridor. Importantly, this was not only a technical intervention but a symbolic act of repair through the restoration of a space with deep historical, cultural and environmental significance, while shifting urban priorities from transport efficiency to public well-being and ecological regeneration.

Although Madrid Río was subject to intense public debate during its long construction period (particularly due to its substantial cost and the resulting municipal debt) it has since been recognised as a landmark urban regeneration project globally. The park has received multiple international awards and has been widely praised for transforming the former motorway corridor into a vital ecological and recreational asset. The linear park, now a key segment of Madrid's southern and western green belt, has improved the city's environmental resilience and restored biodiversity, attracting a variety of avian species who now station there. In addition to environmental benefits, the project has played a critical role in the revitalisation of the surrounding declining urban fabric.

Key takeaways:

- Madrid Río demonstrates that undoing past planning harms requires ambitious, and structural interventions. Removing a major motorway and restoring a riverbed is a bold and resource-intensive act of repair that directly confronts the physical and ecological damage caused by decades of car-centric planning.
- Restorative justice in mobility must integrate environmental, social, and symbolic dimensions of repair: the Madrid Río project didn't only transform former car-centric infrastructure, it reconnected neighbourhoods, revitalized public space, restored ecological continuity, and revived a river that holds cultural and historical meaning for the city.
- By prioritising walkability, biodiversity, and community wellbeing over vehicular dominance, restorative justice efforts lead to intergenerational justice by reclaiming urban space not only for today's residents but as a legacy of environmental regeneration and social equity for those who follow.



5. Conclusion

This report has advanced a comprehensive framework for embedding justice into the transformation of urban streets, drawing on theoretical, empirical, and practice-based insights. By bringing together concepts from transport, mobility, and spatial justice and translating them into a concrete co-creation cycle, it provides a structured yet adaptable roadmap for pursuing fairer and more inclusive street change. By centring local knowledge, prioritising the needs of historically marginalised groups, and building iterative feedback mechanisms, cities can move closer to delivering on the promise of mobility justice. Nevertheless, the report has identified persistent gaps and challenges, including the lack of empirical grounding, the persistence of participation gaps, and the difficulty of institutionalising justice beyond project-based interventions. The proposed framework and tools are not a panacea, but they offer a set of pragmatic strategies to potentially navigate these barriers.

Looking ahead, operationalising street justice requires not only technical innovation but also political will, institutional reform, and cultural change. It demands that planners, policymakers, and communities alike engage in a long-term commitment to justice, and to transforming both material environments as well as the decision-making structures that shape them. As climate change, urban inequality, and public health crises increasingly converge on our streets, the urgency of embedding justice into street transformation has never been greater. This report offers both a theoretical foundation and a practical guide to support this critical work, as well as a call to action towards more systemic change grounded in fairness, inclusion, and care.

To advance just street transformations, cities should embed justice principles as core, not peripheral, goals in planning and implementation. This means prioritising distributive equity in the allocation of resources and space, ensuring inclusive and representative participation through co-creation mechanisms, recognising and responding to the diverse needs of all street users, and addressing historical harms through restorative action. Institutionalising these commitments requires governance innovations, such as formal advisory bodies, dedicated equity audits, and justice-based funding allocations. Finally, cities should embrace experimentation as a tool, using pilots and living labs to foster learning, transparency, and accountability. Only by combining these elements can urban actors move beyond tokenistic engagement and toward truly transformative, justice-oriented street change.

Some key recommendations drawn from this report are as follows:

- **Prioritise distributive equity:** Allocate resources and street space to underserved groups and areas, ensuring access to safe, sustainable, and affordable mobility options for all.
- **Strengthen inclusive participation:** Use co-creation approaches that go beyond consultation, ensuring meaningful involvement of diverse stakeholders, including marginalised voices, throughout all stages of street transformation.
- **Enhance recognition of diverse needs:** Incorporate the needs, experiences, and knowledge of underrepresented groups (such as women, children, people with disabilities, neurodivergent individuals, and minority communities) into design and planning processes.
- **Address historical harms:** Apply a restorative justice lens to repair past damage caused by car-centric infrastructure, disinvestment, or exclusionary planning, through targeted reinvestment, physical redesign, and mobility reparations.



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- Institutionalise justice in governance: Establish permanent advisory bodies, integrate justice metrics into planning tools, and ensure funding mechanisms prioritise equity and inclusion.
- Embrace experimentation and learning: Use pilots, temporary interventions, and living labs as governance tools to test ideas, gather community feedback, and adapt policies in real time.

Future research should focus on applying and testing the proposed Just Streets Co-Creation Cycle in collaboration with cities and communities. Piloting the framework in diverse urban contexts will provide opportunities to refine its stages, evaluate its effectiveness, and generate new insights into how justice principles play out in practice. Importantly, this work should adopt a co-learning approach, where researchers, practitioners, and residents engage in mutual exchange to adapt and improve the framework in response to real-world challenges and local needs. Such collaborative experimentation will not only strengthen the framework itself but also contribute to advancing the broader field of mobility and street justice.



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This deliverable was authored collaboratively. Dipanjan Nag and Wendy Tan (Western Norway University of Applied Sciences – HVL) are the authors of all chapters as well as the overall coordination of the report. Andrea Rosso and Johanna Lange (LINKS Foundation) contributed to Chapter 5 and 8. Stefan Gössling (Vestland Forskning) and Marco Bassani (Polito) contributed to Section 8.1, Elisabetta Vitale and Gabriele D’Adda (Polito) and Fredrik Ingmar Bøge (HVL) to section 8.2 and 8.6, Carolyn Ahmer (HVL) to section 8.3, Enrica Papa and Sabina Cioboata (University of Westminster) to section 8.4, and Dalit Shach-Pinsly and Pnina Plaut (IIT) to section 8.5. Review was given by Jolien Vandoorne and Mario Alves (IFP-r) and Fabian Kuester (ECF).



About JUST STREETS

The JUST STREETS project focuses on developing streets shaped by active mobility that are both sustainable and inclusive for all citizens. This shift from the use of cars towards more active modes of mobility will be led by prioritizing the needs and visions of marginalized social groups often not involved in the planning processes, particularly women, migrants, the elderly, LGBTQI+ individuals, and people with disabilities.

Goal of the strong international consortium is to support 12 cities in revolutionizing public spaces and streets by putting all of its citizens first. The project addresses the pressing need to transform our streets both from an infrastructural as well as behavioural perspective, shifting away from car-centric environments towards streets that cater to the needs of all citizens.

JUST STREETS is a 32-partner international Horizon Europe project coordinated by the Future Cities and Communities division of Turin-based LINKS Foundation and scheduled from January 2024 to June 2027. Partner cities include the cities of Amsterdam (Netherlands), Braga (Portugal), Cugir (Romania), Haifa (Israel), Kozani (Greece), Milan (Italy), Riga (Latvia), Southwark (UK), Vilnius (Lithuania), Vratsa (Bulgaria), Westminster (UK), and Zaragoza (Spain).

Expert partners of the JUST STREETS consortium are Fondazione LINKS (Italy), Agenzia TPL (Italy), Centro Studi Pim (Italy), Climate Alliance (Germany), European Cyclists' Federation (Belgium), Fundación CIRCE (Spain), International Federation of Pedestrians (Belgium), IT University of Copenhagen (Denmark), Politecnico di Torino (Italy), RINA Consulting (Italy), SocialFare (Italy), Southeast European Technological Company – SETECHCO (Bulgaria), Technical University of Cluj-Napoca (Romania), TECHNION – Israel Institute of Technology (Israel), TREDIT (Greece), University of Amsterdam (Netherlands), University of Porto (Portugal), University of Westminster (UK), Urban Future (Austria), and Western Norway University of Applied Sciences (Norway).

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www.just-streets.eu



Executive Summary

This Deliverable provides practical guidance for practitioners seeking to deliver street transformations rooted in the principles of mobility justice. It recognises streets not simply as corridors for movement but as complex, public, and social spaces where questions of equity, inclusion, and fairness play out in everyday life. Streets hold the potential to foster more just, sustainable, and democratic cities — yet historically, transport and urban planning have often prioritised efficiency and technical optimisation over equity, reinforcing spatial injustices and social exclusion.

Rather than offering a fixed blueprint, this Deliverable presents an adaptable and dynamic framework that supports cities in addressing injustices, redistributing resources, amplifying marginalised voices, and co-creating more inclusive, accessible, and vibrant public spaces. It emphasises that street justice is not a one-size-fits-all model, but a locally grounded, iterative practice — one that requires continuous learning, reflection, and adaptation to the specific historical, cultural, social, and political contexts of each place. The framework applies across a variety of street types — from local residential streets to busy main roads, from school streets to commercial high streets. While individual street interventions are the immediate focus, many justice concerns (such as connectivity, displacement risks, or equitable access to public space) require looking beyond single streets to consider neighbourhood and citywide networks.

The **intended audience** for this document includes urban planners, transport engineers, policymakers, designers, community organisations, and other actors engaged in shaping the future of European streets. By using this handbook, practitioners can ensure that interventions in public spaces begin to address systemic inequalities, promote wider accessibility, and enable participatory governance.

This document serves as a practical resource to:

- Support evidence-based decision-making in street design and mobility planning.
- Provide a structured roadmap for implementing just streets, from visioning to execution.
- Offer guiding questions to help cities critically assess whether their interventions promote fairness and inclusion.
- Introduce tools and methodologies that can facilitate community engagement, behaviour change, and innovative design solutions.
- Share case studies from European cities that have successfully embedded mobility justice in street transformations.

Through this handbook, practitioners will gain insights into the key principles of mobility justice and practical ways to apply them, ensuring that streets become more equitable, accessible, and inclusive for all.



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1. Introduction

Mobility is a fundamental human activity performed to meet needs and seize opportunities; therefore, urban mobility in the context of cities is an important activity that warrants attention from stakeholders (practitioners, city authorities, civil societies, researchers, etc.).

Stakeholders often require different instruments to understand urban mobility and who undertakes this important activity. This document focuses on **needs assessment methods** (incl. narratives, ethnography, spatial analysis, etc.) **across modalities** (i.e., walking, cycling, public transport) for a variety of **intersectional user groups** (i.e., children, younger adults, women, older adults, differently abled, LGBTQI+, migrants and others) for assisting stakeholders design public spaces using concepts of justice, perceived safety, universal design and equity.

Mobility and accessibility are distinct but interconnected concepts in transportation planning and social justice (Karner et al., 2023). While mobility refers to the physical capacity for movement - measured through metrics like travel time and distance - accessibility focuses on people's ability to reach and meaningfully participate in societal opportunities (Geurs & van Wee, 2004). North American literature and policies also use the term accessibility more in terms of access for those who are otherwise abled. It is important to note that accessibility and mobility are not mutually guaranteed. An individual who has limited mobility or specialised needs will have a different experience of accessibility than an able-bodied individual.

From a justice perspective, mobility inequality emerges when certain groups face restricted movement due to individual characteristics (e.g., income, gender, age, disability) intersecting with structural inequities in spatial and social conditions (Hidayati, Tan, et al., 2021).

Examples include economic barriers for car-less households, gender-based safety concerns, and inaccessible infrastructure for people with disabilities (Verlinghieri & Schwanen, 2020).

Therefore, needs assessment is important to achieve mobility justice. As mobility justice transcends simply enabling movement - it demands ensuring equitable access to life opportunities, particularly for marginalized and vulnerable groups. [It goes beyond facilitating movement for people with reduced mobility to embrace universal design principles, ensuring that transport systems and the built environment are inclusive by default.](#) This requires:

- Addressing individual social and cultural barriers beyond physical infrastructure through psychological and social perspectives (Individual needs)
- Understanding how different social groups experience mobility challenges within their specific contexts (Collective behaviour)
- Centering marginalized voices in planning processes rather than imposing standardized solutions (Transport policy)

The key insight here is that meaningful accessibility and participation in society should be prioritized over mobility metrics alone (Karner et al., 2020). This shifts focus from technical transportation measures to deeper questions of social justice and inclusion. [As such, accessibility is both a technical and ethical measure, intrinsically tied to our goals for justice, inclusion, and the right to the city.](#)



2. Framing: Understanding Needs

Human behaviour and habits reflect their needs. While behaviour can be observed and recorded, needs are latent (abstract) and require a deeper understanding for interpretation. Human needs have a hierarchy (Maslow, 1943), with physiological (survival) needs towards the bottom, while more creative and intellectually focused needs are placed at the top. Thus, to understand this from the perspective of urban mobility needs, one must ascertain that such needs are mid-tiered in Maslow's hierarchy (see Figure 1). We must also employ a tiered approach, focusing on this abstract concept from various theoretical perspectives. Figure 1 restricts it to three perspectives: psychology, economics, and geography.

- **Psychology/Sociology:** Numerous concepts and theories exist to help explain individuals' choices. They often explore the cognitive processes, motivations, and contextual influences that affect decision-making. Human needs are tailored by their expectations and satisfaction (if they have already experienced a certain mobility product, service, or environment). In addition to expectation and satisfaction, urban mobility needs are influenced by their capability to undertake or experience urban mobility. This is an instance of the famous capability approach (Sen, 1987), in urban mobility which considers that everyone should have real, practical opportunities to move around the city, considering personal, social, and environmental factors affecting their ability to use transport options effectively.
- **Economics:** The focus here is rationality. Rationality in urban mobility refers to making travel choices based on the expected benefits or gains. They weigh their options and choose the best return, typically in terms of convenience, cost, time, or utility. Such choices and behaviour are estimated at an aggregate level, collectively.
- **Geography:** This perspective examines how geography influences travel decisions. It looks at where people are, where they need to go, and how location and activities affect their choices. Travel decisions are influenced by the distance to destinations, available routes, and types of activities people need to do. Locations and activities are key reasons that shape urban mobility policies and vice versa.

The three perspectives described above invite a closer inspection of needs at three levels of investigation. From a psychological perspective, needs are investigated individually (i.e., own motivation, decision-making, etc.). However, from an economic perspective, needs and choices are aggregated using utilitarian theories and assessed at a collected level. A geographic perspective analyses needs through co-location and segregation, highlighting the motivation to overcome distance. Underscoring the interplay between these three levels is necessary for a holistic study.

Levels of needs assessment: We propose three levels of needs assessment: individual, collective, and policy level. At an individual level, it helps realise the specific needs, preferences, and limitations of individual users. This can be analysed from various angles, such as from a safety, accessibility, or connectivity point of view. When many individuals have similar needs, they collectively exhibit a pattern of behaviour. Analysing such needs of specific communities or social groups helps identify common trends and issues. Different social groups face collective mobility challenges, such as transportation deserts in low-income neighbourhoods or culturally relevant services for immigrant communities. Finally, these needs and behaviours of the individual or community should be reflected in urban transport policies, leading to a holistic transport system. Aligning transport policies with broader goals, such as sustainability, economic development, and social inclusion, ensures long-term mobility solutions that benefit all residents. As understood from this explanation,



the first two levels constitute a “human angle” intended for the actual user of the mobility system, while the third level represents a response from the “stakeholder angle.”

Intersectionality: This is a framework for understanding how different aspects of a person's identity—such as race, gender, age, and disability—interact and affect their experiences of mobility and justice in urban environments. Individuals are simultaneously affected by various social categories, leading to unique experiences of inclusion or exclusion in urban mobility. These interactions can amplify issues or barriers to accessing and benefiting from transportation systems. Therefore, intersectionality must be analysed at all levels of needs assessment.

Mobility often involves a trade-off between individual benefits and collective disadvantages, creating a social dilemma. This means that what benefits one person might not be the best for the community. People make travel decisions based on personal convenience, timesaving, comfort, and cost-efficiency. These individual choices can sometimes harm the community by causing traffic congestion, pollution, and increased wear on infrastructure. When most people choose to drive cars for convenience, it benefits them individually by saving time. However, this collective behaviour can lead to traffic jams, air pollution, and fewer resources for public transportation. Against this backdrop, our work aims to present various methods to highlight the above-described ‘trip as an instrument’ angle so that future transport planning may shift from solely focusing on maximising individual benefits towards minimising collective disbenefits. As a side note: In this section, we use the term LGBTQ+ to refer to Lesbian, Gay, Bisexual, Transgender, Queer, and other identities encompassed within the broader spectrum of sexual orientations and gender identities.

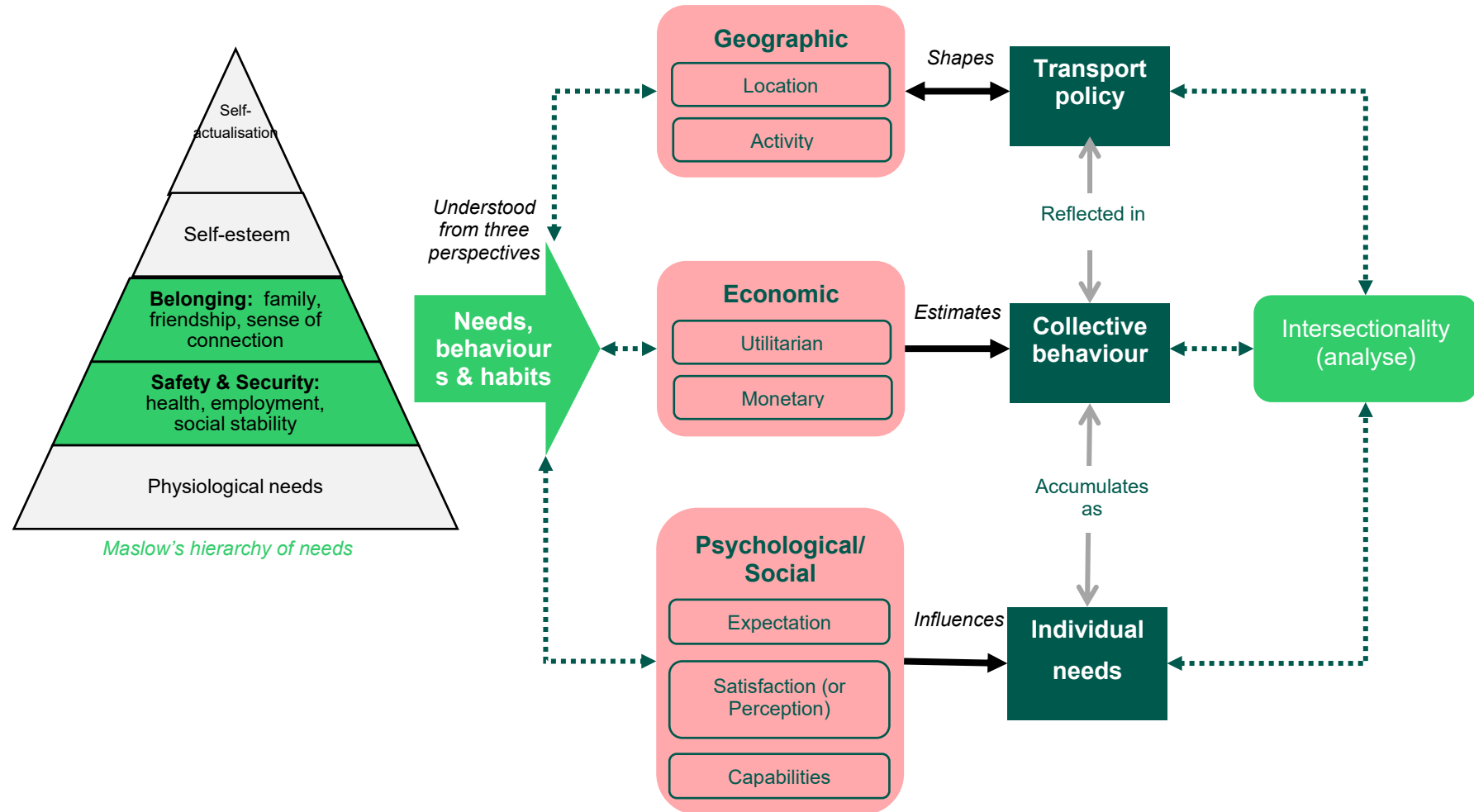


Figure 1 Understanding Needs, Behaviours and Habits Framework (Source: Authors)



2.1 Main questions:

The most common question asked by mobility practitioners and advocates intending to improve urban mobility in their city is, 'What do people need?'. This question is simple and complex, as people's needs stem from daily behaviours or habits that should be understood through the various perspectives described earlier. Evidently, to understand 'what', one needs to break down the previously mentioned questions into 'who' and 'how'. In this light, the main questions this document sets out to answer are:

- Q1. Which user groups require their mobility behaviour and needs to be assessed?
- Q2. What are the current state-of-the-art concepts, methods, tools, and assessment measures of mobility needs of user groups across different modalities, and what are their real-world implementation and impact?
- Q3. How can target audiences choose between these concepts, methods, and tools?

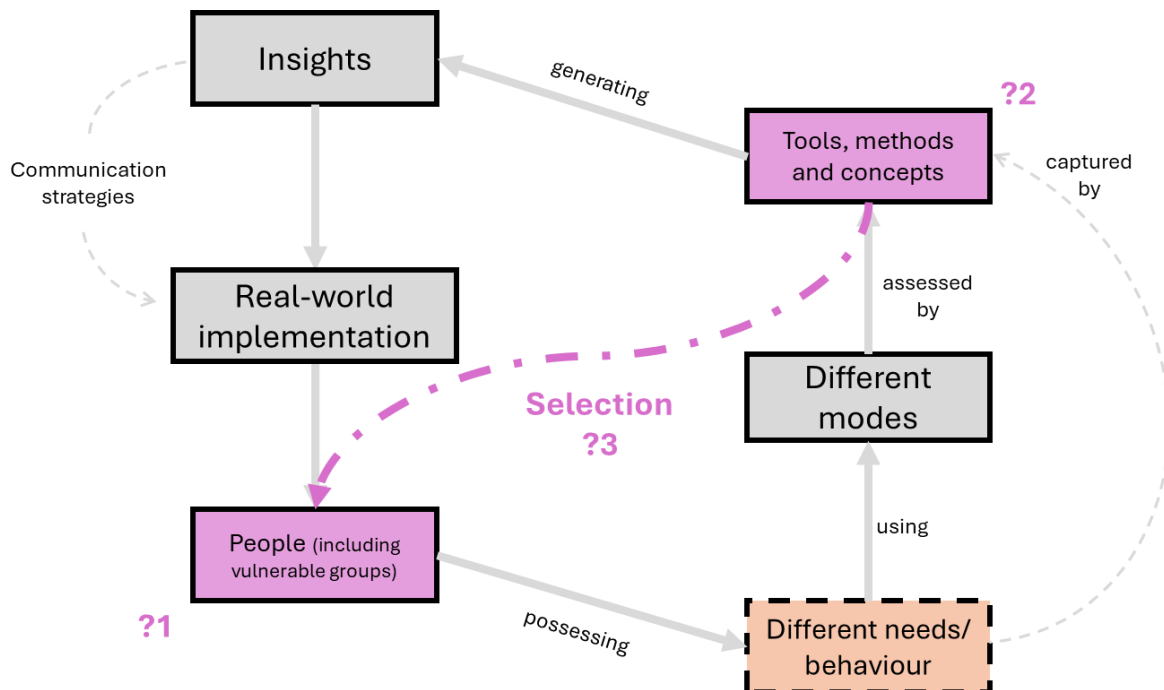


Figure 2 What does this document intend to reflect?

In Figure 2, we formulate the main questions: 'Who' are the different groups of people with different needs (and behaviour) and use various modes (i.e., intersectionality analysis). Also, 'how' can such needs be assessed using different tools, methods and concepts? More pertinently, how can interested stakeholders select among these tools and related concepts to generate insights to make room for more compelling real-world implementation? An example could be using more positive communication strategies, and this document will also discuss this aspect of communication.



2.2 Who, What, and for Whom?

This document is meant for

Target audiences interested in need assessment

- Beginner: General public and interested community stakeholders
- Intermediate: policymakers, planners, and designers
- Advanced: Researchers and experts

We focus on **the needs of the following user groups:** Gender, Socioeconomic status, Age, Disability, Parents, LGBTQ+, Immigrants who **interacts with these modes:** Walking, Cycling and Public Transit



3. Methodology

The most common question asked by mobility practitioners and advocates intending to improve urban mobility in their city is, 'What do people need?'. This question is simple and complex, as people's needs stem from daily behaviours or habits shaped by personal experiences and psychological factors.

Data collection from the lens of themes:

- Safety
- Syntactic and Ethnographic—Accessibility
- GIS methods-Connectivity
- Video and trajectory analytics- Safety (also)
- Epistemic justice
- Communication strategies for effective implementation

Literature review

A literature review was carried out to provide an overview of the "safety" literature and to determine the concepts, methods, measures and tools used to assess or describe safety in transport. Google Scholar was used to identify references, including public transport, walking, and cycling, restricting searches to the more recent period 2018 to 2023. The search was based on the keywords "safety" in combination with "public transport," "walking", "cycling", and "urban mobility".

Expert interviews

Guidance for communication strategies was developed through a comprehensive qualitative research process involving interviews with 28 mobility experts and representatives of marginalised groups. The semi-structured interviews, lasting one hour each, involved participants from 18 countries, with a notable representation from EU nations. The interviewees represented diverse sectors, and their expertise and experiences provided a nuanced understanding of the mobility needs of various target groups, including low-income, ethnic minorities and migrants, women, LGBTQI*, children and youth, older adults, and disabled people.



4. User groups and intersectionality

User groups are the target audience that utilises these methods, including interested community stakeholders, policymakers, planners, designers, researchers, and experts. On the other hand, intersectionality explores how overlapping identities—such as gender, socioeconomic status, age, disability, and more—shape individual experiences.

4.1 Intersectionality Insights from Communication Strategies:

- Embedding this perspective in communication strategies is crucial because the intersections between identities can exacerbate barriers to active mobility. Examples include:
- Gender and Economic Status: Women from lower-income backgrounds often, as highlighted by Johansson & Haandrikman (2023) report a heightened fear of crime in public spaces.
- LGBTQ+ and Disability or Low-Income Status: Respondents notes how compounded challenges necessitate inclusive communication approaches.
- Parenting and Disability: Respondents draws parallels between parenting with unconventional mobility tools and disability-related challenges.

4.2 Intersectionality Insights from Safety:

- (Ison & Matthewson, 2023; Mwaka et al., 2023)(Ng & Acker, 2018) Gender often intersects with other vulnerabilities—such as single parenthood, poverty, or migration status—to compound safety concerns in public space. For example, women from disadvantaged backgrounds may prioritise safety more highly when making transport choices (Ng & Acker, 2018). Tools like diagnostic surveys and ride-alongs help capture these layered concerns by highlighting how gender intersects with other factors. Additionally, targeted interventions such as surveillance technologies and education campaigns are crucial for addressing these compound vulnerabilities—particularly when prioritised in underserved or disadvantaged neighbourhoods (Ison & Matthewson, 2023; Mwaka et al., 2023).
- Differently-abled individuals: Accessibility audits and tailored solutions (e.g., wheelchair-friendly buses) ensure equitable use of transport (Unsworth & Timmer, 2023). Accessibility audits and tailored solutions ensure equitable transport safety (Przybylowski et al., 2021).
- Youth and Elderly: Age-specific needs influence the design and deployment of urban safety measures, such as pedestrian crossings and public transport accessibility (Urbanek et al., 2023). Age-specific needs influence the design and deployment of safety measures, like clearer crossings and safer pedestrian zones (Rahm et al., 2021).

4.3 Intersectionality Insights from Accessibility:

How different **user groups experience urban spaces differently**, highlighting the **importance of inclusive design**:

- **People with mobility impairments** face **physical barriers** (e.g., lack of ramps, uneven surfaces).
- **Visually impaired individuals** rely on **contrast, texture, and sound** for navigation.
- **People with cognitive impairments** benefit from **simplified and intuitive layouts**.
- **Women and gender minorities** often prioritize **safety and lighting in public spaces**.



4.4 Intersectionality Insights from Justice:

Differences Across Intersectional User Groups

- Theories of **transport justice** historically neglected the diverse needs of groups like **women, differently abled individuals, LGBTQI+, and migrants**.
- **Intersectionality matters:** Transport policies impact individuals differently based on race, gender, income, and ability.

New Approaches Include:

- Intersectional **data collection** on mobility barriers.
- Participatory research incorporating **narratives and lived experiences**.

Intersectionality Insights - mixed:

- **Intersectionality and Differentiation for User Groups**
- The tools and methods highlight disparities in urban mobility across user groups:
- **Differently Abled Individuals:** Assessments often include accessibility measures (e.g., ramp availability, obstacle-free pathways).
- **Women & LGBTQI+ Communities:** Tools like the Walkability Index and 15-Minute City Score incorporate safety perceptions, lighting, and surveillance.
- **Children & Older Adults:** Evaluations focus on proximity to schools, senior centers, and public seating availability.

4.5 Intersectionality analysis

Table 1 Matrix to navigate intersectionality

	Low-income	Elderly	Children	Women/females	Parents	Disability	LGBTQ+	Migrants
Low-income								
Elderly								
Children								
Women/females	++ Women with low income	++ adolescent females						
Parents				++ Single mothers				
Disability					++			
LGBTQ+	+					+		
Migrants								



5. Concepts and Theories

Concepts and theories form the basic building blocks of any tool or assessment method. The following topics (disaggregated by themes) are intended to be a starting point for such concepts or theories.

5.1 Accessibility

Physical accessibility in transport planning and urban mobility refers to how easily people reach desired services, destinations, or activities. Accessibility as a concept goes beyond mere transportation infrastructure to encompass all factors that enable efficient, equitable, and inclusive movement within urban areas (Geurs & van Wee, 2004). In this context, three important definitions need explanation.

- **Needs:** These are the basic requirements for people to lead their lives effectively. For example, one needs access to groceries, healthcare, education, employment, and recreation. In terms of transportation, accessibility means being able to reach these services and destinations easily. Imagine if a grocery store is too far away and there's no public transport to get there – that would be a big problem for someone who doesn't drive.
- **Opportunities:** Opportunities refer to people's chances to utilise services, engage in activities, and improve their quality of life. Good accessibility in transportation means one has multiple options to get around, like buses, bikes, sidewalks, or trains. Suppose one can take advantage of these options without spending too much time or money. In that case, they might have better opportunities to work a job they enjoy, attend a school that's best for them, or participate in community events.
- **Abilities:** Abilities relate to whether people can effectively use transportation options. This includes physical, cognitive, and financial capabilities. Accessibility planning must account for users' varying abilities to ensure equitable access (Farrington, 2007).

5.1.1 Equal physical access

Using the concept of abilities explained earlier, this subsection emphasises universal design, aesthetics, and urban design with sustainable and inclusive mobility for all sections of the user group. Table 1 presents the key concepts in this domain, focusing on different areas.

Table 2 Key concepts emphasising accessibility by physical abilities

Concept/Method	Focus Area	Key Applications
Universal Design (UD)	Accessibility & Inclusion	Ensures built environments and transport systems are usable by all people, regardless of ability.
Gap Model of Disability	Accessibility & Social Inclusion	Examines how environmental barriers impact mobility and participation.
Relational Model of Disability	Accessibility & Policy	Moves beyond individual impairments to consider broader social and environmental barriers.
International Classification of Functioning, Disability & Health (ICF)	Accessibility & Health	WHO framework assessing how environments impact functional abilities.



Concept/Method	Focus Area	Key Applications
Sensory-Based Design	Aesthetics & Navigation	Enhances urban spaces using tactile cues, auditory signals, and olfactory elements for accessibility.
Aesthetic Sustainability	Urban Design & Well-being	Focuses on long-term aesthetic and sensory value in urban environments.
Participatory Planning	Policy & Community Engagement	Involves disabled communities in the design of streets and public spaces.
Universal Design at Macro, Meso, and Micro Levels	Multi-Scale Urban Planning	Guides strategic, regulatory, and site-specific implementation of UD principles.

5.2 Safety

Safety is among the leading components that users value alongside travel cost, comfort, and convenience, among other things. This aspect can be divided into two important concepts influencing the safety assessment.

- **Objective safety**
Objective safety is all about the actual, measurable safety of a situation or environment. This includes data and statistics about crashes, crime, and infrastructure conditions. This can be regarded as "hard facts" about how safe something is.
- **Subjective safety**
Subjective safety is how safe people feel in a certain situation or environment. This is more about perception and feelings, which might not always align with the data. It involves people's opinions and emotions regarding their safety.

Consider this situation: imagine contemplating whether to walk home from work. In assessing objective safety, the city might have installed new streetlights, lit the sidewalks, and significantly reduced the crime rates. Statistically, it's unlikely to face any danger due to all the safety improvements. However, from the subjective safety perspective, one might still feel nervous about walking home because, maybe it's late at night, the area feels isolated, or one has heard scary stories about it. Even with all the objective improvements, the trip-makers sense of safety could still be low.

Thus, safety needs can be approached from both a systems perspective (objective) and a psychological perspective (subjective).

- **Safe Systems Approach**
The Safe Systems Approach (European Commission, 2022) is a road safety framework that originated from the realisation that human errors and vulnerabilities should be anticipated and managed within the transportation system. This holistic approach aims to build a system that prevents fatalities and serious injuries even if mistakes occur. The five key principles in this approach are:
 - People make mistakes, so road systems are designed to keep users safe and avoid crashes. For example, setting and enforcing speed limits appropriate to the road environment and usage.



- Because people can get hurt easily, road systems are made to be forgiving and prevent big crashes that cause serious injuries. For example, better road layouts, safer intersections, and barriers to protect vehicles from roadside hazards.
- Everyone involved in the road system is responsible for making it safe. This includes system designers (engineers, planners, policymakers), road users, vehicle manufacturers, and enforcement agencies. One example that promotes safe vehicles from manufacturers is encouraging the use and development of cars equipped with technology that improves safety, such as airbags, anti-lock braking systems, electronic stability control, etc.
- All parts of the system are improved together to make it extra safe, even if one part doesn't work perfectly.
- Permanent organisations set strong rules and management to keep the road system safe. For example, post-crash response for effective assistance after crashes, improving survival rates and recovery outcomes.

Road Danger Reduction

Policy and advocacy approach that seeks to reduce the sources of danger on the road, rather than merely mitigating the consequences of collisions. Unlike traditional road safety approaches that often focus on individual behaviour (e.g. helmets, reflective gear), RDR prioritises systemic changes — such as reducing motor traffic volumes and speeds, reallocating space, and redesigning infrastructure — to address the root causes of danger, especially those posed by motor vehicles (Te Brömmelstroet, 2024).

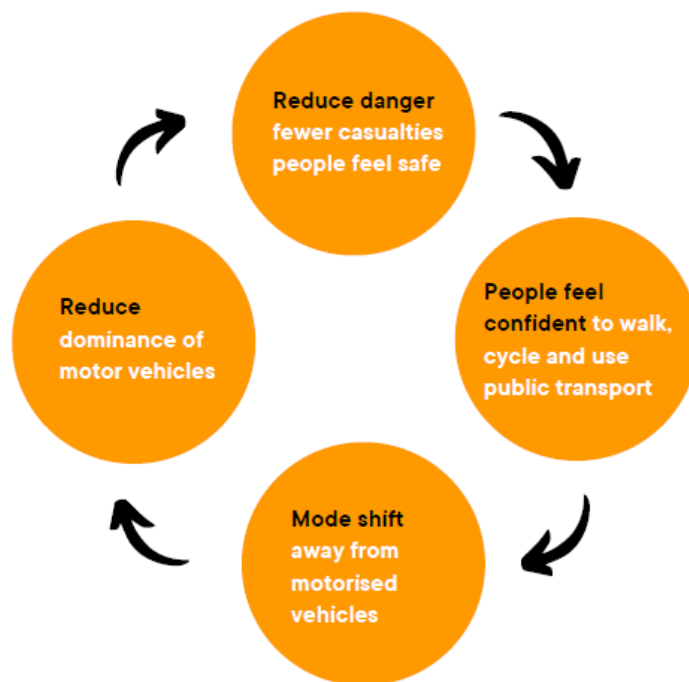
This concept links closely with mobility justice, as it challenges the structural inequalities that expose certain groups — such as pedestrians, cyclists, children, and low-income communities — to higher risks. By shifting responsibility from vulnerable users to the transport system itself, RDR aligns with the goals of active mode promotion, creating environments where walking and cycling are not only encouraged but also made genuinely safe, equitable, and accessible (Inequalities in road danger in London 2017-2021, June 2023).

The basic tenets of Road Danger Reduction:

- **Control danger at the source:**
Focus on reducing the inherent risks posed by motor vehicles, rather than placing the burden of safety on pedestrians or cyclists.
- **Prioritise the most vulnerable:**
Design and evaluate transport systems around the needs of those most at risk— especially children, older people, disabled individuals, and non-motorised users.
- **Reduce motor traffic volumes and speeds:**
Lower overall traffic levels and enforce lower speed limits as a core strategy for improving safety.
- **Promote benign modes of transport:**
Encourage walking, cycling, and public transport as inherently safer, healthier, and more sustainable alternatives to private car use.
- **Reject victim-blaming:**
Move away from narratives and interventions that focus on individual behaviour (e.g. high-visibility clothing, helmets) rather than systemic changes.
- **Challenge car-centric road design:**
Redesign streets to prioritise safety and liveability over vehicular throughput, using tools like filtered permeability, traffic calming, and pedestrian-priority areas.



- **Integrate equity and justice:**
Recognise that road danger is not experienced equally, and that disadvantaged groups are often disproportionately exposed to risk and underrepresented in decision-making.
- **Base policy on public health and ethical principles:**
Use road safety not just as a technical field



Lambeth Council RDR Strategy, 2023

Figure 3 Concept of Road Danger Reduction (Lambeth Council, 2023)

5.3 Psychological theories

Psychological theories are instrumental in understanding human behaviour and help promote habits that decrease risk, such as wearing seat belts, using helmets, following traffic rules, and avoiding distractions and impairments (like texting or driving under the influence). Two theories and one model in this respect need discussion (For more details, read T2.3).

- **Nudge theory:** Nudge theory suggests that small changes in how choices are presented can gently steer people to make better decisions without forcing them. Instead of making laws or rules to force behaviour, small environmental cues or changes are made to 'nudge' people to act in safer ways. Crossing streets safer by, for example, reducing the width of the carriage way "nudging" car drivers to slow down. Signs reminding drivers to slow down near schools can be made more visible.
- **Theory of planned behaviour:** This theory suggests that human behaviour is affected by three questions: (a) How does one feel about a behaviour in question?



(i.e., attitude), (b) How do other people influence one's behaviour? (i.e., perceived social norm), and (c) How easy or hard does one think it is for them to do the behaviour (i.e., perceived control)? Complementing people's perceptions of these three questions can help promote safer behaviour. For example, if the behaviour to promote is safe driving, campaigns showing the dangers of speeding can influence attitudes towards these aspects. Using messages and public welfare ads that show most people driving safely may influence the perceived social norm of safe driving. Ensuring roads are well-lit and maintained may improve drivers' perceived control of their vehicles.

- **Needs-Opportunities-Abilities (NOA) model:** The Needs–Opportunities–Abilities (NOA) model is a behavioural framework used to explain why individuals engage in certain actions. It proposes that behaviour results from the interaction of three factors: needs (the individual's motivations or goals), opportunities (the external conditions that enable or limit the behaviour), and abilities (the individual's internal resources or capacities to act). In the context of mobility, for example, a person may choose to cycle if they are motivated to stay healthy (need), have access to safe infrastructure (opportunity), and possess the physical ability and skills to do so (ability). The model highlights that all three elements must align for a behaviour to occur.

5.4 Connectivity

Connectivity in urban mobility refers to how well different parts of a city are linked together through transportation networks. Good connectivity means it's easy and efficient for people to move around the city, whether going to work, school, shopping, or social activities. Imagine a city's transport system like a web. The more connected the web is, the easier it is to travel from one point to another. Some theories related to connectivity are:

- **Interconnectedness:** We can also imagine the transport system as a network with links and nodes. Usually, the transport links (e.g., roads, rails, footpaths, bikeways, etc.) are the ones which carry the flow of transport modes, and nodes are the points where the transport modes meet (e.g., bus-terminal, multimodal hub, a road intersection, etc.). How well are the different transport modes linked to each other? For example, you can easily switch from a bus to a train to your destination, or the bus routes are direct and timely, reducing travel time and making it convenient to reach different parts of the city. Imagine one lives at a five-minute walk distance to a bus stop, takes a bus to the train station and then catches a train to their workplace with minimal waiting and smooth transitions between different modes of transport. This could be a good example of a well-connected transport system.
- **Syntax:** Just as language has syntax, i.e., grammar rules that govern how words connect to form meaningful sentences, syntactical methods examine how spaces connect and relate to each other to create meaningful urban patterns. Imagine how transport links (spaces) are connected using nodes in a city. The most important road in a city usually carries much traffic, or the most important transit terminal is where we see many passengers. Some destinations may be well connected, making them easy to reach, while others may be located in dead ends, making it difficult to reach from other points in the city.

5.5 Mobility Justice

This concept examines who can move freely and who faces barriers in accessing services and opportunities and links transport access to broader issues like climate justice, social equity, and rights to the city. Traditional transport justice approaches assume rational decision-making through resource distribution while remaining oblivious to social connections



or participatory decision-making processes. The following are key theories that help differentiate between theories favouring traditional approaches and those that instil transport justice.

- **Utilitarianism:** Focuses on maximising travel benefits for most but not all. Benefits are usually measured by reduced travel time or economic gains. They are the basis for many cost-benefit analyses used in transport planning, where projects are deemed just if they improve efficiency for the majority, even if some groups are negatively impacted or neglected.
- **Sufficientarianism:** This philosophy ensures basic transport access for all but struggles to define "enough." It emphasises ensuring that everyone has sufficient access to transport, providing a minimum threshold for all.
- **Egalitarianism:** Egalitarianism advocates focusing on the least advantaged and prioritises transport equity, ensuring that investments improve mobility for disadvantaged groups.
- **Capabilities Approach:** creating systems that enable people to access the opportunities they value, going beyond the mere provision of infrastructure. This is key because it can encourage a more comprehensive way of thinking about mobility justice that considers structural issues.
- **Gender Mainstreaming and Feminist Urbanism:** an approach to city planning and transportation considering all genders' unique experiences and needs, for example, women. This ensures that gender perspectives and attention to the goal of gender equality are central to all activities. It seeks to make urban environments more equitable and safer for everyone. Traditional transport planning often overlooks women's (or other disadvantaged groups') specific travel patterns and needs, such as childcare responsibilities, safety, and flexible travel routes. Feminist Urbanism aims to address these gaps and promote transport justice for everyone.
- **Ethics of Care:** an ethical framework that is increasingly being advocated for use in traditional transport planning (Legacy et al., 2024). Ethics is a branch of philosophy that studies moral principles (i.e., rules about right and wrong) and examines how people's intentions and actions affect the public good. So, ethical frameworks help translate transport planning stakeholders' theories and beliefs into material actions. There are three main ethical frameworks relevant to transport: Consequentialist—the goal is to create the greatest good for the greatest number of people (e.g., relying on economic analysis to maximise efficiency and benefits); Duty—focus on actions that are morally required to fulfil duties (e.g., adhering to set standards and practices based on duty and obligation), and Care—emphasises nurturing and caring for others and the environment (e.g., enhancing security measures at transit stations so that everyone feels secure). This approach focuses on empathy, responsibility, and the interconnectedness of society to create safer, more accessible, and supportive transportation systems.



6. Methods

Methods are generic techniques that build up assessment tools based on concepts and theories. The type of method depends on how the information/ data (of interest) is collected and what we intend to do with the data after collection.

6.1 Data collection

Walk-along interview

This method collects and records observations in public spaces. It encourages walking as an immersive and participatory research experience, offering insights that might be missed otherwise. This method is popular in ethnography or studying people in their familiar environment. The core of this method lies in participant observation and face-to-face interviews, which are qualitative in nature, i.e., rely on the narratives and perceptions of the participants. Walk-along interviews aim to 'sensitise' the participant to how we observe and think in undertaking a walk (O'Neill & Roberts, 2020). Participants may undertake a familiar walk and note down 'usual' observations, thinking of previous walks on this route and what one normally observes and thinks about. The recording can be conducted in a notebook (paper or digital), sketchbook, and/or a camera (or camera/phone). Participants should also reflect on their observation—'what', 'when', 'where', 'how' and 'why' for each observation and the 'surprises' and unexpected elements of the walking experience. If the route was drawn on a map, then annotations should be made by plotting it against each observation. Walk-alongs can also be done with a colleague to corroborate the observations. The participants should be able to point out their belief that informs their observation theoretically.

Mobility anecdotes

This method (von Schönfeld et al., 2020) aims to capture detailed, qualitative insights into individuals' everyday travel behaviours and experiences, enriching the understanding of mobility beyond technical and goal-oriented metrics. Participants are invited to share their everyday mobility stories or anecdotes, essentially short narratives about their travel experiences, including details, thoughts, emotions, and contextual factors. The collection technique includes deep, semi-structured interviews that encourage elaborative storytelling and allow participants to focus on what is most memorable or significant in their travel experiences. Group discussions are utilised to facilitate the sharing and comparing of mobility anecdotes, providing collective insights and highlighting common themes. Participants may also be asked to keep diaries or logs of their daily mobility, capturing real-time reflections and observations. Mobility anecdotes accommodate diverse modes of data collection, including in-person interviews, written narratives, and digital diaries. The method ensures a comprehensive understanding of mobility across different social strata by involving participants from varied backgrounds. This approach provides rich qualitative data that reveals the complexities and nuances of daily travel, thus enabling more empathetic and comprehensive transportation policy and planning.

Streetscape audits

Streetscape audits focus on understanding the real-world usability of streets, sidewalks, crossings, and public spaces, aiming at comprehensive evaluations of urban mobility environments. They employ various techniques, including walk audits, which involve detailed field observations by diverse participants such as residents, urban planners, and mobility experts. Participants assess physical conditions like pavement quality, obstacles, lighting, signage, and safety features. Data collection tools include checklists, photographs, videos, sketches, and mobile apps to guide the audit process. Popular checklist-based approaches



include road safety audits (Calderón Ramírez et al., 2023) and walkability audit instruments. Some of the popular walkability audit instruments are SPACES (Pikora et al., 2002) and PEDS (Clifton et al., 2007). Streetscape audits often use street images from Google Street View (Steinmetz-Wood et al., 2020) and other image collection sources (Nag & Goswami, 2022; Wilson et al., 2012). A notable advancement in streetscape auditing is the use of digital technologies such as Light Detection and Ranging (LiDAR) (Wu et al., 2021) or Building Information Management (BIM) systems for road safety assessment (Svatý et al., 2019). The SidewalkScanner³ developed by IFP uses a hand-held 3D LiDAR system to generate highly detailed street models with a particular focus on sidewalks.

6.2 Data analysis

Video analysis

Video analysis involves examining video footage to extract meaningful information that can be used for various purposes, such as safety evaluations, behavioural studies, infrastructure assessments, and visual quality. This process utilises computer vision and/or human analysts to identify patterns, classify objects, track movements, and systematically make observations. Video analysis can also be used to assess urban vibrancy, as well as curate the users' experience using the "walking with video" approach (Hidayati, Yamu, et al., 2021; Tang & Long, 2019).

Statistical modelling and simulation

One way of understanding users' needs is to use quantitative techniques. Statistical modelling helps gather quantitative insights on transport usage, patterns, congestion, and demographic trends. At larger urban scales, statistical tools are used to analyse large travel behaviour datasets to identify recurring travel patterns and trends over time, such as peak travel hours, preferred modes of transport, and areas with higher demand. Statistical models help forecast future travel demands based on historical data, offering insights into where infrastructure improvements are most needed. Statistical models are also used to understand the safety implications of urban mobility.

³ <https://ifpedestrians.org/sidewalkscanner/>



7. Assessments and tools

The section provides a **literature review** on the following concepts of **safety in urban mobility, accessibility, universal design, justice and hybrid approaches** across different modalities (walking, cycling, public transport). It analyses **state-of-the-art concepts, methods, assessment measures, and tools** used to assess these concepts. Each section is asked to consider what these assessments and tools means for different target audiences. The section provides a robust toolkit for cities aiming to create inclusive and safe public spaces. By integrating spatial, ethnographic, and justice-based analyses, these tools can empower urban planners to make data-driven decisions that enhance accessibility for all user groups.

7.1 Safety (HVL/VF)

7.1.1 State-of-the-Art Literature & Desk Review

Concepts, Methods, Assessment Measures, and Tools

- **Traditional Approach:** Road safety has been historically assessed using crash data, but this has limitations due to the rarity and randomness of crashes.
- **Emerging Approach:** Conflict indicators (e.g., near-misses) provide a more proactive safety assessment by analysing spatial-temporal trajectories of road users.
- **Future approach:** a paradigm shift that focuses on reducing risk at its source—motor traffic—rather than adapting vulnerable users to dangerous conditions. It aligns with mobility justice by prioritising the safety and rights of those most exposed and least responsible for road danger, such as pedestrians, children, and people without access to cars.
- **Methods:**
 - Traffic observation & video analysis (to track road users and interactions).
 - Naturalistic studies (using sensors and cameras to analyse user behavior).
 - Road safety audits & inspections (to evaluate infrastructure hazards).
 - Microsimulations (to model potential conflicts under different scenarios).
 - Quantitative Measures of Conflict:
 - Time-to-Collision (TTC) and Post-Encroachment Time (PET) are key indicators used to measure conflict severity.
- **Technologies:**
 - Video-based tools (e.g., TrafxSAFE, DataFromSky).
 - Microwave & infrared sensors (to track vehicle interactions).
 - LiDAR technology (high accuracy tracking of user movement).

Applications & Real-Life Examples

- **The Hague, Netherlands:** Used **automated video analysis** to assess safety before and after intersection redesigns.
- **Bellevue, USA:** Deployed **AI-based video analytics** at 40 intersections, analysing **8.25 million interactions** to identify risk areas.
- **Trois-Rivières, Canada:** Used **LiDAR sensors** and **neural networks** to analyse **970,000 conflicts** at intersections.

Impact on Different User Groups & Intersectionality

- The methods apply universally across all user types (vehicles, cyclists, pedestrians, etc.), but **do not capture demographic factors like age or gender**, limiting analysis of intersectionality.



- Innovative aspects include **real-time conflict detection**, **user behavioural insights**, and **multimodal analysis**.

7.1.2 Synthetic & Practice-Oriented Compendium for Cities

Evaluation of Walkability, Accessibility, Visibility, Security & Safety

- **Current Methods Focus on Road Safety:** Existing methods are well-developed for road conflict analysis but not tailored for open public spaces.
- **GIS-Based & Site Inspections Needed:** To assess walkability, accessibility, and security, urban planning tools must integrate physical/spatial analysis beyond traffic safety metrics.
- **Potential Data Reinterpretation:** While PoliTO-DIATI specialises in conflict detection, its data can be adapted to inform pedestrian accessibility and safety indicators.

Evaluating the Efficacy of Tools & Methods

- **Technology Choice Matters:**
 - Video tools capture a wide range of interactions but raise privacy concerns.
 - LiDAR technology avoids privacy issues and offers high accuracy but is costly.
- **Key Metrics for Effectiveness:**
 - Surrogate safety measures: TTC and PET for general risks, Headway for lane-specific analysis.
 - Data Size & Complexity: More data improves reliability; urban complexity affects precision.

Tailoring Findings for Different Audiences

- **General Public & Community Stakeholders:** Emphasize the role of proactive safety measures in preventing crashes before they occur.
- **Policy Makers & Urban Planners:** Highlight how data-driven conflict analysis can guide infrastructure redesign for improved safety and equity.
- **Researchers & Experts:** Focus on methodological advancements and technology integration in conflict detection and risk assessment.

Table 3 List of methods per mode

Method	Mode	Description
Analytic Hierarchy Process (AHP)	Multimodal	Evaluates safety in facility location, bus selection, and passenger satisfaction.
Hybrid Methods (AHP + TOPSIS, Fuzzy AHP)	Multimodal	Addresses uncertainty in safety assessments and decision-making.
GIS-Based Accessibility Evaluations	Pedestrian, Multimodal	Analyses spatial-temporal effects and accessibility.
Resilience Modeling (Causal Loop Diagrams)	Vehicles	Examines system adaptability and robustness under disruptions (e.g., pandemics).



Method	Mode	Description
Surveillance Technologies	Public Transport	CCTV, panic buttons, mobile apps for security.
Multimodal Network Models	Multimodal	Assesses efficiency, resilience, and accessibility.
User Experience Surveys	Multimodal	Captures perceptions of safety and accessibility.
Shared Autonomous Vehicles (SAVs)	Urban Mobility	Improves first/last-mile connectivity.
Machine Learning Applications	Public Transport	Predicts travel times and detects safety patterns.
15-Minute City Framework	Pedestrian, Multimodal	Emphasizes proximity planning for safer, more accessible cities.
Safety Audits and Surveys	Multimodal	Identifies urban hazards.
Dynamic Traffic Monitoring	Road Transport	Uses real-time data to enhance safety.
Public Transport Accessibility Measures	Public Transport	Focuses on differently abled users' accessibility.
Structural Equation Modeling (SEM)	Autonomous Vehicles	Examines relationships between safety perceptions and adoption.
Negative Binomial & Ordered Logit Models	Pedestrian	Evaluates crash likelihood at intersections.
Focus Groups and Structured Walks	Multimodal	Investigates the impact of lighting, greenery, and perceived safety.
Multinomial Logistic Regression	Multimodal	Analyses gender-specific transport preferences and safety concerns.
Road Danger Reduction	Multimodal	Focus on reducing the danger at the source.

7.2 Accessibility (HVL)

7.2.1 Real-Life Applications & Users of These Methods

Local Governments

GIS-Based Safety and Accessibility Evaluations used to guide urban planning.

Example: 15-Minute City Initiative in Paris & Barcelona improved pedestrian and cycling safety.

Impact: Reduced traffic crashes increased public satisfaction, and improved inclusivity.

Transport Operators



Surveillance technologies (CCTV, panic buttons, mobile apps) improve public transport security.

Example: London & New York public transport agencies use AI-powered surveillance for safety.

Impact: Reduced harassment incidents, improved passenger confidence, and enhanced system reliability.

Private Sector & Startups

Ride-sharing safety apps & shared mobility options.

Example: Uber safety tracking features for passenger security.

Impact: Increased trust in shared mobility services.

Researchers

Machine learning and AI-based safety prediction models.

Example: Multimodal Network Resilience Studies in Singapore & China.

Impact: Informed policies and improved safety forecasting.

7.2.2 Differences Across User Groups & Intersectionality

User Group-Specific Safety Considerations

- **Women & Vulnerable Groups:**
Surveillance technologies & gender-sensitive safety audits reduce harassment risks.
Example: Gender-Specific Safety Surveys show that women prioritise safety over speed in mobility choices.
- **Differently Abled Individuals:**
Accessibility audits ensure equitable transport safety (e.g., wheelchair-accessible buses).
- **Youth & Elderly:**
Safety interventions (e.g., pedestrian-friendly crossings, well-lit pathways).

7.2.3 Innovative & Groundbreaking Approaches

- **Multimodal Network Integration:** Enhances **seamless transport safety**.
- **Proximity Planning (15-Minute City):** Aligns urban safety, walkability, and accessibility.
- **Machine Learning:** Predicts safety risks before incidents occur.
- **Flood Vulnerability Index:** Analyses road safety risks under extreme weather conditions.
- **Ride-Along Surveys:** Captures subjective safety experiences.



7.2.4 Synthetic & Practice-Oriented Compendium for Cities

Table 4 Methods for Evaluating Walkability, Accessibility, Visibility, Security, and Safety

Domain	Tool/Method	Example Tools
Walkability	Proximity indices, pedestrian traffic models	SidewalkScanner, Walk audits (IFP-r), Walk Score, GIS-based tools
Accessibility	Spatial gap analysis, ADA compliance audits	ArcGIS Network Analyst
Visibility	Sightline analysis, lighting assessments	3D modelling software (SketchUp, Rhino)
Security	Crime mapping, surveillance systems	Heatmaps, GIS + CCTV integration
Safety	Hazard detection, incident reporting tools	IoT dashboards, Dynamic Traffic Monitors

7.2.5 Key Dimensions to Evaluate Safety Method Effectiveness

- Equity Considerations:
 - Are all groups (women, differently abled, migrants, LGBTQI+) represented in safety planning?
 - Are past injustices addressed through restorative justice approaches?
- Methodological Robustness:
 - How accurate are safety tools? (e.g., AI vs. perception-based audits).
 - Can methods be applied across multiple scales? (e.g., street-level vs. city-wide safety).
- Usability for Policymaking:
 - Can decision-makers easily integrate safety findings into urban planning?
 - Do safety tools enable participatory governance?

7.2.6 Tailoring Findings for Different Audiences

- **For the General Public & Community Stakeholders**
 - Communicate how safety tools impact daily life (e.g., well-lit streets, safer public transport, safer schoolzones, reduced crime).
 - Encourage citizen participation in urban safety audits and reporting.
- **For Policy Makers, Planners, & Designers**
 - Present GIS-based and AI-driven safety assessments to inform policy decisions.
 - Highlight best practices from real-life case studies (e.g., 15-Minute City, London AI surveillance).
 - Show return on investment (ROI): Present data on how improvements can reduce health costs, boost local economies, and increase active travel. (KPI's of Just Streets or e.g. Pedestrian Pound (2020) outcome)
- **For Researchers & Experts**



- Explore emerging methodologies (e.g., predictive safety modeling, AI-driven accessibility mapping).
- Encourage cross-disciplinary approaches integrating data science, urban planning, and social justice.

7.2.7 Conclusion & Key Takeaways

- **Safety in mobility is not just about infrastructure but also social equity, accessibility, and perception.**
- **Cutting-edge tools like AI, GIS, and multimodal data integration improve safety planning.**
- **Participatory approaches ensure urban safety solutions are inclusive for all user groups.**

7.3 Universal Design (HVL)

7.3.1 State-of-the-Art Literature & Desk Review

Concepts, Methods, Assessment Measures, and Tools

- **Traditional Approach:** Traditional accessibility assessments have often relied on **compliance-based** frameworks, focusing on the **physical presence of infrastructure**.
- **Emerging Approach:** Universal Design (UD) has shifted from minimal compliance toward a more holistic, justice-oriented framework. It no longer focuses solely on disability but addresses the full range of human diversity — including age, gender, language, and income.
Emerging models like the Relational Model of Disability, the Gap Model, and the AON framework view accessibility as a dynamic relationship between people and environments. Feminist disability theory (Hamraie, 2013) reframes UD as a practice of collective access, calling for the dismantling of ableism and recognition of how mobility is shaped by intersecting identities.

Methods

- **Universal Design audits** assess how public spaces accommodate diverse users in terms of usability and clarity.
- **Walk-along interviews** capture real-world accessibility experiences through observation and personal narratives.
- **Participatory workshops** involve vulnerable groups in co-designing inclusive spaces.
- **Sensory mapping** documents how people navigate space using sound, touch, and sight.
- **GIS tools** measure spatial access.

7.3.2 Real-Life Applications & Users of These Methods

The document highlights real-world case studies showcasing universal design and aesthetic principles in urban planning.



Table 5 Real-world cases of Universal Design

Location	Application	Impact
Schandorffs Square (Oslo)	Universal design of public space with accessible pathways, seating, and visual contrasts.	Improved usability for wheelchair users, elderly, and visually impaired.
Bergen Light Rail (Norway)	Step-free tram access, tactile indicators for navigation.	Increased public transport use by differently-abled passengers.
Stovnerårnet (Oslo)	Inclusive outdoor recreation space with accessible pathways.	Encouraged diverse user groups to engage in outdoor activities.
Pilestredet Park (Oslo)	Car-free, green urban oasis with sensory-based navigation.	Enhanced well-being and accessibility for pedestrians and cyclists.

7.3.3 Differences Across User Groups & Intersectionality

The document emphasizes how different user groups experience urban spaces differently, highlighting the importance of inclusive design:

- People with mobility impairments face physical barriers (e.g., lack of ramps, uneven surfaces).
- Visually impaired individuals rely on contrast, texture, and sound for navigation.
- People with cognitive impairments benefit from simplified and intuitive layouts.
- Women and gender minorities often prioritise safety (for example lighting) in public spaces.

Groundbreaking approaches include:

- Sensory-Based Urban Design (e.g., smell, sound, and tactile elements).
- Participatory Planning with Disabled Communities (co-designing urban spaces).
- Aesthetic Sustainability (long-term usability and sensory experience).

7.3.4 Synthetic & Practice-Oriented Compendium for Cities

Table 6 Methods for Evaluating Walkability, Accessibility, Visibility, Security, and Safety

Evaluation Focus	Tools & Methods
Walkability	Pedestrian accessibility audits, GIS-based mapping
Accessibility	Universal design audits, Gap Model analysis
Visibility	Lighting studies, contrast assessments for visually impaired users
Security & Safety	Safety perception surveys, crime mapping
Aesthetic Experience	Sensory mapping, participatory design workshops



7.3.5 Dimensions for Evaluating Effectiveness of Methods

- **Usability Across User Groups:** Does the design serve diverse needs?
- **Aesthetic and Sensory Value:** Does the space enhance well-being?
- **Long-Term Accessibility:** Is the design sustainable over time?

7.3.6 Tailoring Findings for Different Audiences

For General Public & Community Stakeholders

- Highlight the impact of accessible public spaces on daily life and well-being.
- Encourage participation in co-designing inclusive streets.

For Policy Makers, Planners, & Designers

- Showcase best practices from cities implementing universal design.
- Provide evidence on the benefits of participatory planning.

For Researchers & Experts

- Encourage interdisciplinary approaches integrating urban design, health, and mobility.
- Explore new methods for evaluating aesthetic and sensory experiences.

7.3.7 Conclusion & Key Takeaways

- Universal design is critical for making cities inclusive and sustainable.
- Aesthetics play a key role in encouraging walking, cycling, and social interaction.
- Future urban planning must integrate sensory-based design for accessibility.

7.4 Justice (UoW/HVL)

Key Dimensions of Mobility Justice:

- **Distributive Justice:** Fair allocation of transport resources (e.g., safe cycling paths for all).
- **Procedural Justice:** Inclusive decision-making that values diverse voices.
- **Recognition Justice:** Acknowledging marginalized groups' experiences and needs.
- **Restorative Justice:** Addressing historical inequalities in transport infrastructure.

7.4.1 Users and Real-Life Applications of Mobility Justice Approaches

- **Distributive Justice Example:**
Cycle Superhighways in Copenhagen extended cycling routes to low-income areas to ensure equal access.
- **Procedural Justice Example:**
“Living Streets” in Ghent involved residents in designing car-free zones, ensuring community participation.
- **Recognition Justice Example:**
Inclusive Pedestrian Design in Malmö addressed accessibility issues for disabled and elderly populations.
- **Restorative Justice Example:**



Superblocks in Barcelona reclaimed street space for pedestrians in underserved areas, reducing pollution and improving safety.

Differences Across Intersectional User Groups

- Theories of transport justice historically neglected the diverse needs of groups like women, differently abled individuals, LGBTQI+, and migrants.
- Intersectionality matters: Transport policies impact individuals differently based on race, gender, income, and ability.

New Approaches Include:

- Intersectional data collection on mobility barriers.
- Participatory research incorporating narratives and lived experiences.

7.4.2 Synthetic & Practice-Oriented Compendium for Cities

Evaluating Walkability, Accessibility, Visibility, Security & Safety Through Epistemic Justice

Methods for Evaluation:

- Inclusive Data Collection: Surveys, focus groups, and digital tools that capture marginalized voices.
- Intersectional Analysis: Examines overlapping barriers faced by different user groups.
- Participatory Planning: Ensures affected communities shape transport decisions.
- Justice-Focused Project Appraisal: Assesses whether transport initiatives reduce social inequalities rather than just improve efficiency.

Justice Dimensions for Evaluation:

- Who benefits from mobility policies? Are marginalized groups included?
- Who participates in decision-making? Are policies co-created with communities?
- Are past injustices being addressed? Are resources reallocated to historically underserved areas?

7.4.3 Tailoring Findings for Different Audiences

General Public & Community Stakeholders:

Emphasize how mobility justice improves daily life, safety, and access to opportunities.

Policy Makers, Planners & Designers:

Highlight policy tools and interventions that create fairer transport systems.

Researchers & Experts:

Provide in-depth methodologies and frameworks for mobility justice analysis.

7.4.4 Conclusion

Mobility justice is not just about transport infrastructure but about power, access, and equity.

Achieving Just Streets requires an integrated approach considering distributive, procedural, recognition, and restorative justice.

Tools like inclusive data collection, participatory planning, and justice-oriented project evaluation are essential for ensuring fairness in mobility systems.



7.5 Hybrid approaches (IIT)

7.5.1 State-of-the-Art Literature & Desk Review

Walkability Assessment Methods

- Macro-Scale Walkability:
- SMARTRAQ Walkability Index (GIS-based) – Measures land-use mix, residential density, and street connectivity.
- Walkability Index (WI) – Uses parcel-level data to assess walkability at a block level (King County, Washington).
- Global Walkability Index – Evaluates pedestrian infrastructure quality, applied in developing countries (World Bank study).

Micro-Scale Walkability:

- Walkability Audit Tools – Observational methods analysing pedestrian facilities, safety, and aesthetics.
- SPACES Index – Street-scale walkability measurement based on functional, safety, aesthetic, and destination factors (Perth, Australia).
- Walk Score® Index – Measures street-level walkability by proximity to services, intersection density, and block length.

Objective Accessibility:

- **CT WALK Map** – Measures **co-accessibility for diverse age groups** within a walkable range (Amsterdam, Rotterdam).
- **PTV Access Score** – A GIS-based tool scoring accessibility for **walking, cycling, and public transport**.
- **Smart Traffic Monitoring Device** – AI-powered **vision sensors** tracking pedestrian and cyclist behavior (UK).

Subjective Accessibility:

- **YouWalk-UOS Mobile App** – Collects **user-perceived urban space accessibility** via images and ratings (Newcastle, UK).
- **Testing Accessibility for People with Disabilities** – Field study involving **disabled users evaluating accessibility barriers** (Vilnius, Lithuania).

Visibility Assessment Methods

Objective Visibility:

- Isovist Analysis – 3D modeling of visibility fields from specific urban locations.
- View Shade (ArcGIS) – Determines raster surface locations visible to observers.
- Visual Openness Analysis – Measures view corridors and street-level façade exposure (Urbanism Journal).
- Depthmap Tool – Visibility graph analysis to assess urban environments.

Security & Safety Assessment Methods

Safety Evaluation:

- SafoMeter Platform – Crowdsourced public space safety assessment, integrating subjective and objective data (Prishtina, Kosovo).
- Women-Oriented Perceived Safety Evaluation – Uses street view images and mobile phone data to analyse women's safety perceptions (Guangzhou, China).



- Virtual Reality Safety Perception Experiment – Simulates different street scenarios to assess safety perceptions (Zurich).

Security Assessment:

- Security Rating Index (GIS-based) – Maps urban areas vulnerable to crime (Portland, Tel Aviv).
- Relief Maps – Digital tool visualizing emotional perceptions of urban safety and discrimination (Barcelona).

7.5.2 Synthetic & Practice-Oriented Compendium for Cities

Quantitative Methods:

- GIS-based walkability/accessibility indexes.
- AI-powered traffic monitoring devices.
- Virtual reality experiments for perceived safety analysis.

Qualitative Methods:

- Community-driven assessments (e.g., YouWalk-UOS, Relief Maps).
- Survey-based safety evaluations (e.g., women's perceived safety tools).
- Participatory planning with marginalized groups (Vilnius disability study).
- Walk audits (e.g. IFP-r walk audit)
- Dimensions for Evaluating Effectiveness of Methods

Equity Considerations:

- Are all groups represented? (LGBTQI+, women, migrants, disabled individuals).
- Are past injustices addressed? (Restorative justice focus).

Methodological Robustness:

- How accurate is the data? (e.g., AI-based tracking vs. subjective surveys).
- Can it be applied across multiple scales? (street-level vs. city-wide).

Usability for Policymaking:

- Can decision-makers integrate findings into planning?
- Does the tool enable participatory governance?

7.5.3 Tailoring Findings for Different Audiences

- **General Public & Community Stakeholders:**
- Tools like YouWalk-UOS, Relief Maps, and Walkability Audits can help communities identify issues and advocate for urban improvements.

Policy Makers, Planners, & Designers:

- GIS-based methods (e.g., Walk Score®, PTV Access, SafoMeter) offer data-driven solutions for urban planning.
- Security Rating Index & Accessibility Mapping help prioritise investments in underserved areas.

Researchers & Experts:



- Advanced visibility analysis, connectivity modeling, and virtual safety perception tools offer deep insights into urban space design and its impact on mobility justice.

7.5.4 Conclusion

- Innovative approaches in urban mobility evaluation integrate GIS tools, AI-driven analytics, and participatory methods.
- Data collection should be intersectional, capturing diverse experiences (women, LGBTQI+, migrants, differently abled, etc.).
- Cities should adopt multi-scale assessments—from street-level audits to city-wide accessibility tools—to ensure equitable mobility.

7.6 Spatial analysis methods (HVL)

Walkability and Accessibility Analysis:

- OS-WALK-EU: A QGIS plugin that evaluates the walkability index based on factors like residential density, proximity to amenities, green/blue space, and pedestrian activity.
- Walkability Audit: Assesses pedestrian infrastructure and safety by measuring connectivity, land use diversity, and density.
- 15-Minute City Score Toolkit: Uses isochrone mapping to measure how well residents can access essential services within a 15-minute walk or bike ride.

Spatial and Network Analysis:

- sDNA (Spatial Design Network Analysis): Evaluates urban and transport networks based on betweenness, closeness, and density to identify key mobility corridors.
- Urban Network Analysis: Computes graph measures such as reach, gravity, betweenness, and closeness to assess how transport networks serve different areas.

Multi-Criteria Decision-Making in Transport Planning:

- Analytic Hierarchy Process (AHP) & Hybrid Methods (TOPSIS, Fuzzy AHP): Used to assess service quality, safety, and accessibility for different transport modes.

Urban Resilience and Justice Principles:

- Street Justice Principles Integration: Many tools (OS-WALK-EU, 15-Minute City Score, sDNA) emphasize equity by identifying underserved areas and promoting pedestrian-friendly interventions.

7.6.1 Who Uses These Methods and Real-Life Applications:

Policy Makers & Urban Planners: Utilize tools like OS-WALK-EU and Walkability Index for decision-making on urban design.

Academics & Researchers: Employ network analysis tools (sDNA, Urban Network Analysis) to study transport justice and accessibility.

Real-World Case Studies:

- OS-WALK-EU applied in **Dublin, Düsseldorf, and Lisbon** to assess walkability and identify pedestrian-friendly areas.
- 15-Minute City Score used in **Paris and Milan** to optimize urban accessibility.
- AHP & TOPSIS methods applied in **urban transport research** to evaluate service quality and passenger satisfaction.



Intersectionality and Differentiation for User Groups

The tools and methods highlight disparities in urban mobility across user groups:

- **Differently Abled Individuals:** Assessments often include accessibility measures (e.g., ramp availability, obstacle-free pathways).
- **Women & LGBTQI+ Communities:** Tools like the Walkability Index and 15-Minute City Score incorporate safety perceptions, lighting, and surveillance.
- **Children & Older Adults:** Evaluations focus on proximity to schools, senior centers, and public seating availability.

7.6.2 Compendium of Tools and Methods for Cities

Methods for Evaluating Walkability, Security, and Safety:

- **GIS-Based Walkability Assessments:** OS-WALK-EU, Walkability Index, and Urban Network Analysis provide spatial insights on pedestrian infrastructure.
- **Crime & Perceived Safety Analysis:** Some studies (e.g., on transport justice and gender-sensitive planning) suggest using participatory mapping and user surveys to assess fear perception in urban spaces.
- **Multi-Modal Network Analysis:** sDNA and Urban Network Analysis help assess public transport connectivity, identifying mobility barriers.

Evaluation Dimensions for Efficacy:

- **Inclusivity:** Tools assess accessibility for diverse user groups.
- **Efficiency:** Methods like sDNA and AHP help optimize transport networks.
- **Equity & Justice:** The tools help identify disparities in public space access.
- **Sustainability:** Tools like the 15-Minute City Score promote reduced car dependency.

Recommendations for Target Audiences

- **General Public & Community Stakeholders:** Findings should emphasize how improved walkability and safer streets benefit community well-being.
- **Policy Makers & Urban Designers:** Provide evidence-based recommendations to implement equity-driven transport policies.
- **Researchers & Experts:** Offer methodological insights into innovative transport planning approaches.



8. Selecting appropriate methods and tools

The following tables can help you **select which tools are most appropriate** In relation to the **mobility needs of a city** (safety, accessibility, comfort, attractiveness, justice and multimodal integration) and **typology of disadvantaged groups** (socio-economic, age, gender, disability, LGBTQ+)

8.1 Who needs priority? (ethics of care concept)

First, we suggest that you determine who/which groups have priority in the to be decided strategy or intervention.

Table 7 Matrix of mobility needs against disadvantaged groups

Mobility needs? → Disadvantaged groups ↓	Safety	Accessib ility	Comfort	Attractive ness	Justice	Multimod al integratio n
Socio-economic						
Age	*					
Gender	**					
Disability	*	**	***	**	****	**
LGBTQ+	***	*				

8.2 Which tools to select?

Next, consider which tools and methods are available and which target users are these tools meant to address.

Table 8 Tool selection matrix

Tools/ methods? → Target users↓	Syntactic & GIS	Indices	Epistemic justice	Video and trajectory analysis	Communica tion strategies?
Civil societies (Basic)	+		++		++
Polycymake rs, researchers , Designers	+	+++	++	+	+++



Tools/ methods? → Target users↓	Syntactic & GIS	Indices	Epistemic justice	Video and trajectory analysis	Communica tion strategies?
(intermediate)					
Researchers (Advanced)	++	+	++	+++	+

8.3 Conclusion

Tools are context specific. There is a forest of tools out there all geared towards specific concerns and target audiences. There is value in context specificity. However, what is currently lacking is a good framework (toolbox) for balancing injustices and conflicts.

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D2.1 Literature reviews and compendium reports

Compendium 3

Behavioural strategies for achieving just active mobility

EU project number
Project website

101104240
www.just-streets.eu



Deliverable Details

EU project number	101104240
Project title	Mobility justice for all: framing safer, healthier and happier streets
Project acronym	JUST STREETS
Project start date	January 2024
Deliverable number	D2.1
Deliverable title	Literature reviews and compendium reports. Compendium 3: Behavioural strategies for achieving just active mobility
Related workpackage	WP2 Framing active users' mobility needs and envisioning innovative solutions
Related task(s)	T2.3 Nudging behavioural change
Lead organisation	LINKS Foundation
Submission date	31/05/2025
Delivery type¹	R
Dissemination level²	PU

Version	Date	Person	Action	Status
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0.2	24/04/2025	Alberto Magni, Quynh Nhu Nguyen, Roxana Olariu (SF)	Peer Review	Draft
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¹ Delivery type: **R**: Document, report; **DEM**: Demonstrator, pilot, prototype; **DEC**: Websites, patent filings, videos, etc; **OTHER**; **ETHICS**: Ethics requirement; **ORDP**: Open Research Data Pilot.

² Dissemination Level: **PU**: Public; **CO**: Confidential, only for members of the consortium (including the Commission Services); **EU-RES** Classified Information - restraint UE; **EU-CON**: Classified Information - confidential UE; **EU-SEC**: Classified Information - secret UE



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About JUST STREETS

The JUST STREETS project focuses on developing streets shaped by active mobility that are both sustainable and inclusive for all citizens. This shift from the use of cars towards more active modes of mobility will be led by prioritizing the needs and visions of marginalized social groups often not involved in the planning processes, particularly women, migrants, the elderly, LGBTQI+ individuals, and people with disabilities.

Goal of the strong international consortium is to support 12 cities in revolutionizing public spaces and streets by putting all of its citizens first. The project addresses the pressing need to transform our streets both from an infrastructural as well as behavioural perspective, shifting away from car-centric environments towards streets that cater to the needs of all citizens.

JUST STREETS is a 32-partner international Horizon Europe project coordinated by the Future Cities and Communities division of Turin-based LINKS Foundation and scheduled from January 2024 to June 2027. Partner cities include the cities of Amsterdam (Netherlands), Braga (Portugal), Cugir (Romania), Haifa (Israel), Kozani (Greece), Milan (Italy), Riga (Latvia), Southwark (UK), Vilnius (Lithuania), Vratsa (Bulgaria), Westminster (UK), and Zaragoza (Spain).

Expert partners of the JUST STREETS consortium are Fondazione LINKS (Italy), Agenzia TPL (Italy), Centro Studi Pim (Italy), Climate Alliance (Germany), European Cyclists' Federation (Belgium), Fundación CIRCE (Spain), International Federation of Pedestrians (Belgium), IT University of Copenhagen (Denmark), Politecnico di Torino (Italy), RINA Consulting (Italy), SocialFare (Italy), Southeast European Technological Company – SETECHCO (Bulgaria), Technical University of Cluj-Napoca (Romania), TECHNION – Israel Institute of Technology (Israel), TREDIT (Greece), University of Amsterdam (Netherlands), University of Porto (Portugal), University of Westminster (UK), Urban Future (Austria), and Western Norway University of Applied Sciences (Norway).

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Executive Summary

This report, developed within the JUST STREETS WP2, D2.1 explores how behavioural strategies can be designed and implemented to promote active mobility in ways that are just, inclusive, and responsive to the needs of diverse urban populations. The focus is on enabling walking, wheeling, and cycling for individuals and groups who face systemic barriers to mobility, particularly those who are often marginalised in transport planning, including older adults, children, persons with disabilities, low-income communities, ethnic minorities, migrants, and LGBTQIA+ individuals.

Recognising that behaviour is shaped by a dynamic interplay of individual, societal, and infrastructural factors, the report draws on the COM-B model (Capability, Opportunity, Motivation–Behaviour) and Behaviour Change Wheel (BCW) to understand and influence mobility behaviours. Through these frameworks, the report identifies six core mobility needs that must be addressed to foster equitable access to active transport: accessibility, safety and security, reachability of essential services, affordability of mobility equipment, reliability of infrastructure, and environmental comfort. The reports also draws on 27 semi-structured interviews were conducted with mobility specialists and representatives of marginalised communities across 18 countries, with the aim of identifying groups who face the biggest barriers to walking, cycling and wheeling.

To inform practical application, the report compiles 92 good practices from 22 countries and organises them into five main categories of behavioural interventions: (A) coaching, empowerment, and community engagement; (B) informational and awareness-raising strategies; (C) digital and smart mobility systems; (D) economic levers and incentives; and (E) improvements to the walking and cycling environment. Each category includes subgroups (e.g., personalised information services, placemaking initiatives, school mobility programmes) and is mapped against COM-B components and relevant BCW intervention functions such as education, enablement, persuasion, and environmental restructuring.

The report also outlines a structured approach to designing interventions, offering practical tools including the Theoretical Domains Framework (TDF), Behaviour Change Techniques (BCTs), and the APEASE criteria (Affordability, Practicability, Effectiveness, Acceptability, Side-effects, Equity). Together, these instruments support the development of interventions that are not only evidence-based but also context-sensitive and adaptable to diverse urban realities.

The report highlights that equitable active mobility cannot be achieved through infrastructure upgrades alone. While physical improvements remain essential, they must be paired with behavioural insights, educational tools, economic measures, digital supports, and participatory processes. Only through the integration of these diverse strategies can cities respond effectively to the complex realities faced by marginalised populations and create environments that truly enable and encourage just active mobility for all.



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1. Introduction

The objective of this report is to explore effective behavioural interventions that promote active mobility in urban environments, with a focus on addressing the needs and barriers faced by vulnerable groups in walking, wheeling, and cycling.

Developed under Task 2.3 “Nudging behavioural change”, this part aims to provide **overview and guidance on the most appropriate behavioural strategies to motivate and accompany vulnerable target groups towards sustainable active transport choices**. These strategies can be adopted by cities, urban planners, mobility service providers, local administrations, NGOs, and community organisations seeking to promote inclusive and low-carbon mobility solutions at the local level.

Indeed, individual mobility choices are influenced by a combination of personal, societal, and infrastructural factors. Beyond personal preferences, and socio-economic status, elements such as cultural norms and social relationships significantly impact transportation decisions¹. Multiple studies show that psychographic variables (e.g. personality, lifestyle, social class) often predict human behaviour more effectively than demographic ones (e.g., age, sex, income, education). Factors such as attitude, motivation, interests, and opinions, as well as the historical-social context, strongly influence the ways individuals behave. Past research emphasizes that crowd behaviour must be understood within its social context^{2, 3}, reinforcing the notion that individual behaviour cannot be separated from the society in which a person lives⁴. Additionally, it has been argued that human behaviour is best understood through the interplay between language, culture, and social relationships, highlighting the interdependence of individuals and their societies⁵. This social dimension has been clearly demonstrated in classic studies showing how people's judgments and decisions often conform to group norms⁶, as well as research revealing that obedience to authority can override personal moral standards. Collectively, these studies underscore the profound impact that norms, social forces, and contextual factors have on shaping human behaviour.

Over time, researchers across psychology, sociology, and economics have proposed various frameworks to explain, predict, and influence human behaviour. Although each model highlights several aspects (ranging from internal motivations and social pressures to habitual cues and cognitive biases) they collectively reinforce the notion that behaviour is neither purely rational nor fixed. Instead, it emerges from a dynamic interplay of personal beliefs, environmental contexts, and interpersonal influences. By mapping out these elements and their interactions, the frameworks offer valuable insights for designing interventions, policies, and communication strategies aimed at guiding individuals and communities toward more desirable or sustainable actions.

Several influential models have been developed to unpack these complex dynamics. Among the most notable frameworks that have shaped our understanding of behaviour change are:

- **Theory of Reasoned Action (TRA)**⁷ focuses on behavioural intention as the main predictor of action, driven by personal attitude (positive/negative evaluation of the behaviour that refers to the individual's personal judgement about whether performing the behaviour will lead to desirable or undesirable outcomes; for example, viewing cycling to work as beneficial for health and the environment that is positive, or as inconvenient and tiring as negative, which in turn shapes their



intention to engage in that behaviour) and subjective norm (social pressure or expectations).

- **Theory of Planned Behaviour (TPB)**⁸ extends the above by adding perceived behavioural control (the perceived ease or difficulty of performing the behaviour). Experience and social feedback further influence whether individuals feel capable of acting.
- **Behaviourism**⁹ and **Social Learning Theories**¹⁰ argue that complex behaviours are shaped gradually through reinforcement and imitation. Positive outcomes or rewards increase the likelihood of repeated behaviour.
- **Fogg Behaviour Model (FBM)**¹¹ proposes that motivation, ability, and triggers must converge at the same time for behaviour to occur. Motivators include pleasure/pain or social acceptance/rejection, while ability depends on factors like time, mental effort, or routine. Triggers (e.g. alarms, alerts) must happen at the right moment.
- **Nudge Theory**¹², based on behavioural economics, suggests that minor changes in our environment can help guide us to better choices without limiting our freedom. It works by using common habits—like sticking with default options—to gently steer behaviour toward positive outcomes.
- **COM-B**¹³ and **Behaviour Change Wheel**¹⁴ (BCW) suggests that Capability (psychological/physical), Opportunity (social/physical), and Motivation (reflective/automatic) interact to produce a specific behaviour. This model integrates a range of interventions to help design and evaluate behaviour change strategies.

The COM-B and BCW are among the most recent frameworks and have guided this study, supporting the authors in defining interventions effectively able to influence people's behaviour.

2. Framing: Behavioural strategies for just active mobility

The following sequence outlines the methodological process we followed to identify, analyse, and select good practices capable of influencing mobility behaviours. While these stages reflect key principles from behavioural science (such as the Behaviour Change Wheel and COM-B model), they are presented here not as a guide for intervention design per se, but rather to describe our analytical approach. A separate box (“Key actions to design a behavioural intervention”) offers insights and resources for planners interested in applying these concepts directly.

2.1 Step 1: People targeted by the behavioural interventions

The first crucial step for this study was to define **which categories of people should be considered vulnerable when speaking of active mobility**. Specific categories of vulnerable groups were considered in this study, based on the criterion that they may face difficulties (whether physical, cognitive, or financial for example) in moving by walking, cycling, or wheeling. This approach considers therefore all individuals who use the city’s streets, whether they are residents or temporary populations (such as for example tourists), and assumes that everyone has the need and the right to move freely. Specifically, between May and November 2024, semi-structured interviews were conducted with 27 mobility specialists and representatives of marginalised communities, as part of the activities foreseen under Work Package 2 of the *Just Streets* project. Participants came from 18 countries, with the majority (23) based in EU member states. The interviewees represented a range of sectors, including academia (7), consultancy (5), activism (5), policymaking (3) and networks (7). These interviews helped identify the groups of people who face the greatest barriers to engaging in active mobility. They also provided valuable insights into what are perceived to be their main needs as further outlined in Step 2 of this chapter. The following table shows the different vulnerable groups considered, sorted in alphabetical order, and their short definition.

Vulnerable groups	Short definition
Children	Children between birth and puberty (0-12 years).
Ethnic minorities	Individuals from minority ethnic backgrounds.
Families	Households that include at least one small child who requires mobility assistance.
LGBTQIA+ individuals	Individuals with not-heterosexual orientations, not-cis gender identities, and gender roles.
Low-income individuals	Individuals whose financial resources fall below the urban average income level.
Migrants	Individuals from other countries who have moved to find work or better living conditions.
Older adults	Individuals above 65 years old.
Persons with disabilities	Individuals with physical, sensory, or cognitive impairments, including permanent or temporary physical and/or mental disabilities.



Street workers / night workers	Individuals engaged in jobs conducted outdoors such as couriers and riders, street vendors, performers, or individuals involved in informal or unregulated economic activities and individuals who primarily work during nighttime hours.
Women	Individuals who perceived themselves as part of the woman gender.
Youth	Teenagers and youth (from 13 to 24 years).

Table 1. Vulnerable groups considered and their definition.

Starting from the premise that positive and respectful language fosters equality, inclusivity, and respect for diversity, special attention was given to ensuring justice also in the terminology used.

The construction of an inclusive context requires the use of a language that refers to the most accredited conceptual models and what is supported by international bodies, such as the United Nations, the World Health Organization, and the European Community. Therefore, the PVS groups have been named based on the latest official indications, although not without considerable challenges and doubts in the process. For example, **it is better to talk of “older people” or “older adults”** that are more neutral terms instead of terms that are homogenising and stocking such as “seniors” or “elderly”¹⁵. According to the United Nations¹⁶ **the people-first language is the most widely accepted** language for referring to “**persons with disabilities**” and it is also the language used in the Convention on the Rights of Persons with Disabilities. Indeed, this terminology acknowledges that disability does not define an individual; rather, it represents just one aspect of their life or a condition that may be temporary. Regarding **ethnic minorities**, while the term may appear inappropriate (given that racism and racial or ethnic discrimination are often shaped by how society categorises individuals in racialised terms) this study adopts the terminology as it relates to discrimination. Additionally, it serves as a broad statistical category that facilitates the disaggregation of data to evaluate societal equality. Furthermore, it can reflect an aspect of a person’s self-identification and ethnic affiliation, highlighting a personal characteristic^{17, 18}.

2.2 Step 2: People’s intersectional identities and needs

To develop effective and inclusive active mobility behavioural interventions, it was essential to first identify the specific needs and shared challenges faced by vulnerable groups. Behavioural change toward active mobility is influenced by both internal motivations and external affordances. When, for example, infrastructure is perceived as unsafe, exclusionary, or physically demanding, vulnerable users are less likely to adopt active mobility habits²⁸. Therefore, this step of the study focuses on **mapping these needs to different populations**, recognising that an **intersectionality lens** suggests mobility barriers are not simply additive but are shaped by complex, interacting factors that can amplify or mitigate each other.

A combination of insights from the 27 interviews conducted in 2024 within the Just Streets project and findings from a literature review helped to identify the key needs related to active mobility that are often experienced by vulnerable groups. As a result, six main needs, outlined in the following table (Table 2), have been identified as particularly relevant. These needs represent potential barriers that may limit or prevent vulnerable individuals from engaging in active mobility.



Needs	Description
Accessibility	<i>Having accessible infrastructure for walking/wheeling and cycling to travel destinations, along with other physical factors that facilitate active mobility on foot/wheels along the routes and having accessible public information on walkable/rolling and cycling pathways in both urban and suburban areas.</i> Accessibility can be considered as a pre-requisite for active mobility. Accessible infrastructure includes step-free pathways, smooth and unobstructed pavements, clearly marked and protected bike lanes, and the presence of supportive elements like benches, lighting, and rest areas¹⁹. Such features are not mere conveniences but necessities for groups like older adults, persons with disabilities, and families with small children, who may rely on mobility aids or strollers. For instance, benches and accessible public toilets significantly affect older adults' capacity to engage in walking^{20, 21}, while poorly designed crossings and high curbs restrict persons with disabilities and their caregivers^{22, 23}. In low-income and ethnic minority neighbourhoods, a legacy of underinvestment has led to a scarcity of quality cycling and pedestrian infrastructure. Bike-sharing services often exclude these areas, and even when infrastructure is introduced, it may reflect cultural biases that fail to resonate with local populations²⁴. This disparity perpetuates inequality in access to mobility options²⁵. However, infrastructure alone is insufficient without accessible public information. Maps, tactile signage, and audio navigation tools enhance confidence and autonomy, particularly for individuals with sensory or cognitive impairments²⁶. For migrants, language barriers can make it difficult to understand mobility systems; thus, multilingual signage and simplified visual guides are essential to enhance urban navigation. Similarly, persons with disabilities benefit from digital tools which can highlight accessibility barriers in advance²⁷.
Safety and security	<i>Feeling of being safe from direct or collateral injuries or incidents on the road (safety) and, from intentional criminal activity or violence (security). This dual aspect is especially crucial for vulnerable groups who may face heightened risks or feel more exposed in certain environments. The safety perception is influenced not only by external, objective conditions but also by individual attitudes and subjective perceptions.</i> In terms of road safety, traffic safety measures, including dedicated bike lanes, well-marked pedestrian crossings, traffic-calming strategies, and proper lighting, are essential components of infrastructure design aimed at minimizing the risk of accidents and collisions. When such infrastructure is designed to accommodate diverse users (such as for example incorporating wide sidewalks for strollers and barrier-free pathways for people with mobility challenges) it significantly improves safety outcomes for vulnerable populations. Pedestrian crossings, for example, are commonly calibrated to a walking speed of at least 1.2 meters per second, a threshold many older individuals cannot meet²⁸. As a result, these users may feel rushed or unsafe, increasing both physical risk and psychological



	stress. This issue is also relevant for families with small children, who typically walk at a slower pace or use strollers, and for persons with disabilities, including those with chronic illnesses or temporary impairments. In terms of road safety and gender dynamics, cycling is perceived by many women as requiring assertiveness and confidence which can further deter participation in environments that lack dedicated, protected infrastructure^{29, 30}. These barriers highlight the role of subjective risk perception in mobility decisions and underscore the need for inclusive and reassuring design. Also, living in peripheral urban areas where infrastructure investment is scarce presents additional challenges. Low-income neighbourhoods, which typically feature poor pedestrian infrastructure, often report higher rates of pedestrian crashes and injuries³¹. Also, the complexity of family trip-chaining, where caregivers must coordinate multiple errands, school drop-offs, and work commutes, combined with time pressures, leads many families to opt for car-based transport. This dynamic is reinforced by parental safety concerns, which are a major factor contributing to the decline in youth cycling, even in contexts where cycling is otherwise common. The perception that walking or biking to school is unsafe lead to a growing reliance on cars. When speaking of security, environmental restructuring, including the implementation of well-lit, open, and visible public spaces, especially those that remain active and populated at night, plays a critical role in improving perceptions of personal security and reducing the risk of crime or harassment. Slower walking speeds can amplify the perception of exposure and limit the ability to avoid or escape potentially threatening situations. This is especially relevant for persons with disabilities, older adults, women, and LGBTQIA+ individuals, who may respond to perceived insecurity by adopting self-policing behaviours such as avoiding certain areas or refraining from traveling at specific times of day³². Among women and LGBTQIA+ individuals, fear of harassment, violence, or public scrutiny is a commonly reported deterrent to walking or cycling, particularly after dark. For women, these safety concerns often result in modified travel behaviours, such as avoiding certain routes or times of day, which contributes to the persistent gender gap in active mobility or modified means of transport (cars instead of walking/cycling also for short distances).
Reachability	<i>Having essential services and amenities (such as schools, healthcare facilities, shops, public transportation, social services, recreational spaces, and workplaces) accessible within a reasonable distance or time by walking, wheeling, or cycling.</i> The "15-minute city" model, by Carlos Moreno³³, advocates for an urban environment in which most daily needs can be met within a 15-minute walk or bike ride from home. However, what constitutes a "reasonable distance" is not uniform across populations; it varies depending on socio-demographic and environmental factors such as age, mobility level, urban density, and trip purpose. For example, older adults and individuals with health conditions tend to walk or cycle shorter distances due to physical limitations and safety concerns³⁴, reinforcing the need for local service availability. Housing in walkable areas is often prohibitively expensive, limiting lower-income individuals' ability to reside near key amenities and



	basic services and education, healthcare, or employment centres ³⁵ . This spatial inequality in access to active mobility-friendly neighbourhoods can reinforce socio-economic segregation.
Affordability	<i>Financial accessibility to essential cycling equipment (such as cargo bikes, hand-bikes, or electric bicycles) that can be crucial for certain groups, including parents with young children, individuals with physical disabilities, and those who need to travel longer distances. It is particularly important to consider groups with limited financial means, who may not have the economic resources to purchase such specialised equipment, ensuring that cycling remains an inclusive and equitable mode of transport for all.</i> Beyond the direct costs of cycling equipment, broader socioeconomic factors exacerbate these challenges. Rising living expenses and escalating rents in city centres compel many low-income households to relocate to peripheral areas where housing is more affordable. This displacement increases commuting distances and complicates the feasibility of cycling as a primary mode of transportation. Longer commutes not only demand more time and physical effort but also require reliable infrastructure and favourable weather conditions.
Reliability	Having assurance that active travel options are consistent, safe, and dependable under varying conditions. This is especially critical for vulnerable groups, including the elderly, individuals with disabilities, parents with young children, or those with limited financial resources, who may face greater challenges in adapting to unexpected disruptions. Reliability in active mobility means that routes and infrastructure must be resilient to challenges such as: extreme weather conditions (for example heavy rain, snow, heatwaves), that can deter or endanger users; equipment failures, like a broken bicycle or wheelchair, which can have a disproportionate impact on individuals who rely on specific mobility aids; infrastructure disruptions, such as poorly maintained pavements, inaccessible crossings, or unplanned roadworks, which can pose obstacles, especially for those with limited mobility.
Pleasantness and comfort	The need for pleasantness and comfort in active mobility emphasises the importance of creating environments that offer both ease and enjoyment for individuals while walking, wheeling, or cycling. These factors play a crucial role in encouraging regular use of active mobility modes, particularly for vulnerable populations. A pleasant and comfortable active mobility environment should incorporate: aesthetically pleasing and well-maintained infrastructure (such as tree-lined paths, clean sidewalks, green spaces, public art); environmental considerations (such as shaded areas, reduced noise pollution, better air quality) especially important for those with respiratory issues or young children; ergonomic design features (such as seating areas, resting spots, accessible water fountains), which are essential for people who may need breaks during their journey, such as older adults.

Table 2. Active mobility needs across vulnerable populations: definition.



While these needs are relevant for all individuals, regardless of their socio-demographic profiles, certain groups are disproportionately impacted by these factors when choosing their modes of transportation.

The analysis of various vulnerable groups reveals how **each one faces distinct challenges** in engaging with active travel due to factors such as economic resources, physical abilities, and the design of shared spaces. By examining both the common barriers and the groups most heavily affected, it becomes clear that certain structural issues hinder multiple segments of the population.

Below is an overview of the key insights:

- **Diverse needs among vulnerable groups:** individuals and communities experiencing different forms of vulnerability often require tailored measures to enable safe and comfortable active journeys. For instance, older adults may rely on level pavements, frequent resting points, and unobstructed paths due to decreased mobility; parents with small children benefit from stroller-friendly footpaths or protected cycle lanes; and individuals with disabilities need seamless, obstacle-free routes and accessible crossings. Meanwhile, people on low incomes may find it difficult to acquire or maintain necessary equipment (e.g. specific bicycles), and residents in suburban areas can face inadequate infrastructure, such as missing sidewalks or poorly lit walkways.
- **Most common barriers to active mobility:** despite varied contexts, many vulnerable groups share recurring obstacles, including insufficient or poorly maintained pathways, lack of safe pedestrian crossings, and inadequate lighting. Where these deficits coincide with specific needs (such as a steep, uneven route combined with limited physical ability) mobility options become even more restricted. These barriers can be structural in nature, reflecting broader gaps in urban planning that disproportionately affect those with the least flexibility.
- **Multiple layers of disadvantage and intersectionality:** although each vulnerable group faces its own set of challenges, some individuals experience multiple disadvantages at once. For example, a person with limited mobility living in a hilly area lacking continuous sidewalks must contend with both difficult terrain and inaccessible infrastructure. Older adults on low incomes may struggle not only with physical constraints but also with financial barriers, making it hard to invest in adaptive equipment. This concept of intersectionality highlights how overlapping vulnerabilities amplify overall hardship (or on the contrary mitigate), significantly restricting the ability to walk, cycle, or wheel independently.

2.3 Step 3: Applying the COM-B model and the Behaviour Change wheel

In addition to the mobility needs identified and highlighted in the previous section, there are several factors that can either support or hinder the adoption of certain behaviours, which depend specifically on the individual and their physical, psychological, and social condition. These factors have been identified by economists and behavioural psychologists and are described through a behavioural model known as COM-B.

The COM-B model offers a comprehensive and structured method for understanding behaviour change, particularly valuable in addressing the complexity of human behaviour in the context of mobility choices. Its core strength lies in identifying the root causes of existing behaviours, whether they act as barriers or enablers, thus providing a solid foundation for developing targeted strategies to promote active mobility³⁶.



The COM-B Model

To improve intervention design, multiple frameworks have attempted to account for both internal and external factors affecting behaviours. Michie et al. (2011)³⁷ introduced the COM-B model of behaviours change as a “behaviours system,” where Capability, Opportunity, and Motivation interact to produce behaviours. Any change in behaviour must therefore involve at least one of these components.

- **Capability** refers to an individual’s *psychological* and *physical* capacity to engage in a specific activity, including both the necessary knowledge and skills as well as the bodily functions required.
- **Opportunity** includes all the external factors within *physical* and *social environment* which makes the behaviour feasible.
- **Motivation** encompasses both *reflective* and *automatic* processes: reflective motivation involves conscious decision-making (e.g., plans, beliefs, attitudes, goals), while automatic motivation involves habitual and emotional responses that occur largely outside of conscious awareness.
-

By combining the three key-elements that determine behaviours, the behavioural system ultimately identifies six underlying components.

While some of the three components may be linked to the specific mobility needs previously identified, they are also considered enabling conditions for behaviour change itself. For this reason, they will serve as the reference framework, within this study, used to identify, explore, and categorise the different experiences and initiatives aimed at promoting behavioural change.

When applying the COM-B model to active mobility choices:

- **Capability** refers to the knowledge and skills necessary to perform active travel behaviour as well as physical ability as well as cognitive skills.
- **Opportunity** evaluates whether the surrounding physical and social conditions enable or encourage active travel.
- **Motivation** when operates as a reflective process, it may involve personal goals and beliefs about the benefits of walking or cycling, while when operates as automatic process encompasses habits and emotional responses to commuting choices.

The following table (Table 3) provides a more comprehensive explanation.

COM-B key elements	COM-B key sub-elements
Capability	Psychological <i>Refers to internal cognitive abilities required for active mobility, such as understanding routes, navigating urban spaces safely, knowledge of traffic rules, and mental resilience to manage challenges in the environment.</i>
	Physical <i>Involves the physical capacity to engage in active mobility, including body mechanics, strength, endurance, balance, and overall physical readiness.</i>
Opportunity	Physical <i>Encompasses external, tangible factors that enable or hinder active mobility, such as the availability and quality of infrastructure, resources, tools, and environmental conditions.</i>



	Social <i>Involves the influence of social norms, community dynamics, interpersonal relationships, and social support systems that shape active mobility behaviours.</i>
Motivation	Reflective <i>Relates to conscious decision-making processes, including planning, evaluating outcomes, and setting goals. Reflective motivation drives individuals to choose active mobility based on personal values, knowledge, and perceived benefits.</i>
	Automatic <i>Refers to habitual behaviours and emotional responses that influence active mobility. This includes ingrained habits, routines, or impulses (such as routinely choosing to walk or cycle) that occur without deliberate decision-making.</i>

Table 3. COM-B model for active mobility choices.

Building on this, Table 4 maps the specific needs of vulnerable groups to the COM-B model, highlighting which behavioural components are most relevant to addressing each need. This mapping reveals how numerous factors either enable or constrain active mobility for diverse groups. By understanding these connections, practitioners can identify which areas to target when designing interventions. For instance, improving accessibility may require addressing both physical opportunity and capability, while enhancing safety and security involves strengthening both capability and social opportunity.

Vulnerable groups needs	Link to the COM-B Model					
	Capability		Opportunity		Motivation	
	<i>psychological</i>	<i>physical</i>	<i>physical</i>	<i>social</i>	<i>reflective</i>	<i>automatic</i>
Accessibility	x	x	x	x		
Safety and security	x		x	x		x
Reachability			x	x	x	
Affordability			x	x	x	
Reliability		x	x		x	x
Pleasantness and comfort		x	x		x	x

Table 4. Link between COM-B key elements and vulnerable groups' needs.

The COM-B model has been then combined with the Behaviour Change Wheel (BCW) to identify intervention strategies. Indeed, the BCW provides a framework for classifying behavioural change practices into specific categories of interventions, ensuring that the most appropriate approaches are applied to overcome identified barriers and leverage existing enablers.

The Behaviour Change Wheel (BCW) acts as a bridge between the factors influencing behaviour (as identified by the COM-B model) and the types of interventions that can effectively drive a change. In other words, **while the COM-B model helps to understand why people behave in certain ways (by looking at their Capability, Opportunity, and Motivation) the**

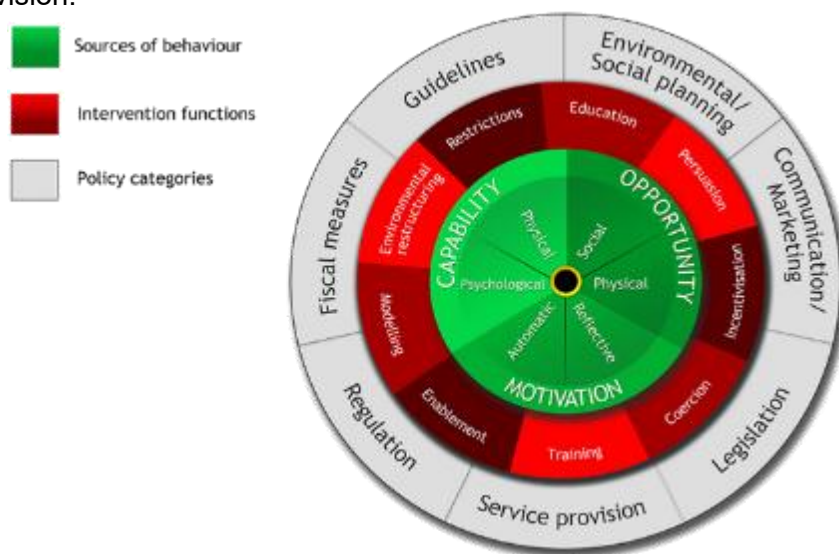


BCW guides how to design targeted interventions that address these factors. It offers a **structured method to map specific behavioural challenges to appropriate strategies**, ensuring that interventions are not only evidence-based but also tailored to the context.

The Behaviour Change Wheel (BCW)

The Behaviour Change Wheel (BCW)³⁸ was developed by reviewing 19 existing behaviour change frameworks and offers a structured approach to designing effective interventions. It consists of three interconnected layers, where each layer provides a different perspective to help design behavioural interventions:

- **the hub** focuses on identifying the **key sources of behaviour** (based on the COM-B model) that should be targeted for change.
- **the middle layer** presents **nine types of intervention functions** (which are Education, Persuasion, Incentivization, Coercion, Training, Restriction, Environmental Restructuring, Modelling, and Enablement) that can be selected depending on the specific behavioural factors identified (note that the diagram it's only a representation and does not imply that intervention functions are directly matched with the specific correspondents COM-B elements displayed in it).
- **the outer layer** outlines **seven policy categories** that can help implement these interventions, such as legislation, environmental planning, or service provision.



Through the analysis and interplay of these three layers, the BCW provides a systematic way of identifying relevant intervention functions and policy categories based on what is understood about the target behaviour.

By focusing on the nine types of intervention functions within the BCW, practitioners can systematically tailor interventions to overcome specific challenges in active mobility and enhance their effectiveness. The table below outlines the nine BCW intervention functions and how they align with elements of the COM-B model to shape behaviour.

Intervention Functions	Definition	Link to the COM-B Model					
		Capability		Opportunity		Motivation	
		psychological	physical	physical	social	reflective	automatic



Education	Increasing knowledge or understanding	x				x	
Persuasion	Using communication to induce positive or negative feelings or stimulate action					x	x
Incentivization	Creating expectation of reward					x	x
Coercion	Creating expectation of punishment or cost					x	x
Training	Imparting skills	x	x			x	x
Enablement	Increasing means/reducing barriers to increase capability (beyond education and training) or opportunity (beyond environmental restructuring)	x	x			x	x
Modelling	Providing an example for people to aspire to or imitate				x		
Environmental restructuring	Changing the physical or social context	x	x	x	x	x	x
Restriction	Using rules to reduce the opportunity to engage in the target behaviour (or to increase the target behaviour by reducing the opportunity to engage in competing behaviours)			x	x		

Table 5. Intervention functions from BCW and links to COM-B and vulnerable groups' needs.



The mapping of vulnerable groups' needs to the COM-B and BCW frameworks highlights how diverse intervention functions can support behavioural change in active mobility.

A central element across many needs is environmental restructuring, which plays a pivotal role in both capability and opportunity. By physically altering urban spaces (such as creating safer crossings, improving lighting, or adding green areas) cities can significantly enhance accessibility, safety, and the overall experience of active mobility. For needs like accessibility and affordability, enablement becomes essential. This function helps reduce systemic barriers, whether they are physical or financial. Paired with education, which builds the necessary knowledge to navigate urban spaces safely and efficiently, these interventions empower vulnerable groups to make more active mobility choices. Education and training also strengthen psychological capability, ensuring that users not only know how to engage in active mobility but also feel confident doing so. When addressing motivation, particularly the reflective and automatic components, functions like persuasion, incentivisation, and coercion come into play. Persuasion helps reshape perceptions (emphasizing the health, environmental, and financial benefits of walking or cycling) while incentivisation (such as reward programs or subsidies) creates tangible benefits for users. Coercion, though less common, may involve measures like traffic restrictions in certain zones to encourage walking or cycling.

Practical tools for the design of behavioural interventions

Designing effective behavioural interventions requires more than identifying a problem, it demands a structured, evidence-based approach that connects behavioural insights with practical action. Once a target behaviour and its determinants have been identified using frameworks like COM-B and the BCW, planners can deepen their analysis and strengthen their interventions by drawing on additional tools. These include the Theoretical Domains Framework (TDF) to understand underlying behavioural influences, Behaviour Change Techniques (BCTs) to specify intervention content, and the APEASE criteria to assess implementation feasibility and impact. Together, these tools form a comprehensive toolkit that supports the development of effective, context-sensitive interventions, particularly in complex urban contexts where behaviour change is both a social and infrastructural challenge.

Theoretical Domains Framework (TDF)

After identifying barriers to behaviour change, the process can be further supported by the Theoretical Domains Framework (TDF)³⁹, which helps categorise factors relevant to the three core elements of behaviour (capability, opportunity, and motivation). The TDF consists of 14 detailed domains essential for understanding and promoting behaviour change, providing an additional layer of insight beyond the COM-B Model and it is used to identify determinants of behaviour and barriers/enablers to behaviour change.

The TDF enriches the capability dimension by incorporating factors such as knowledge, skills, behavioural regulation, memory, attention, and decision-making processes. It addresses opportunities by considering environmental resources and social influences. Lastly, it informs the motivation dimension by including beliefs about capabilities and consequences, optimism, goals, professional roles and identity, reinforcement, and emotional responses.

Therefore:

- Capability: Knowledge, skills, memory, attention, decision-making processes, and behavioural regulation.
- Opportunity: Environmental context, resources, and social influences.
- Motivation: Beliefs about capabilities and consequences, goals, reinforcement, emotions, optimism, and identity.

Figura 1. Based on Cane et al (2012). Image developed by the Center for Implementation, ©2023 / V2024.01.



Behaviour Change Techniques (BCTs)

While the Behaviour Change Wheel (BCW) provides a strategic framework for selecting intervention functions, Behaviour Change Techniques (BCTs) offer more granular ‘on-the-ground’ methods to operationalise those functions in practice, showing particularly effective in designing and evaluating interventions aimed at encouraging active mobility^{40, 41}. BCTs represent the “active psychological ingredients” of an intervention, identifying specific methods and components to promote behaviour change.

For example:

- Self-monitoring of behaviour to enhance awareness.
- Providing instructions to improve knowledge and skills.
- Goal setting to foster motivation and commitment.
- Feedback on performance to reinforce progress.

Together, the BCW and BCTs provide a systematic framework for designing interventions by addressing the needs and barriers to active travel. They also help define the content and delivery mechanisms of the interventions. A study by Bird et al. (2013)⁴² examined the relationship between intervention content (BCTs) and the efficacy of interventions designed to increase walking and cycling. It found that techniques such as self-monitoring of behaviour, prompting intention formation, providing instruction and information on consequences, and offering general encouragement were effective in increasing active travel behaviours. Furthermore, setting specific goals and creating detailed plans enabled individuals to overcome barriers and adopt active travel behaviours more easily.

Affordability, Practicability, Effectiveness, Acceptability, Side-effects, and Equity (APEASE)

After selecting appropriate BCTs, assessing the Affordability, Practicability, Effectiveness, Acceptability, Side-effects, and Equity (APEASE)⁴³ criteria can help ensure that these techniques remain viable and relevant for both practitioners and target groups. Similarly, applying the EAST framework (Easy, Attractive, Social, Timely) encourages a user-friendly perspective that complements BCTs, ensuring the intervention is not only theoretically sound but also appealing and accessible to participants⁴⁴.

Key actions to design a behavioural intervention

1. Define the problem in behavioural terms. Clearly describe the behaviour you want to change. Example: “Too few women cycle to work.”
2. Select the target behaviour. Choose one specific, observable, and measurable behaviour. In this case, it might be: “Increase the number of women cycling to work at least three times a week.”
3. Specify the behaviour in detail. Ask: Who needs to change their behaviour? In this case, for example, it might be: “*Adult women living in urban areas who currently commute by car*”. What exactly should they do differently? In this case, for example, it might be: “*Choose to cycle to work*”. When, where, how often, and with whom? In this case, for example, it might be: “*On weekday mornings and evenings, during commuting hours (e.g., 7:30–9:00 am and 5:00–6:30 pm)*” “*At least three times per week*”.
4. Understand the current behaviour using the COM-B. Use the COM-B model to explore what’s influencing the behaviour: Do they have the knowledge and skills (Capability)? Are there environmental or social barriers (Opportunity)? Are they motivated, either consciously or automatically (Motivation)? Gather this information through surveys, interviews, or focus groups.



5. Choose the right intervention functions. Based on what's missing (capability, opportunity, or motivation), select functions from the BCW. For example, to promote cycling to work, you might provide training (bike safety classes), enablement (bike subsidies), environmental changes (bike lanes), and persuasive campaigns (positive messaging).
6. Select policy categories to support the intervention. Think about what policies are needed to make the intervention work, like guidelines, regulations, funding, or public services.
7. Choose Simple Behaviour Change Techniques (BCTs). Break down the intervention into concrete actions. These are the "active ingredients" of change. For examples: set goals, provide instructions, give feedback, use reminders and prompts
8. Plan how to deliver the intervention. Decide how and where it will happen, through schools, workplaces, apps, community centres, etc. Always consider practical issues like cost, ease of use, public acceptance, and fairness.
9. Evaluate the impact. Set clear and measurable indicators before you start. Then track progress to see if the behaviour has changed.

2.4 Step 4: Connecting good practices to the BCW interventions

In this step, effective behavioural change interventions on active mobility targeting vulnerable groups were collected through a comprehensive literature review and web research, including searches for other European projects funded on these themes. Institutional reports and online sources highlighting effective practices in promoting active mobility were also consulted. The practices collected were analysed and categorised using the BCW (as already outlined before) to enable cities to adopt evidence-based approaches that address the specific needs of people groups considered. This collection of good practices serves as a core resource, providing both inspiration and practical guidance for implementing behavioural interventions.

The review encompasses **92 good practices from 22 different countries** (for a complete overview of the good practices, see the Appendix to this Report) across Europe and beyond, including regions in North and South America, and Asia. Several of these practices have been implemented across multiple cities and/or regions within the same country or even cross-border, highlighting the replicability and scalability of certain interventions. Out of these 9 practices, **5 main categories of intervention types have been identified**, comprising a total of **16 sub-categories of active mobility behavioural interventions**. The following table (Table 6) offers a comprehensive overview of the active mobility intervention types that have been mapped. It is important to note that this is a clustering exercise aimed at providing a structured guidance. However, there are inherent overlaps, and some intervention types could potentially relate to multiple BCW intervention functions. In this table, we have assigned each intervention to the function where its impact is most prevalent. This mapping cannot be considered exhaustive; however, it serves as a structured framework to support analysis and planning that can be adapted and expanded based on specific contexts and evolving strategies.

Active mobility intervention types	Active mobility intervention types sub-groups
A - Coaching, empowerment, and community engagement	A.1 - Coaching and training
	A.2 - Community initiatives
	A.3 - School mobility



B - Informational, educational, and awareness-raising initiatives	B.1 - Personalised guidance and information services
	B.2 - Storytelling and awareness initiatives
C - Digital and smart systems	C.1 - Route planning Apps
	C.2 - Walking/Cycling smart systems
D - Economic levers and incentives	D.1 - Challenge/game-based initiatives
	D.2 - Support for bike/e-bikes ownership and use
	D.3 - Economic incentives and pricing strategies
E - Walking and cycling environment	E.1 - Streetscape design (visual cues)
	E.2 - Bike supporting infrastructures
	E.3 - Placemaking initiatives
	E.4 - Car-free areas
	E.5 - Climate-proof walking/cycling streets

Table 6. Active mobility intervention types and related subgroups.

3. Actionable ideas for just behavioural interventions

To effectively address the unique needs of vulnerable groups, good practices of behavioural interventions from various contexts provided valuable insights. This section highlights initiatives that successfully address the main needs of vulnerable people offering practical solutions adaptable to diverse urban environments and target groups. As already written in the



previous section, five main active mobility intervention types that have been mapped. [Table 7](#) summarises various intervention types aimed at promoting active mobility, categorized according to the COM-B model and the Behaviour Change Wheel (BCW) framework. It is structured to show clear links between intervention strategies, their specific sub-groups, and the relevant behavioural components (COM-B key elements and sub-elements) they address.

Active mobility intervention types	Active mobility intervention types sub-groups	COM-B key elements	COM-B key sub-elements	BCW Interventions functions
A - Coaching, empowerment, and community engagement	A.1 - Coaching and training	Capability	Psychological	Training Education
		Opportunity	Social	Education
	A.2 - Community initiatives	Capability	Physical	Enablement Environmental restructuring Education
		Opportunity	Social	Modelling
	A.3 - School mobility	Motivation	Automatic	Education
			Reflective	Education Persuasion
B - Informational, educational, and awareness-raising initiatives	B.1 - Personalised guidance and information services	Capability	Physical	Enablement Education
			Psychological	Enablement
	B.2 - Storytelling and awareness initiatives	Opportunity	Social	Education Environmental restructuring
		Motivation	Automatic	Environmental restructuring
C - Digital and smart systems	C.1 - Route planning Apps	Capability	Psychological	Enablement
	C.2 - Walking/Cycling smart systems	Opportunity	Physical	Environmental restructuring
		Motivation	Automatic	Persuasion
D - Economic levers and incentives	D.1 - Challenge/game-based initiatives	Motivation	Reflective	Incentivisation
	D.2 - Support for bike/e-bikes ownership and use	Opportunity	Physical	Incentivisation
		Motivation	Automatic	Incentivisation
	D.3 - Economic incentives and pricing strategies	Motivation	Reflective Automatic	Incentivisation Coercion
E - Walking and cycling environment	E.1 - Streetscape design (visual cues)	Motivation	Automatic	Environmental restructuring
		Opportunity	Physical	Environmental restructuring
	E.2 - Bike supporting infrastructures	Opportunity	Physical	Environmental restructuring
	E.3 - Placemaking initiatives	Opportunity	Physical	Environmental restructuring



	E.4 - Car-free areas	Opportunity	Physical	Restrictions
	E.5 - Climate-proof walking/cycling streets	Opportunity	Physical	Environmental restructuring

Table 7. Active mobility intervention types, related subgroups, COM-B elements and BCW intervention functions.

As can be seen from the table, therefore:

- **A – Coaching, empowerment, and community engagement:** includes interventions which primarily target psychological and physical capabilities through enablement, education, training, and environmental restructuring. They also leverage social opportunities through education and modelling, as well as motivational factors, both automatic and reflective.
- **B – Informational, educational, and awareness-raising initiatives:** includes interventions aimed to enhance capability (physical and psychological) and social opportunity through enablement, education, and environmental restructuring. They also target automatic motivational factors.
- **C – Digital and smart systems:** includes interventions which primarily enhance psychological capability through enablement and address physical environmental restructuring and automatic motivational persuasion.
- **D – Economic levers and incentives:** includes interventions which largely address reflective and automatic motivational elements through incentivisation and coercion, while also providing physical opportunities.
- **E – Walking and cycling environment:** includes interventions which primarily involve environmental restructuring and physical opportunity enhancements, directly impacting automatic motivation and social opportunity.

The following sub-chapters explain in detail each of the active mobility intervention types and related sub-groups, providing details, descriptions, and highlighting good practices that have been implemented.

3.1 A) Coaching, empowerment, and community engagement

A. COACHING, EMPOWERMENT AND COMMUNITY ENGAGEMENT						
Intervention types	A.1) Coaching and training A.2) Community initiatives A.3) School mobility					
COM-B components	Capability		Opportunity		Motivation	
	<i>psychological</i>	<i>physical</i>	<i>physical</i>	<i>social</i>	<i>automatic</i>	<i>reflective</i>
Vulnerable groups	Older people, Women, Youth, Children, Families, LGBTQIA+, Migrants, People with disabilities					
Good practices	A1 – Coaching and training					
	○ UCL Bike Buddy Scheme (London, UK).					
	○ De.SI.re La Città che vorrei (Rome, Italy).					
	○ Cycling Exam (Utrecht, The Netherlands).					
	○ Piste Junicode (Lille, France).					



	○ Cykeløen - The Bicycle Playground (Aarhus, Denmark). ○ Cycling Games (Copenhagen, Denmark). ○ Bikeability (UK). ○ Bike Bank (Coventry, UK). ○ Fearless Flyers (New York, USA). ○ Casual Cycling Club (Brussels, Belgium). ○ Intergenerational Walking & Cycling (London, UK). ○ Fietsvriendinnen (Tilburg, The Netherlands). ○ Paths for All - Training for Health Walks (Scotland, United Kingdom).
	<u>A2 – Communities initiatives</u> ○ Date Your City (DyC) (Lisbon, Portugal; Barcelona, Spain; Milan, Italy; Munich, Germany; Copenhagen, Denmark) ○ Safety Walks (Gothenburg and other Swedish cities) ○ Meldeplattform Radverkehr (Hessen, Germany). ○ Wher App (Milan, Italy). ○ Elderly on Track (Rubí, Spain). ○ Elders Programme (Masquefa, Spain). ○ VR Pedestrian Safety (Urbana-Champaign, USA). ○ STEP UP - Walkability for Women in Milan (Milan, Italy). ○ Wise Women (Glasgow, UK). ○ Tackling Loneliness (Lancashire, UK). ○ Rainbow Walks (Stoke-on-Trent, UK). ○ MEZZO (½) (Olbia, Italy). ○ Winter Cycling Campaign (Gävle, Sweden). ○ Bike Pride (Turin, Italy). ○ Cycling May (Gdansk, Poland). ○ Kidical Mass (Coimbra, Portugal).
	<u>A3 – School Mobility</u> ○ Climb – PediBusSmart (Trento, Italy). ○ STARS - Sustainable Travel Accreditation for Schools (Zaragoza, Spain) ○ Barcelona's Bicibús (Barcelona, Spain). ○ Intergenerational Pedibus (Switzerland). ○ PéPedal (Aveiro, Portugal). ○ TRA: WELL (Austria). ○ Kids Go Green (Trento, Italy). ○ Utrecht Road Safety Label (Utrecht, Netherlands). ○ School Roads Project (Aragón, Spain). ○ Besser zur Schule ("Better to school") (Hessen, Germany).

A.1 - COACHING AND TRAINING

Coaching and training are key in fostering personal development and self-efficacy. In mobility, these activities facilitate the adoption of new behaviours, providing individuals, particularly those whose physical or psychological conditions may lead them to believe they are not capable of undertaking that specific activity, with structured mentorship and hands-on-experience. This not only support alleviating initial apprehensions but also encourages long-term cycling habits. Many people, particularly in urban settings, do not cycle simply because they have never had the opportunity to learn. Therefore, having trained leaders and safe spaces for training is essential to broaden the appeal of active mobility, making cycling



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accessible even to beginners. Coaching and training work on both individual and community levels, promoting individual safety and happiness but also social cohesion, a sense of belonging, and better integration within the society. Studies demonstrate that direct training significantly enhance new mobility habits on a community scale⁴⁵.

In this section, coaching and training programs offer practical guidance but also a safe space for feeling part of a community. Such initiatives are particularly beneficial for individuals who have never cycled before or who face societal challenges, including safety concerns, cultural barriers (e.g. coming from a country that is not bicycle-friendly) or physical limitations. These interventions are particularly effective in removing psychological barriers such as fear, lack of familiarity and perceived risk, which often deter individuals from cycling and walking. They also foster independence for parents, enjoyment for children or older people, community building for LGBTQIA+ individuals, integration for migrants and empowerment for women.

Vulnerable groups	Older people, Families, Youth, Children, LGBTQIA+, Migrants, Women
Intervention Functions	Training, Education

CASE STUDIES

The **UCL Bike Buddy Scheme**, launched in 2020 at University College London (UCL), connects experienced cyclists with university staff and students who are new to cycling in London. Through personalised route guidance and safety advice, **the scheme helps participants build confidence and feel safer** during their journeys to and from the university. The initiative is part of a wider effort by the university to cultivate a culture of active mobility among students and staff. Beyond practical support, the scheme has also contributed to strengthening the cycling community within the university, encouraging **knowledge sharing and mutual support between experienced and new cyclists**. Drawing on similar experiences, such as the Bike Buddies (*Fietsmaatjes* in the Netherlands) campaign, which was not specifically designed for vulnerable groups but targeted employees, the results were significant. **Two years after the campaign, a substantial majority of former car commuters had maintained their cycling habits**: 85% cycled at least one day a week, and 62% cycled three or more days per week.





Figure 1. UCL Bike Buddy Scheme (London, UK).

Introducing cycling at an early age encourages being an adult using active mobility. For this reason, many associations and municipalities focus on providing **coaching and training sessions to children and teenagers**. The **De.SI.re initiative** (Rome, Italy) which ran from 2018 to 2023, targeted primary and lower secondary school students, along with their parents. It **started directly from the Municipality**, training 4,300 students from 14 primary schools and delivering 2,000 hours of training in the first year. Similarly, the **Cycling Exam** (Utrecht, The Netherlands) has been assessing primary school students' road safety awareness and cycling skills since 2016 through **cycling traffic test**. This program has engaged thousands of children annually, reinforcing cycling proficiency in real traffic conditions with strong community involvement. In 2016, 79 schools participated with 2,758 students, of whom 2,630 passed the test. **The city invested around 5.000 euro a year the measure**. Volunteers, parents, police, all help to implement this practice.



Figure 2. Practical Cycling Exam in Utrecht (The Netherlands).

Beyond structured programs, dedicated training spaces, such as cycling playgrounds, further support empowerment through practical experience. **Piste Junicode** (Lille, France), established in 2012, provides a cycling education track where children can learn street safety rules and cycling techniques through a structured free training program. The playground was designed with the help of the ADAV (Association Droit Au Vélo), the main NGO promoting active mobility in the region (Hauts-de-France) and an expert bike instruction organisation and is placed in the Maison des Mobilités Durables (MMD), a **mobility awareness-spreading centre** in Lille. This initiative engages around 1,200 children annually and works in partnership with the local organizations, ADAV, which deliver free weekly training sessions / bike school programmes. In France, the **"Savoir Rouler à Vélo" (ability to ride a bike) scheme implemented in schools teaches every child to ride a bike by the time they start secondary school** and sets the habit of using low-carbon mobility from an early age. The city of Lille encourages school to partake in learning sessions at the MMD.



Figure 3. Piste Junicode playground (Lille, France).

A similar training space **Cykeløen** was created recently in Aarhus (Denmark). It is a pioneering cycle playground located on a former ferry dock in the city, opened in 2024 and temporarily in place until the end of 2025, and offers a space for young children and families to learn cycling in a safe environment. In relation to the design of the playground, Aarhus has successfully involved carpenters in training. They have built playhouses for the site, creatively incorporating elements that encourage children to touch, engage with, and play. This initiative mainly **targets schools and kindergartens** to make use of Cykeløen. However, an aim within the project is to also provide opportunities for **parents to practice cycling alongside their children**. The facility has already attracted significant community interest, with 44 families and 75 children enjoying the area in only one day. An interesting point is that **the City of Aarhus has hired an employee from Dansk Skolecykling to attend Cykeløen twice a week**. His job is to teach and inspire visitors to the facility.

Another example is **Copenhagen's Cycling Games**, which uses "learning by playing" techniques to teach cycling skills to children in a fun and engaging way. Since 2019, the initiative, promoted by the Danish Cyclists' Federation in Copenhagen, integrates **playful activities into cycling skills and safety training**. The initiative offers **20 structured cycling games** divided into four categories: Motor Skills (balance and coordination), Catching Games (reflexes and agility), Cognition (memory and orientation), and Teamwork (collaboration). These games help children develop essential cycling abilities such as balance, spatial awareness, speed, and distance judgment. To ensure effective implementation, the federation provides an instructional guide titled "20 Cycling Games" along with demonstration videos, making learning accessible and enjoyable for children.



20 CYCLING GAMES

— MORE FUN CYCLE TRAINING FOR ALL CHILDREN



Figure 4. The book "20 Cycling Games" (Copenhagen, Denmark).

The national cycle training program called **Bikeability**, is the **UK government's national cycle training programme**. It teaches children and adults the practical skills and confidence needed to cycle safely on today's roads. Bikeability is administered by the Bikeability Trust. Over three million children have completed Bikeability cycle training to date. The government has pledged £13 million to support the continuation of the scheme, with the aim of promoting more active travel. In addition, Bikeability **supports low-income families through bicycle donation initiatives**, working with programmes that collect, refurbish, and distribute bicycles. For example, 800 Strider balance bikes were donated through these programmes to help children access cycling opportunities.

In Coventry (UK), the city set up a **Bike Bank** using a **refurbished shipping container**. Residents can **donate bicycles** they no longer use (especially bikes their children have outgrown) and **pick up a different bike** if needed, without being required to leave one in return. Donations also include helmets and bike pumps to ensure safety. The project relied on **community donations**.

The **Fearless Flyers program** (New York, USA) which began in 2016, provides LGBTQIA+ youth (16-25 years old) with a 13-week training program on cycling. Beyond cycling skills, this program **promotes a sense of belonging and mental well-being** by offering participants access to resources such as food boxes and job opportunities. Most participants reported gaining a sense of community, building friendships, and finding support within the group. The **program secures funding through grants and donations, allowing the organisation to provide equipment** (bikes, helmets, locks) **and training to low-income or homeless youth**, who are a **higher percentage among the LGBTQIA+ community**, to participate.



Figure 5. Fearless Flyers Poster (New York, USA).

The **Casual Cycling Club** (Brussels, Belgium), launched in 2021, focuses on the broader LGBTQIA+ community, including older individuals and non-binary people, through several activities such as a **casual ride twice per month, off-road group rides to explore the surroundings of Brussels, bike-to-work events every Wednesday, and bike mechanics workshops**. It has grown into a community of over 500 members, emphasising that all bikes, body types, and fitness levels are welcome.

Some associations promote active mobility, emphasising its **multiple benefits, such as the interplay between physical and mental health, social inclusion, and integration**, with clear plans and tailored activities. One example is the **Intergenerational Walking and Cycling** project (London, UK) which offers walking and cycling activities for everyone with qualified cycle/walk leaders, encouraging diverse groups to engage in active mobility while benefiting from **health monitoring support**. During the weekly activities, **participants are**



offered access to healthy equipment (e.g. heart monitoring devices and blood pressure monitors).

In Tilburg, (The Netherlands), a cycling education program, the **Fietsvriendinnen program**, has been running since 2009, specifically **supporting migrant women** by providing a safe space and training to enhance their mobility and independence. Recognising that many of these women come from countries where cycling is uncommon or culturally restricted, **the program focuses on enhancing their mobility, independence, and integration into Dutch society**. The program has also inspired a national movement, the Annual Inspiration Day, which promote cycling education across the Netherlands.



Figure 6. Cycling training session with migrant women (Tilburg, The Netherlands).

Another example of a health-focused and socially inclusive approach is the **Paths for All - Training for Health Walks** in the Community programme (Scotland, UK). This initiative trains volunteers to lead Health Walks, short, accessible group walks tailored to people facing barriers to physical activity. These include **older adults, people with long-term health conditions, and individuals at risk of social isolation**. The programme helps participants improve their physical and mental health, while also **building social connections and enhancing confidence** to walk independently. With over 800 volunteers trained each year and more than 600 Health Walks taking place weekly across Scotland, the programme reaches over 20,000 participants annually, making it a recognised best practice in community health and social inclusion through active mobility.

A.2 - COMMUNITIES INITIATIVES

Community initiatives represent a strategy for promoting sustainable urban mobility and driving long-term behavioural change. Engaging residents directly in the planning and co-design of transport solutions strengthens the legitimacy and effectiveness of such interventions and empowers communities to address their unique mobility needs. A growing body of literature emphasises that engaging local communities (through participatory audits,



citizen reporting, and co-creation processes for example) not only leads to more sustainable and context-sensitive urban planning but also addresses the unique needs of vulnerable groups.

By systematically assessing the safety, accessibility, and comfort of streets and public spaces, these community-led audits provide valuable insights into the lived experiences of residents. They empower traditionally marginalised groups, including women, older adults, and ethnic minorities, by ensuring that their voices are heard in the planning process. This approach leads to tailored interventions also promoting social inclusion. The initiatives discussed below, ranging from digital reporting platforms to co-creation workshops.

Vulnerable groups	Older people, Women, Youth, Children, Families, LGBTQIA+, People with disabilities, Ethnic minorities
Intervention Functions	Enablement, Environmental restructuring, Education, Modeling

CASE STUDIES

Walking and cycling audits are systematic assessments of the environment designed to evaluate how safe, accessible, comfortable, and convenient streets and public spaces are for people walking and cycling. Their primary purpose is to highlight barriers and challenges that discourage walking and cycling, while also identifying opportunities for improvements that could encourage more people to choose these modes of travel. **Audits can help to identify physical obstacles** (such as unsafe crossings, lack of cycling infrastructure or poor lighting), **depending on the perspective and profile of the evaluators** which can therefore lead to different perceptions and priorities being highlighted. Audits can be conducted at distinct stages (before, during, or after urban development projects) to ensure that the needs of local communities are fully considered. They can be **community-led** and informal, with residents and community groups documenting challenges and opportunities, or conducted by multidisciplinary teams of professionals, including planners, engineers, transport experts, and pedestrian and cycling specialists. When a diverse team is involved, audits benefit from fresh perspectives, helping to uncover overlooked issues and holistically improve the walking and cycling environment.

Date Your City (DyC) is a participatory and creative initiative developed within the framework of EIT Urban Mobility. Its primary goal is to **engage citizens in the reimagination and co-creation of urban public spaces by encouraging them to "date" their city**, in other words, to explore, observe, and share their experiences of urban spaces. The process combines **storytelling, public engagement, and urban data collection**, creating a citizen-centred approach to urban design and mobility planning. Date Your City has been piloted in several European cities, including Lisbon (Portugal), Barcelona (Spain), Milan (Italy), Munich (Germany), Copenhagen (Denmark). Each city adapted the methodology to fit its specific local context and urban challenges, with a particular **focus on walkability, placemaking**, and sustainable urban mobility. Hundreds of citizens actively contributed with their stories, ideas, and feedback, helping to build local narratives that linked individual experiences with urban mobility and space use. Special efforts were made to involve women, older adults, and youth, ensuring a more inclusive view of urban mobility challenges and opportunities. **Several cities incorporated findings from Date Your City into their Sustainable Urban Mobility Plans (SUMPs)**, using citizen feedback to prioritise pedestrian-friendly design, enhance safety, and improve wayfinding.



Figure 7. “Date your City” in several European cities, including Lisbon (Portugal), Barcelona (Spain), Milan (Italy), Munich (Germany), Copenhagen (Denmark).

The **Meldeplattform Radverkehr** is an **online reporting platform** developed in Hessen, Germany, which **enables cyclists to directly report defects, obstacles, and damages** in the cycling infrastructure. Via both web and mobile interfaces, users can pinpoint issues on a map, provide descriptions, and upload photos, which are then automatically forwarded to the appropriate municipal authorities for action. This platform exemplifies a transparent and participatory approach to mobility planning, aligning with Sustainable Urban Mobility Plan (SUMP) guidelines. The platform has been widely adopted, with thousands of reports submitted in about 130 municipalities participating voluntarily. It led to significant enhancements in cycling conditions across Hessen. Its success demonstrates the potential for similar initiatives to be implemented in other regions, provided there is an existing cycle path network and support from higher administrative levels.



Figure 8. Meldeplattform Radverkehr (Hessen, Germany).

The **Safety Walks** program in Sweden involves **residents and local authorities collaboratively evaluating public spaces to identify and address safety concerns**. Implemented since the beginning of the early 2000s in multiple Swedish cities, including Gothenburg, these walks aim to improve community safety through participatory audits of neighbourhoods. **Participants use structured protocols to document problems**, such as poor lighting or obstructive vegetation, generating tangible outcomes and accountability. The program is ongoing, becoming a **widespread method for addressing safety**. Its primary achievement is creating visible safety improvements, enhancing residents' perceptions of safety, and **fostering community engagement in urban planning processes**.



Figure 9. Safety walks (Sweden).



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Wher by Walk21 is an example of a mobile application designed to enhance women's safety by providing **community-sourced information on the security level of urban streets** and services **tailored for women**. Users can access reviews about streets' safety, considering factors like lighting and crowd density, and discover local services addressing social and gender issues. The app was launched in January 2018 and continued to operate till 2021, offering women a platform to share insights and navigate cities more securely. Users assess streets based on individual experiences, considering factors determining safety during different times of the day. The app then aggregates these evaluations to produce a color-coded map where green indicates safe streets, yellow suggests that caution is advised and red denotes areas better to be avoided. Users can input their destination, and Wher works also as a **route-planner recommending the safest routes based on the community's feedback** and the time of day.



Figure 10. Wher App.

The **Elderly on Track (ElTra)** project, implemented in Rubí within the Metropolitan Region of Barcelona, aimed to promote active **mobility among the elderly to enhance their health and strengthen social cohesion**. By exploring the relationship between seniors' comfort levels and environmental factors during walking routes, the project sought to reconnect them with their community and natural surroundings. **Two workshops were held with the elderly community to define and evaluate walking routes**, gathering valuable insights into their walking needs and urban environment quality. **Three walking routes were identified and analysed, focusing on safety, comfort, and environmental quality**, tailored to the preferences of the elderly participants. During the first workshop, in September 2022, participants identified walking routes based on their needs, considering factors like safety, comfort, and utility. During the second workshop, in October 2022, participants walked the previously defined routes, evaluated them, and shared feedback. Approximately 45 individuals participated, documenting their experiences through photos and videos, highlighting both positive aspects and challenges. The project produced a free graphic report that guides participatory workshops with the elderly and the design of suitable walking routes.



Figure 11. Elderly on Track (Barcelona, Spain).

Similarly to the previous one, **Elders** program in Masquefa, Spain, aims to enhance **physical and mental well-being of the elderly** through active mobility, community engagement, and improved public space design. Launched in March 2024, the program involved participatory processes to **identify and improve walking routes, culminating in the installation of new urban elements co-designed by elderly residents and design professionals**. The project concluded in December 2024 with the successful implementation of these enhancements, positively impacting the community's accessibility and social inclusion. Funded by the European Union's EIT Urban Mobility program, the initiative was **part of Masquefa's Local Urban Agenda**, aligning with Sustainable Development Goal 11 for sustainable and resilient communities.



Figure 12. "Elders" program (Masquefa, Spain)



The **Urbana-Champaign** project used **Virtual Reality (VR)** to study **pedestrian behaviours and safety at intersections**, specifically examining the effects of mobile phone distraction on street-crossing behaviours among young adults. Conducted by researchers at the University of Illinois, Urbana-Champaign, this project employed the Beckman Institute's Virtual Reality CAVE, a sophisticated virtual environment setup with interactive capabilities, including a manual treadmill and motion tracking sensors. The research involved 36 university students and demonstrated that distractions from cell phone conversations significantly increased the time taken to initiate and complete a crossing, highlighting the impact of distractions on pedestrian safety. This controlled experiment, which took place entirely within a VR environment, enabled safe, accurate observation of risky pedestrian behaviours without real-world dangers. The initiative, part of broader research exploring active transportation applications of VR technology, concluded successfully, demonstrating VR's potential to improve pedestrian safety through behavioural insights and innovative safety training methodologies.



Figure 13. Urbana-Champaign.

Coordinated by Transform Transport with partners including TeMA Lab (Università di Napoli Federico II), Sex and the City, and Walk21 Foundation, the **STEP UP – Walkability for Women in Milan** (Italy) project **examined women's perceived safety while walking in Milan at night**. Recognising that women often experience cities differently than men due to concerns about aggression and harassment, especially after dark, the research identified three main safety factor categories: spatial features (e.g. street geometry and lighting), city use (e.g. presence of other people), and hotspots (e.g. recognisable safe or unsafe areas). **Data was collected through the Wher App** (the crowdsourced mapping app illustrated before) where women rated approximately 67% of Milan's streets on nighttime safety perceptions. Analysis revealed that **enhancing street lighting could improve safety perceptions** on 28% of streets (521 km of streets), **increasing nighttime social venues like bars and restaurants** could benefit 54% of streets (1007 km of streets), and **boosting**



nighttime public transport frequency could positively impact 26% of streets (479 km of streets). These **findings were intended to guide urban planning policies** to create safer, more inclusive environments for women.



Figure 14. Step-up (Milan, Italy).

Wise Women is a feminist organization based in Glasgow, Scotland, dedicated to enhancing women's safety, confidence, and well-being. Established in 1994, the organization addresses women's fears and experiences of violence and crime by offering **free personal safety and confidence-building courses** and workshops to women in local communities. These programs aim to empower women, foster self-expression, and encourage collective action for societal change. A notable initiative within the organisation, is the **Safer Steps** program, which focuses on increasing women's safety across Glasgow. This program involves **facilitating safety tours, consulting with women, and developing partnerships to address safety concerns in public spaces**. Additionally, Wise Women supports the Glasgow Women's Voluntary Sector Network, enabling consultations with women and engagement with decision-makers to highlight community issues.



Figure 15. Wise Women (Glasgow, UK).

Since July 2022, the **Tackling Loneliness** program in Lancashire, UK, has been addressing social isolation among adults over 50 in Burnley, Blackburn with Darwen, and Fleetwood. Through the **Walking Connects** initiative, funded by the Department for Transport, the program organises **short, accessible group walks to boost confidence and foster friendships among participants**. These walks have successfully **reduced feelings of loneliness and improved mental and physical well-being**. The program is ongoing, with activities tailored to the needs of the communities involved.



Figure 16. Walking Connects initiative from Tackling Loneliness Program (Lancashire, UK).

The **Rainbow Walks Stoke Local Group**, based in Stoke-on-Trent, UK, is a **volunteer-led group** under the Living Streets organisation that curates walks **highlighting the city's rich LGBTQ+ history to foster a safe and inclusive walking environment**. Established in 2023, the group has organized **events such as a circular walk** around Hanley Town Centre, showcasing sites significant to the local LGBTQ+ community. These ongoing initiatives aim to **promote social connection and community engagement**. Activities are supported through community involvement and resources provided by Living Streets, a charity dedicated to making streets safer, more accessible, and more pedestrian friendly. Living Streets promotes walking, advocates for improved urban planning policies, and supports community-led projects that enhance public spaces.



Figure 17. Rainbow Walks Stoke Local Group (Stoke-on-Trent, UK).

Community cycling campaigns, such as the **Bike Pride** (Turin, Italy), organised by FIAB (the Italian Federation of Bicycle Friends) with the support of the City of Turin, are **cycling parade organised to promote sustainable mobility and equitable public space usage**. The Bike Pride, is an **annual event** which focuses on advocating for public streets as collective, safe, and accessible spaces, emphasizing the importance of distributing public spaces equitably among all citizens. The 13th edition, held on 20 October 2024, featured a lively 14 km route through various neighbourhoods, highlighting the city's diversity. The event is free welcoming families, students, and cycling enthusiasts alike. Participants not only enjoyed the parade but also had the opportunity to support the initiative through memberships and merchandise, reinforcing the idea that public spaces should be collectively owned and maintained. The event emphasised the importance of transforming public streets into safe, accessible, and equitable spaces for all citizens. With lively displays, local vendors, and an energetic atmosphere, Bike Pride in Turin effectively highlighted how annual cycling events can **drive social inclusion and promote sustainable urban living**.



Figure 18. Bike Pride (Turin, Italy).

MEZZO (1/2) is an initiative launched in Olbia, Italy, aimed at enhancing active and sustainable mobility, particularly for vulnerable populations and their caregivers with a focus on inclusivity. The project seeks to make the city's central areas more accessible and inclusive by integrating three levels of mobility: cycling, walking, and intermodal transport. Supported by Fondazione CON IL SUD, MEZZO (1/2) project **provides various pedal-assist bicycles, including tandems and cargo bikes designed for individuals with mobility challenges**, managed within a dedicated space called the "velostation" at the Olbia Terranova Railway Station. These bicycles were displayed to the public during events like "In MEZZO al parco," allowing residents to evaluate and experience the new equipment, fostering community involvement and raising awareness about accessible mobility options. Additionally, the initiative implements **tactical urbanism interventions** and **intuitive wayfinding** systems to improve pedestrian routes connecting the railway station, urban bus stops, and the historic centre. MEZZO (1/2) represented Italy at the "Velo-City 2024" conference in Ghent, Belgium, the world's premier summit on cycling. This participation highlighted the project's commitment to inclusive mobility on an international platform.



Figure 19. Mezzo (1/2) (Olbia, Italy).

The **Winter Cycling Campaign** (Gävle, Sweden) aims to encourage **habitual car users to adopt cycling during winter months**. Launched in 2010, the campaign has been conducted annually each autumn/winter. Participants **commit to cycling to work at least three days a week** and are provided with studded bike tires, saddle covers, and reflective vests to facilitate safe winter cycling. They also report their cycling activities and feedback on infrastructure conditions via a mobile application. Over six campaigns, more than 400 motorists participated, collectively cycling approximately 200,000 kilometres, resulting in a reduction of about 35 tons of carbon dioxide emissions. Notably, **83% of participants continued to cycle at least once a week post-campaign**, indicating a lasting shift in commuting habits. The campaign has also been adopted by other Swedish municipalities, including Uppsala, Sundsvall, and Västra Götaland County. The campaign continues to operate, with the 2024/2025 season scheduled from November 18, 2024, to March 2, 2025.

The **Cycling May** campaign is a large-scale initiative implemented annually in Gdansk, Poland, aimed at encouraging **active commuting to school by bicycle, scooter, skateboard, or rollers during the entire month of May**. The campaign employs a **gamification strategy** where children and school staff collect stickers for each active trip, competing individually, as classes, and between schools, fostering motivation and enthusiasm through rewards. The main achievement has been a significant and measurable increase in active commuting, demonstrated by a quantitative evaluation showing an **18% rise in bicycle traffic in Gdansk during the campaign period**. Despite its clear short-term success, the campaign's impact tends to diminish once it ends, suggesting **ongoing engagement may be required for lasting behavioural change**.



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Figure 20. Cycling May (Gdansk, Poland).

The **Massa Crítica de Crianças - Kidical Mass Coimbra** is a **local and volunteer-driven event** of the global Kidical Mass movement, aiming to promote active mobility among children and families in Coimbra, Portugal. The initiative encourages the use of bicycles, walking, rollerblading, and skating in daily commutes, advocating for improved cycling infrastructure and safer streets, especially around schools. The first edition in Coimbra took place on May 7, 2023, attracting around a hundred participants. Subsequent events, such as the one on September 24, 2023, featured community aggregation events such as a community picnic. These events are ongoing, with the latest held on September 15, 2024.



Figure 21. Massa Crítica de Crianças (Coimbra, Portugal).

A.3 - SCHOOL MOBILITY

School mobility initiatives play a crucial role in driving sustainable behavioural change among young people. Sustainable school transportation methods, such as bike buses and walking buses (pedibus), offer more than just a means to get to school; they actively promote a shift in daily travel behaviours. By enabling children to walk or cycle in organised groups under adult supervision, these programmes enhance physical capability through increased daily activity, create opportunities by providing safe, well-managed routes, and foster motivation through social interaction and community engagement. When children are equipped with the skills to navigate their urban environment (capability), provided with accessible and safe transport options (opportunity), and encouraged through positive social reinforcement and community support (motivation), they are more likely to adopt and sustain active commuting habits.

The following school mobility initiatives highlight diverse examples from across Europe, from technology-enhanced route management systems and gamification elements to collaborative, intergenerational programmes, that collectively work to instil long-term sustainable mobility habits in school communities.

Vulnerable groups	Children, Families
Intervention Functions	Education, Persuasion

CASE STUDIES

Bike and walking school buses (the latter also known as "pedibus") are gaining traction as sustainable options to traditional motorised school buses and as alternatives to car trips. A **walking bus involves groups of children walking to school together under adult supervision, following predetermined routes with designated stops**. Similarly, a **bike bus operates on the same principle**, but participants travel **by bicycle** instead of on foot. The **Bicibús** project in Barcelona, Spain, is an initiative that enables children to cycle to school safely in organised groups, following specific routes with designated stops and schedules. **Launched in March 2021 with a pilot route in the Sarrià neighbourhood, it has expanded to 15 routes across the city, involving over 700 participants during the 2020-21 school**



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year. **Supported by the Barcelona City Council**, the Bicibús continues to operate, inspiring similar schemes in cities like Glasgow and Portland. The initiative benefits from both municipal backing and community volunteer efforts.



Figure 22. Bicibús (Barcelona, Spain).

The CLIMB (Children's Independent Mobility) **PediBusSmart** project, implemented in Trento, Italy, enhances the pedibus concept by **integrating mobile applications** and smart devices to **streamline route management, attendance tracking, and communication between volunteers and parents**. The project features a smartphone app, proximity tags, and an online dashboard to assist volunteer "drivers" and ensure a secure, fun journey to school for all participants. Since its inception in 2016, the project has expanded to include multiple schools in Trento, engaging over 600 children and 100 teachers during the 2017-2018 academic year. The project is ongoing, continually promoting active and autonomous mobility among children.



Figure 23. CLIMB – PediBusSmart (Trento, Italy).

The **Intergenerational Pedibus** is a walking initiative where children aged 4 to 8 are accompanied to school by adults of all ages, including parents and senior volunteers. This program fosters **intergenerational connections**, **enhances neighbourhood cohesion**, and **promotes physical activity among participants**. Operating in various Swiss communities, the initiative offers flexible participation, allowing seniors to join existing routes or establish new ones.



Figure 24. Intergenerational Pedibus (Switzerland).



Schools serve as key environments where children and young people can develop independence, learn road safety, and adopt sustainable commuting behaviours. In **school programs** families, teachers, and local authorities are the key stakeholders which collaborate to support sustainable mobility programs. The **PéPedal – Active School Mobility Program**, launched in November 2023 by the association Ciclaveiro in partnership with the Aveiro School Group (Agrupamento de Escolas de Aveiro), aims to promote active commuting among children aged 3 to 10 by encouraging walking and cycling to school. Implemented in four schools in Aveiro, Portugal, the program seeks to reduce car usage and combat childhood sedentarism. Key initiatives include the "Comboios PéPedal," **organized groups of students walking or cycling to school under adult supervision**, and the "Consultório Médico PéPedal," where **healthcare professionals educate students on the benefits of active mobility**. In its first year, the program organised approximately 2,000 such group journeys and conducted health consultations with 805 children. The program is ongoing, with plans to expand its reach and impact in the coming years.



Figure 25. CLIMB – PéPedal (Aveiro, Portugal).

The **TRA:WELL** (Transport & Wellbeing) project investigates **how active and independent mobility influences children's well-being**, focusing on how urban environments can promote child-friendly mobility. Conducted in collaboration with three schools in Austria, the project involves students aged 10-14 in developing **methods to assess the relationship between mobility behaviours and well-being in a child-centred perspective**. The study began in September 2022 and concluded in 2024.



Figure 26. TRA:WELL project (Austria).

Kids Go Green, by GreenShare and the Sustainable Development Foundation (*Fondazione Sviluppo Sostenibile*), is an educational initiative developed within the CLIMB project, aimed at promoting sustainable and active home-school mobility among children aged 6 to 11. Implemented in Trento, Italy, since 2016, **the project involves schools, students, and families in a collective virtual journey**. Children log their daily **sustainable travel** kilometres (walking, cycling, or using public transport) and **contribute to the class's progress along a customised educational route** (for example the “Naturalistic tour of Italy”), **unlocking multimedia content at each milestone**, which are then addressed as lesson topics at school. By 2022, it engaged 1,800 children across 109 classes in 28 primary schools in Trentino, collectively achieving 178,000 car-free kilometres. The project has expanded to other areas, including Emilia-Romagna and Lecco, in cooperation with local partners.



Figure 27. CLIMB – Kids go green. “Naturalistic tour of Italy” (Trento, Italy).

The **Utrecht Road Safety Label (UVL)** is an initiative by the Regional Transport Safety Agency (ROV) of the Utrecht province, The Netherlands, aimed at enhancing road safety around primary schools. Participating schools commit to **five key pillars: in-class training, practical traffic education, parental involvement, ensuring safe school environment, and embedding these practices into school policy**. Upon active engagement, schools receive support and the establishment of designated school zones with visible road signs to alert traffic near schools. The program has seen participation of 82 primary schools in 2011, reflecting a strong commitment road safety in school areas. The program was active from 2012 to 2017, during which two-thirds of Utrecht's schools obtained the label. In 2018, the program was evaluated, and it was decided to develop a novel approach to school mobility, focusing on schools without the label and those still experiencing mobility issues. As of 2023, the program has evolved into a new school approach, and the UVL as initially conceived is no longer ongoing.



Figure 28. Road Safety Label. (Utrecht, The Netherlands).

The **STARS** (Sustainable Travel Accreditation and Recognition for Schools) project in Zaragoza, Spain, promotes sustainable, active, and autonomous mobility among primary and secondary school students, emphasizing the use of bicycles. Launched in 2017, it has expanded in 2023 to include 31 schools (19 primary and 12 secondary) engaging approximately 12,000 students. The project operated on three strategic lines: assessing



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student transportation modes, integrating mobility topics into educational programs, and enhancing infrastructure around schools. STARS set up an **accreditation scheme** for primary schools and a **peer-to-peer scheme for secondary schools** where the students themselves were directly involved in encouraging fellow students to choose more sustainable travel modes (as “**ambassadors**”). A notable achievement is the creation of a network among STARS centres in Zaragoza, fostering collaboration and the exchange of best practices. The program is ongoing, with continued support from local and regional authorities. This project is led, coordinated and promoted by the Sustainability and Strategic Development Service of the City Council of Zaragoza, and relies on the collaboration of the Urban Mobility Service for the selection and execution of improvements to schools; it also relies on the support of external Technical Assistance for the development of its actions.



Figure 29. STAR - Sustainable Travel Accreditation and Recognition for Schools (Zaragoza, Spain).

The **School Roads Project of Active Mobility** is an EU mobility initiative aimed at altering school commuting patterns by promoting walking and cycling, to combat sedentarism, enhance student autonomy, and reduce vehicular emissions. Implemented in various European cities, the project fosters **participatory processes involving students, families, school staff, and local communities to create friendlier neighbourhoods** and reclaim public spaces. Around Aragón, Spain, during last year, 21 schools participated, with 305 children and 258 families engaged, establishing 102 routes.

Besser zur Schule (Better to School) is a comprehensive initiative in Hessen, Germany, aimed at enhancing school mobility by promoting safe and independent travel for students. Established in 2018, the program operates under the Hessian Competence Centre for School Mobility, managed by GmbH. It offers **consulting services to municipalities, schools, and public authorities to improve mobility situations**. The initiative encompasses various coordinated modules, including the school cycling competition and the school cycle route planner, to positively influence the mobility habits of children and young people. Participation in the program is free of charge for schools and municipalities, as **consulting services are state funded**. As of 2024, the program has developed **tailored school mobility plans for**



36 schools, with 21 already successfully completed. In 2024, the school cycling competition (*Schulradeln*) celebrated its 10th successful edition. That year, **391 schools participated, with a total of 29,400 participants collectively cycling 3 million kilometres** and it continues to engage schools, with preparations for the 2025 competition underway.

3.2 B) Informational, educational and awareness raising initiatives

B. INFORMATIONAL, EDUCATIONAL AND AWARENESS-RAISING INITIATIVES						
Intervention types	B.1 - Personalised guidance and information services B.2 - Storytelling and awareness initiatives					
COM-B components	Capability		Opportunity		Motivation	
	<i>psychological</i>	<i>physical</i>	<i>physical</i>	<i>social</i>	<i>automatic</i>	<i>reflective</i>
Vulnerable groups	Older people, Youth, Children, Older people, Women, LGBTQ+ community					
Good practices	<u>B.1 - Personalised guidance and information services</u>					
	○ Bicicultura (Coimbra, Portugal). ○ Metrominuto (Pontevedra, Spain) ○ Cycling Against Diabetes Mellitus (Thessaloniki, Greece). ○ New Residents Welcome Kit (Almada, Portugal). ○ Legible London (UK). ○ Upcycle Milano Bike Café (Milan, Italy).					
	<u>B.2 - Storytelling and awareness initiatives</u>					
	○ Chalk Back (Global). ○ I Bike CPH (Copenhagen, Denmark) ○ #NousToutes (France). ○ HarassMap (Egypt).					

B.1 - PERSONALISED GUIDANCE AND INFORMATION SERVICES	
<i>Personalised guidance and information services are a powerful tool for informing citizens about sustainable transport options and encouraging behaviour change. By offering clear, tailored, and context-specific information on mobility choices, these services can address and overcome informational barriers that often hinder individuals from shifting to more sustainable modes of transport. These initiatives influence travel behaviours by enhancing individual capabilities (e.g. knowledge of available alternatives), increasing opportunities (e.g. highlighting underused or unfamiliar mobility services), and boosting motivation (e.g. by showcasing personal or societal benefits such as health benefits, time savings, cost reduction, or environmental impact). In this light, information services are not merely a means of communication, but a strategic lever to foster more conscious, informed, and sustainable travel decisions across diverse populations.</i>	
Vulnerable groups	Older people, Youth, Children,
Intervention Functions	Enablement, Education, Environmental restructuring
CASE STUDIES	
Cycling Against Diabetes Mellitus is an annual event in Thessaloniki, Greece, initiated in 2016 by the Hellenic Association for the Study and Education of Diabetes Mellitus (HASEDM).	



Held along the city's main waterfront bike route, the event encourages citizens of all ages to participate, promoting the benefits of cycling and raising awareness about diabetes prevention through physical activity, while **making salient positive health impacts** of cycling. Each year, approximately 400 participants, including both experts and citizens, join the cycling race. Alongside the race, an open-access conference near the cycling area educates attendees on preventing diabetes through exercise. The initiative is supported by HASEDM, the Region of Central Macedonia, and various sponsors, ensuring its sustainability and community impact.



Figure 30. Cycling Against Diabetes Mellitus (Thessaloniki, Greece).

Bicicultura is an active mobility initiative, a **community hub**, in Coimbra, Portugal, led by Coimbr'a Pedal, aiming to **integrate bicycles into everyday life as both transportation and a cultural symbol**. The project promotes cycling through arts, literature, public talks, and events while also engaging in infrastructure planning, behavioural change programs, and school mobility projects. *Sextas da Bicicultura* is a **monthly cultural program** with debates, presentations, documentaries, and social gatherings focusing on sustainability, urban living, and mobility, with the bicycle often highlighted. The *Conversas da Bicicultura Podcast* features discussions on cities, mobility, and sustainability, emphasizing the bicycle as a transformative factor, while it explores topics influencing daily life quality and encourages **conversations that inspire positive change**. *Eventos e Passeios* are organised to **build community around cycling**, offering opportunities for experience sharing and socialisation among participants.



Figure 31. Bicicultura (Coimbra, Portugal).

Upcycle Milano Bike Café, established in 2013 in Milan, Italy, is a **venue that blends cycling culture with community engagement**. Beyond its café offerings, Upcycle serves as a **dynamic hub for cyclists**, hosting events such as bike travel storytelling sessions, bicycle presentations, and film screenings. Since its inception, it has organised over **300 events**, including bike travel storytelling sessions, bicycle presentations, and film screenings. In 2023, to commemorate its 10th anniversary, Upcycle introduced the "One-Off" bikes, custom-built bicycles crafted with high-quality frames and components by skilled professionals under 30, reflecting the café's commitment to fostering a vibrant cycling community. Additionally, Upcycle has collaborated with esteemed figures in the cycling world, such as Ernesto Colnago, and has been instrumental in initiatives like the Trail Show 2023, which featured workshops, talks, and the Best Trail Award ceremony, further cementing its role in advancing cycling culture and sustainable mobility.



Figure 32. Upcycle Milano Bike Café (Milan, Italy).

Clear and effective **wayfinding systems** can encourage individuals to choose walking, cycling, and public transportation over private car use by providing the right information and knowledge at the right time. When people are provided with **intuitive navigation tools** and comprehensive information about their surroundings, they are more likely to engage in active travel modes. The **Metrominuto** project is an initiative implemented in Pontevedra, Spain, aimed at promoting pedestrian mobility. It consists of an **informational map displaying both the walking distances and estimated walking times between key locations** in the city, encouraging residents to walk. The project was launched in 2011 in Pontevedra, Spain, as part of the city's comprehensive strategy to promote urban walkability. Since its inception, Metrominuto has been actively maintained and expanded. For instance, in May 2020, a specific Metrominuto map was created for the Monte Porreiro neighbourhood. As of March 2025, the initiative continues to operate, with its maps available through various platforms, including the official website and mobile applications. Metrominuto's success in Pontevedra has inspired numerous cities across Europe such as Florence (Italy), Toulouse (France), Poznań (Poland), London (UK) and various Spanish cities such as Zaragoza, Seville, and Cádiz to implement similar pedestrian maps. The project is part of a series of best practices in the *In Common Sports* project, which focuses on fostering an active lifestyle among senior citizens.



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Figure 33. Metrominuto (Pontevedra, Spain).

Legible London is a comprehensive **wayfinding system** implemented in London, UK, designed to provide a **consistent visual language** that aids both residents and visitors in navigating the city. Started in 2007 with prototype installations around Oxford Street and Bond Street, the system expanded following successful pilots in areas like South Bank, Richmond, and Twickenham. As of 2023, over 1,500 signs have been installed, covering most of London's 32 boroughs. The **design has been developed with organisations representing disability groups to ensure its inclusivity**. For example, the Legible London maps show steps and pedestrian crossings. The project has achieved measurable outcomes, including a 5% increase in walking, a 60% decrease in people feeling lost, and a 16% improvement in pedestrian journey times.



Figure 34. Legible London (London, UK).

The **"New Residents" Welcome Kit** is an initiative implemented in Almada, Portugal, in 2012 as part of the European SEGMENT Project, co-financed by the Intelligent Energy Europe (IEE) Programme and AGENEAL. Inspired by Munich's approach, the campaign aimed to encourage new residents to use public transport by providing tailored information on Almada's public transport network. Over two months, the campaign **reached 600 new residents, resulting in a 13% increase in public transport usage and a 6% decrease in car use**. The initiative had an estimated cost of €30,000 and involved four local staff members plus external services. Even if focused on public transport it is a tool that could be used to showcase also cycling and walking possibilities.

B.2 - STORYTELLING AND AWARENESS INITIATIVES

Storytelling and awareness initiatives can transform policies into narratives that resonate with citizens, fostering engagement and understanding. By crafting such narratives, communities can challenge existing paradigms (for instance, the automotive industry's historical use of storytelling to equate car ownership with freedom) and envision more inclusive, secure environments. Indeed, storytelling can be instrumental in shifting perceptions towards sustainable transportation, encouraging citizens to rethink their travel behaviours and embrace alternatives to car usage. Similarly, storytelling plays a crucial role in addressing safety concerns for women and LGBTQ+ communities in urban settings, shedding light on the prevalence of sexual harassment and violence, advocating for safer public environments.

Vulnerable groups	Women, LGBTQ+ community
Intervention Functions	Environmental restructuring

CASE STUDIES

By harnessing the power of **storytelling**, it is possible not only raise awareness but also inspire collective action, leading to transformative changes. The **Chalk Back** movement



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began in 2016 in New York City, founded by activist Sophie Sandberg through her Instagram account, @catcallsfornyc. The initiative involves **collecting real-life experiences of street harassment, specifically catcalling, and writing these phrases in chalk at the exact locations where they occurred.** The goal is to **raise awareness, challenge normalised behaviours, and reclaim public spaces** for those affected. Inspired by Sandberg's approach, Farah Benis launched a similar initiative in London, creating the @catcallsfondon Instagram account. Since then, the movement has spread to cities around the world, including Paris, Amsterdam, Montreal, Philadelphia, and Fez in Morocco. In each location, local activists adopt the same chalking method to highlight and confront gender-based street harassment in their communities. By 2023, the movement had documented over 3,500 stories of street harassment in chalk across the globe. It operates at a grassroots level, driven entirely by volunteer efforts and community engagement, with no centralised or allocated budget. Today, Chalk Back is an **international, youth-led movement expanded to over 150 cities worldwide**, supported by a growing network of more than 1,000 activists across six continents. The initiative exemplifies the transformative power of storytelling in public space as a tool for awareness, solidarity, and resistance.



Figure 35. Chalk Back (worldwide).

The French movement **#NousToutes** exemplifies the power of storytelling in combating gender-based violence. Through **collective narratives and public demonstrations**, they have successfully brought attention to the pervasive issue of violence against women, influencing public discourse and policy reforms. **#NousToutes** is a French feminist collective founded in 2018, dedicated to ending sexist and sexual violence against women and children across France. While the organisation does not provide direct support services to victims, it offers guidance by directing individuals to professional associations and structures equipped to handle such cases effectively. To empower individuals with practical tools to combat gender-based violence, **#NousToutes** published the action manual "En finir avec les violences sexistes et sexuelles" in 2021, authored by Caroline De Haas. This manual presents key statistics, legal information, and actionable strategies aimed at eradicating these forms of violence. Comprised of volunteer activists, the collective organises nationwide events, such as feminist strikes on March 8th (International Women's Rights Day) to raise awareness and advocate for effective public policies addressing gender-based violence. Notably, in



November 2019, the collective mobilised approximately 150,000 participants across France to protest against sexual and sexist violence. The collective remains active, with local committees engaging in ongoing initiatives throughout the country. Operating as a grassroots organisation, Nous Toutes relies on volunteer efforts and community engagement.



Figure 36. #NousToutes (France).

HarassMap is an Egyptian initiative founded in late 2010 to combat the widespread issue of sexual harassment in Egypt. Leveraging mobile and online technology, **HarassMap enables individuals to anonymously report incidents of sexual harassment** through various channels, including SMS, email, Twitter, Facebook, or an online form. These reports are then verified and plotted on an **interactive map, highlighting harassment hotspots** across the country. By visualising the prevalence of such incidents, HarassMap raises awareness and fosters community engagement. **Volunteers actively participate in community outreach**, visiting areas identified as harassment hotspots to **engage with local stakeholders** (such as shop owners, police officers, and residents) **to promote harassment-free zones**. HarassMap also offers **self-defence classes and educational programs**, aiming to cultivate a culture of zero tolerance toward sexual harassment. The initiative has inspired activists in over 25 countries to adopt similar strategies, demonstrating its global impact.



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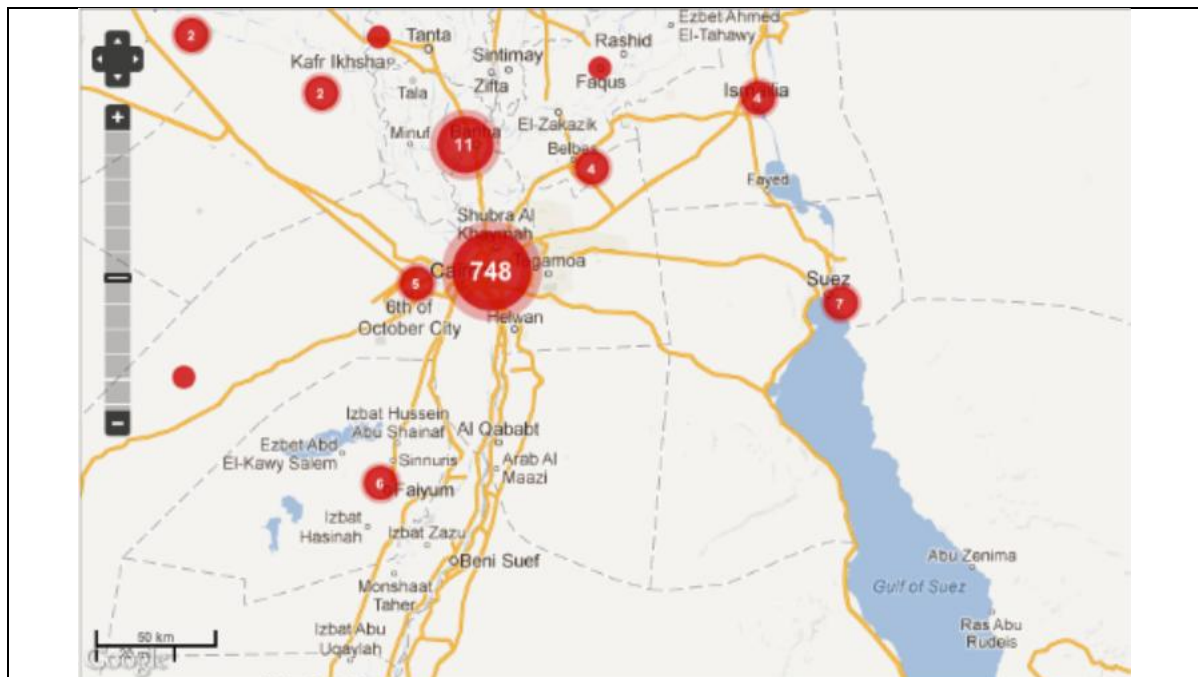


Figure 37. HarassMap (Egypt).

Copenhagen exemplifies the power of storytelling in promoting cycling culture. In 2017, the city adopted the vision of becoming the world's best cycling city, encapsulated in the slogan "I bike CPH," a play on the iconic "I ♥ NY", replacing the heart with a bicycle symbol. **This branding initiative has ingrained cycling into the identity of Copenhageners**, with 49% of all trips to work and education made by bike in 2018. Such narratives have been instrumental in reducing car dependency and fostering a sustainable, bike-friendly urban landscape.



I 
CPH

Figure 38. I bike CPH (Copenhagen, Denmark).



3.3 C) Digital and smart systems

C. DIGITAL AND SMART SYSTEMS						
Intervention types	C.1 - Route planning Apps C.2 - Walking/Cycling smart systems					
COM-B components	Capability		Opportunity		Motivation	
	<i>psychological</i>	<i>physical</i>	<i>physical</i>	<i>social</i>	<i>automatic</i>	<i>reflective</i>
Vulnerable groups	Youth, Children, People with disabilities.					
Good practices	<u>C.1 - Route planning Apps</u>					
	○ FOLLOW (Brest (France) and Dublin (Ireland)) ○ School Bike Route Planner (Frankfurt Rhine–Main, Germany).					
Good practices	<u>C.2 - Walking/Cycling smart systems</u>					
	○ Smart Bicycle Counters (Copenhagen, Denmark) ○ Smart Traffic Lights (Vienna, Austria): ○ Flo Cycling Feedback System (Utrecht, Netherlands): ○ Rain-Responsive Traffic Lights (Rotterdam, Netherlands).					

C.1 - ROUTE PLANNING APPS	
<i>By providing users with real-time, accessible, and multimodal travel information, route planning apps simplify decision-making and can promote more environmentally friendly options such as walking, cycling, and public transport. For vulnerable groups (including older adults, people with disabilities, those with limited language literacy) route planning apps can be particularly impactful. When designed with inclusivity in mind, they can reduce informational and psychological barriers, offering tailored routes that consider safety, comfort, accessibility (e.g. step-free access or well-lit pathways), and affordability. Beyond convenience, these tools support behavioural change by making sustainable travel not only viable but also preferable. They help users explore alternatives to car dependency, visualise active travel benefits (e.g. calorie burn, CO₂ saved), and build trust in unfamiliar or multimodal journeys.</i>	
Vulnerable groups	Youth, Children, People with disabilities
Intervention Functions	Enablement, Environmental restructuring
CASE STUDIES	
The School Bike Route Planner (developed by Austrian Mobility Research), known locally in Frankfurt Rhine–Main as <i>Schülerradrouten</i>, is a web-based and smartphone application that helps students choose safer, more comfortable cycling routes to and from school. Originally piloted in Austria, the solution has been adapted to local conditions in Germany and now spans over 4,000 kilometres of connected routes, linking 240 secondary schools across the Frankfurt Rhine–Main metropolitan region. By analysing factors such as traffic density, dedicated bike infrastructure, and potential hazards, the planner boosts safety for young cyclists and provides local authorities with data for targeted infrastructure improvements.	



JUST STREETS

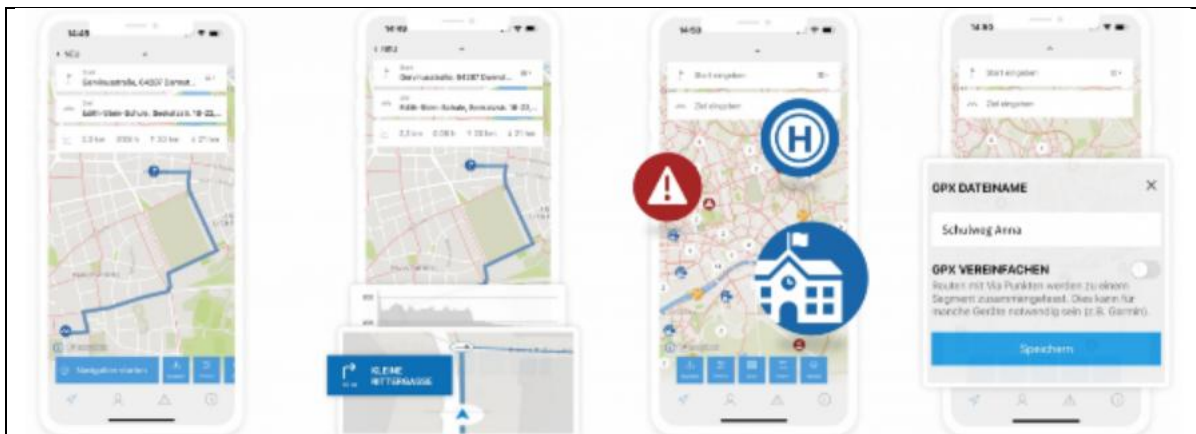


Figure 39. School Bike Route Planner – Schülerradroutes (Frankfurt Rhine–Main, Germany).

The **FOLLOW** project is an innovative initiative aimed at enhancing active mobility **for individuals with reduced mobility** by developing a **route planner that identifies the safest and most accessible walking paths**. Launched in 2023, the project is being implemented in Brest, France, and Dublin, Ireland, through a collaborative effort led by CARNET, in partnership with organizations such as Streetco, Instant System, and the Technical University of Eindhoven. The app uses user-generated data, allowing participants to photograph and report obstacles like potholes or overhanging branches; this information is then processed using artificial intelligence to categorize and map these barriers, enabling the app to suggest optimal routes that circumvent such hindrances. FOLLOW is co-funded by EIT Urban Mobility, an initiative of the European Institute of Innovation and Technology, a body of the European Union.



Figure 40. Follow (Brest, France and Dublin, Ireland).



C.2 - WALKING/CYCLING SMART SYSTEMS

Smart systems in mobility, powered by data, connectivity, and automation, are key enablers in making walking and cycling more viable, safe, and attractive. These technologies go beyond traditional infrastructure by creating responsive, adaptive environments that prioritise active mobility. Examples include intelligent traffic signals that give priority to pedestrians and cyclists, smart signage, and sensor-based monitoring that enhances safety and efficiency. When integrated thoughtfully, smart systems support behavioural change. Features such as real-time feedback, gamification, and seamless integration with public transport services encourage people to shift towards active travel. These tools can also inform users of the environmental and health benefits of their choices, reinforcing motivation.

Vulnerable groups	General
Intervention Functions	Enablement, Environmental restructuring, Persuasion

CASE STUDIES

The following case studies are reported. They focus on the development of smart technologies to facilitate and prioritise active mobility such as walking and cycling.

Vienna, Austria has been implementing “denkende” Ampeln (“smart” pedestrian traffic lights) to enhance urban mobility and safety. Initiated in 2018, the project replaces traditional push-button systems with **advanced sensors and computer algorithms that detect pedestrians approaching crossings**. By analysing individuals’ direction and behaviour, these lights predict crossing intentions, reducing **unnecessary waiting times, and improving traffic flow**. The system was developed by the Graz University of Technology in collaboration with Vienna’s Municipal Department 33. As of 2024, 21 intelligent traffic lights are operational, with plans to expand further.

The **Flo** project, initiated in 2017 by Dutch developer Springlab, introduced an innovative system in Utrecht, Netherlands, aimed at enhancing the cycling experience by minimising stops at red lights. The term “Flo” in the context of the Dutch cycling project refers to the concept of maintaining a continuous and smooth cycling experience, allowing cyclists to “flow” through traffic lights without unnecessary stops. This system detects an approaching cyclist’s speed and provides real-time feedback, such as whether to speed up or slow down, to help them catch green lights, thereby enhancing the overall cycling experience. The system uses **sensors positioned approximately 100 meters before traffic lights to detect an approaching cyclist’s speed**. Based on this data, it provides real-time feedback through animal symbols: a hare suggests speeding up, a tortoise indicates slowing down, a cow means the cyclist will not make the green light, and a thumb up signifies maintaining the current speed. This guidance **helps cyclists adjust their pace to catch green lights, thereby reducing stops and improving traffic flow**.



JUST STREETS

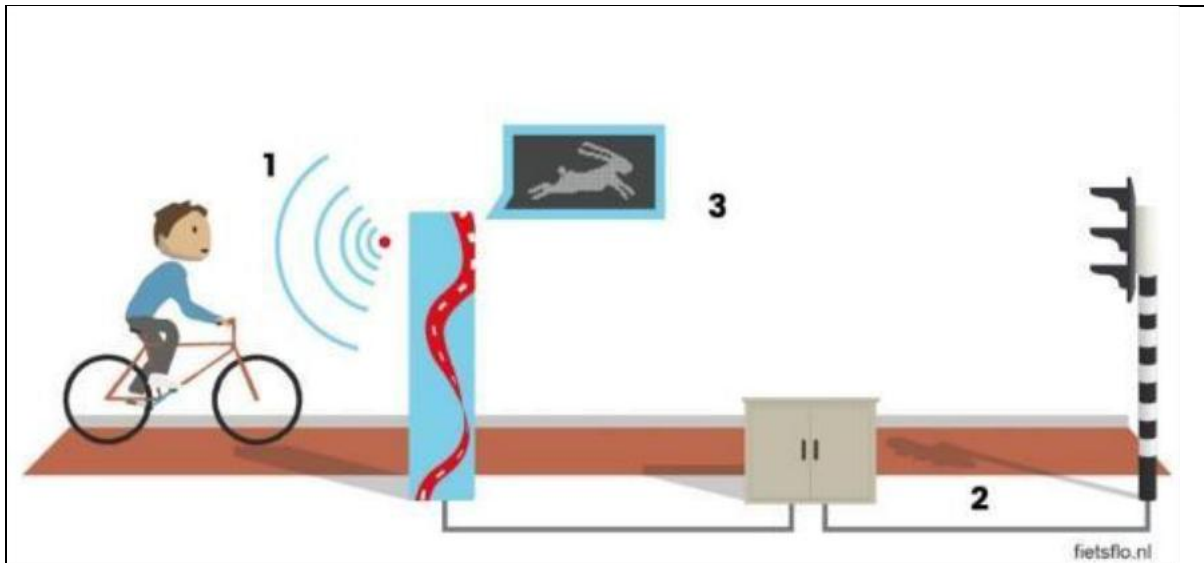


Figure 41. Flo (Utrecht, The Netherlands).

In Copenhagen, **smart bicycle counters** have been installed to monitor cycling traffic. The first electronic counter was installed in 2009, at the City Hall Square, and ever since, many other counters have been installed across the city. These devices detect and display the **number of cyclists passing specific points daily and annually reinforcing the message that cyclists are valued and integral to urban mobility**. Beyond public display, the counters collect data that the City of Copenhagen uses to monitor cycling trends and plan infrastructure improvements. This initiative aligns with Copenhagen's goal of becoming the world's best bicycle city by 2025. These counters serve **not only as data collection tools but also as public acknowledgments of the city's cycling culture**, encouraging more residents to choose bicycles for transportation.



Figure 42. Smart Bicycle Counters (Copenhagen, Denmark).

In Rotterdam, since 2015, the city has implemented **Rain-Responsive Traffic Lights** to support cyclists during rainy conditions. **Rain sensors** installed at traffic lights detect wet weather and subsequently **reduce cyclists' waiting times** by approximately 40 seconds, encouraging cycling even in adverse weather. This initiative is part of Rotterdam's broader strategy to promote cycling, which has seen a 10% increase in bike traffic over the past year. The rain-responsive traffic lights are among 40 measures introduced by the local government to further stimulate cycling in the city.

3.4 D) Economic levers and incentives

D. ECONOMIC LEVERS AND INCENTIVES						
Intervention types	D.1 - Challenge/game-based initiatives D.2 - Support for bike/e-bikes ownership and use D.3 - Economic incentives and pricing strategies					
COM-B components	Capability		Opportunity		Motivation	
	<i>psychological</i>	<i>physical</i>	<i>physical</i>	<i>social</i>	<i>automatic</i>	<i>reflective</i>
Vulnerable groups	General, Youth, Children, Families, Migrants, Low-income, Employees					



Good practices	<u>D.1 - Challenge/game-based initiatives</u>
	○ Wecity App (originated in Modena, Italy). ○ MUV App (Multiple EU cities). ○ Beat the Street (United Kingdom, multiple cities) ○ European Cycling Challenge (Multiple EU cities). ○ Traffic Snake Game (launched in Flanders, Belgium; implemented EU-wide). ○ Bike to Work (Brussels, Belgium; widely used across Europe).
	<u>D.2 - Support for bike/e-bikes ownership and use</u>
	○ Bonus Bici (Emilia-Romagna, Italy). ○ Bota pra Rodar ('Cycle it out') (Recife, Brazil) ○ CampusBike (Berlin, Germany). ○ BiciRegistro (Spain, national initiative). ○ Bicycle Collective (Salt Lake City, USA). ○ Bike Project - Getting Refugees Cycling (London and Oxford, UK). ○ Cycle-R (UK, various locations).
	<u>D.3 - Economic incentives and pricing strategies</u>
	○ MyClub (France). ○ Be-Cyclist (Belgium). ○ Workplace Parking Levy (WPL) (Scotland, UK). ○ Glasgow's Low Emission Zone (LEZ) (Glasgow, UK).

D.1 - CHALLENGE/GAME-BASED INITIATIVES

Game-Based initiatives are gaining a wider recognition amongst practitioners and policymakers, as effective tools for encouraging people not using active mobility to start cycling and walking. By incorporating elements of gamification, such as goal setting, rewards, and interactive community-based challenges, these initiatives transform everyday mobility into an engaging and enjoyable experience. Clear goals, instant feedback, and incentives (from digital badges to real-world rewards) can significantly boost, and leaderboards and social competition foster long-term engagement and a sense of belonging. The rapid integration of technology has also played a crucial role in the success of gamification for active mobility. Smartphones, GPS tracking, and wearable fitness devices provide users with real-time feedback, fostering continuous participation. Cycling and walking apps now incorporate game mechanics such as daily step goals, route-based challenges, and CO₂ savings tracking, reinforcing positive mobility choices.

Vulnerable groups	Youth, Children, Families, Migrants, Low-income, Workers
Intervention Functions	Incentivization

CASE STUDIES

With rewarding eco-friendly travels, **Wecity App** (developed by an Italian startup in 2012) automatically **track user's and company's travel while calculating saved CO₂ emissions**. Users and companies choosing sustainable mobility earn points which generate "blue clouds", symbolising reduced emissions. Similarly, unsustainable trips result in point deductions and "red clouds". The app also offers daily lifestyle tips, such as BikeToWork, initiatives happening in your city, and provide rewards, such as public transport incentives or purchasing in eco-friendly markets. Companies, shops, and public entities can collaborate with Wecity to provide **prizes and economic incentives**. Another feature is that **users can rate their biking experiences**, reflecting their perceived safety of specific paths. These **ratings contribute to**



the Urban Cyclability Index. In 2015, users collectively saved over 200 tons of CO₂ emissions, having cycled more than 1 million km.

Building on the idea of gamifying sustainability but adopting a more collaborative and competitive approach, **MUV** emphasizes a **game-based, team-oriented approach, transforming urban mobility into a sport-like competition among people and cities.**

Launched in 2017 as part of an EU Horizon, MUV is a mobile app that rewards users using sustainable transportation. These points can be used to train, participate in challenges, and compete in tournaments, with prizes sponsored by local businesses. The initiative was co-created and tested in six pilot cities: Amsterdam, Barcelona, Ghent, Fundão, Helsinki, and Palermo. Following two open calls in 2018 and 2019, more cities joined. Over 5,000 citizens actively participated in the game, collectively recording more than 260,000 km of sustainable travel. This effort led to an average improvement of 32% in their carbon footprints, equating to the environmental impact of planting a 2-hectare forest in an urban area. Moreover, the app recorded an impressive +55% average propensity for behaviour change, confirming its effectiveness in promoting long-term mobility shifts. In 2020, MUV transitioned into a benefit corporation, MUV Società Benefit, with the goal of transforming sustainable urban mobility into a global movement and undertaking increasingly ambitious challenges. MUV's success lies in its ability to blend technology, play, and civic engagement, making active mobility not only sustainable but also fun, social, and measurable. It serves as a compelling example of how **gamified urban challenges** can foster long-term behaviour change and support data-driven mobility policies.



Figure 43. MUV App (Italy).

Game-based initiatives can take the form of **Beat the Street** (developed by Intelligent Health, a UK-based company), an **interactive game that transforms your town into real-life games.** Players use the app at designated “Beat Boxes” placed throughout the area. **Each tap earns points**, allowing individuals and teams to compete to travel the furthest and score the most. Individuals can win weekly “Lucky Boxes”, while top-performing teams can receive rewards of up to £750, often donated to local schools or charities. Since its launch, over 1.9 million people across more than 170 areas have taken part in the challenge. In terms of



benefits, Beat the Street has been effective in **increasing physical activity levels among participants**. For instance, in Burnley, the game saw 12,364 participants who collectively walked, cycled, and wheeled over 155,121 miles during the competition period. These outcomes demonstrate the program's success in promoting active mobility and enhancing community well-being.

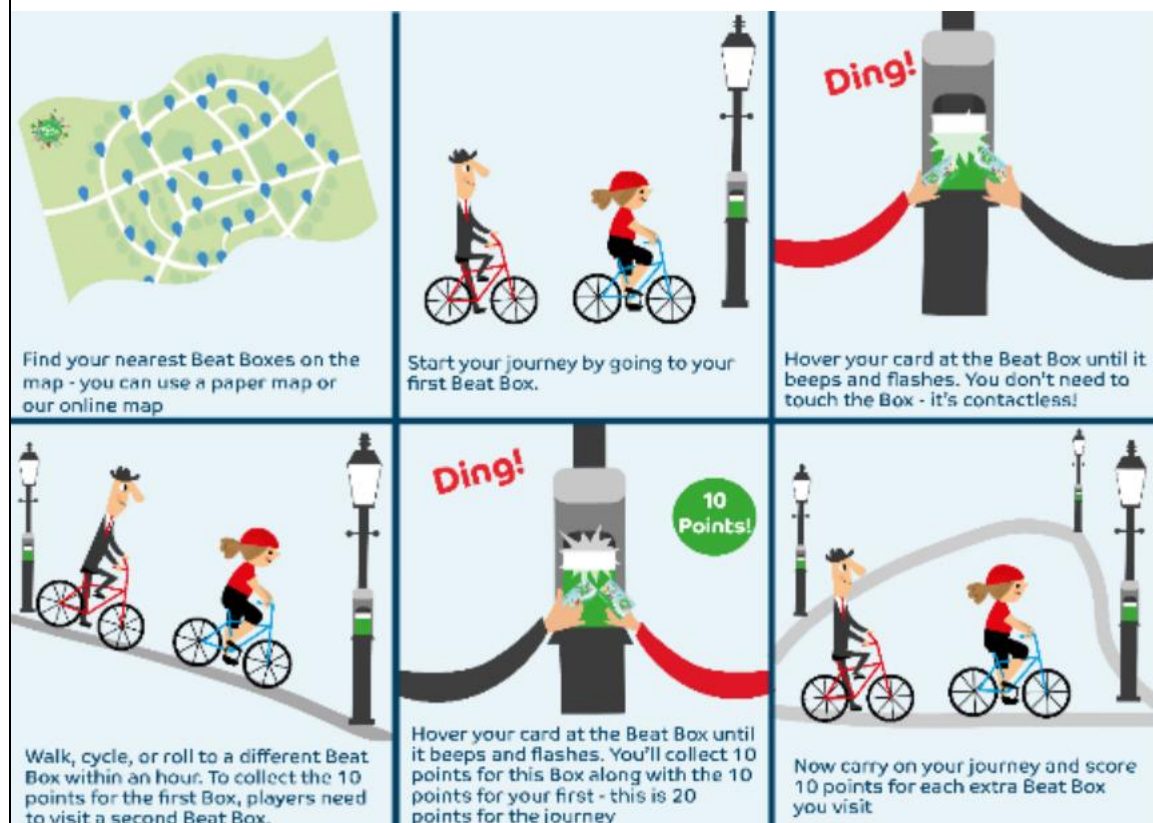


Figure 44. Beat the Street (UK).

While these initiatives are primarily tech-driven or supported by private companies, municipal-led efforts have also demonstrated the power of gamification in mobility. The **European Cycling Challenge** (2012-2017) in Gdańsk, Poland was an initiative aimed at promoting cycling to and from schools. This challenge involves **students from 14-16 years old, competing in teams**, recording the number of km cycled over a month-long period. The initiative engaged 800 students from 20 schools, who collectively cycled 106,500 kilometres during the challenge period. The campaign's budget was approximately €30,000, averaging €7.50 per participant. Half of these funds were allocated to prizes. The competitive aspect of the challenge also enhanced community involvement and school pride, while raising awareness about the environmental benefits of cycling.

Aiming even younger, the **Traffic Snake Game** (TSG), established 15 years ago by Mobiel21 in Belgium, engages children aged 6 to 12 and their parents for their journeys to and from schools. The game operates over a two-week period during the school year, during which **children put dots on a snake's body every time they walk, cycle, use public transport or carpool to school**. The **goal is to fill the snake with dots** by the end of the two weeks, symbolising the collective effort that the school is doing toward greener mobility choices. Schools **set realistic goals, and progress is visually tracked** through the Traffic Snake banner in shared areas to motivate continued participation. Each day, the class adds their



stickers to the banner, helping the snake "grow". The goal is to reach a predefined target of sustainable trips by the end of the campaign. Schools often host events and activities to keep the energy high, while teachers use the campaign as a chance to talk about climate, health, and community. Between 2014 and 2017, the Initiative expanded its reach across 19 European countries, involving 177,587 pupils from over 1,000 schools. Collectively, these participants avoided 397 tonnes of CO₂ emissions. The TSG has proven effective in shifting travel behaviour among schoolchildren, achieving a 15% increase in sustainable trips during the campaign and maintaining a 7% retention effect post-campaign.



Figure 45. Traffic Snake Game (Belgium).

The "**Bike to Work**" initiative is a **widespread European campaign** with national and local adaptations across several countries. Launched in 2011, it has become one of the most recognisable grassroots efforts promoting cycling as a primary commuting option for workers across Europe. Each year, the campaign is implemented in different formats depending on the country, but always with the common goal of **encouraging sustainable daily travel through friendly competition** and community engagement. To provide some figures for example, in Greece, the "Bike to Work" initiative has been running annually since 2011 and continues to grow. It takes the form of a national challenge among cities, designed to promote everyday cycling among employees. Held each May, the initiative invites **participants to log their bicycle commutes, recording both the number of days cycled and the total distance travelled**. The competition fosters a playful and engaging environment where individuals, teams (up to four people), companies, and entire cities compete for the highest participation and cycling rates. To ensure fair comparisons, city rankings are weighted relative to population size. The Greek edition has had a tangible and steadily growing impact. Over the years, more than 8,500 participants from over 320 companies and 170 cities have taken part. Together, they have cycled over 1.3 million kilometres, avoiding an estimated 200 tons of CO₂ emissions. Beyond environmental benefits, the campaign has raised public awareness of sustainable commuting, strengthened inter-company and local engagement, and promoted healthier lifestyles by integrating physical activity into daily routines.

D.2 - SUPPORT FOR BIKE/E-BIKES OWNERSHIP AND USE

Incentives and access to affordable bicycles are powerful tools for encouraging a shift toward active mobility. Subsidised or low-cost access to bicycles has proven effective in engaging individuals who might not otherwise choose cycling, particularly those from lower-income backgrounds or with limited mobility options.

Ownership programmes that specifically target disadvantaged groups tend to result in more lasting changes in travel behaviour, reducing dependency on private cars. These outcomes are strengthened when the provision of bicycles is paired with additional support such as maintenance workshops, cycling skills training, and peer mentoring. Such integrated approaches build confidence, routine, and a sense of self-sufficiency around cycling.



Vulnerable groups	Migrants, Youth, Children, Low-income
Intervention Functions	Incentivization

CASE STUDIES

Launched in 2020 and currently ongoing, the **Bonus Bici** initiative by the Region of Emilia-Romagna (Italy) is a **public incentive program aimed at supporting the purchase of pedal-assist bicycles and electric cargo bikes, offering financial subsidies to residents living in municipalities most affected by pollution**. In practice, eligible residents can receive a subsidy covering up to 50% of the purchase price, with a maximum of €500 for e-bikes and €1,000 for electric cargo bikes. Additional incentives are available: an extra €200 for residents in municipalities affected by recent floods, and up to €1,400 for those who have scrapped an old car since January 1, 2023. Since its introduction, the initiative has led to thousands of new bicycles being introduced across the region, and in 2025 alone, €2.65 million has been allocated to support the initiative. The Bike Bonus has significantly contributed to increasing the number of electric bicycles in Emilia-Romagna, promoting healthier lifestyles and environmental benefits.

In Berlin, the **Campusbike** initiative launched in 2015 offers affordable bike-sharing services to university students. Developed in collaboration with the Technical University of Berlin and Nextbike, the system enables students at participating universities to ride for free during the first 30 minutes (riding more than 30 minutes, it's 1 € for each additional 30 minutes). **Campusbike has become an integral part of student mobility in Berlin**, helping to foster a culture of active travel while reducing dependency on cars and public transit. The program is a key component of Nextbike Berlin, one of the most successful public bike-sharing systems in Europe, with millions of rides recorded annually.



Figure 46. CampusBike (Berlin, Germany).

Security and bike recovery also play a role in encouraging cycling. In Spain, the **BiciRegistro** platform was established as a **national bicycle registration system to deter theft and facilitate the identification and recovery of bicycles in case of loss or theft**. Its primary goal is to discourage cycle theft and assist in the identification of owners. To register a bicycle, owners need to create an account on the BiciRegistro website, provide personal and bicycle



details, and pay a fee of €7. After registration, users receive a marking kit containing ultra-resistant adhesive labels with a unique code and QR code, which should be affixed to the bicycle in specified locations. These labels are difficult to remove and leave a traceable mark under ultraviolet light, aiding in the identification and recovery process. In the event of theft, registered users can mark their bicycle as "missing" in the system, alerting local authorities, and increasing the likelihood of recovery.

Grassroots and community-led initiatives are similarly impactful in providing support for those in needs. For example, the **Bicycle Collective** is a group of nonprofit bike shops founded in 2002 in Salt Lake City, US, focused on **refurbishing donated cycles and providing educational programs** (e.g. bicycle maintenance courses) to the community, particularly children and lower income households. In 2025, the Bicycle Collective announced the naming of its new hub. This new centre now serves as a place for community gathering and support, providing critical and accessible services like independent transportation. It also **provides access to tools and workspaces**, allowing community members to perform their own bicycle maintenance and repairs with guidance from experienced volunteers and staff. In 2024, the collective gave over 1,200 bicycles to those in needs and received over 5,000 bicycled from donations.



Figure 47. Bicycle Collective (Salt Lake City, USA).

In the UK, the **Bike Project**, founded in 2013 and still operating today, is a **charity association that empowers refugees by providing them with refurbished cycles**. The organization operates on the belief that access to a bike can improve a refugee's life, enabling them to access essential services, attend language classes, visit friends, or support networks, and travel to job interviews without financial burden. The initiative collects donated **second-hand bikes, refurbishes them with the help of volunteers and mechanics, and distributes them for free to refugees across the UK**. It also runs dedicated programs to increase accessibility and confidence among vulnerable groups. One of its standout initiatives is *Pedal Power*, a cycling **training program specifically designed for refugee women**, which teaches riding skills in a safe and supportive environment. It reached out 670 women to lessons. Another core activity, *Bike Buddies*, **pairs refugees with local volunteers for joint rides and mentoring**, fostering a sense of community, safety, and belonging. 313 refugees joined the program. Since its launch, The Bike Project has donated over 11,300 bicycles, avoided 1,600 tons of CO2 emissions through reuse and organized more than 250 social events and activities.



Figure 48. Bike Project (UK).

Similarly, the charity-based **Cycle-R** initiative in Cannock (UK), supports low-income people in accessing cheap cycles, learning maintenance skills. At the heart of Cycle-R's work is the refurbishment of donated bicycles. The **organization collects used bikes, repairs and restores them, and then makes them available to the public at affordable prices.** This circular model not only diverts waste from landfills but also helps people, particularly those from low-income backgrounds, gain access to reliable, low-cost transport. Cycle-R also runs community repair workshops, where individuals can learn how to fix and maintain their bikes. In addition, Cycle-R delivers cycling education and awareness programs, encouraging safer riding habits and fostering a cycling-positive culture across the region.

Established directly by the Municipality in 2015 to address socio-economic inequalities among poor communities, the **Bota pra Rodar** is a **community-based bicycle-sharing initiative** in Recife, Brazil which collects donated cycles that are then refurbished and maintained through community engagement. In communities where bicycles are a crucial means of daily transport, especially for commuting to work, it quickly became clear that there simply weren't enough bikes to meet demand. In response, Bota pra Rodar developed a model where residents participate in workshops covering bicycle mechanics, entrepreneurship, and discussions on the right to urban mobility. Weekly meetings provide space for collective action and technical support, while also exploring how bicycles can be tools for both citizenship and income generation. This collaborative approach ensures that the community not only benefits from the bicycles but also gains valuable skills and a **sense of ownership over the program.**



Figure 49. Bota pra Rodar (Recife, Brazil).

D.3 - ECONOMIC INCENTIVES AND PRICING STRATEGIES

Financial incentives and pricing strategies are among the tools to encourage individuals, companies, and organisations to adopt active mobility. These approaches work through both positive reinforcement (such as rewards for sustainable behaviours) and disincentives, including increased costs for polluting or car-dependent habits.

Well-designed schemes such as loyalty programmes, tax benefits for sustainable commuting, and employer-based cycling allowances have been shown to significantly increase uptake of active travel. Similarly, pricing policies that target car use (such as congestion charges, parking levies, or low-emission zones) can effectively discourage private vehicle use in urban areas.

The most successful programmes are often multi-layered, combining financial levers with social engagement, gamification elements, and public recognition. In corporate mobility schemes and national cycling strategies, the introduction of reward-based systems has helped reframe commuting as a shared, value-driven practice. These approaches not only influence individual behaviour but also align personal choices with wider environmental and public health goals.

Vulnerable groups	General, Low-income, Employees
Intervention Functions	Incentivization, Enablement, Coercion

CASE STUDIES

At the organizational level, **My Club** platform offers a compelling example of how **private companies** can drive behavioural change through positive reinforcement. Launched in 2021 by the French Transdev, this initiative encourages employees to go to work sustainably. It enables **employees to record their daily transport** using an app. **Points are awarded based on the type of transport chosen**, with active mobility generating the highest rewards. These points can then be **redeemed for gift vouchers, extra vacation days, or contributions to charitable causes**. The platform also encourages team-based challenges, turning mobility into a shared experience that strengthens workplace culture and engagement. Since its inception, My Club has been adopted by more than 40 companies and public



institutions in France, logged over 2.5 million kilometres of sustainable travel. Participating organizations report improved employee satisfaction, higher rates of active mobility uptake, and a clearer path toward their internal environmental goals.

At the national level, in September 2021, the Belgian federal government launched its first-ever comprehensive **national strategy for cycling promotion**, titled “**BE CYCLIST**”. This ambitious plan outlines 52 concrete measures, including **fiscal incentives** for cycling to work. Belgium already provides a **tax-exempt mileage allowance** of €0.24 per kilometre **for employees who commute by bicycle**, benefiting over 570,000 workers. Under the new plan, the government is exploring ways to extend this incentive more broadly, with discussions on potentially making it a mandatory benefit across sectors.

Meanwhile, in the UK, more **restrictive pricing mechanisms** are being used to reduce car dependency and fund sustainable transport infrastructure. In 2019, the Scottish Government introduced the Transport (Scotland) Act, granting local authorities the discretionary power to implement a **Workplace Parking Levy (WPL)** as a **measure to reduce urban congestion**. The WPL allows councils to charge employers an annual fee based on the number of parking spaces they provide for employees, incentivizing a shift from private car use to more eco-friendly commuting options. Under this scheme, employers are required to obtain **a license for each workplace parking space made available to employees** and certain visitors. The respective local authority determines the cost of these licenses, and while the employer is legally responsible for the fee, they may choose to pass the cost onto their employees. The revenue generated from the WPL is intended to support local transport strategies, including cycling infrastructure, and pedestrian pathways. For example, Nottingham utilised the funds to expand its tram network.

Complementing these strategies, **Glasgow’s Low Emission Zone (LEZ)** leverages pricing through enforcement rather than incentive. This is Scotland’s first comprehensive urban policy initiative aimed at reducing air pollution and improving public health by **restricting access for the most polluting vehicles**. Phase 1, introduced on 31 December 2018, targeted local bus services, requiring progressive improvements in the emissions standards of vehicles operating within the city centre. Phase 2, which came into full effect on 1 June 2023, expanded the LEZ requirements to encompass all vehicles entering the designated area, with specific provisions for residents. The LEZ operates continuously, 24 hours a day. To enter the zone, vehicles must meet minimum emissions standards, Euro 6 for diesel vehicles and Euro 4 for petrol. Those failing to comply are subject to automatic fines, enforced through Automatic Number Plate Recognition (ANPR) technology installed at key access points across the zone. The initial penalty charge for non-compliant vehicles is £60, but this amount doubles with each repeated breach, up to a maximum of £480 for cars and light goods vehicles, and £960 for buses and heavy goods vehicles. These charges reset after 90 days if no further violations occur. The latest Air Quality Annual Progress Report indicates that NO₂ levels in the city centre and LEZ area have decreased by 20% compared to the previous year. Financially, the LEZ has generated net revenue, with £0.748 million reported for the 2023/24 period. These funds are intended to support environmental projects and further initiatives to enhance air quality in Glasgow.



3.5 E) Walking and cycling environment

E. WALKING AND CYCLING ENVIRONMENT						
Intervention types	E.1 - Streetscape design (visual cues) E.2 - Bike supporting infrastructures E.3 - Placemaking initiatives E.4 - Car-free areas E.5 - Climate-proof walking/cycling streets					
COM-B components	Capability		Opportunity		Motivation	
	<i>psychological</i>	<i>physical</i>	<i>physical</i>	<i>social</i>	<i>automatic</i>	<i>reflective</i>
Vulnerable groups	Older people, people with disabilities, Families, Children, Street Workers, Low-income, Migrants.					
	<u>E.1 - Streetscape design (visual cues)</u> - Coloured Cycle Lanes (Amsterdam, The Netherlands). 3d Zebra Crossing (Ísafjörður, Iceland, replicated globally) - Flowell (Imatra, Finland). - Croix-Rousse Tunnel (Lyon, France). - Starling Crossing (London, UK). - Intelligent Crosswalks (Madeira, Portugal) <u>E.2 - Bike supporting infrastructures</u> - Secure Bike Shelters (Paris, France) - Rotterdam Central Station Bicycle Parking (Rotterdam, Netherlands). - Supervised Bicycle Park Experiment (Lahti, Finland). <u>E.3 - Placemaking initiatives</u> - Citizen Bench (Munich, Germany) - City Dress Up: Seats • Together (Hong Kong). - The Bench Project (London, UK). - Livable Streets Initiative (New York City, USA). <u>E.4 - Car-free areas</u> #Via Libera (Rome, Italy). - Parklets (Munich, Germany) - Low Traffic Neighbourhoods (London, UK). - Pop-Up Plazas / Neighbourhood Plazas (Vancouver, Canada). <u>E.5 - Climate-proof walking/cycling streets</u> - Cool islands (Paris, France). - Climate Shelters Network (Barcelona, Spain) - Reflective Asphalt Coatings (Los Angeles, USA).					

E.1 - STREETSCAPE DESIGN (VISUAL CUES)

Streetscape design and visual cues directly influence how people interact with public space and make their mobility choices. Beyond infrastructure alone, the visual environment can influence perceptions of safety, comfort, and accessibility, factors that are especially important for vulnerable groups such as older adults, children, families, and people with disabilities. By embedding clear, engaging, and inclusive visual elements into the streetscape, cities can subtly “nudge” individuals toward more active forms of travel, such as walking and cycling. These interventions function as forms of environmental restructuring, a behavioural strategy that modifies the physical context to make sustainable and healthy choices easier and more intuitive. Whether through eye-catching crossings, adaptive lighting, or colour-coded cycle lanes, visual enhancements to the built environment can increase visibility, slow down traffic,



and provide reassurance to those who may feel less confident navigating urban space. When designed with inclusivity in mind, such features not only improve safety but also empower more people to move independently and actively through the city.

Vulnerable groups	Older people, people with disabilities, Families, Children, Street Workers
Intervention Functions	Environmental restructuring

CASE STUDIES

3D zebra crossings are innovative **pedestrian crosswalks** designed to create an **optical illusion** of three-dimensionality, **making them appear as physical barriers to drivers**. This visual effect encourages motorists to reduce their speed, thereby enhancing pedestrian safety. The first European implementation of such a crossing occurred in Ísafjörður, Iceland, in 2017, where environmental commissioner Ralf Trylla collaborated with street painting company Vegmálun GÍH to create the illusion. Inspired by similar initiatives in India, this approach has since been adopted in various cities across Europe, including Aarhus, Denmark, and several towns in Belgium. The primary achievement of 3D zebra crossings lies in their **ability to effectively slow down traffic** and improve pedestrian safety, of the older people and people with reduced mobility, through cost-effective visual design.



Figure 50. 3D Zebra (Ísafjörður, Iceland).

In Amsterdam, **coloured cycle lanes**, particularly those using red asphalt, have been implemented to **improve visibility, enhance cyclist safety, and subtly influence road user behaviour**. While red lanes have been widely used across the Netherlands, a comprehensive study by Fyhri, Karlsen, and Sundfør (2021) in Oslo provides robust insight into their effectiveness. The study found that red cycle lanes significantly increased cyclist visibility, improved perceived safety, and nudged both cyclists and motorists to adopt safer behaviours, such as cyclists staying in-lane and motorists maintaining greater passing distance. Although primarily conducted in Oslo, the findings reflect practices common in Dutch cities like Amsterdam, where red lanes are **part of an integrated cycling strategy**. The study highlighted that **coloured lane function as a “nudge,” subtly influencing behaviour**



without restricting choices. However, they can be costlier than standard black asphalt (approx. €35 vs. €25 per m²), but the benefits may justify the investment for cities prioritising cycling safety and uptake.



Figure 51. Coloured cycle lanes (Amsterdam, The Netherlands).

Flowell is a dynamic, LED-based road marking system to enhance traffic safety with light-emitting panels. Designed for use in locations where traditional traffic lights are not viable, Flowell activates in response to approaching pedestrians or vehicles, guiding traffic more effectively than standard paint markings. In autumn 2022, the system was piloted in Imatra, Finland, to test its **resilience under harsh Nordic winter conditions**. Despite heavy snowfall, snow ploughing, and traffic, the panels performed exceptionally well, remaining visible and intact. The ongoing pilot continues to inform future development, with Flowell already in use in countries like France, the US, Japan, and the Netherlands.



Figure 52. Flowell light-emitting pedestrian crossing.

The Tunnel de la **Croix-Rousse** in Lyon, France, features an innovative **artistic bike path that enhances the experience** for cyclists and pedestrians. Opened in December 2013, this 1,760-meter-long tunnel is exclusively dedicated to non-motorized transport modes, including bicycles and pedestrians. The tunnel's interior is decorated with dynamic light installations and digital art projections, creating an **immersive environment that transforms a simple transit route into a cultural journey**. These artistic elements are accompanied by ambient music, offering a unique and engaging passage beneath the city. The project was part of a larger renovation effort, with the entire infrastructure upgrade costing approximately €283 million.



Figure 53. Artistic Bike Paths: Croix-Rousse (Lyon, France).

The **Starling Crossing** (STigmergic Adaptive Responsive LearnING Crossing) is an innovative pedestrian crossing system developed by Umbrellium in London, UK. Implemented in 2017, this adaptive crossing uses reactive stigmergic neural networks to adjust in real-time to various scenarios and changes. Equipped with ultra-bright LEDs and a network of cameras, it can distinguish between vehicles, pedestrians, and cyclists, modifying its layout and signals accordingly to enhance safety and traffic flow. The trial demonstrated the potential of **responsive infrastructure to improve urban safety**. The system also features a durable, non-slip surface that can withstand vehicle weight and adverse weather conditions.



Figure 54. Starling crossing (London, UK).

In Funchal, Madeira, Portugal, an innovative **intelligent crosswalk system** was implemented to enhance pedestrian safety and energy efficiency. This system integrates LED strips into the



ground at pedestrian crossings near popular tourist areas and public transport hubs. The LEDs, powered by renewable solar and wind energy, illuminate in green or red based on traffic signals, alerting pedestrians engrossed in their smartphones when it's safe to cross. Additionally, motion sensors detect approaching pedestrians, activating both ground-level LEDs and overhead lighting to increase visibility for drivers. Since its implementation, in 2019, there have been no recorded accidents near these crosswalks, and the system generates approximately 9 kWh of energy daily. The total cost of the project was €75,500, funded through the CIVITAS DESTINATIONS (H2020) initiative.



Figure 55. Intelligent crosswalk system (Funchal, Portugal).

E.2 - BIKE SUPPORTING INFRASTRUCTURES

Cycling infrastructure in urban settings, particularly when located in strategic areas, plays a key role in reducing both real and perceived barriers to cycling. Secure and well-integrated bicycle parking facilities are especially important for individuals considering a shift from private car use or public transport. By enhancing convenience, safety, and accessibility, these interventions support environmental restructuring, one of the core functions for enabling behaviour change. Well-designed bike parking not only deters theft and protects bicycles from weather-related damage but also signals institutional commitment to cycling as a legitimate and encouraged mode of transport. When integrated into transport hubs or positioned in high-demand locations, such infrastructure facilitates multimodal travel and encourages the integration of cycling into daily routines.

Vulnerable groups	All
Intervention Functions	Environmental restructuring

CASE STUDIES

In Paris, the implementation of **secure bike shelters** aims to enhance urban cycling by providing safe parking options, thereby encouraging more residents to choose bicycles for transportation. These shelters offer **protection against theft and weather conditions, addressing common concerns among cyclists**. By offering safe, weather-protected parking, Paris is removing **key psychological and practical obstacles**, thereby creating more favourable conditions for behaviour change.



Figure 56. Secure bike shelters (Paris, France).

In November 2013, Rotterdam unveiled a state-of-the-art underground **bicycle parking** facility at its Central Station, accommodating up to 5,190 bicycles. Designed by architect Maarten Struijs, the facility features the Easylift+ two-tier parking system, optimising space, and user convenience. Its interior employs **distinct colours and numbered walkways to assist cyclists in locating their bikes**. Integrated **sensors** monitor parking durations to **prevent long-term storage**, ensuring availability. The facility offers both free and guarded sections, with **direct connections to the railway station and public transport terminal**. The primary achievement of the bicycle parking facility at Rotterdam Central Station is its substantial contribution to promoting cycling as a viable mode of urban transportation. It **encourages commuters to integrate cycling into their daily routines**, thereby reducing reliance on motor vehicles and alleviating urban congestion. This initiative underscores Rotterdam's commitment to sustainable urban mobility and serves as a model for integrating cycling infrastructure with public transportation hubs.



Figure 57. Bicycle Parking in Rotterdam Central Station (Rotterdam, The Netherlands).

In Lahti, Finland, the **Supervised Bicycle Park Experiment** addresses common concerns among cyclists, such as theft and vandalism by offering a **safe place to park their bicycles**. The bicycle park operates under the management of Inspis, a third-sector organisation which support youth at risk of unemployment. The supervised bicycle park not only offers secure parking but also introduces citizens to the sharing economy by **providing bicycle maintenance services** and access to a wide range of tools. In 2020, the continuation of the guarded bicycle park at the Market Square received €3,000 in funding and garnered 751 votes from residents, reflecting strong community backing.



Figure 58. Supervised Bicycle Park Experiment (Lahti, Finland).



E.3 - PLACEMAKING INITIATIVES

Placemaking initiatives encourage people to move, interact, and develop a sense of belonging. By transforming underused or overlooked public spaces into accessible, welcoming, and functional environments, placemaking contributes directly to environmental restructuring, a core intervention function for promoting active mobility and social engagement. Features such as public seating, participatory art, and small-scale infrastructure not only enhance the visual and functional quality of urban spaces, but also make them more comfortable and inclusive, particularly for marginalised or less mobile groups. These elements provide places to pause, rest, and connect, offering both practical support and a sense of dignity for those who may need breaks during walking or cycling, such as older adults, people with disabilities, or families with children. The following case studies demonstrate how placemaking can function as a powerful behavioural lever: improving the usability and appeal of public spaces, encouraging spontaneous physical activity, and empowering people of all ages and abilities to reclaim streets and plazas as part of everyday urban life.

Vulnerable groups	All
Intervention Functions	Environmental restructuring

CASE STUDIES

City Dress Up: Seats • Together was a public art initiative in Hong Kong that transformed urban spaces by **installing 20 sets of artistically designed functional furniture** across the city's 18 districts. Launched in July 2017 and concluding in July 2020, the project was organised by the Art Promotion Office with assistance from some guest curators. Collaborating with 20 teams of artists, designers, and architects, the installations were placed in public venues such as parks, waterfronts, and playgrounds, enhancing the city's landscape and **fostering community engagement**, significantly contributing to enhancing the city's public spaces. **Citizens were engaged through various creative activities, such as soundwalks, workshops, and performances, encouraging interactions among residents of diverse backgrounds.** The initiative's success was further recognised through multiple local and international awards, highlighting its impact on public art and community cohesion in Hong Kong.



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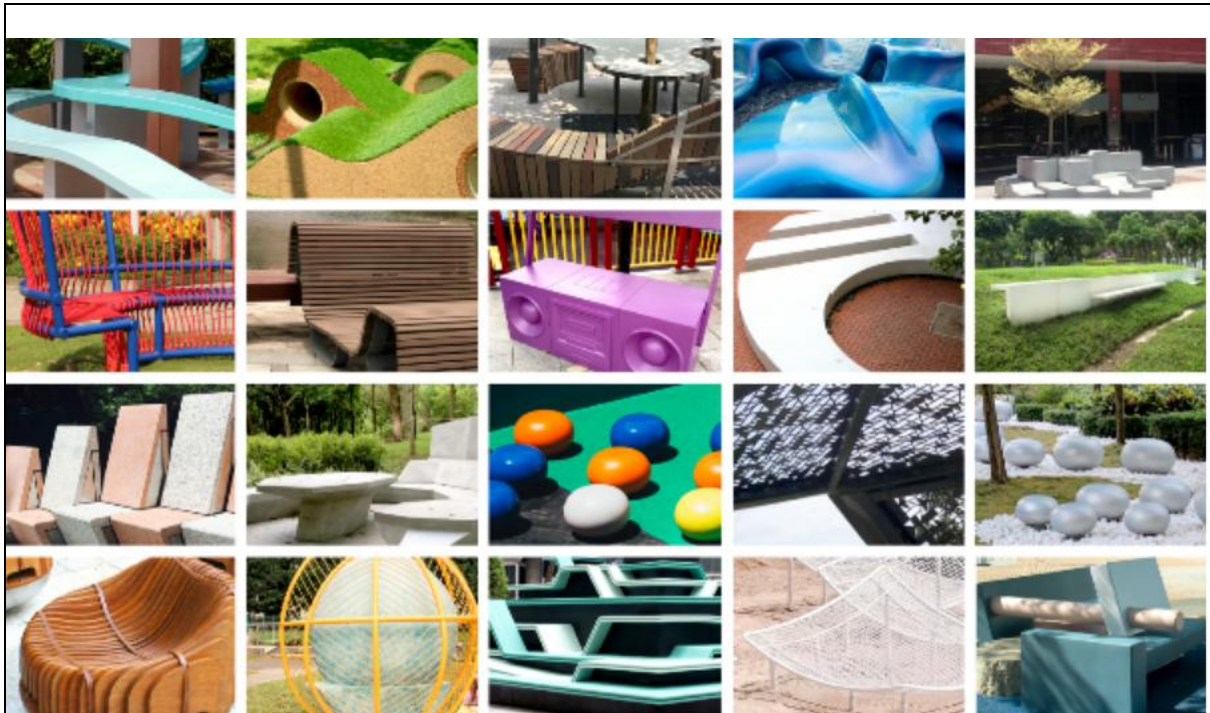


Figure 59. City Dress Up: Seats • Together (Hong Kong).

Similarly, **The Bench Project**, implemented in London in 2015, highlighted the significance of benches as inclusive public furnitures that encourage social interaction and community well-being. Funded by the Arts and Humanities Research Council, the initiative specifically examined three sites: General Gordon Square and Winn Common in Woolwich, and St Helier Open Space in Sutton. The main achievement was demonstrating that **well-designed public seating** significantly **supports** mental health, active lifestyles, and **community cohesion**, especially for marginalised groups. Although the project concluded in 2015, its findings continue to influence urban design strategies, emphasizing benches as essential, affordable, and egalitarian public amenities.

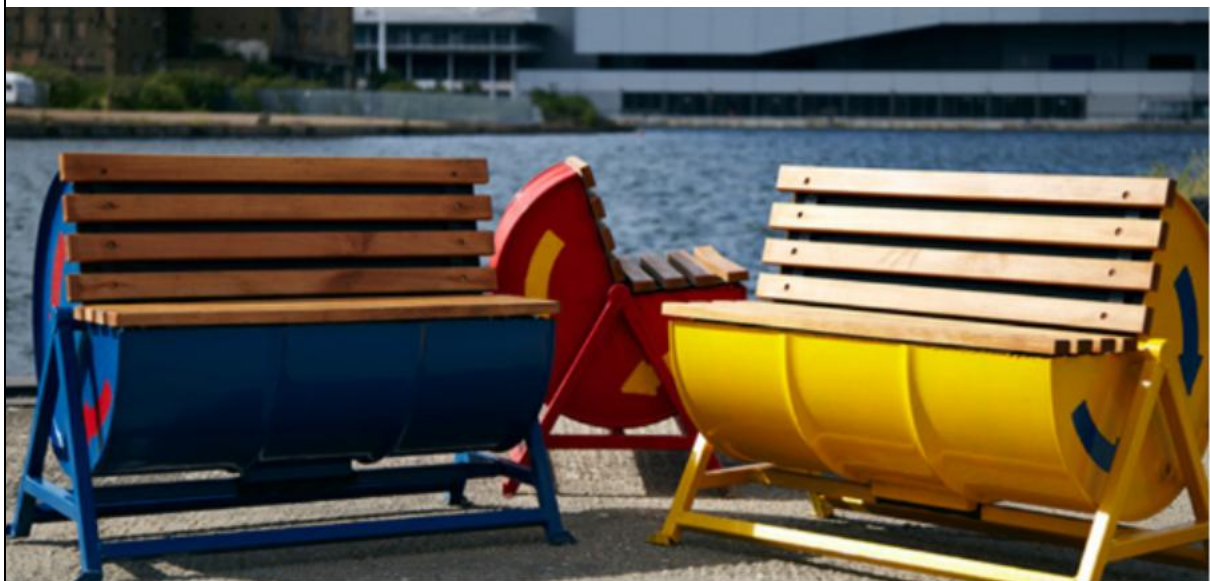


Figure 60. The Bench Project (London, United Kingdom).



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The **Citizen Bench** project aimed to enhance urban public seating by actively involving citizens in the design and placement process. Implemented in Munich, Germany, the initiative utilized the **user-friendly web application *hogga.me* to gather residents' feedback on their seating preferences**, including aspects like form, material, location, and orientation. This citizen-centric approach empowered individuals, strengthened environmental awareness, and promoted community engagement. **The insights collected enabled city planners to tailor public seating to better meet the diverse needs of the community**, thereby improving the quality of urban spaces and encouraging active mobility. The project's methodology and findings have been compiled into a toolbox, including training programs, to assist other cities in refining their public seating strategies.

The **Livable Streets Initiative** in New York City, launched in 2008, is a collaborative effort between Groundswell and the Department of Transportation (DOT) aimed at enhancing street safety through community-driven art projects. This ongoing program engages **youth to create public artworks** (such as banners, signs, and murals) that promote traffic safety awareness and foster community involvement. Key components include the Traffic Safety Banner Residency and the Traffic Safety Sign Education Program, which have been implemented across various neighbourhoods in the city. The initiative has received funding from the DOT and local Business Improvement Districts.



Figure 61. Livable Streets Initiative (New York City, USA).

E.4 - CAR-FREE AREAS

Car-free areas shift the focus from private vehicles to people-centred environments. By restricting or eliminating motorised traffic in selected zones, these interventions contribute directly to environmental restructuring, making cities safer, healthier, and more accessible for walking, cycling, and social interaction. Beyond reducing noise, air pollution, and congestion, car-free initiatives create the conditions for behavioural change by offering alternative uses of public space that prioritise active mobility and community life. These interventions often have a strong demonstrative effect, helping citizens to experience different forms of urban living, less reliant on cars and more oriented toward sustainable, inclusive mobility. Car-free



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strategies can take many forms, from temporary road closures and low-traffic neighbourhoods to reimagined parking spaces and neighbourhood plazas. While often framed as general interventions, they hold relevance for vulnerable groups, including children, older adults, and people with disabilities, by improving safety, pleasantness and comfort, and access to public space.

Vulnerable groups	All
Intervention Functions	Environmental restructuring

CASE STUDIES

#Via Libera is an initiative in Rome that, since June 2018, has designed approximately **15 kilometres of city streets into pedestrian and cyclist-friendly zones available for free initiatives one Sunday each month** promoting sustainable mobility and reducing vehicular traffic. The project emerged from the Sustainable Urban Mobility Plan (SUMP) consultation phase, encouraging active citizen participation through the PUMS Portal, where residents can propose new car-free routes. #Via Libera ongoing initiative features a dedicated visual identity and comprehensive communication strategy, using various media channels to engage the public. The initiative has enhanced urban liveability by encouraging walking and cycling, leading to decreased pollution levels and less congestion in the city. Additionally, it has fostered community engagement by transforming these car-free streets into spaces for cultural events, sports, and social interactions, thereby strengthening community bonds. The initiative has also served as a platform for educational campaigns on road safety and environmental awareness, further contributing to a healthier urban environment.

Low Traffic Neighbourhoods (LTNs) are initiatives implemented across London to **reduce through-traffic in residential areas**, thereby promoting safer and more pleasant environments for walking and cycling. The implementation of LTNs in London began around 2020, with many schemes introduced as part of the response to the COVID-19 pandemic. The initiative is ongoing, with continuous monitoring and adaptation based on community feedback and research findings. The primary accomplishment of these schemes includes a **50% reduction in road casualties within LTNs**, as well as a **74% decrease in traffic on internal streets**, enhancing overall community safety and air quality. LTNs are considered **cost-effective**, often requiring minimal infrastructure such as planters or bollards to restrict traffic flow.



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Figure 62. Low Traffic Neighbourhoods (London, United Kingdom).

In Munich, the **Parklets** initiative transforms **parking spaces into public areas, enhancing community interaction** and urban greenery. Launched as a pilot in 2021 under the city's Mobility Department, residents and local initiatives were invited to design and install these **temporary structures** featuring seating, plants, and bicycle racks. The project's success led to its **annual recurrence each summer, with 16 parklets established across six locations** during the initial phase. The initiative received support from organisations like Green City e.V. This ongoing program continues to reimagine Munich's public spaces, fostering community engagement and environmental awareness.



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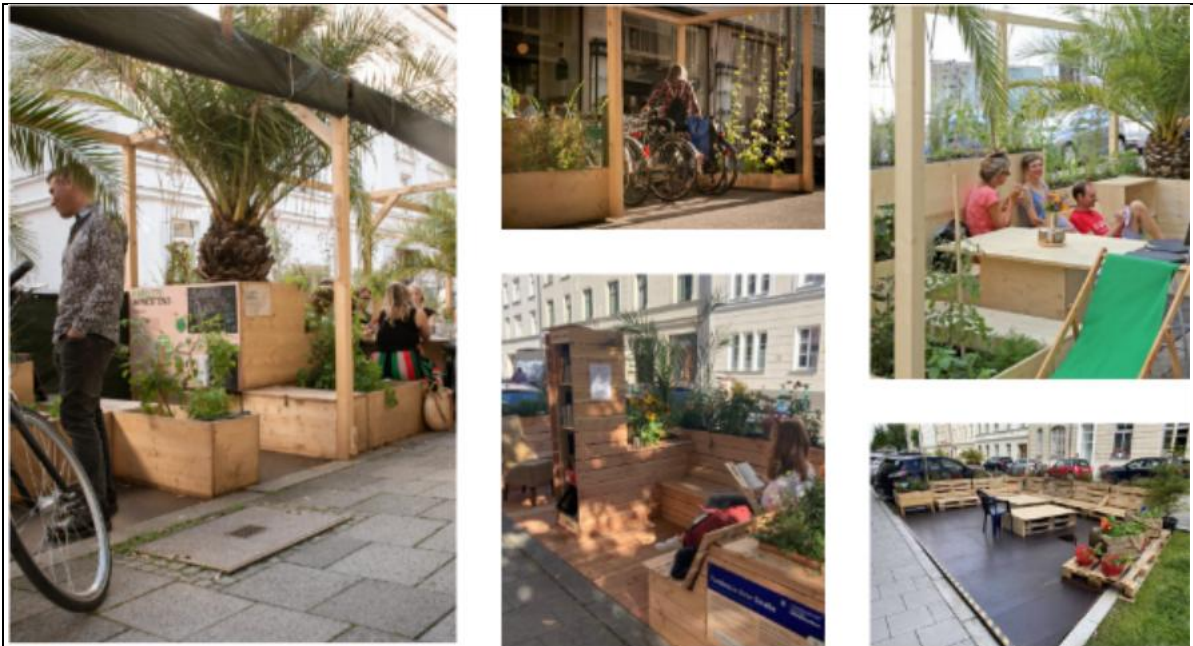


Figure 63. Parklets (Munich, Germany).

The **Pop-Up Plazas** (or Neighbourhood Plazas) initiative in Vancouver was introduced during the Covid-19 pandemic, converting streets into community spaces designed for socialising, dining, and leisure. **Originally temporary, their success has led the city to upgrade many into semi-permanent neighbourhood plazas** with improved materials intended to last 5-10 years. Over 20 plazas were established throughout Vancouver in **collaboration with local businesses and community organisations**, significantly enhancing local economic activity, community cohesion, and public life. The project is ongoing, with continued input from residents shaping their future development.



Figure 64. Neighbourhood Plazas (Vancouver, Canada).

E.5 - CLIMATE-PROOF WALKING/CYCLING STREETS

As climate change accelerates, cities around the world are facing increasing exposure to extreme weather events, particularly heatwaves, which significantly impact the comfort, safety, and accessibility of public spaces. In this context, urban heat mitigation strategies have become essential not only for public health, but also for the promotion of active mobility. Climate-adapted urban environments, designed to remain accessible and comfortable in high-temperature conditions, can help sustain and even increase rates of active travel, particularly in dense urban areas. The concept of “climate-proof streets” integrates urban adaptation with sustainable transport planning. It refers to the transformation of streetscapes into thermally resilient corridors that support movement, leisure, and refuge during climate extremes. Key design interventions include the use of blue and green infrastructure, such as trees, parks, and water features, as well as reflective and permeable materials that reduce surface temperatures. These elements not only cool urban environments but also enhance their aesthetic appeal and usability, especially for vulnerable groups who rely on walking, cycling, or public space for daily life.

Vulnerable groups	Children, Families, Low-income, Migrants, Older people, People with Disabilities, Street workers
Intervention Functions	Environmental restructuring

CASE STUDIES

Barcelona's **Climate Shelters Network** is a pioneering initiative aimed at providing residents with accessible **refuges during extreme weather conditions, particularly heatwaves**. Established as part of the city's comprehensive climate adaptation strategy, the network encompasses a variety of indoor and outdoor spaces, including libraries, parks, and gardens, all designed to offer thermal comfort while maintaining their regular functions. The primary objective of these climate shelters is to safeguard public health by offering safe havens where individuals can escape extreme temperatures. These spaces are especially vital for vulnerable populations such as the elderly, infants, and those with chronic illnesses. Since its inception in 2020, the network has experienced significant growth. Initially comprising 70 shelters, it expanded to over 350 in 2024. This expansion ensures that approximately **97% of Barcelona's population resides within a ten-minute walk of a climate shelter**, enhancing the city's resilience to climate-induced challenges. By promoting the use of public spaces that are designed or retrofitted to withstand climatic variations, the initiative encourages active mobility practices such as walking and cycling. **Shaded parks and gardens, for instance, not only serve as cool refuges but also as pleasant thoroughfares for pedestrians and cyclists**, thereby integrating climate resilience with sustainable urban mobility.



Figure 65. Climate Shelters Network (Barcelona, Spain).

Launched in 2015 as part of Paris's broader Climate Adaptation Plan, the Blue and Green Infrastructure Initiative is a citywide strategy designed to combat urban heat and improve liveability through the creation of **"cool islands"**, interconnected **networks of parks, vegetated areas, and water features that naturally reduce ambient temperatures** and enhance climate resilience. The cool islands include a mix of newly designed green corridors, retrofitted public spaces, and enhanced access to water features such as fountains and misting systems. These spaces are strategically distributed across the city to ensure that residents have equitable access to cooler environments during periods of extreme heat. Many of these areas also **support active mobility by providing shaded, pleasant walking and cycling routes**, reinforcing the role of public space as a connector for sustainable transport. The achievements of the initiative are substantial. According to municipal assessments and external evaluations, areas featuring blue and green infrastructure have recorded reductions in surface temperature of up to 4°C during peak heat. By 2023, the city had implemented more than 800 cool areas, with a commitment to expanding the network to ensure that **every Parisian is within a seven-minute walk of a cool zone**.



Figure 66. Cool islands (Paris, France).

The City of Los Angeles launched an innovative urban cooling initiative focused on mitigating the urban heat island effect by absorbing infrastructure like asphalt roads and concrete buildings. Since 2017, Los Angeles has been piloting and expanding the use of **reflective asphalt coatings**, known as “**cool pavement**,” to **reduce road surface temperatures and improve thermal comfort** in some of the city’s most heat-vulnerable neighbourhoods. Monitoring research has shown that the coated streets remain, on average, 10 to 15°C cooler than untreated roads during peak heat hours. The cool pavement treatment has been deployed in underserved areas that face disproportionate exposure to heat-related health risks. In addition to temperature mitigation, the reflective street surfaces also support walkability and cycling, making active mobility more viable and comfortable in warmer months. Residents have reported greater willingness to walk and bike in neighbourhoods where cool pavement and shading have been introduced. As of 2023, more than 75 lane miles of streets across Los Angeles had been coated with reflective materials.



Figure 67. Reflective asphalt coatings (Los Angeles, USA).



4. Conclusions

This report has examined behavioural strategies aimed at promoting just and inclusive active mobility, with a specific focus on vulnerable population groups. By adopting established theoretical frameworks such as the COM-B model (Capability, Opportunity, Motivation – Behaviour) and the Behaviour Change Wheel (BCW), it was possible to construct an analytical framework which guided the identification of needs, barriers, and enabling factors affecting individuals' ability to engage in walking, cycling, and wheeling in urban environments.

The collection and classification of 92 good practices from 22 different countries (for a complete overview of the good practices, see the Appendix to this Report) have been structured into five main intervention categories: coaching and empowerment, educational and awareness initiatives, digital tools, economic incentives and walking and cycling environment.

From this study, several key takeaways can be identified, offering valuable insights into effective strategies for promoting active mobility across diverse contexts:

- **Designing for specific needs:** active mobility interventions must be tailored to the specific needs of the targeted groups, such as older adults, children, women, migrants, people with disabilities, and low-income individuals. Using an intersectional lens is also essential, as overlapping vulnerabilities often amplify the barriers people face in engaging with walking, cycling, or wheeling. Interventions should begin with **real data gathered through surveys, participatory workshops, and lived-experience mapping to ensure evidence-based and context-sensitive strategies.**
- **Behavioural science as a foundation for intervention design:** Embedding behavioural science early in strategy development ensures that interventions target the psychological, physical, and social drivers of behaviour. Behavioural frameworks such as the COM-B model and the Behaviour Change Wheel (BCW) provide structured methods for identifying what enables or inhibits active mobility behaviours. This systematic approach helps cities shift from general aspirations to specific and assessable actions.
- **Co-creation and listening to communities:** behavioural interventions are more effective when designed *with* people, not just *for* them. Direct engagement with target groups helps identify practical and acceptable solutions. Participatory co-creation ensures that interventions address real – not assumed – barriers (whether they relate to fear, accessibility, cost, or cultural norms) and promote a sense of ownership and empowerment.
- **From framework to practice:** the interventions were categorised into five strategic areas that lead to action: (A) Coaching, empowerment, and community engagement; (B) Informational, educational and awareness-raising initiatives; (C) Digital and smart systems; (D) Economic levers and incentives; (E) Improvements to the walking and cycling environment. These categories respond to the different behavioural levers identified by the COM-B model and show that behaviour change requires coordinated action across education, infrastructure, incentives, and social support.
- **Normalising active mobility through multi-level and inclusive behavioural strategies:** normalising means making active mobility socially standard and emotionally accepted, so people feel it's natural and expected to act that way; to reach normalisation behavioural interventions should be implemented as part of a broader, multi-level strategy that acts across physical, social, and psychological dimensions. The adoption of multiple levers (ranging from coaching and community



engagement to digital tools, economic incentives, and public space redesign) shows that behaviour change is more likely to happen when such elements work in coordination. A comprehensive approach increases the visibility and perceived legitimacy of walking and cycling as primary modes of transport. This, in turn, helps normalise active mobility behaviours and encourages uptake among new user groups, particularly those who may not have previously considered these options as viable. Above all, cities must move beyond one-size-fits-all solutions and toward dynamic, inclusive strategies rooted in behavioural science, social justice, and human-centred design.

- **Highlighting social (not just environmental) benefits of active mobility:** Active mobility should not be framed solely as an environmental solution, but also as a social opportunity. Walking, wheeling, and cycling foster friendships, reduce loneliness, build community bonds, and improve mental beyond physical health.

While behavioural approach provides a concrete and action-oriented framework, **some key challenges remain**. A central challenge is the need to embed behavioural design more systematically into the early stages of mobility strategy development, rather than treating it as a supplementary layer. At present, many urban and mobility strategies are still predominantly driven by traffic engineering perspectives, or urban planners focusing heavily on technical, data-driven, or solution-based approaches. This can make it harder to integrate behavioural science, which requires a more human-centred, context-sensitive view of how people move through cities. Another major obstacle is that many organisations lack the internal capacity, skills, or resources to work with behavioural models. There are also institutional and cultural barriers: incorporating behavioural thinking demands not only new skills, but also a shift in organisational mindset: from "building" infrastructure to "enabling" behaviour. The future direction points towards embedding behavioural insights at the heart of urban policy, training multidisciplinary teams, and reframing success not only by infrastructure metrics, but by how people's daily mobility behaviours are enabled, supported, and transformed.

Appendix – Good practices list

[illegible]

D2.1 Literature reviews and compendium reports

Compendium 4 - Prefigurative design and planning
approaches

EU project number
Project website

101104240
www.just-streets.eu



Deliverable Details

EU project number 101104240
Project title Mobility justice for all: framing safer, healthier and happier streets
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Related task(s) T2.4 Innovative planning, design and implementation approaches

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¹ Delivery type: **R**: Document, report; **DEM**: Demonstrator, pilot, prototype; **DEC**: Websites, patent filings, videos, etc; **OTHER**; **ETHICS**: Ethics requirement; **ORDP**: Open Research Data Pilot.

² Dissemination Level: **PU**: Public; **CO**: Confidential, only for members of the consortium (including the Commission Services); **EU-RES** Classified Information - restraint UE; **EU-CON**: Classified Information - confidential UE; **EU-SEC**: Classified Information - secret UE



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Authorship and Contributions

This deliverable was authored collaboratively. Jonne Silonsaari and Marco te Brömmelstroet (UvA) are the authors of all chapters as well as the overall coordination of the report. Gabriele D'Adda, Elisabetta Vitale (PoliTO-DIST); Andrea Rosso (LINKS); Mario Alves (IFP-r); Philip Amaral (ECF); Sabina Cioboata (UoW); Enrica Papa (UoW) & Clement Sebastiao (ITU) contributed to chapters 2, 3 and 4.



About JUST STREETS

The JUST STREETS project focuses on developing streets shaped by active mobility that are both sustainable and inclusive for all citizens. This shift from the use of cars towards more active modes of mobility will be led by prioritizing the needs and visions of marginalized social groups often not involved in the planning processes, particularly women, migrants, the elderly, LGBTQI+ individuals, and people with disabilities.

Goal of the strong international consortium is to support 12 cities in revolutionizing public spaces and streets by putting all of its citizens first. The project addresses the pressing need to transform our streets both from an infrastructural as well as behavioural perspective, shifting away from car-centric environments towards streets that cater to the needs of all citizens.

JUST STREETS is a 32-partner international Horizon Europe project coordinated by the Future Cities and Communities division of Turin-based LINKS Foundation and scheduled from January 2024 to June 2027. Partner cities include the cities of Amsterdam (Netherlands), Braga (Portugal), Cugir (Romania), Haifa (Israel), Kozani (Greece), Milan (Italy), Riga (Latvia), Southwark (UK), Vilnius (Lithuania), Vratsa (Bulgaria), Westminster (UK), and Zaragoza (Spain).

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www.just-streets.eu



Executive Summary

This report explores the potential of prefigurative planning and design as a means to create safer, healthier, and more inclusive streets.

Prefigurative planning builds on two key principles: (1) creating alternatives to prevailing practices and institutions, and (2) ensuring that goals and processes align, so that desired futures are enacted in the way they are pursued. This approach challenges car-dominated, technocratic planning regimes by experimenting with new practices that are participatory, equitable, and open-ended. It is particularly valuable for empowering marginalised groups who are often excluded from mainstream planning, and for fostering collective learning by demonstrating that alternative realities are possible.

The report structures its analysis around five dimensions of prefiguration (Yates 2015; 2021): substituting existing institutions and practices; experimentation, innovation and learning; preparing or resourcing new actors; directly achieving tangible change in the present; and ensuring consistency between ends and means. Using this framework, it reviews a wide range of state-of-the-art prefigurative initiatives, organised into three main areas:

- **Prefigurative politics for physical infrastructures:** street experiments, school streets, play streets, temporary cycle lanes, and superblocks. These interventions reclaim space from cars, test alternative street uses, and create immediate benefits such as improved air quality, safety, and children's autonomy.
- **Prefigurative politics for social infrastructures:** community events and initiatives such as car-free days, PARK(ing) Day, Jane's Walks, pedibus and bicicú schemes, urban greening projects, and community walk audits. These initiatives build civic engagement, foster cultural change, and empower communities to co-produce mobility futures.
- **Prefigurative approaches during COVID-19:** The pandemic accelerated the use of tactical interventions (pop-up bike lanes, parklets, and slow streets) that temporarily transformed urban mobility but also inspired lasting institutional change.

The report concludes that prefigurative planning must be understood as a movement of mixed strategies, combining physical redesign with social, cultural, and political innovations – and provides examples and inspiration for action.



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1. Introduction

Urban planning and street design are facing unprecedented difficulties. Streets are a key part of the socio-spatial assemblage of the urban and as such crucial sites for cities to become climate resilient, tackle social injustices and promote the health and wellbeing of citizens. The interrelated nature of these needs generates a complex web of uncertainty where the effects of one issue reverberate across other dimensions. Many scholars and experts assert that conventional planning measures are not well-suited for the job (Banister, 2008). The point is that conventional methods and approaches were developed in an era when the environmental and societal situations were different: visions about the problems and solutions were easier to point out and the aim was to preserve the prevailing urban order (Stead and Albrechts, 2023). In this context, some scholars have argued that planning has lost its ability to imagine and act in radically different ways when it is most needed (Davoudi, 2023). Current societal and environmental predicaments call for fundamentally different approaches to planning and design that break away from outdated paradigms.

In this evolving situation, cities and societies should be able to create planning approaches that are able to imagine and experiment with solutions and places that *don't yet exist* (Davoudi, 2023). Despite the fact that the hegemonic planning regime might be reluctant to change, what we can do is to start figuring out something new *here and now*. We do not need to wait for the planning institutions, practices and structures to change, if we can start today building something "in the shell of the old" (Ince, 2012) – new approaches that can navigate instability and uncertainty and transform the way streets and cities are used.

This report suggests that innovative planning must adopt *prefigurative approaches*. Prefiguration – the enactment of the desired future societies and cities in here and now – has historically been used as a tactic among various social movements and forms of collective actions to enact desired societies that don't yet exist (Swain, 2019; Yates, 2021). More recently it has become an important concept also in the fields of geography, planning and transition studies (Casey et al., 2020; Chertkovskaya et al., 2024; Davoudi, 2023; Haugland, 2023; Schiller-Merkens, 2022; Thorpe, 2023; Törnberg, 2021; Wittmayer et al., 2022).

Prefiguration as political activity is rooted in two core principles. First, it entails building alternatives to the prevalent practices and institutions, and secondly, doing it in a way that goals correspond to the ways they are pursued (Yates, 2015). The first aspect means that structures and institutions (organisational forms; workflows, materials; knowledge creation tools; software etc.) that dictate societal processes and rationalities need to be gradually substituted with alternative ones. Often this is deemed as a parallel process of dismantling the old institutions, while developing and institutionalising the alternatives. The second aspect is often referred to as the means-ends equivalence: that the end goals of the actions should be reflected and reproduced in the process of reaching them. This stands in contrast to authoritarian and instrumental movements and initiatives where goals are pursued "at any cost" and "any means necessary".

Given the emancipatory focus, prefigurative politics has been especially useful in rethinking key societal processes through a social justice lens. It opens spaces for and seeks to empower marginalised groups that might not have the powers or capabilities to engage in established processes. The idea that "whatever the nature of the present, situations can change, and even the most marginalised might participate in effecting that transformation" (Jeffrey & Dyson, 2021, 653), is an organic part of prefigurative action.



1.1 Prefigurative planning and design

Prefigurative planning brings the ideas of prefigurative politics to the field of urban planning and design. It is not interested in the status quo - how things are (and what is “possible” or “impossible” in the current regime). Instead, it focuses on how things are made to be and how they can be unmade (Davoudi, 2023). It encourages reimagining and exploring alternative ways of designing, using and living on the streets which are not known in advance. Thus, rather than implementing predefined solutions, prefiguration promotes open processes of learning by doing, experimenting and reflecting, and questions the usual motivations of planning to work towards a predefined outcome, according to a predefined blueprint (Silonsaari, 2024; Van Poeck et al., 2020).

Practically, prefiguration often demands some sort of improvisation, or more precisely, actions that might *seem* like improvisation as they are not subsumed to the hegemonic regime (Jeffrey & Dyson, 2021). But, at the same time, it needs to create institutional forms to become transferable and recognisable. In the field of planning these can be for example practices (e.g. street experiments) or concepts (e.g. 15 min city) that are not restricted to their localities. Institutionalisation protects prefigurative action from becoming marginalised or coopted and eventually allows the initiatives to become widely impactful, far beyond their initial context. Impact happens often for example by scaling up the new practices; spreading them to new territories; developing transferable skills and assets for different stakeholders; triggering far reaching attitudinal changes and creating a shared sense of association, purpose and hope for change (Jeffrey & Dyson, 2021; Raekstad & Gradin, 2020).

In this report (and the respective section of the Just Streets deliverable D2.1) some state-of-the-art transformative planning approaches are discussed respective to five key dimensions of prefiguration (Yates, 2015; 2021). This framework is used to break down the prefigurative powers of certain planning approaches and tools as discussed in academic literatures, grey literatures and other case studies.

Five key dimensions of prefiguration (Yates 2015; 2021)

- **Substituting existing institutions and practices** - The goal of creating alternatives may be to reshape a state, redefine practices, or question established norms. In concrete terms, this may mean substituting key practices and institutions of doing planning (e.g. administrative processes, software etc. that have impact the planning process).
- **Experimentation, innovation and learning** – Starting initiatives and processes that can generate new social forms, ideas and ways of living. This also includes inspiring other people and even reassessing who the relevant actors might be.
- **Preparing or resourcing actors** – Spreading responsibility and agency, and involving and empowering groups who might usually be sidelined from planning processes. Prefiguration typically entails the process of creating new social spaces and platforms that allow new ideas to flourish.
- **Directly achieving something here and now** – This ideal encompasses the urge of prefiguration to avoid compromising and delay that often happen if one is to engage with conventional design and planning approaches. Direct enactment of the desired futures gives prefiguration a direction and sets an example of what we want to achieve.
- **Micropolitics of political activity** – This principle means that the ends of prefigurative planning (e.g. child-friendly designs) should correspond the means that it is achieved by (e.g. planning methods involving children).



2. Prefigurative politics for physical infrastructures

The way how space is allocated is evidently important to how streets are used. This section analyses the prefigurative powers of some of the most prevalent space reallocation concepts: street experiments and superblocks. After introducing the concepts, the section provides some prominent examples how cities can move concepts to action.

2.1 Street experiments

Street experiments have become a key planning innovation in recent years (Bertolini, 2020). Accelerated by the COVID-19 pandemic (Combs & Pardo, 2021) and championed by a wide range of stakeholders from public authorities to grassroots activists, they are in many respects a prime example of prefigurative planning. Street experiments intentionally question traditional street use and regulations and represent a departure from established norms, demonstrating alternative ways to utilise urban spaces.

In a nutshell, a street experiment is “an intentional, temporary change of the street use, regulation and/or form, aimed at exploring systemic change in urban mobility, away from “streets for traffic”, and towards “streets for people”” (Bertolini, 2020, p. 735). They are often implemented using low-cost, short-term, fast and scalable interventions aimed at catalysing long-term change, and examples include school streets, parklets, or mobility hubs. But in addition to experimenting, at least conceptually, street experiments pay attention to the associated learning process as is apparent in the definition of Schreiber et al. (2023, p. 226) of planning experiments as “spatially and temporally bound arenas in a real-world setting that bring together multiple actors in an open, collaborative process, with the goal of learning and gaining experience on urban challenges and developing and testing novel practices to address the challenges”. This means that street experiments should effectively complicate one-dimensional and simplistic understandings of “what works” and suggest a complex social learning process.

This kind of a process, in turn, evidently entails structures of power and hierarchies of knowledge along questions such as:

- Who defines the experiment?
- Whose concerns are a priority?
- What kind of data is collected before, during and after the experiment and with what methods?
- What kind of information is valid?

Street experiments might not be automatically prefigurative but they have high potential to be, because they can provide a glimpse of a future that is possible, but does not exist just yet. For example, if streets serve radically different purposes than vehicular traffic – as spaces of play, socialisation, learning and care – experiments allow to see what kinds of social forms emerge and how and why lives of human communities as well as more-than-human entities can be better. And still without requiring full commitment to that change and leaving space for potential “failure”. They allow people to experience a different reality and, by sharing experiences between different groups and actors, instil transformative social learning processes.

Crucially, street experiments allow bypassing the often difficult discussion of what is possible in urban planning. It can expand the limits of public and planning discourse on what is possible and what is not possible. As such they come close to the prefigurative ideas of “real utopias” (Wright, 2020) or “concrete utopias” (Archer, 2020). Broadly these terms both mean that as far as we can identify current or past social structures, practices and mechanisms that allow

things to be “otherwise” it is credible to assume that experimenting with them can be successful.

For inspiration see for example

- [The platform created by the EX-TRA project](#)

2.1.1 Open streets

Open Streets is a community-driven initiative that temporarily closes streets to motor vehicles, transforming them into safe, accessible spaces for walking, cycling, socializing, and cultural activities. These events promote active transportation, public health, and civic engagement by encouraging people to experience their cities in a new way. Open Streets programs are often organized by local governments or grassroots organizations and vary in scale, from small neighbourhood events to city-wide initiatives. They are closely linked to broader urban sustainability and mobility movements, advocating for streets as shared public goods rather than spaces dominated by cars.

From a prefigurative politics perspective, Open Streets embodies the practice of creating and enacting alternative social structures in the present to model a desired future. By (temporarily) redesigning urban environments, these experiments call into question car-centric urban planning and demonstrate the potential of people-cantered streets. This aligns with movements that advocate for sustainable and just urbanism, such as tactical urbanism and placemaking. Open Streets programs often inspire longer-term policy changes, such as permanent pedestrian zones, expanded cycling infrastructure, and reduced car dependency, making them a strategic tool for reimagining public space.

Open Streets has historical roots in the Play Streets movement, which began in the second half of the 20th century to provide children with safe outdoor spaces in dense urban areas (see for example Cowman, 2017). While Play Streets primarily focus on child-friendly spaces, Open Streets extends the concept to all ages, promoting broader community engagement. The first large-scale Open Streets event took place in Bogotá, Colombia, in 1974 under the name *Ciclovía*, which remains one of the most successful and long-running programs today (see Cox, 2024). Since then, cities worldwide, including New York, Paris, Cape Town, and Melbourne, have embraced Open Streets, tailoring them to local needs and urban landscapes. These initiatives continue to grow in popularity and might inspire top-down initiatives like the Low Traffic Neighbourhood in the UK (urban areas where through-traffic is restricted using physical barriers or modal filters to prioritize walking, cycling, and local access while reducing car dominance).

Substituting existing institutions and practices	By redesigning urban environments, Open streets challenge car-centric urban planning and demonstrate the potential of people-cantered streets.
Experimentation, innovation and learning	Open streets serve as real-life laboratories for testing new urban policies, mobility solutions, and community-led interventions. They provide an opportunity to experiment with different layouts, traffic restrictions, and public activities, generating insights for long-term



	urban planning. Cities and communities can learn from these events, adapting and refining strategies based on public response and engagement.
Resourcing stakeholders	Successful open streets rely on collaboration between various stakeholders, including local governments, businesses, community organizations, and residents. By providing logistical, financial, or regulatory support, authorities can empower grassroots initiatives to take ownership of public space. At the same time, these events highlight the value of non-monetary contributions, such as volunteer efforts and local knowledge, in shaping more inclusive urban environments.
Directly achieving something here and now	Unlike long-term infrastructure projects, open streets create immediate, tangible benefits by transforming public space in real-time. Participants experience cleaner air, safer environments, and vibrant social interactions, demonstrating the potential of car-free streets without waiting for legislative or structural changes. This direct impact can inspire broader movements for sustainable urban transformations.
Micropolitics	Open streets often become arenas of negotiation, where different interests and power dynamics play out. Conflicts may arise between advocates for active mobility and businesses concerned about lost car access, or between residents who support pedestrianization and those who resist change. These small-scale political tensions highlight the broader struggles over urban space and can serve as stepping stones for long-term shifts in mobility and planning policies.

For inspiration see for example

- [Video from 1972 on a prefigurative social movement in Amsterdam](#)
- [Placemaking Through Open Streets • TIP Strategies](#)
- Open Streets Guide: [Tactical Urbanism Materials and Design](#)

Street experiments come in many forms, but one prominent and widely adapted example is school streets. As in any street experiment, the design procedure and implementation is not a standardised process but rather an experimental approach to street design and street uses. It is notable that many cities are applying measures that are not called “school streets” or “school zones” but still adopt the basic idea that traffic should be calmed around schools and street space should be allocated to other purposes than transport. Thus, one of the only feasible ways of defining school streets is the idea that as far as streets and neighbourhoods outside schools are extensively used by children and their families (especially before lessons start and after they finish), they should be allocated for the mobility modes and various other uses of the street that are important for these groups.



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As a planning approach school streets are a good example of prefiguration of alternative urban realities, by sidelining conventional parameters for assessing the aims and successes of street design. The design process often involves the local school community to understand what is needed in that specific socio-spatial context. School streets are implemented in different ways. Some schemes simply propose car-drivers to slow down or avoid school zones but often it is deemed important to enforce the street closure with a physical barrier (gates, beams, flower boxes etc.) or cameras. Implementation and enforcement is often a gradual process where schemes move from experimentation towards more regular closures and sometimes even to complete redesign of the street.



Figure 1 School streets are often enforced with more or less temporary physical barriers (Left: London, UK / Right: Antwerp, Belgium).

School streets have generated a wealth of knowledge in academia (Bernardino et al., 2023; Harrington et al., 2024; Hidalgo et al., 2016 ; Huang et al., 2018; Donoff & Brigdman, 2017; Thomas, 2023; Thomas et al., 2022; Thompson et al., 2024) as well as in grey literatures and practice/policy domain (Active travel England, 2024; Air Quality Consultants, 2021; Belcourt-Weir et al., 2022; Clarke, 2022; Davis, 2020; Hopkinson et al., 2021; Transport for London, 2021; 2022; Thomas, 2022). The key topics in this body of knowledge include the impacts of school streets on:

- levels of children's physical activity;
- air quality around schools;
- transition towards more active and sustainable mobility;
- children's autonomy and independence;
- social equity among children from different backgrounds and going to different schools and;
- diversity of ways of using the street.

These impacts highlight the prefigurative powers of school streets: they propose a reality where these crucial benefits (enhanced physical activity, improved air quality, increased autonomy and good quality public space) are not only possible but also normalised and accessible to all environments where children attend school. In that sense, by redefining the function and design of streets, school streets serve as a model for how urban spaces could be transformed to put children first and prioritise the needs of children and families, ultimately contributing to a more just and equitable urban landscape.



Substituting existing institutions and practices	School streets are challenging prevalent ideas around how streets should be used and what they are for. As is often said, they are allocating streets from traffic to people. Importantly, they propose that planning practice should attend to the local community dynamics – schools are spaces where certain populations with certain needs attend.
Experimentation, innovation and learning	School streets are often defined as street experiments – meaning that they are enforced only during some parts of the day; their implementation is often based on special street laws and regulations...
Resourcing stakeholders	School street schemes invite schools, families and children to plan and implement the street designs and uses. These stakeholders are not conventionally involved in street design processes but there are several ways to empower them. School streets are also prefigurative in their recognition of children as key urban stakeholders.
Directly achieving something here and now	School streets are often implemented in an agile way and are immediately instilling alternative uses of the streets (as spaces of physical activity, nature-based learning and socialising among families), but also creating a modal shift of school trips towards walking and cycling.
Micropolitics	In order to be truly prefigurative the implementation processes, school streets should be co-designed with children and should involve them in ways that are natural to them – through play and exploration.

For inspiration see for example

- [Just Streets knowledge clip on School Streets](#)
- [School Streets How to -guide of Active Travel England](#)
- [Information on Paris School Street schemes](#)

to cycle, which in addition to walking was a way for people to safely be outdoors during the COVID pandemic. But this tactic has not only been limited to COVID – installing temporary cycle lanes has often been a way for cities to enable citizens to immediately see the effects of reallocating road space away from cars, and to encourage people to replace one or more of their car trips with cycling trips. Temporary cycle lanes also enable cities to experiment and observe the real-life effects of urban planning in ways that cannot be done by modelling. The best outcomes are when temporary cycle lanes become permanent. Unfortunately, sometimes temporary lanes are rolled back due to political pressure.

Substituting existing	Temporary lanes are often implemented by removing space from car traffic and reallocating it to cycle traffic. Various examples exist. What may have once been a street blocked with car traffic is then
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institutions and practices	transformed into a street where a segment of traffic – cycle traffic – is more fluid.
Experimentation, innovation and learning	Temporary lanes are often easier for cities to implement because they are not permanent, meaning they can be adjusted or further experimented with. Cities can learn how citizens use the lanes and, after a period, how it affects other forms of traffic.
Resourcing stakeholders	Citizens can directly experience the reallocating of road space and use the road with their bicycle instead of a car. Citizens may discover they can realistically do their journeys with a bicycle than a car. Active mobility groups can use the opportunity to show decision makers the benefits of having more cycling infrastructure. Measurements can be made of air and noise quality, for example.
Directly achieving something here and now	Temporary lanes enable immediate real-time observation and results, which can be helpful for policymakers who may want to install more cycling infrastructure but are in need of public support.
Micropolitics	The sudden change in the street space enables behaviour adaptation. If done well, a temporary cycle lane can literally change a person's mind from driving to work or school and taking a bike instead, and that can lead to more cycling. A temporary cycle lane that is well implemented and has high use also has a good chance of becoming permanent, as citizens realise the cost of removing it is far higher than the cost of k

For inspiration see for example

- [A Guide to Temporary bike lanes from Berlin](#)

2.2 Superblocks

Superblocks are another important approach to changing the way urban spaces is allocated. A Superblock is a neighbourhood transformation strategy combining multiple urban blocks, forbidding or severely limiting drive-through traffic through built means, thereby pacifying its streets and giving priority to active modes of transport (walking, cycling) and multiple uses (Nieuwenhuijsen et al., 2024). It limits any traffic not coming from or to the neighbourhood. Consequently, the roads are safer and more welcoming for people. As the borders of a Superblock are still driveable for cut-through traffic, a city could consist of Superblocks adjacent one to another: a main network of thoroughfares intended to support cut-through traffic, and all the meshes of this network redesigned as superblocks to support non-motorised mobility and multiple street use.

By designing streets for people and not just for traffic, streets become more inclusive. They are less hazardous, both directly by a reduction of cars, and indirectly by a reduction of air



and noise pollution. Taking space and freedom of movement away from the most harmful actors – cars – and redesigning local streets, the superblock approach makes local streets more inviting, increasing the vitality in the neighbourhood. This empowers citizens to reclaim streets as shared social spaces for a more inclusive city.

2.2.1 Superblockify

Superblockify is a Python package designed to assist in planning future Superblock implementations by partitioning an urban street network into Superblock-like neighbourhoods and providing tools for visualizing and analysing these partition results (Büth et al. 2024).

Superblockify is designed to be modular, allowing new partitioner to be added to the method. This is done to ensure flexibility and adaptivity to a local context, either based on the local knowledge, or on the local desire and goal.

Substituting existing institutions and practices	The concept of Superblocks is a paradigm shift in what streets are for, from a car-centric vision in which the goal is to facilitate traffic to reclaiming it as a shared social space by people. The Superblockify Python package is a tool that can help substituting key practices of planning through the partitioning and visualization of superblock-like neighbourhoods
Experimentation, innovation, and learning	With superblocks, streets become shared social spaces again, fostering experiments for experiencing the streets differently. Superblockify is designed to be modular, allowing flexibility and adaptivity to experiments in different local contexts.
Resourcing stakeholders	By fostering the presence of a multiplicity of actors in the street, Superblocks may promote processes of 'empowerment' and 'awareness' for subjects who are traditionally not considered central to planning and mobility. Superblockify is an open-source software allowing any stakeholder, from citizens to policymakers, to create a vision of the city informed by a designated goal.
Directly achieving something here and now	Since Superblocks are not dependent on heavy material or complex infrastructural changes, they can be tried through "fail-to-safe" experiments. Superblockify can create a vision of the future here and now with the click of a button.
Micropolitics	To be truly prefigurative, Superblocks should be designed with the involvement of the communities (residents, streets users, owners of local shops, etc.) in the different steps of their development (from design to implementation. While the framework of Superblockify has been initially developed by researchers, it is designed modularly to allow input by local citizens and users who have both local knowledge of the city and their own goals and constraints. Superblockify allows to add a new method to partition the city, allowing anyone a clear objective (and potentially additional data) to tailor the outcome to their goals.



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For inspiration and practical assistance go to

- <https://superblockify.city>

3. Prefigurative politics for social infrastructures

The physical transformations often benefit from being coupled with “soft measures” to prefigure outcomes where physical infrastructures are coupled with social/human infrastructures (Latham & Layton, 2019; Nello-Deakin & Nikolaeva, 2021). One-day events, community initiatives or audits among various street users are some of the most notable tools.

3.1 Events

According to Cox (2024, 143) a “major problem in breaking with current embedded mobility practices is the weakness, even lack, of political imaginaries sufficiently vivid to conceive of mobility-scapes not wedded to current patterns of automobility”. Breaking away from current thinking of what is possible does not necessarily demand unretractable physical changes in the build environment. Even relatively short (one day) events are important prefigurative tools, as far as they manage to create strong shared experiences among people that cities and mobilities could be different.

3.1.1 Car-free days

Car-free days happen in a variety of ways, but all share one feature: cars are restricted from accessing certain spaces in the city for a fixed period. In Europe, cities often implement car-free days during European Mobility Week which occurs during mid-September. Cities will often restrict cars from accessing the city centre, for example, allowing other forms of mobility such as walking, cycling and public transport . This restriction might last anywhere from several hours to an entire day. The Brussels Capital Region is known for implementing a regional-wide car-free day in September, Europe’s largest. In this case, motor vehicles are not allowed to circulate within the entire region from 09h00 to 19h00. Exceptions are permitted: taxis, public transport and emergency vehicles can circulate, as can drivers who obtain and pay for a special permission prior to the car-free day.

Car-free days give a city’s inhabitants an extraordinary chance to witness how a city’s mobility system can change overnight. People remark how they can hear birdsong, and how the streets are so quiet save for the occasional bicycle bell rings . People realise just how much public space cars occupy. Inhabitants can explore the city at their pace, discovering new places within the city or perhaps rediscovering places they usually quickly drive past. Pollution dramatically decreases during car-free days. Car-free days get inhabitants to ask, “what if ... we had more space on our streets?”, and enable them to immediately see the results.

Substituting existing institutions and practices	Car-free days replace the dominance of car traffic for a set period, providing more space for citizens to walk, cycle, meander, to discover that they can be mobile without driving.
Experimentation, innovation and learning	The sudden restriction of cars from the city frees up space for people to use the space as they like: to walk, cycle, to play, to draw, to meet with neighbours, or to simply just enjoy the space. The sudden freeing up of space for people enables citizens to realise that the public space usually reserved for cars can be used for other means that bring more benefits.



Resourcing stakeholders	Citizen-led active mobility groups use car-free days to generate activities with citizens. Many other citizens groups use the opportunity to pursue their own outdoor interests. Citizens immediately see what a car-free city can be like without needing to understand complex city planning documents.
Directly achieving something here and now	A car-free day may be short in duration, but the effect is immediate: it is like removing the wool from one's eyes.
Micropolitics	Citizens who see the difference a car-free day brings then ask themselves and others the question, "why couldn't this happen more often?" and "what would it take for this to happen more often?" These questions immediately enable citizens to engage in a dialogue with their politicians, and in local political discussions with the people around them.

For inspiration see for example

- [The United Nations World Car-Free Day](#)

3.1.2 PARK(ing) Day

PARK(ing) Day involves temporarily transforming (metered or not) parking spaces into "parklets" that are creatively used for social or artistic purposes. Participants might pay a parking meter to "rent" the space and then use it for activities like socializing, reading, or creating art, often with items like chairs, plants, and tables. This initiative challenges the dominance of cars in urban areas and promotes a more human-centred use of public space. Rather than just protesting car culture, PARK(ing) Day encourages people to rethink urban spaces as places for community. It highlights key issues such as health, air pollution, and road safety while advocating for more public spaces dedicated to people. The event also raises awareness of environmental justice, as marginalized communities often bear the burdens of car-centric development. (Thorpe, 2020; Culver, 2018)

Originating in 2005 as a guerrilla art installation in San Francisco, PARK(ing) Day has since expanded worldwide taking place yearly, on the third Friday of September. A small group of artists and activists initially transformed a metered parking space into a temporary park, sparking a movement that continues to grow. (Endres, Senda-Cook & Cozen, 2014; Herman & Rodgers, 2020)

PARK(ing) Day is most effective in high-traffic areas where it can maximize visibility and engagement. Participants use accessible materials such as chairs, tables, and plants to design inviting spaces. The initiative serves as a prototype for open-source urban design, with toolkits available for public use. (RebarGroup, 2011) In this sense, PARK(ing) Day exemplifies prefigurative politics by allowing participants to create and demonstrate their own vision for alternative urban spaces. By transforming parking spots into temporary social spaces, the event directly challenges car-centric urban design while offering a tangible alternative. This



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action not only critiques the status quo but also experiments with new forms of urban space, embodying the "create the future in the present" ethos of prefigurative politics.

This bottom-up initiative was adopted by various cities into a top-down approach, with cities like San Francisco, Vancouver, Leeds and London offering parking permits or have even official parklet programs. The spread of parklets demonstrates how a simple idea can influence urban planning policies and reshape public spaces on a broader scale. (Herman & Rodgers, 2020) This again shows the potentially lasting positive impact of prefigurative politics.

Substituting existing institutions and practices	PARK(ing) Day challenges the dominance of car-centric urban spaces, replacing car parking with temporary public spaces like parklets. It substitutes conventional urban planning with a bottom-up participatory, citizen-led process.
Experimentation, innovation and learning	PARK(ing) Day inherently promotes experimentation in reimagining urban spaces in a creative way. Through the temporary transformation of parking spots, it allows for experimentation with different forms of public space use, such as social areas, art installations, gardens etc. Rebar Group, who are pioneers in PARK(ing) Day, mentioned creative ideas as barbeque, outdoor classroom, painting studio etc. Participants learn that change can start from the community, become aware of car dominance in public space, and experiment with design to reclaim it.
Resourcing stakeholders	Participants in PARK(ing) Day contribute their time, resources, and creativity to activate and reimagine public spaces. Local authorities or community organizations might also provide support, offering permits and resources for parklet design.
Directly achieving something here and now	PARK(ing) Day achieves immediate, visible change in urban spaces, transforming parking meters into human-centred spaces for a certain timespace. The event directly creates a temporary space for conversation, or play, contributing to the sense of belonging and community.
Micropolitics	PARK(ing) Day engages with micropolitics by questioning how urban space is allocated and who gets to decide over it.

For inspiration see for example

- [PARK\(ing\) day How to Manual of Rebar Group](#)
- [Parklets: Your Guide to Creating a Pop-up Park on Your Street](#)
- [Parklets for local authorities](#)
- [Healthy Streets Everyday Parklet guidance](#)



Figure 2 Parking lot turned into co-working garden (Picture PARK(ing) DAY Barcelona)

3.1.3 Jane’s Walks

Jane’s Walks embody the prefigurative approach by reimagining urban spaces through community-led walking tours, allowing participants to directly experience and enact a more people-cantered city.

Jane’s Walks were inspired by urbanist and activist Jane Jacobs, whose work emphasized the importance of walkable, community-oriented cities. The initiative started in 2007 in Toronto, Canada, to honour Jacobs' legacy and has since grown into a global movement. The walks encourage residents to engage with their surroundings, share local knowledge, and discuss issues such as gentrification, accessibility, and urban sustainability—all in an informal, bottom-up manner.

Jane’s Walks have expanded to cities across six continents, with events taking place in over 500 locations worldwide. From New York to Nairobi, Tokyo to São Paulo, communities use these walks to address local difficulties and foster civic engagement. While some walks focus on historical and cultural storytelling, others highlight social justice issues, such as the impact of urban renewal on marginalized communities. Their popularity demonstrates a growing global interest in participatory urbanism and the collective reimagining of public space.

Substituting existing institutions and practices	Jane’s Walks call into question traditional top-down urban planning by promoting community-led exploration of cities. Instead of relying on experts or municipal authorities to define urban spaces, residents reclaim the streets as spaces for storytelling, knowledge-sharing, and collective reflection. These walks substitute formal consultation processes with grassroots participation, emphasizing lived experiences over bureaucratic decision-making.
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Experimentation, innovation and learning	Each Jane's Walk is an experiment in reimagining urban life. Participants engage in spontaneous conversations, explore alternative routes, and uncover hidden urban narratives. These walks encourage innovation by testing new ways of seeing and using public space, fostering a culture of learning where residents become both guides and learners, shaping a more inclusive urban discourse.
Resourcing stakeholders	Jane's Walks provide a low-cost yet powerful tool for communities to mobilize and advocate for their needs. They leverage local knowledge, volunteer efforts, and existing public spaces rather than relying on financial or institutional resources. By connecting individuals, advocacy groups, and policymakers in an informal setting, they strengthen networks that can later influence urban policies and community projects.
Directly achieving something here and now	Unlike long-term urban reforms, Jane's Walks create immediate impact by transforming the experience of a place in real-time. Walking together fosters social cohesion, challenges dominant urban narratives, and sparks discussions on accessibility, safety, and public space usage. The simple act of walking and talking shifts perceptions and demonstrates the power of community agency.
Micropolitics	Jane's Walks operate within the micropolitics of everyday urban life. They highlight tensions between different visions of the city—such as car-centric development versus pedestrian-friendly spaces. The act of walking as a collective can be a subtle yet political statement, asserting the right to the city and opening small but significant spaces for negotiation and activism in urban environments.

For inspiration see for example

– <https://janeswalk.org/>

3.2 Community initiatives

Generally, perhaps the most common forms of prefiguration happen when certain people in acertain places simply start to live differently. New collective practices, manifesting “as if” we lived in a different kind of reality grow from activism where local communities simply adopt new social relations.

3.2.1 Pedibus and Bicibus

A *pedibus*, also known as a “walking bus” or “walking school bus”, is a sustainable and community-driven alternative to the traditional school run, where a group of children walk to school together, usually under the supervision of parents or volunteers, in a manner similar to

a school bus. Instead of relying on cars or buses, a *pedibus* encourages walking, promoting both environmental sustainability and physical health. It offers a safer, social, and more active means of transportation for children, reducing traffic congestion and emissions in local areas.

Similarly, bike bus (or *bicibús*) is an organized group bike ride for children, typically designed to take them from home to school (bicibús.eu; bikebus.world). Like a traditional bus, it follows a set route and schedule, with designated "stops" where participants can join the group. Bike buses are told to exist since the 1990 and a recent study collected statistics on more than 400 regular bike buses, but noted that they might have missed a substantial amount of activities (Simon I Mas & Honey-Roses, 2024).

While each *bicibús* is tailored to meet the specific needs of its community, the concept has gained global recognition as a powerful social innovation. It not only facilitates children's daily commutes but also challenges an urban structure that often suppresses children's right to the city, weaving intentional, transformative action into everyday life.

Pedibus and *bicibús* relate to prefigurative politics as they directly embody a vision of a sustainable, collective future through *practice* that can be performed here and now. Organizing a pedibus or a *bicibús* is a practical, grassroots example of substituting existing institutions—namely, car-dependent school transport systems—with a more sustainable, community-based model. It encourages experimentation and learning by trial and error, empowers local citizens (parents, schools, children) to take direct action, and demonstrates immediate, tangible results in terms of reduced emissions, healthier habits, and stronger community bonds. It also introduces micropolitics, as local communities navigate and negotiate the logistics of organizing such systems and dispute broader societal norms around mobility.

The pedibus and *bicibús* concepts have their roots in European initiatives, particularly in countries like Spain, Italy, Portugal and France, where "school walking buses" have been implemented for decades. The idea emerged as part of efforts to address urban mobility issues, reduce traffic congestion around schools, and promote healthier lifestyles among children. In Italy, for example, the "*Pedibus*" system has been a feature in several cities, where walking buses operate as part of municipal transportation and community wellness programs.

Substituting existing institutions and practices	Organizing a <i>pedibus</i> directly challenges the dominance of car-dependent school commutes, substituting in some cases a well-established practice (private car transportation) with a more sustainable, community-based alternative. This substitution not only addresses environmental concerns but also helps to reimagine the role of mobility in everyday life, fostering a collective responsibility for children's well-being and the quality of life of their community.
Experimentation, innovation and learning	The <i>pedibus</i> is an experimental initiative that encourages innovation in how we think about school transport. It allows participants—parents, schools, and children—to explore alternative mobility systems, learning through direct experience what works and what doesn't. This process encourages iterative problem-solving and adaptation, providing valuable insights into more sustainable practices.



Resourcing stakeholders	A <i>pedibus</i> relies on resourcing stakeholders, from parents and children to local authorities, who contribute to its organization and success. By equipping these groups with the tools and knowledge necessary for operation—whether it's through logistical support, safety guidelines, or community mobilization—the initiative builds a network of active participants, enabling the collective to take ownership of the mobility system. Not having to take the children to school every morning also means freeing up some time for their parents. In many contexts this means reducing care work for mothers, thus promoting a more just balance in the family.
Directly achieving something here and now	The <i>pedibus</i> immediately addresses several pressing issues: reducing carbon emissions, promoting physical health, and improving local traffic conditions. By organizing it, participants directly achieve these benefits in the present, offering a tangible demonstration of how local actions can lead to broader societal change, without waiting for top-down policies to materialize.
Micropolitics	The <i>pedibus</i> creates a space where individuals negotiate power dynamics within their community. Parents, schools, and local governments all play roles in shaping the initiative, with decisions made through dialogue and consensus-building. This empowers participants to engage in everyday political acts, influencing the design of mobility systems in their immediate environment and challenging traditional, hierarchical structures.

For inspiration see for example

- [The Swiss Pedibus System — Observing Leslie](#)
- [School transport & Pedibus | Niederrhein](#)
- bicibus.eu
- bikebus.world



Figure 3 BiciBús in Barcelona. (Photo: [Calvox Periche/CityLab Barcelona](#))

3.2.2 Urban greening and community gardening

There is range of initiatives that are about highlighting the importance of urban greening to sustainable, active and inclusive mobility, as well as alternative ways of using public space (e.g. as community gardens). Greening projects are sparking interest and discussions about streets by giving nature a voice on them. These project highlight how issues such as urban heat islands (Brandsma et al. 2024), the biodiversity crisis (Lehmann, 2021), air pollution, water retention, and physical, mental and social health problems (Nieuwenhuyzen, 2021) are connected to people's abilities and willingness to use street spaces in different ways. Urban heat islands are a concrete example of phenomena that prevent for example elderly people's use of urban space, but that can be tackled with greening initiatives (Zhu & Yuan, 2023).

Greening projects are often created as community initiatives to share the ownership and responsibility beyond institutional actors (often discussed as community gardening, see Guitart et al., 2012). These initiatives can be more or less temporary from "walking forests" to permanent new green spaces. In any case, while there are many pitfalls in the initiatives, at best collective care for common spaces can prefigure radically different ways of inhabiting and using the city (Ghose & Pettygrove, 2014).

Substituting existing institutions and practices

Rewilding initiatives can expand planning understanding regarding what streets are for and how cities can become more climate resilient. In other words, they substitute the technical resiliency solutions with natural ones.



JUST STREETS

Experimentation, innovation and learning	Greening can spark discussions about the priorities of street design and uses, and greening project can be experimental and reversible with temporary solutions.
Resourcing stakeholders	Community gardening projects can be used to empower a range of stakeholders and nurture people's ownership on their living environments.
Directly achieving something here and now	Especially in temporary or "mobile" greening projects, cities and directly get knowledge on people's experiences and observe how green alters how streets are used.
Micropolitics	Allowing agency for nature in urban spaces by the means of greening initiatives reflects the end goal of sustainability and resilience efforts – urban life that is balanced with surrounding ecological systems.

For inspiration see for example

- [Community gardens on URBACT Good Practices](#)
- [BOSK project in the city of Leeuwarden](#)



Figure 4 A "walking forest" occupying the city square in the BOSK project (Photo: [Duurzaam Gebouwd](#)).



3.2.3 Community Walk Audits

Unlike some forms of prefigurative planning that focus on the 'occupation' of public space, community walk audits focuses on walking as an activity and a means of engaging citizens in urban assessment and improvement. These audits embody the principle of direct action central to prefigurative politics as well as fostering a participatory approach to urban planning. (Sandt, 2011) It engages residents in identifying and addressing issues to their neighbourhood. Individuals of all ages and abilities can participate in walking audits in their communities. In this way, it is important that streets, sidewalks, crosswalks, and other critical infrastructure are accessible to all community members.

The process of conducting a walk audit is straightforward yet effective. Participants can be a group of community members or a mix of stakeholders adding e.g. politicians or urban planners. Participants walk a predetermined route (typically under 1,5 Kilometer) and take notes and photos to document issues and positive features. A micro-scale perspective, which examines the actual conditions of a route—including its infrastructure, maintenance, and context-specific features—is relatively easy to execute, as it involves direct observation and assessment of tangible elements (D'Orso et al., 2023). Community walk Audits can also be thematic and the observations and evaluation of the public spaces can be tailored to a particular demography, namely women, elderly, children or in the case of Budapest people with reduced mobility.

For thematic or group tailored walks there are many toolkits available which do not require expertise and experience with domains such as, for example, engineering. In other words, you can select to focus on walk audits that foster engagement and can be used by nontechnical stakeholders.

Substituting existing institutions and practices	Instead of relying on municipalities to address accessibility issues, community members take the initiative to evaluate walking conditions, shifting power from formal institutions to citizens.
Experimentation, innovation and learning	While observing the public space with a directed critical point of view the participants learn, talk among themselves about potential innovative solutions.
Resourcing stakeholders	The initiative empowers people with less of a voice e.g. people with disabilities, residents, and advocacy groups to document problems and demand action, giving them an active role in urban planning.
Directly achieving something here and now	Impact is the conversation of the group act – talking about something which is ignored. Immediate visibility is given to inaccessible streets, with reports leading to quick fixes like curb adjustments, sidewalk repairs, and better pedestrian crossings.
Micropolitics	The process fosters a small-scale political action by bringing together citizens, politicians, and planners in a shared space,

shifting accessibility from a niche issue to a broader urban concern.

For inspiration see for example

- [A Toolkit for Planning and Conducting a Walk Audit](#)



Figure 5 Walk audit in Józsefváros by the advocacy group 'Without Barriers' 2023 (Photo: [Living independently](#)).



4. Prefigurative Approaches during COVID-19

The COVID-19 pandemic is a recent example of how quickly urban landscape can change. The pandemic triggered an unprecedented transformation in urban mobility, revealing the potential of experimental and tactical initiatives to reclaim public space. These initiatives, often originating in local communities, quickly adapted urban spaces to meet new public health needs and shifting social behaviors. Crucially, many of these actions have since inspired institutional change, pointing to a future where local efforts are embraced by larger systems and incorporated into permanent urban strategies.

One of the most significant transformations during the pandemic was the **rethinking and repurposing of how the streets could be used**. In many cities, street space traditionally reserved for cars was swiftly repurposed to create larger pedestrian areas and new temporary bike lanes (Combs and Pardo, 2021). This shift allowed for safer movement in public spaces, while reducing congestion on sidewalks. In New York, where official street interventions were sometimes slow to materialize, residents took action, using traffic cones to temporarily open streets to active mobility, allowing for safer walking and outdoor activities (Shamshiripour et al., 2020). A similar grassroots initiative took place in Portland (Basu & Ferreira, 2021), where a local physical education teacher transformed a residential street into a safe play area for children, using chalk and signs to create boundaries. With playgrounds closed and parks often overcrowded, these improvised solutions gave children a much-needed space to be active and healthy.

The most widely replicated intervention worldwide of prefigurative urbanism during this time was the **creation of parklets**—car parking spaces converted into small public areas adjacent to sidewalks, serving different purposes. While not a new concept (originating with Matthew Passmore and partners in San Francisco in 2005), parklets gained prominence during the pandemic as essential urban spaces, particularly for outdoor dining when indoor venues were restricted for restaurants. The concept of **Park(ing) Day**, initiated in 2005, encouraged communities to reclaim parking spots and use them for more desirable purposes, including urban gardens, art installations, and social spaces (Passmore, 2005). Parklets became crucial during the pandemic, with cities like Melbourne and San Francisco evolving them nowadays into community hubs that host activities such as urban gardening, board game sessions for the elderly, and live music performances (Stevens; 2024). These interventions not only provided vital public space during the crisis but also contributed to long-term shifts in how cities view the use of parking spaces. In London, the Cross River Partnership developed guidelines to support the implementation of parklets as long-term solutions for enhancing public space (CRP; 2020).

While many of these transformations started as bottom-up initiatives, they were often mirrored by structured approaches from municipal authorities. In Bogotá, Colombia, authorities implemented 35 km of pop-up bicycle lanes overnight, later expanding to 49 km to reduce crowding on public transport (WHO; 2020). Similarly, Berlin introduced temporary bike lanes that received high public acceptance and significantly increased cycling usage (Becker; 2022). In Auckland, the local municipality covered 90% of the municipal costs for implementing approximately 17 km of temporary bike lanes and expanding sidewalks (Auckland Transport, 2021). These interventions made it easier for people to navigate the city while maintaining social distance. In Bristol, **designated lanes for runners** helped separate joggers from pedestrians, preventing overcrowding on sidewalks (Raje & Saffrey, 2021). San Francisco also took decisive action through its "Slow Streets" program, closing select streets to vehicular traffic, allowing people walking and cycling to move freely and safely (San Francisco Municipal Transportation Agency, 2021).



The shift in public space also extended to **food initiatives**. In cities like New York, **temporary farmers' markets** were implemented as an essential part of the "Open Streets" program (New York City Department of Transportation, 2020). By repurposing car-free streets, these markets allowed locals to access fresh and local products while maintaining proper social distancing. Farmers set up booths in areas such as Park Slope and Lower Manhattan, with measures like one-way walkways, contactless payments, and pre-ordering systems to minimize face-to-face interactions. These markets, still in operation, not only supported local farmers but also residents to maintain a safe and accessible way of acquiring food during the pandemic.

These initiatives demonstrate how urban environments could be quickly and affordably transformed in response to crises and shocks, improving public space and mobility. Many of these measures, originally conceived as temporary, sparked discussions about permanent urban redesign, **prioritizing people over cars**. Communities around the world reimaged their public spaces, often leveraging low-cost, effective interventions that proved the potential for prefigurative urbanism—where grassroots movements shape the future of urban planning.

The pandemic also had measurable effects on **pedestrian behavior**. Angel et al (2023) analyzed pedestrian movement changes during the COVID-19 restrictions, finding that pedestrian traffic volume increased by 41% to 63%. Interestingly, while the pandemic affected the number of people walking and the time of day they walked, it did not change their preferred walking locations – streets near parks and squares remained popular.

At the same time, the forced experiment of remote work, online education, and telehealth services demonstrated the potential for reducing unnecessary travel while reinforcing the need for accessible recreational spaces near residential areas (Adedoyin & Soykan, 2020; Cicha et al., 2021; Engelhardt et al., 2021). Even activities based on high social interaction, such as book clubs and exercise classes, were broadly adopted via web conferencing, fostering a sense of togetherness in the virtual world (Hacker et al., 2020). Studies found that retail activities were more likely to be replaced by digital alternatives than leisure and entertainment, indicating a nuanced interplay between physical and virtual spaces in shaping future mobility patterns (Zaban and Plaut (2024).

Concluding, the pandemic acted **as a catalyst for reimagining public space**, demonstrating that urban environments can be swiftly, cheaply and affordably modified to prioritize people. Many emergency interventions, originally temporary, led to debates on permanent urban redesign. Moving forward, integrating prefigurative approaches—where communities actively shape their urban spaces—should remain a priority. Lessons from COVID-19 reveal that by **empowering grassroots movements and institutionalizing their low-cost innovation**, urban environments can evolve to be more inclusive, adaptable, and centered around human-scale mobility.



5. Conclusions: A new planning institution for just urban futures?

This piece has introduced the concept of prefigurative politics in street planning with a view of promoting social justice. This means imagining and producing street spaces to prioritise equitable access, to reallocate street space, and to support social inclusion and community engagement, ensuring that the needs of all users are met.

As discussed in the above, prefiguration can work through different ways to emancipate various groups, but the exact local dynamics of this are most often contextual – what justice is and means in the context of everyday urban mobility depends on a range of different issues (Nixon & Schwanen, 2018). This is why prefigurative learning should always incorporate an element of social learning. Indeed, prefiguration is essentially about allowing new rationalities and imaginaries emerge in open ended processes. Contrary to any intuitive idea of “planning”, prefiguration does not rely on predefining the exact end goals and working with blueprints.

More practical and academic work is needed around prefigurative planning. Firstly, more understanding is needed on how space reallocation schemes and social initiatives are changing the lives of the people using the streets. This evidence and narratives should be crucial in spreading and communicating the benefits of the prefigurative approach. For example the widely praised change from “streets for traffic to streets for people” (Bertolini, 2020) still encompasses little understanding of the social mechanisms that facilitate things like care, inclusivity and holistic wellbeing. Secondly, this report outlines only a handful of prefigurative schemes and initiatives but more of them are currently deployed and arguably many are still to be invented. Importantly, the “prefigurative planning movement” should refrain from dictating what sorts of initiatives count as prefiguration and how it exactly works. Local expertise is crucial in implementing and studying the effects of prefigurative planning approaches.

Lastly, and connecting all the points of the above, we need more understanding on how the piecemeal and partial changes of prefigurative planning can transcend the boundaries of individual concepts and local initiatives to make more profound impact on how urban mobility and living is understood. Moreover, this concerns not only street planning and the realm of urban mobility but also issues like housing, food and energy. If we believe that the whole institution of urban planning is outdated respective to the needs that cities and societies are showing, prefigurative planning should be harnessed as a thinking device to change the urban planning institution as a whole (Davoudi, 2023).



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D2.1 Literature reviews and compendium reports

**Compendium 5 - Navigating Technology and Innovation:
the Techno-Practical Wisdom Approach for Just Streets**

EU project number 101104240
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Deliverable Details

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Authorship and Contributions

This deliverable was authored collaboratively between António Ferreira, Silvia Spolaor and Cecilia Silva (University of Porto).



About JUST STREETS

The JUST STREETS project focuses on developing streets shaped by active mobility that are both sustainable and inclusive for all citizens. This shift from the use of cars towards more active modes of mobility will be led by prioritizing the needs and visions of marginalized social groups often not involved in the planning processes, particularly women, migrants, the elderly, LGBTQI+ individuals, and people with disabilities.

Goal of the strong international consortium is to support 12 cities in revolutionizing public spaces and streets by putting all of its citizens first. The project addresses the pressing need to transform our streets both from an infrastructural as well as behavioural perspective, shifting away from car-centric environments towards streets that cater to the needs of all citizens.

JUST STREETS is a 32-partner international Horizon Europe project coordinated by the Future Cities and Communities division of Turin-based LINKS Foundation and scheduled from January 2024 to June 2027. Partner cities include the cities of Amsterdam (Netherlands), Braga (Portugal), Cugir (Romania), Haifa (Israel), Kozani (Greece), Milan (Italy), Riga (Latvia), Southwark (UK), Vilnius (Lithuania), Vratsa (Bulgaria), Westminster (UK), and Zaragoza (Spain).

Expert partners of the JUST STREETS consortium are Fondazione LINKS (Italy), Agenzia TPL (Italy), Centro Studi Pim (Italy), Climate Alliance (Germany), European Cyclists' Federation (Belgium), Fundación CIRCE (Spain), International Federation of Pedestrians (Belgium), IT University of Copenhagen (Denmark), Politecnico di Torino (Italy), RINA Consulting (Italy), SocialFare (Italy), Southeast European Technological Company – SETECHCO (Bulgaria), Technical University of Cluj-Napoca (Romania), TECHNION – Israel Institute of Technology (Israel), TREDIT (Greece), University of Amsterdam (Netherlands), University of Porto (Portugal), University of Westminster (UK), Urban Future (Austria), and Western Norway University of Applied Sciences (Norway).

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Executive Summary

This document addresses the increasing influence of pro-digital stakeholders leading to a growing reliance on digital mobility tools in many planning processes. These stakeholders often have promoted their interests, narrowing mobility planning to approaches heavily dependent on digital tools. This scenario poses a significant threat to street justice, as these tools come with inherent limitations, biases, and drawbacks. Over-reliance on technology-intensive mobility solutions risks exacerbating inequalities, environmental degradation, monopolistic control by large tech corporations, and exposure to hackers and terrorists.

Guided by the concept of street justice—the idea that streets can become safer and more equitable by embedding justice principles into decision-making—this practice-oriented compendium critically examines the deployment of Digital Mobile Technologies (DMT). Moving beyond “smart solutions”, the compendium proposes the notion of techno-practical wisdom as an approach to support decision-making. Concerned about the widespread adoption of technology-heavy solutions in the transport sector, either in attempts to reduce car use or as a means to facilitate it in a more sustainable way, this document highlights the risks and challenges associated with such solutions. It advocates for a proportional and balanced perspective, encouraging planners to consider different perspectives – such as low-tech and high-tech – in the pursuit of environmentally and socially sustainable mobility solutions. Likewise, it encourages planners to approach with some level of prudence market-oriented solutions. There is a growing tendency for urban areas to be seen as spaces for economic growth, which leads planning organisations to embrace market-oriented solutions as a means to extract economic value from cities.

It is necessary that decision-makers in general, and mobility planners in particular, are offered means to cultivate what we have designated here as *techno-practical wisdom*. It is a form of practice-oriented understanding that enables making sound choices when facing fracturing situations in highly complex techno-social environments that can be problematic and destructive. The Diverse and Balanced Intervention Spectrum (DIBIS) framework is presented as a guide for creating equitable, sustainable and adaptable transport systems. It organises mobility planning tools along axes that represent polarisations of significant relevance when considering the design and implementation of a given intervention. Following the notion of *wisdom*, we structure a practical and adaptable framework for policymakers, planners and communities to manage the complexity of integrating these technologies into mobility planning practice. Given the rapid development of Digital Mobile Technologies, we emphasise the importance of developing adaptive, diverse and balanced strategies that respond to the changing technological landscapes and social dynamics.



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List of Acronyms

DIBIS – Diverse and Balanced Innovation Spectrum

DMT – Digital Mobile Technologies

DMT-MPT – Digital Mobile Technologies and Mobility Planning Tools (combination)

MPT – Mobility Planning Tools

Glossary

Commons: a general term for shared resources in which each stakeholder has an equal interest.

Digital Mobile Technology (DMT): term used when digital components are applied to Mobile Technology. Examples range from mobile applications used for planning to sensors, devices and software.

Diverse and Balanced Intervention Spectrum (DIBIS): framework proposed in this compendium as an approach to support decision-making.

DMT-MPT assemblage: when digital solutions are incorporated to mobility planning decisions.



JUST STREETS

Mobile Technology (MT): technologies used for mobility purposes.

Mobility Planning Tool (MPT): instruments and methods applied in mobility planning.

Polarisation: gaps between social groups that may cause divisions and consequently conflicts.

Techno-practical wisdom: a form of practice-oriented understanding that enables making sound choices when facing fracturing situations in planning.



1. Introduction

1.1 Setting the stage

In contemporary mobility planning, a range of approaches is available to address the evolving demands of urban systems. However, the increasing influence of pro-digital stakeholders has led to a growing reliance on digital mobility tools in many planning processes. This trend can be attributed to the rising prominence of market-driven and high-tech normative visions, which prioritize technology-intensive solutions. These stakeholders often have vested interests in narrowing mobility planning to approaches heavily dependent on digital tools, sometimes aiming solely at the deployment of their proprietary technologies. This scenario poses a significant threat to street justice, as these tools come with inherent limitations, biases, and drawbacks, which we will explore throughout this document.

Guided by the concept of street justice—the idea that streets can become safer and more equitable by embedding justice principles into decision-making—this practice-oriented compendium critically examines the deployment of Digital Mobile Technologies (DMT). Moving beyond “smart solutions”, the compendium proposes the notion of techno-practical wisdom as an approach to support decision-making. This document is developed within the scope of the JUST STREETS research project which aims at transforming cities’ car-centred mobility narratives, approaches and solutions. Concerned about the widespread adoption of technology-heavy solutions in the transport sector, either in attempts to reduce car use or as a means to facilitate it in a more sustainable way, this document highlights the risks and challenges associated with such solutions. It advocates for a proportional and balanced perspective, encouraging planners to consider different perspectives – such as low-tech and high-tech – in the pursuit of environmentally and socially sustainable mobility solutions. Likewise, it encourages planners to approach with some level of prudence market-oriented solutions. There is a growing tendency for urban areas to be seen as spaces for economic growth, which leads planning organisations to embrace market-oriented solutions as a means to extract economic value from cities. This document also highlights the risks and challenges associated with such solutions, in particular when they are entangled with high-tech approaches. It is therefore important to consider solutions that are not only low-tech but also oriented to preserve and reestablish commoning in urban areas.

This document is a deliverable of the Just Streets project, specifically addressing Work Package 2: JUST ENGAGE – Framing Active Users' Mobility Needs and Envisioning Innovative Solutions. WP2 aims to collect, refine, and adapt approaches that guide cities toward sustainable, safe, and active mobility. More specifically, this compendium addresses Task 2.5: Envisioning Just, Sustainable, and Healthy Digital Technologies for Smart Mobilities. It examines how digital mobile technologies (DMTs) can support and enhance the strategies developed in Tasks 2.1 to 2.4. Additionally, it highlights the risks of overreliance on digital solutions in mobility planning while offering insights into how decision-making can be steered toward more just and balanced planning solutions.

The compendium is structured in five parts. This introduction sets the stage by outlining the concerns that motivated the creation of this document, introducing key concepts and ideas, and describing the methodology adopted. Questioning the alignment of “smartification” with the public interest, the compendium considers critical inputs for mobility planning strategies that increasingly incorporate digital solutions. The concept of DMTs is explored as well as their current role in mobility planning.

The main body of the compendium is divided into three chapters.



Chapter 2 introduces the Diverse and Balanced Intervention Spectrum (DIBIS) framework (expanded in Chapter 3). This framework proposes a dynamic way of critically analysing and improving interventions in the public domain. Questioning the over-reliance on technology-intensive mobility solutions, the chapter presents the notion of techno-practical wisdom to address urban mobility solutions. The concept of “wisdom” adopted is presented as well as a discussion about the constant search of new mobility technologies to promoting innovation. The last part of the chapter addresses the risks and drawbacks of using digital mobility tools. Drawing on a comprehensive literature review, expert feedback, and insights from workshops, the chapter argues for greater diversity in the way problems in general, and mobility-related problems in particular, are addressed in urban areas. By prioritizing a thoughtful approach to the benefits and drawbacks of technology and markets, planners can safeguard the public interest and mitigate the risks associated with over-reliance on high-tech market-oriented solutions and tools.

Chapter 3 explores the potential of mobility planning tools, including DMTs, according to the DIBIS framework. Tools are divided into three groups: (a) tools for information, customisation and participation, (b) tools for data integration, storage and analysis and (c) tools for mobility simulation, monitoring and assessment. Following these three groups, tools are classified using the DIBIS according to their technological intensity and level of commodification and citizen participation as: i. high-tech market-oriented, ii. high-tech commons-oriented, iii. low-tech market-oriented and iv. low-tech commons-oriented.

Chapter 4 proposes the operationalisation of the techno-practical wisdom approach. Transcending the initial polarisations of low-tech/high-tech and market-oriented/commons-oriented, it proposes that the DIBIS framework could be used to face many different planning situations to develop actionable techno-practical wisdom capabilities. A flowchart systematises the reasoning behind the DIBIS framework in the face of polarisations. DIBIS is proposed as a procedural approach, an iterative and learning process for planners to reach better decision-making, not just to inform the final result, but also to integrate the notion of techno-practical wisdom in the entire process.

Finally, the conclusion (**Chapter 5**) points out for key insights for mobility planning practitioners, summarizing the main contribution of the compendium into suggestions for practitioners to embrace the diversity of available solutions, promote adaptability, address polarisations encountered in decision-making, balance technological innovation with social equity, promote community engagement, address the growing dominance of market-oriented high-tech instruments and use mobility as a driver for positive social change.

Overall, this document aims to promote the conscious use of mobility planning tools and methods in decision-making processes. The concept of techno-practical wisdom is introduced as a means to achieve more equitable and sustainable mobility planning, contributing to just streets. The DIBIS framework is then proposed to operationalise and integrate wisdom into daily planning conflicts.

1.2 Methodology

This document employed a multi-stage methodology that integrates academic rigour and practical insights. The process combined a literature review, expert feedback and validation through a workshop to ensure the robustness of the recommendations offered.

The first phase of the methodology was a comprehensive literature review. First, the literature review focuses on the notion of “wisdom” to contribute to the development of the techno-practical wisdom approach. Questioning the excessive use of digital tools and the “smartification” of processes and tools used in mobility planning, the literature review of this document was conducted for searching a theoretical basis for this contribution in a different

direction. The concept of wisdom adopted was relevant to build a critical view towards the use of digital tools. The second part of the literature review was dedicated to identifying and analysing key publications on DMT concerning environmental sustainability, social equity, health impacts and cybersecurity. The third part focused on digital mobility planning tools and the importance of achieving a well-balanced level of technological intensity to propose mobility solutions. Peer-reviewed academic journals, reports from planning organisations and policy documents were examined to provide a basis for the critical arguments and proposed solutions.

A selection of international academic experts reviewed a draft to refine the ideas presented. Their feedback was valuable in assessing the proposed recommendations' validity, practicality and clarity. These experts provided valuable insights that contributed to developing well-rounded and actionable policy proposals. This collaborative process ensured that the recommendations considered multiple perspectives.

A workshop with the experts who reviewed the document validated the recommendations further. This interactive session allowed for an in-depth discussion of main ideas and suggestions, encouraging critical engagement and feedback in a collective environment. The workshop assessed the feasibility and potential impact of the recommendations, identified remaining gaps, and helped fine-tune the final arguments. This method allowed testing the proposed conclusions against practical considerations and ensuring the recommendations were theoretically sound and implementable. Table 1 presents the participants in this process.

Table 1. Participants in the process.

#	Name	Gender	City and country
PoliTO-DIST			
1	Gabriele D'Adda	M	Torino, Italy
2	Elisabetta Vitale Brovarone	F	Torino, Italy
PoliTO- DIATI			
3	Marco Bassani	M	Torino, Italy
4	Arastoo Karimi Maskooni	M	Torino, Italy
CIRCE			
5	Felipe del Busto	M	Zaragoza, Spain (Bogotá, Colombia)

By combining these methods, this document ensures that its recommendations are based on a thorough review of existing research, shaped by the insights of experts and validated through collective discussion. This comprehensive approach provides planners with a practical framework for deciding if, when, and how to deploy DMTs and a way to deal properly with polarisations seen in daily planning practice.



2. The Diverse and Balanced Intervention Spectrum

2.1 Introduction

The widespread adoption of Digital Mobile Technologies (DMT) in the transport sector is often framed as transformative, but it also brings significant social, environmental, and ethical challenges. Over-reliance on technology-intensive mobility solutions risks exacerbating inequalities, environmental degradation, monopolistic control by large tech corporations, and exposure to hackers and terrorists. Drawing on a literature review and expert feedback, this chapter argues that balancing low-tech and high-tech alternatives is constructive, ensuring that solutions are sustainable, equitable, and resilient. In addition, it advocates for an approach that considers the social dynamics, proposing citizen engagement beyond the market logic in the development and deployment of mobility solutions.

The Diverse and Balanced Intervention Spectrum (DIBIS) framework is presented as a guide for creating equitable, sustainable and adaptable transport systems. It organises mobility planning tools along axes that represent polarisations of significant relevance when considering the design and implementation of a given intervention. In this chapter we focus on explaining how the DIBIS was thought of and structure and how the concept of “wisdom” can help us move beyond.

The term Digital Mobile Technologies (DMT) used in this document encompasses a wide variety of digital technologies that are relevant to mobility issues. They range from those used by transport and mobility planners, to those used by people to get around and inform their mobility choices. They have in common heavy reliance on digital functions to fulfil their role, and they are becoming increasingly important in mainstream visions of the future of mobility. Their growing dominance and protagonism represent an important socio-technological transition, often (but not always) resulting from adding extra digital functions to existing technologies. For example, electric scooters or bikes on transport sharing systems becomes digitalized when mobile phones and apps are necessary to access them. In other cases, DMTs result from replacing specific socio-technological configurations that are considered outdated or inadequate, e.g. when the timetable at the bus stop disappears and is replaced by a mobile phone app or when the ticket shop is closed and replaced by a function linked to the same mobile phone app that displays the bus timetables.

Digital Mobile Technologies (DMTs) can be used to support Digital Mobility Planning Tools (MPT). These tools entail software packages and devices used to help in making decisions at various stages of the planning process. MPTs can be useful for information, customization and participation to empower individuals and communities to engage in mobility planning. The trend in contemporary mobility planning is to implement a growing number of *DMT-MPT assemblages* (see figure 1), so that Digital Mobile Technologies (DMT) are used to inform Mobility Planning Tools (MPT) in an increasingly responsive, automated, fast, and efficient way. Conversely, the Mobility Planning Tools are supposed to operate as high-level managers of the Digital Mobile Technologies (DMT) operating across the city. The assumption is that these assemblages will lead to extremely positive outcomes, as data, innovation, technology, highly skilled professionals, mobility and urban areas become increasingly synergistic and capable of serving the public interest.

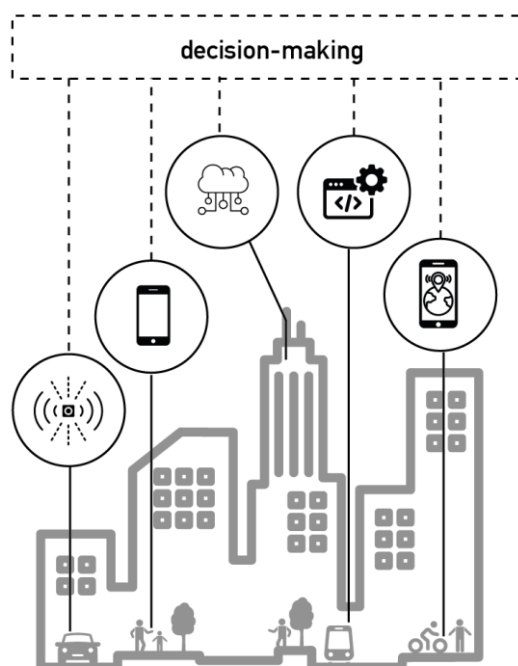


Figure 1. Scheme of DMT-MPT assemblages

DMT-MPT assemblages enjoy widespread recognition and are often hailed as critical drivers of radical yet positive changes across various sectors. Indeed, mobile applications and digital platforms are frequently cited as "transformative" in the transport sector. An example of the trust and hopes placed in DMT-MPT assemblages is provided by the European Commission, particularly on the *Sustainable and Smart Mobility Strategy: Putting European transport on track for the future*. As is stated in this document (E.C., 2021):

... in order to make the digital transformation of the transport sector a reality, the EU needs to ensure that the key digital enablers are in place, including electronic components for mobility, network infrastructure, cloud-to-edge resources, data technologies and governance, and Artificial Intelligence. The EU should further strengthen its industrial capacities related to the digital supply chain. This includes designing and producing components, software platforms and the Internet of Things technology for further electrification and automation in transport and mobility.

However, the deployment of DMTs has also faced significant criticism on several grounds, including the tendency to prioritise technological solutionism over deeper social or environmental justice issues (Sætra, 2023). For instance, the reliance on data-driven approaches, such as those found in ride-hailing and navigation apps, can exacerbate inequalities by catering primarily to affluent users while neglecting the needs of marginalised communities who may not have access to these digital tools and whose data does not constitute a priority for algorithmic analysis due to their low purchase power (Pandey and Caliskan, 2021). Moreover, DMT-MPT assemblages can contribute to digital colonisation, where global tech companies exert disproportionate control over urban and mobility planning, often pushing solutions that may not align with the specific needs and contexts of the communities they serve (Ferreira, Oliveira, and Schönfeld, 2022). This dynamic can lead to transformations prioritising profitability for tech companies and convenience for wealthier individuals rather than fostering genuinely inclusive, equitable, and sustainable cities. The adverse effects of ubiquitous exposure to digital screens and portable digital technologies,



such as mobile phones, have also been a source of deep concerns, especially regarding children's development, health and well-being (Desmurget, 2019).

These critiques suggest that while DMT-MPT assemblages might potentially improve transport systems and society in general, their implementation needs to be carefully designed and scrutinised to avoid reinforcing existing inequalities, undermining democracy, and harming people. It also suggests that excessive reliance on DMT-MPT assemblages might lead the desired transformation of the transport sector to a fiasco. As we are now trying to address the impacts of generalised car dependence, we might also have to address the effects of generalised digital technology dependence in the future.

This document outlines a rationale with the potential to deliver just, sustainable, and safe use of digital technologies in mobility systems. In the scope of the JUST STREETS research project, this compendium invites planners to consider the effects of over-reliance on digital tools for providing mobility solutions. Moreover, it proposes a framework to address emerging polarisations in the context of urban planning. In the context of living labs and street experiments which is a burgeoning area of action-oriented urban research, there is a significant concern of equity, fairness, inclusion with an intrinsic idea of social learning (Beukers & Bertolini, 2021; Kinigadner et al., 2024; VanHoose et al., 2025). With the aim of inspiring those initiatives, the DIBIS framework is presented as a means to overcome diversity fallacy. Bearing in mind that group diversity in participatory activities do not necessarily mean different perspectives are going to be adopted, we propose a planning support approach to acknowledge and address multiple viewpoints. Drawing from the concept of wisdom, next section describes how the DIBIS framework was structured to advance the notion of techno-practical wisdom.

2.2 Seeking techno-practical wisdom in the age of complexity: the DIBIS framework

In addition to the increasing pressure to solve problems in the mobility planning domain via implementing continuous rounds of high-tech solutions, we are living today in a cultural-political context of an increasing tension and polarisation around this topic, as critical voices alert for the dangers and drawbacks of continuous technological intensification. This can be seen as a manifestation of a broader trend in contemporary societies, where escalating polarisation is becoming a serious threat to the viability of democracy and its institutions.

It is necessary that decision-makers in general, and mobility planners in particular, are offered means to cultivate what we have designated here as *techno-practical wisdom*. It is a form of practice-oriented understanding that enables making sound choices when facing fracturing situations in highly complex techno-social environments that can be problematic and destructive. Considering how people frame (and reframe) such situations can be very effective in moving forward in a constructive way (Schön and Rein, 1994). Building on such approach and engaging as well with Ardel's work on wisdom (Ardelt, 2003), we argue that techno-practical wisdom entails three dimensions, namely the reflective, cognitive and affective. According to Ardel, the cognitive dimension refers to our ability to understand the significance and deeper meaning of events. A better understanding of the behaviours of people around us and assessing the presence of positive emotions should improve our affective dimension. The reflective dimension requires that we perceive reality looking at different perspectives to develop self-awareness. The reflective is the foundational dimension, from which the other two emerge. The three elements are not independent however they are not the same. The conditions of "being wise" only exist when the three elements can be observed at the same time. The idea is that the DIBIS framework could help us integrate the notion of wisdom into decision-making.

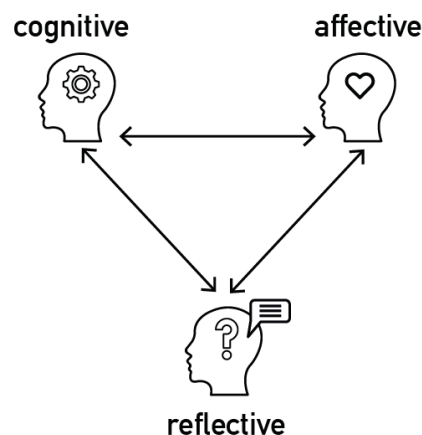


Figure 2. The three dimension of wisdom based on Ardelt (2003).

Following the concept of wisdom, we structure a practical and adaptable framework for policymakers, planners and communities to manage the complexity of integrating these technologies into mobility planning practice. Given the rapid development of Digital Mobile Technologies, we emphasise the importance of developing adaptive, diverse and balanced strategies that respond to the changing technological landscapes and social dynamics. DMTs should not be naively designed and implemented without critically understanding their risks, limitations, and drawbacks. They should also not be deployed without suitable awareness about the possible alternatives that might achieve better and faster outcomes in a safer and more just way. The framework aims to help stakeholders create resilient, equitable and sustainable mobility ecosystems by presenting a diverse and balanced approach that integrates solutions from different spectrums.

The Diverse and Balanced Innovation Spectrum (DIBIS) is inspired by the work of Schumacher (1973). Schumacher emphasizes the importance of achieving a well-balanced level of technological intensity—maintaining a sufficiently high standard of productivity and efficiency without inducing excessive dependence on corporate lobbies or incurring constant maintenance and innovation costs. The DIBIS framework is also informed by the concept of organizational ambidexterity, which highlights the necessity of balancing the benefits and drawbacks of pursuing innovative, high-tech solutions for emerging problems while maximizing the potential of already established solutions (Gibson and Birkinshaw, 2004; Raisch and Birkinshaw, 2008; Raisch et al., 2009; Bodwell and Chermack, 2010).

2.3 Technologies change over time, so do our solutions?

Societies face challenges that led to the development of new technologies, either with the evolution of existing ones (e.g. bikes become e-bikes) or with the invention of new objects or gadgets. This section reflects on the relevance of the temporal dimension in relation to technological innovations. Through the course of years, technologies have evolved to the point that we became totally dependent of certain features. Think about mobile phones and computers, for instance.

In mobility planning, we can describe the evolution and transformation of many tools used for different purposes such as informing, producing, integrating and analysing data and for simulation, monitoring and assessment. The constant evolution pushed by innovation – bear in mind that not always innovation means positive results – has led the production of new methodologies, tools, devices, software or the improvement of existing ones.



Consider the example of a bicycle. There was a moment in time that it was launched as a technological innovation, providing us a new way to move. With time, bikes become electric, adding a battery to help us move around faster. Digitalization systems made it possible to access a bike from a bike sharing system using an app on a mobile phone. What is the next step?

In this document, we address technological innovation and digitalisation with a critical perspective. It is important to consider that not all digital “things” are high-tech, and not all digital innovation is pro-market. Technology is necessary and technological innovation has improved our daily life. Our main perspective here is to shift the idea that innovation means “better solutions”, instead of advocating against high-tech and digital solutions. Yet, it is important to consider time as an important dimension in relation to decision-making and technological intensity.

Rapid technological advances can render older digital systems obsolete, leading to premature disposal of functioning technology and increasing the waste production rate (Kim and Kim, 2020). These implicate in the necessity of replacements, substituting existing instruments by more updated ones. Having in mind the example of mobility planning, it is possible that for every problem that emerges we may have a high-tech solution that needs constant maintenance, either of a product or software. However, planning solutions might have low-tech perspectives than can be taken into consideration to avoid the overreliance in high-tech pro-market instruments. The following section reflects about the risks and drawbacks of DMT-MPT assemblages and provides some ideas to avoid or complement high-tech solutions.

2.4 Using DMT-MPT assemblages: Risks and drawbacks

While DMTs are often praised for their capacity to optimise mobility, increase efficiency, and reduce emissions, their widespread adoption also brings significant issues that cannot be ignored. Therefore, it is essential to establish a clear framework for identifying and understanding DMT-related risks and drawbacks. By mapping out these issues, we can critically engage with DMTs' limitations and ensure that justice- and sustainability-oriented initiatives deliver what they promise. The intention is to highlight the extent to which exclusively seeking solutions in technological intensification is not necessarily a good idea and can be, in some cases, highly detrimental as it prevents policymakers from approaching the challenges they face with all the available resources. It can lead them to aspire to deploy tech-intensive solutions that do not exist or are both complex and problematic to implement instead of deploying low-tech solutions that are currently available and might entail reduced monetary costs or, at least, lead to more cost-effective solutions in a long-term perspective.

The adopted framework for the identification of DMT-related risks and drawbacks is composed of six elements. The elements are 1) Environmental sustainability, 2) Health and Well-being, 3) Equity and Social Justice, 4) Monopolization and Power Dynamics, 5) Data Governance and Privacy, and 6) Hacking and Terrorism. We provide a range of possible solutions to help policymakers understand how they could move forward.

2.4.1 Environmental sustainability

Although DMTs are often associated with efficiency gains, environmental benefits and reduced carbon footprints, there are hidden environmental costs associated with these technologies' production, maintenance, energy consumption, and disposal. Fundamental areas of concern include the full environmental impacts of DMT, from production to end-of-life and whether these technologies genuinely lead to lower emissions or contribute to e-waste, cost-shifting, and additional energy consumption. This subsection presents some issues



related to environmental sustainability and discusses proposals on how to address them with high-tech and low-tech solutions.

Increased energy demand: Using digital technologies such as AI, data centres, and cloud computing for transport management brings significant benefits but also consumes considerable energy (Masanet et al., 2020).

- High-tech: implementing AI-driven energy optimisation systems that intelligently manage data centres' energy usage, adjusting power consumption based on workload demand (Tuli et al., 2022; Ran et al., 2023).
- Low-tech: using energy-efficient building designs and natural cooling systems in data centres, such as improved airflow and natural ventilation, could be adopted to address electricity demand (Liu et al., 2018).

Carbon footprint of digital infrastructure: the infrastructure that supports digital technology systems (servers, sensors and communication networks) has a significant carbon footprint due to its manufacture, maintenance and operation (Callegari et al., 2024).

- High-tech: developing and implementing green computing technologies, such as liquid-cooled servers and energy-efficient chips, which reduce energy consumption during data processing.
- Low tech: policy solutions that encourage the location of regional data centres closer to the users or services they support, reducing, in this way, the need for long-distance data transmission and excessive data load.

Rebound effects: efficiency gains lead to increased usage and overall efficiency losses (Özsoy, 2024).

- High-tech: using dynamic pricing algorithms and AI-based transport demand management to reduce unnecessary travel and discourage the overuse of transport services.
- Low-tech: Developing public awareness campaigns about the environmental impacts of the overuse of DMT-enabled transport services, encouraging individuals to consider alternative, lower-emission and active transport modes for short trips.

Technological obsolescence: Rapid technological advances can render older digital systems obsolete, leading to premature disposal of functioning technology and increasing the waste production rate (Kim and Kim, 2020).

- High-tech: Investing in modular, upgradable hardware designs that allow for component replacement rather than complete system overhauls. For example, using standardised modular parts in sensors or digital systems would allow for upgrades without total replacement.
- Low tech: include promoting hardware refurbishing and recycling programs, in which consumers can return old or obsolete devices for refurbishment or recycling.

Growing electronic waste: The production and disposal of digital hardware, such as sensors, GPS devices, and mobile phones contribute to the growing problem of electronic waste (e-waste) (Kim and Kim, 2020).

- High-tech: employing smart recycling technologies using AI and robotics to disassemble and recycle electronic waste efficiently.
- Low-tech: implementing communal e-waste collection centres and creating repair workshops where individuals can drop off old electronics for repair or recycling.



Extraction of resources: The production of digital hardware requires mining rare metals and minerals that can harm the environment, leading to habitat destruction, water pollution and high carbon emissions (Ali, 2014).

- High-tech: investing in researching alternative materials, such as developing synthetic or bio-based alternatives to rare earth metals.
- Low-tech: involving policy elaboration towards encouraging resource-saving manufacturing standards, such as reducing the use of rare metals in hardware production and the return to cabled devices to stop the proliferation of battery-enabled devices.

Dependence on non-renewable energy: Digital technologies require a significant amount of electricity to function, and in regions where electricity generation still relies on fossil fuels, this dependence exacerbates carbon emissions (Mayer, 2022).

- High-tech: introducing smart energy management systems powered by AI that help ensure DMTs rely more on renewable energy.
- Low-tech: implementing energy efficiency audits for all transport-related digital systems, identifying areas where energy consumption can be reduced.

2.4.2 Health and well-being

The increasing integration of digital technologies in the transport sector is often hailed as having the potential to improve comfort and safety among travellers. However, this digital-intensive approach can also lead to various health and well-being concerns that policymakers must be aware of. Over-reliance on digital solutions can lead to unintended consequences, such as cognitive overload, sedentary behaviour and increased screen time, negatively impacting physical and mental health. In addition, there is growing concern about issues such as radiation exposure from wireless devices, sleep disturbances and social isolation, exacerbated by the ubiquitous use of digital platforms in everyday transport. These risks emphasise the need for a balanced approach considering technological innovation and the potential harm to health and well-being. This subsection describes some crucial health-related challenges associated with DMT deployment and offers high-tech and low-tech solutions to mitigate these issues.

Digital overload and cognitive fatigue: Constant exposure to digital interfaces in the transport sector (e.g., navigation systems, ride-hailing apps and real-time traffic alerts) can affect drivers, passengers and transport system operators leading to stress, anxiety and poor concentration.

- High-tech: Developing AI-based user interfaces that can adapt to the user's cognitive load by presenting information incrementally and reducing unnecessary alerts.
- Low-tech: Implement more intuitive and basic interfaces for drivers and operators without unnecessary distractions.

Sedentarism: DMTs provides convenient transport options that can discourage physical activity.

- High-tech: creating integrated fitness apps into transport platforms and encouraging users to choose active modes of transport such as walking or cycling.
- Low-tech: adopting an urban design approach that encourages walking and cycling and reduces the need for passive transport.

Social isolation: In their mission to achieve efficiency, some DMT-based transport solutions, such as ride-hailing apps or autonomous vehicles, reduce opportunities for social interaction.



- High-tech: utilising social engagement features in ride-hailing and ride-sharing apps that encourage shared rides and conversations between passengers.
- Low-tech: developing design ideas for public spaces, such as community-based transport hubs, where people using transport services can interact.

2.4.3 Equity and Social Justice

As DMTs become increasingly embedded in society, they are often seen as tools to enhance equity and social justice. However, a digital-intensive approach risks exacerbating existing social inequalities and creating new forms of exclusion if not carefully managed. Issues such as unequal access to digital platforms, algorithmic bias, data privacy concerns, and the exploitation of gig workers highlight the complex relationship between DMT and social justice. This subsection outlines equity and social justice challenges associated with DMT deployment, offering high-tech and low-tech solutions to ensure that the benefits of digital innovations are distributed fairly and that the transition to digital mobility does not deepen societal divides.

Digital divide: the unequal access to digital technologies such as the internet, computers and smartphones. It can disproportionately affect low-income, elderly and people in rural areas and exclude them from the benefits of digital transport solutions (Durand et al., 2022).

- High-tech: developing inclusive digital platforms that work on low-cost devices and require minimal data usage.
- Low-tech: ensure that non-digital transport alternatives remain available, such as cash payment options for public transport, printed timetables and analogue route maps.

Algorithmic bias: Algorithms underlying digital transport platforms (e.g. ride-hailing or traffic management systems) can reinforce biases and induce discrimination in pricing, service availability and route planning (Pandey and Caliskan, 2021).

- High-tech: Introducing ethical guidelines for AI that require transparency and regular audits of algorithms used in transport systems
- Low-tech: creating regulatory frameworks that ensure equal access to transport services for all regions and population groups, requiring transport providers to serve low-income and underserved areas with the same quality and affordability as more affluent regions

Economic exclusion: Digital mobility services like ride-hailing apps can be prohibitively expensive for low-income populations.

- High-tech: introducing dynamic pricing systems that adjust the cost of digital mobility services based on income, ensuring that low-income users pay less for essential transport.
- Low-tech: introducing tiered fares for public transport could be an idea. In this case, individuals could pay based on their income.

Exploitation of gig workers: Digital platforms in the transport sector, such as ride-hailing apps, are criticised for creating precarious working conditions for drivers and delivery staff (Koivusalo, 2024).

- High-tech: developing blockchain-based smart contracts (Koivusalo, 2024) to ensure that workers on transport platforms receive fair wages, benefits and a safe workplace.
- Low-tech: strengthening labour laws and enforcing minimum wage standards for all workers in the gig economy, including those in the transportation sector.



Gentrification: The emergence of digital transport services combined with smart city initiatives can affect the overall value of a city and contribute to the displacement of low-income residents (De Falco and Romeo, 2024; Gstrein, 2024).

- High-tech: using geospatial data and AI models to identify areas at risk of gentrification and displacement.
- Low-tech: prioritising community involvement in urban planning to ensure that residents have a say in implementing digital transport solutions. Policymakers should enact planning regulations that protect affordable housing and limit the risk of displacement from smart city initiatives.

2.4.4 4.4. Monopolisation and Power Dynamics

In the rapidly expanding DMT landscape, the concentration of power in the hands of a few global tech giants is an increasingly pressing concern. The dominance of these companies not only stifles competition but also shifts control over public infrastructure and urban policy to private entities, raising profound implications for market dynamics, public accountability, and consumer access. As tech monopolies consolidate their influence over transport platforms, they dictate the terms of innovation, data use, and pricing strategies—often with little transparency or oversight (Hu and Cheng, 2023). This power imbalance can exacerbate inequalities, limit local governance, and curb the potential for diverse, locally adapted solutions. This subsection delves into critical issues related to monopolisation and power dynamics in DMT, offering high-tech and low-tech strategies to address the concentration of control and promote fairer, more competitive digital ecosystems.

Concentration of control in global tech companies: This concentration leads to monopolistic practices where a few companies dominate the market, restricting competition, stifling innovation and preventing smaller, local companies from entering the market (Birch and Bronson, 2022).

- High-tech: developing open-source digital public transport platforms that allow local governments or communities to manage their transport systems independently of global tech companies.
- Low-tech: introducing local or regional government transport services that reduce reliance on private digital platforms. Cities could retain more control over transport policy and infrastructure by creating and promoting public transport alternatives.

Lack of local governance and influence: As global tech giants dominate the digital transport sector, local governments and authorities are losing their ability to influence or regulate public services such as transport (Khanal, 2024).

- High-tech: Using blockchain to create decentralised governance models for transport systems could allow local governments and users to participate in decision-making processes and ensure services are tailored to regional needs while maintaining transparency.
- Low-tech: establishing local transport committees of officials, community members and transport experts. These can directly influence transport policy and work with digital platforms to meet local priorities.

Lack of public oversight: When DMTs are controlled by private companies, public oversight and accountability are often limited. This lack of transparency makes it difficult for governments to regulate or hold these companies accountable for their services, particularly in pricing, accessibility and environmental sustainability (Vrikki, 2024).



- High-tech: policing AI with AI, that is, develop real-time monitoring and auditing systems that utilise AI and machine learning to ensure private digital platforms comply with public transport regulations.
- Low-tech: creating independent oversight bodies to monitor the activities of DMT developers and operators.

2.4.5 Data Governance and Privacy

In the digital age, data has become one of the most valuable assets, particularly in the transport sector, where DMT heavily rely on vast amounts of personal and operational data. However, data collection, use, and governance present significant privacy challenges that, if left unchecked, could undermine user trust and security. The trade-off between convenience and privacy becomes increasingly complex as DMT systems evolve. How companies collect, store, and exploit data affects individual privacy and raises broader concerns about data monopolies, algorithmic fairness, and transparency. Addressing these issues requires a comprehensive approach that could balance technological innovation with strict governance measures to protect user rights. This subsection explores key issues related to data governance and privacy in DMT. It offers high-tech and low-tech solutions to ensure data is managed securely, ethically, and transparently.

Collection of personal data and user consent: DMT systems often rely on large amounts of personal data to function effectively, such as GPS location, travel behaviour, and payment details. The question arises regarding how this data is collected, stored and used, particularly whether users know it and have provided consent (Abirami, 2024; Stehlin and Payne, 2023).

- High-tech: Implementing user-centric consent management platforms that could give individuals real-time control over what data is collected and how it is used.
- Low-tech: Prescribing clear and simple privacy policies that are easy for users to understand could ensure they know precisely what data is being collected and for what purpose. Enforcing stricter rules for obtaining explicit consent before collecting personal data could complement this solution.

Data security and data breaches: As large amounts of data are collected and stored, there is an increased risk of data breaches where sensitive information falls into the hands of unauthorised persons (Zinovieva, 2022).

- High-tech: developing end-to-end encryption protocols for all data transmitted and stored by DMT systems.
- Low-tech: applying mandatory security audits for DMT providers, requiring them to regularly test their systems for vulnerabilities. Audits would ensure that security measures are up-to-date and can protect users' data.

Data governance and accountability: The governance of data collected by digital systems is often opaque, with unclear regulations or insufficient oversight.

- High-tech: setting up AI-powered data governance platforms that automatically track and report all data processing activities in DMT systems. These platforms would highlight any compliance breaches or unethical activities to ensure accountability (Kontos, 2024).
- Low-tech: establishing independent data oversight committees to monitor how organisations collect, store and use personal data. These committees would have the power to audit companies, impose penalties and make recommendations to improve data governance.

2.4.6 Hacking and Terrorism

As DMTs increasingly become integral to transport systems, they open up new vulnerabilities, particularly hacking and terrorism. These technologies manage critical infrastructure such as traffic controls, public transport networks and autonomous vehicles, making them attractive cyberattack targets. Hackers and terrorists can exploit vulnerabilities in digital systems, potentially causing widespread disruption, data theft or even life-threatening situations (Tonn, 2019). Robust security measures are essential to protect against these threats and ensure public safety. This subsection looks at the main risks posed by hackers and terrorists in the transport sector, introducing high-tech and low-tech solutions to mitigate these threats and effectively protect the public interest.

Cyber-attacks on critical infrastructures: DMT systems used to manage traffic, GPS navigation and public transport networks are vulnerable to cyberattacks that can disrupt transport services, cause accidents or even lead to widespread chaos (Marassi and Marrone, 2023).

- High-tech: using AI-driven cybersecurity systems monitor transport infrastructure in real time, detect anomalies, and automatically neutralise potential threats.
- Low-tech: implementing manual bridging systems and offline backups for critical transport infrastructure, allowing human intervention during a cyber-attack.

Ransomware attacks on transport systems: Hackers can infiltrate DMT platforms and lock users out of critical systems or data until the payment of a ransom. Such attacks can paralyse public transport networks or ride-hailing services.

- High-tech: developing advanced ransomware detection tools that use machine learning to recognise early signs of a ransomware attack so that systems can be shut down and important files protected before they are encrypted.
- Low-tech: concerns introducing regular offline backups of critical transport systems and data, allowing transport providers to restore their services without paying a ransom, reducing the impact of hackers in such attacks.

Hijacking of autonomous vehicles: Complex DMTs for navigation, communication and control used in those vehicles are vulnerable to hijacking, where hackers can take over the vehicle's systems, leading to dangerous situations such as accidents or the vehicle being used for criminal purposes (Mwanje et al., 2024).

- High-tech: integrating blockchain technology into vehicular systems could ensure secure communication between autonomous vehicles and their control systems, making it extremely difficult for hackers to disrupt the data flow or take control of the vehicle systems.
- Low-tech: requiring manual override features in all autonomous and connected vehicles that allow a human driver or operator to take control of the vehicle in case of a system breach or malfunction.

Risk of terrorism: Terrorists could exploit vulnerabilities in DMT to carry out attacks (Iftikhar, 2024).

- High-tech: using AI-based predictive analytics to identify potential terrorist threats by monitoring traffic system usage patterns and detecting unusual behaviour that could indicate malicious intent.
- Low-tech: increasing physical security measures at key transport hubs such as railway stations and airports through additional checks, patrols and spot checks to prevent cyber-attacks and other forms of terrorism.



2.5 Beyond high-tech: exploring possibilities

There is a growing cultural inclination, driven by economic forces, to increasingly rely on digital mobile technologies (DMT) in transport systems, compelling planners to focus on integrating these technologies to boost efficiency while addressing potential drawbacks. High-tech solutions, such as AI-driven systems, offer the potential for improved traffic management, optimised energy consumption, and increased safety. However, these solutions are often resource-intensive and can exacerbate problems such as inequality, environmental pollution, or monopolisation of power in corporate agents. It is, therefore, important to find a balance between high-tech innovations and low-tech alternatives that are often more accessible, affordable, and can be implemented immediately. A comprehensive planning approach must consider the strengths and limitations of both technological intensification and simpler, more adaptable solutions.

Regarding high-tech recommendations, planners could prioritise implementing AI-based systems to optimise traffic flows, reduce energy consumption and improve cybersecurity. AI and predictive analytics can play an essential role in managing the complexity of transport networks by enabling real-time data analysis and threat detection to mitigate risks such as cyber-attacks. In addition, investment in green technologies, such as energy-efficient servers and renewable energy systems, will ensure that the infrastructure supporting these technologies is sustainable. At the same time, AI-powered data transparency tools and open-source platforms can boost public trust and ensure fairer access to digital services while fostering local economic activity.

Low-tech solutions, on the other hand, offer a valuable alternative to high-tech strategies. Strengthening public transport, cycling infrastructure, and pedestrian routes promotes sustainability and equity while reducing reliance on costly, energy-intensive digital platforms. Introducing manual backup systems for critical transport infrastructure ensures resilience during a cyber-attack or technical failure. Repair initiatives and e-waste recycling programmes can extend the lifespan of digital devices and reduce the environmental impact of DMT. In addition, community involvement in mobility planning ensures that all voices are heard, especially those of vulnerable communities that technology-driven solutions may overlook.

The proposed solutions have been categorised from a technological perspective, considering the risks and opportunities associated with each approach for addressing the issues identified. However, it's equally important to consider the socio-economic frameworks inherent to these solutions. Some are aligned with a market-oriented approach, fostering the development of new ideas, projects, and products that are most likely to be addressed by the tech industry. Meanwhile, other solutions are focused on innovation in policy-making and collective planning, leading to outcomes that, even though related to DMT usage, would probably benefit a broader community.

In this sense, another possible risk of prioritizing high-tech solutions could be to postpone once again, and a little bit longer, changes that are urgent, searching for technological solutions without questioning and changing the existing models, such as economic, social, ecological, and political. Most scenarios related to a high-tech solution suggest creating a new product idea. This product has an associated cost, yet it might also have an associated profit with the new software, device, infrastructure or patent created.

Among the second set of solutions based on a low-tech approach, most of the solutions presented comprise structural transformation, including policy creation, infrastructural works and community participation. Reaching the best-scenario solution, in this case, depends on the available resources, personnel and time to build a new agenda that will prevent the risks



associated with DMT usage. Those low-tech solutions offer greater durability and a stronger social response to the issues identified. Still, they can be more challenging to develop and implement, considering the number of stakeholders involved and the possible impact generated.

The choice between tech-intensive and low-tech solutions will have different outcomes. To achieve a balanced approach, various factors must be evaluated for each option, such as costs, implementation timelines, and the target audience. The development model in question can lead to different socio-economic consequences. For instance, commons-oriented solutions can enhance economic resilience and foster a sense of belonging among affected users, although they may encounter resistance from the public. In contrast, while potentially more expensive and resource-intensive, market-oriented solutions can often be rapidly made available to the public, depending on the company's interest in launching the product.

While advanced technologies can lead to significant improvements, they should not overshadow the importance of simpler, cost-effective alternatives that meet immediate needs in ways that can be significantly more resilient and less prone to hacking, technical failure, and corporate take-over. Planners should adopt the following rule of thumb: for every investment in a high-tech solution, there should be an equivalent investment in a low-tech approach to maintain balance. If there is uncertainty or limited funding, the low-tech option should probably be prioritised as it is often more comprehensive, easier to implement, and has lower risks. With this balanced approach and some preference towards low-tech, planners can create resilient, adaptable and equitable transport systems that meet the needs of all users while making reasonable use of DMTs. The next chapter dives further into this discussion, presenting an application of the DIBIS (Diverse and Balanced Innovation Spectrum) framework.



3. Using wisely your mobility tools: finding balance

3.1 Introduction

This chapter presents an application of the Diverse and Balanced Intervention Spectrum (DIBIS) framework as a guide for creating equitable, sustainable and adaptable transport systems. In this application, the DIBIS framework organises planning tools and methods along two key axes: the technological spectrum (low-tech to high-tech) and the governance spectrum (market-oriented to community-oriented). By mapping possible tools using the four quadrants that result from considering these two axes simultaneously, the chapter encourages planners to take a holistic approach that balances high-tech with low-tech as well as market-oriented and commons-oriented tools to create more resilient and equitable urban mobility systems.

The perspective proposed by this application of the DIBIS framework, contrasting and placing tools according to technological intensity and governance level is an idea aligned to another current research. In the Mobility Futures document published recently by TU Delft (TU Delft, 2025), four scenarios for the Dutch mobility system in 2050 are proposed. Each of those scenarios are based on different levels of government intervention and on societal approaches towards emerging technologies: innovation fast track, hyperconnected systems, mobility patchwork and sustainable slowdown. This shows that considering these two spectrums is a relevant way of analysing and applying our mobility tools.

Other deliverables within the scope of the JUST STREETS research project have collected tools and methods to support mobility planning according to the issues faced, resources available and level of expertise necessary and they can be found as part of the Work Package 3 ([D3.1 Draft 02.pdf](#), [D3.2 v0.4 Final.pdf](#)). Our idea here is, instead, to offer planners an array of planning tools presented in a framework that points out disadvantages and potentialities of their application when addressing mobility planning. This chapter assumes a critical perspective towards the usage of purely high-tech and market-oriented tools, discussing their purposes and the intentions behind their creation. Many of the available planning tools can ease and support urban interventions yet, their choice and justification might be based on an informed assessment.

Even though the DIBIS framework might be used to address different issues concerning planning, in this chapter, we will then focus on two polarisations in particular. The first polarisation concerns the intensity of technological deployment (low-tech versus high-tech). Low-tech solutions are generally easily accessible and straightforward to implement from a technical point of view. However, they typically represent a very intense human workload, require sophisticated social, organisational, and emotional skills, and are unsuitable for generalised application and scalability. In contrast, high-tech solutions leverage advanced digital innovations, often including sophisticated technologies such as artificial intelligence, Big Data mining, and automated devices.

The second polarisation concerns the intensity of markets in the governance of the mobility sector (market-oriented versus community-oriented). Private companies, global innovation networks and other capital-driven institutions are the ones driving market-oriented solutions. These solutions tend to focus on achieving efficiency, low cost-benefit ratios, competitive advantages, and profitability. However, they tend to come at high social and environmental costs, as negative externalities are often not addressed. Conversely, commons-oriented approaches are led by communities, neighbourhoods, small local businesses, non-profit organisations, and collaborative initiatives that emphasise shared resources, collective action, and meeting local needs. From a social point of view, commons-oriented approaches



are nearly ideal. However, implementing and maintaining such approaches is often very difficult since the public sector must dedicate substantial efforts to them, which can have significant costs.

When these two axes are juxtaposed, four quadrants emerge, each representing a different blend of technological intensity and governance style to address mobility planning:

- High-tech, Market-oriented: Advanced technological solutions led by private companies focusing on efficiency, profit, and innovation.
- High-tech, Commons-oriented: Advanced digital solutions integrated into community-led, shared, open-source, and collective initiatives that promote local engagement.
- Low-tech, Market-oriented: Low-resource solutions led by private companies that are commercially oriented even though they are not technologically innovative (however, they might be socially innovative).
- Low-tech, Commons-Oriented: Simple, citizen-driven approaches focusing on local solutions, collective ownership, decommodification, and grassroots participation.

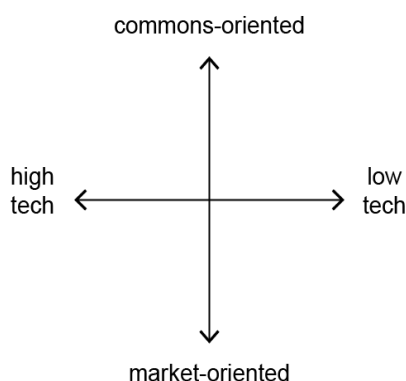


Figure 3. Two polarisations represented in the DIBIS framework.

A key argument of this chapter is that implementing Digital Mobility Technologies (DMTs) and Mobility Planning Tools that are digital (DMT-MPT assemblages) should neither be seen as an end in itself nor as a sign that societies and cities are evolving or progressing in a positive way. DMTs and DMT-MPT assemblages are seen instead as instruments and methods that should be critically analysed through the DIBIS framework to avoid over-reliance on market-driven high-tech solutions. The chapter also critically assesses how these tools, particularly those promoted by for-profit corporations, increasingly dominate the imaginations of policymakers, planners, funders and even the public, often eclipsing simple, inclusive, commons-oriented approaches that can better and more sustainably serve local communities.

The chapter looks at examples of tools and methods used in mobility planning framed in three groups: **i. information, adaptation, participation; ii. data integration, storage and analysis and iii. simulation, monitoring and evaluation** within the four defined quadrants of the DIBIS framework. The structure of the three groups follows a logic that mirrors the typical phases of classic mobility planning processes, with each section focussing on a particular phase in the planning and decision-making cycle. Each section builds on the previous one, creating a holistic framework that supports theoretical reflection and practical application in transport systems. It emphasises the importance of using a wide range of



approaches at each stage of the mobility planning process. In this application we demonstrate that planners will find it easier to align technological innovation with the public interest so that transport systems can become more equitable, sustainable and adaptable to people with different needs. Furthermore, this approach supports continuous improvement at all stages of the planning process.

3.2 Tools for information, customisation and participation

Informative, customised and participatory tools are crucial to empower individuals and communities to engage in mobility planning and promote transparency, education and inclusion. These tools aim to inform the public while offering customised mobility services, responding to the diverse needs of users, promoting sustainable practices, and encouraging active participation in mobility planning (Gil et. Al, 2011; Giuffrida et al., 2019). Through various technological and governance approaches, these tools ensure the representation of different voices and preferences in mobility-related decision-making processes. The tools for information, customisation, and participation can be categorised into four quadrants (high-tech/low-tech and market-oriented/commons-oriented) as an example of the DIBIS framework application. The table below presents the characterisation and possible applications of a number of tools by quadrants.



Table 2. Tools for information, customisation and participation represented in four DIBIS quadrants.

TOOLS FOR INFORMATION, CUSTOMISATION AND PARTICIPATION	
High-tech commons-oriented tools <i>Examples: Open Street Maps (OSM)</i>	Low-tech commons-oriented tools <i>Examples: Community-led mobility forums, bulletin boards for transport updates, and face-to-face meetings</i>
• developed based on advanced technologies but guided by commons-oriented and inclusive approaches. • focus on customisation to the needs of specific groups or individuals to promote co-ownership, inclusivity, and shared decision-making. • empower communities by integrating sophisticated digital solutions shaped by local stakeholders' preferences and inputs. • based on technological co-development (communities, local authorities and developers) to create digital platforms and mobility services that inform and empower citizens. • use open-source software and shared digital infrastructure to promote transparency and encourage collective responsibility. • provide real-time data and allow users to give feedback, creating a two-way flow of information. • apply customisation to ensure that technological advances are aligned with local values, making tools accessible and relevant to different groups in the community.	• use minimal technological infrastructure while prioritising collective management, active community participation, and customisation to local needs. • emphasise grassroots approaches to information sharing, decision-making, and mobility management • focus on human-centred, participatory processes that promote local agency, shared governance, and inclusive dialogue in every step of the process. • ensure that transportation services are not only accessible but also responsive to the distinct realities of different neighbourhoods. • stimulate transportation cooperatives where members collaborate on shared transport services voluntarily or to provide travels free of charge. • based on community collectively decision on transportation services and infrastructure. • designed to be flexible and adaptable, allowing communities to modify or expand them as local needs evolve.
High-tech market-oriented tools <i>Examples: Navigation apps used in mobile phones</i>	Low-tech market-oriented tools <i>Examples: SMS-based notifications, printed timetables, or public information boards.</i>
• driven by advanced digital technologies developed by private companies to offer customisation options for user needs. • protected by proprietary software and hardware systems to preserve the company's intellectual property. • employ state-of-the-art digital infrastructures such as real-time data analytics, connectivity solutions, and advanced user interfaces to optimise urban mobility conditions. • enable users to make real-time informed transport decisions based on personalised preferences and individual travel patterns. • participation is limited to utilisation providing innovative, customisable interfaces that empower individual agency. • Interaction is fundamentally transactional: user data is collected and analysed to improve services (often from a cost-benefit perspective) and maximise the provider's profitability and scalability.	• emphasis on simplicity and accessibility while remaining commercially viable. • include customisation capabilities. • designed to be affordable and scalable, ensuring that key transport-related services are accessible. • transport information is accessible to all, including those who do not have access to digital infrastructure or the know-how to use high-tech tools. • commercial interests remain front and centre as companies seek to profit by providing widespread, basic urban mobility services. • Achieve public participation via simple and traditional means such as market surveys and interviews. • employ dedicated staff to regularly engage with the users to understand which changes are most needed or requested to obtain larger scale public feedback.



3.3 Tools for data integration, storage and analysis

The effective management of data is a fundamental aspect of modern mobility planning. Integrating, storing, and analysing data from different sources enables planners and policymakers to understand mobility patterns, identify issues, establish priorities, and make decisions. Data-driven tools provide the necessary basis to collect and interpret large amounts of information to improve transport systems, promote sustainability, and enhance the overall mobility experience (Pettit et al., 2020).

While high-tech market-oriented solutions often dominate discussions about data management and analysis, it is important to emphasise the critical role that low-tech and commons-oriented tools can play in promoting inclusive, locally adapted data collection and analysis approaches. These tools rely less on advanced technologies and more on grassroots community efforts, such as citizen science initiatives that enable communities to actively contribute with data about their mobility environment in ways that make sense to them (Pedersen et al., 2022). Such approaches ensure that data collection reflects the realities of different population groups. These tools empower citizens to co-create knowledge, democratising data collection and making mobility planning fairer and more connected with local realities (Kolbe-Alexander et al., 2024).

In technology-poor, technology-sceptical, and/or citizen-oriented environments, community-organised mobility surveys can play an essential role in filling the gaps left by the absence and the excessive use of sophisticated, high-tech solutions. Citizen science, in particular, provides a powerful mechanism for local communities to contribute to data collection, especially in underserved or under-resourced areas.

Citizen science refers to the active involvement of non-professional scientists or members of the general public in formulating research questions and goals and collecting, analysing, and disseminating scientific data or research deliverables. This approach allows citizens to contribute to various scientific fields by gathering data, conducting surveys, or fully participating in collaborative research projects alongside professional scientists. Importantly, citizen science has the potential to democratise the research process by integrating local knowledge and perspectives that may otherwise be overlooked, leading to more inclusive and context-sensitive outcomes. For example, and considering the specific case of mobility, citizens can record their daily travel routes, report on barriers to accessibility, or identify gaps in infrastructure using both high-tech and low-tech tools such as digital devices and paper-based surveys. Storytelling can also play a key role in identifying problems and idealised solutions, increasing the amount of data available and ensuring that the data reflects people's experiences, challenges, and aspirations on the ground.

In line with this proposed application of the DIBIS framework, data integration, storage and analysis tools are categorised into four quadrants. Each quadrant offers a unique blend of technological sophistication and management models.

While high-tech, market-centric tools are essential for scale and efficiency, low-tech and community-centric approaches are equally important to ensure inclusivity, contextual relevance, and diverse voices in a data-driven decision-making process. However, in contrast to market-oriented tools, where private companies usually provide technical support, upgrades, and maintenance, community-oriented tools often rely on community maintenance and public sector support. This puts additional pressure on local authorities to develop in-house expertise or rely on volunteers. For authorities already overburdened by day-to-day operations, this can be a major challenge, leading to questions of long-term sustainability. Furthermore, national authorities may encounter difficulties when trying to scale these systems. While high-tech tools focused on commoning might work well at the local level,



where communities can engage directly, their wider application may require centralised coordination, which is at odds with decentralised governance structures. This dilemma highlights the tension between promoting participatory, inclusive data systems and the practical limitations many government agencies face regarding resources, expertise, and scalability.

These factors require careful consideration of whether public authorities are willing to take on the responsibility and complexity of managing such systems or whether they need alternative models that reduce the burden while promoting inclusivity. By integrating various tools, local transport authorities can create a multi-faceted, holistic approach to community-focused data collection, integration, analysis and storage. Combining structured, recurring discussions with more fluid, narrative storytelling allows communities to analyse current mobility issues and imagine future possibilities. These methods are costly and labour-intensive. However, they enable communities to actively shape mobility planning processes and ensure data integration reflects practical concerns and residents' lived experiences and aspirations.

Table 2 below presents tools for data integration, storage and analysis divided in four quadrants. Examples and a detailed description of four types of tools are proposed.



Table 3. Tools for data integration, storage and analysis represented in four DIBIS quadrants.

TOOLS FOR DATA INTEGRATION, STORAGE AND ANALYSIS	
High-tech commons-oriented tools <i>Examples: Big Data analytics, Artificial Intelligence (AI), cloud computing, Internet of Things (IoT)</i> • based on advanced digital technologies usually developed and used by private companies. • designed to handle extensive data collection, storage and analysis processes. • offer scalable and efficient solutions emphasising real-time performance, precision and comprehensive data integration. • integrate data from various digital platforms (e.g. sensors, GPS systems, mobile apps, and GIS platforms) into centralised databases. • focus on cost efficiency and optimising mobility systems to improve system performance, reduce operating costs, and maximise profitability. • reliance on proprietary technologies lead to data silos where information is spread across different systems, limiting the ability of public authorities to fully utilise data. • closed-source nature reduces transparency. • privacy and security concerns arise when large amounts of personal data are collected through apps and digital platforms linked to commercial interests.	Low-tech commons-oriented tools <i>Examples: Participatory mapping, workshops, guided meeting, memory wall, analogue data storage systems (facilitated by local authorities), community data circles, storytelling</i> • local authorities facilitate participatory processes and manage data integration rather than outsourcing these tasks to for-profit intermediaries. • development of internal resources, building local staff's capacity to engage with the community through workshops, participatory mapping and public discussions. • emphasise ongoing engagement and a stronger, long-term relationship between planners and the community. • more informed and better-customised decisions as planners gain a deeper, ongoing understanding of mobility challenges. • involve initial costs but bring long-term benefits by ensuring continuity, reducing reliance on external contractors and enabling more coherent planning over time. • storytelling events can provide a platform for residents to share personal stories about their transport experiences, focusing on how mobility (or the lack of it) impacts their daily lives.
High-tech market-oriented tools <i>Examples: Citizen science, collaborative GIS platforms and community-operated data portals</i> • based on advanced digital technologies while emphasising inclusivity, transparency and de-commodification. • designed to be open, collaborative and community-focused. • enable local communities, non-profits and grassroots organisations to actively participate in data collection, sharing, and analysis to ensure that transport systems reflect and respond to the needs of the people they serve. • ensure that the data collected is accessible and usable by all stakeholders (equitable access). • operated with simple digital devices to monitor traffic patterns enabling citizens to actively participate in data collection. • collaborative nature also brings challenges, such as the need for ongoing community engagement, capacity building and sustained public sector support to ensure long-term viability. • combine advanced technology with inclusive governance models and ensure that data is a public good, not a commercial commodity.	Low-tech market-oriented tools <i>Examples: Participatory mapping, workshops, guided meeting, memory wall, analogue data storage systems (facilitated by consultants, artists)</i> • rely on tangible, accessible methods that integrate and analyse data without advanced technologies. • represent a commercially viable way for service providers to support agencies with limited resources and smaller scales. • enable valuable data integration through manual visualisation techniques such as hand-drawn charts, graphs, and whiteboards. • interactive and collaborative sessions provide unique market opportunities for skilled group facilitators. • facilitators can collect insights from community members, which are manually analysed to identify recurring themes. • using simple methods, data collected can inform strategic documents and policy recommendations. • commercial services can focus on creating efficient filing systems and providing regular updates or enhancements. • might involve visual artists in producing artworks.



3.4 Tools for mobility simulation, monitoring and assessment

Tools are needed to help predict, envision or simulate future traffic scenarios and evaluate the impact of the measures implemented in planning and managing urban mobility systems. Mobility simulation, monitoring and evaluation tools serve these two purposes. They enable planners to predict potential outcomes, test interventions in controlled environments and evaluate real-world performance to make adaptive decisions.

Mobility simulation tools such as digital twins, AI-driven predictive models, and pedestrian microsimulation systems allow planners to anticipate traffic patterns, model infrastructure changes, and evaluate policies before implementation. These high-tech solutions provide sophisticated insights into the evolution of transport systems in response to different scenarios, such as new public transport lines, road widening or congestion charging. Monitoring and evaluation tools, on the other hand, focus on real-time performance tracking and post-implementation evaluation. Using data collected from sensors, traffic cameras or manual surveys, these tools help planners understand how measures have actually impacted mobility patterns, safety, and environmental outcomes (Husein and Sayed, 2017; Dembski et al., 2020; Mahrez et al., 2022).

Given the overlap between simulation and monitoring tools, this section entails these two aspects to reflect the iterative nature of mobility planning. Simulation tools help model future conditions, while monitoring tools allow continuous feedback, creating a dynamic process where predictive insights and real-world outcomes constantly influence decisions. By integrating these two phases of mobility planning, this section shows how simulation and monitoring can and should work hand in hand to create more responsive and adaptive urban transport systems.

In this DIBIS framework application, tools are categorised into four quadrants based on technological intensity and governance approaches. While market-oriented high-tech tools such as AI models and real-time data platforms dominate the discussion, it is important to recognise the role of low-tech and public good-oriented tools. For example, street experiments, which can be defined as temporary interventions in urban spaces, offer a simple but highly effective way to simulate and monitor the impact of mobility measures. In addition, community-based approaches to monitoring and collecting feedback, such as participatory assessments, provide alternative evaluation models that strongly emphasise local engagement and citizen involvement. Table 3 presents four sets of tools for simulation, monitoring and assessment according to the DIBIS framework.



Table 4. Tools for mobility simulation, monitoring and assessment represented in four quadrants.

TOOLS FOR MOBILITY SIMULATION, MONITORING AND ASSESSMENT	
High-tech commons-oriented tools <i>Examples: Big Data analytics, Artificial Intelligence (AI), Internet of Things (IoT), digital twins, open-source smartphone apps, open data dashboards, civic tech platforms (Mačiulienė and Skaržauskienė, 2020).</i> • emphasise openness, transparency and public collaboration while using advanced technologies. • utilise sophisticated digital infrastructures but with a clear focus on collective ownership and community engagement. • based on open-source platforms ensuring transparency and inclusiveness. • simulate urban transport systems while flexibly adapting the models to specific local needs and incorporating community input into the decision-making process. • enable community participation in tracking and evaluating the real-world outcomes of transport measures, collecting data on traffic flows, pedestrian activity, and public transport. • visualise transport data and results in user-friendly formats, making the data accessible to a wider audience and enabling citizens to take an active role in the evaluation process. • requires considerable investment in technical training and capacity building for local authorities and communities. • depends on the willingness of public institutions to prioritise commoning over proprietary solutions.	Low-tech commons-oriented tools <i>Examples: Community mapping, counter cartography, storytelling, community walks, subversive cartography, role-playing games,</i> • radically different approach drawing from critical and radical feminist perspective. • create shared, decommodified spaces, resources and services collectively managed by communities. • using tools is transformed into an act of resistance, challenging the patriarchal, racist, and class-based hierarchies embedded in transport systems and critically evaluate the intersections of gender, ethnicity and accessibility that determine the use of public space. • contribution from underrepresented groups guide planners recounting their mobility experiences from the perspective of care work, safety, pain, and exclusion. • planners are no longer the experts, they are learners, absorbing the rich, qualitative insights that traditional metrics and simulations cannot capture. • role-playing games that invite planners to step into the shoes of different community members (e.g. migrants, senior citizens or single mothers) who experience the city drastically differently
High-tech market-oriented tools <i>Examples:</i> Big Data analytics, Artificial Intelligence (AI), Internet of Things (IoT), digital twins, microsimulation models • based on advanced technologies developed and offered by private companies. • integrate cutting-edge computational modelling, data analytics, artificial intelligence (AI) and Internet of Things (IoT) devices to simulate, predict and evaluate the performance of transport systems. • enable authorities to forecast mobility patterns, optimise traffic flows and test infrastructure changes in virtual environments before implementation. • allow continuous monitoring and real-time assessment of impacts as changes are implemented. • simulations allow detailed modelling of traffic flows, pedestrian behaviour, and urban dynamics and give considerable precision in testing the potential impact of policies, infrastructure changes and new regulations. • proprietary technologies bring challenges in terms of cost, accessibility and data control. • prioritise optimisation for market-driven goals over the common good.	Low-tech market-oriented tools <i>Examples:</i> Serious games, street experiments, hand-drawn diagrams, pinboard displays, physical models • offer practical alternatives to high-tech solutions using simpler methods • valuable for resource-limited environments or situations where digital scepticism is predominant. • use games as physical, board-based simulations to help planners, policymakers, and stakeholders explore mobility scenarios interactively (Sousa, 2020). • street experiments offer cities the opportunity to test the real-world impact of traffic reconfigurations (Bertolini, 2020). • physical simulations provide planners with immediate, tangible insights, using low-cost materials such as cones, paint and barriers to create temporary changes in street design • communicate complex ideas in a way that is more accessible to decision-makers and the public, especially in situations where digital literacy is low or digital scepticism is high. • may not capture the full complexity of urban mobility challenges.

3.5 Balancing tools: towards a diverse societal configuration

Figure 4 represents the axes and the possibilities of combining different solutions to achieve a balanced societal configuration when addressing mobility planning. Achieving balance requires finding a solution combining high-tech/market-oriented and low-tech/community-oriented approaches. This combination leverages the benefits of DMT usage while effectively mitigating its risks. The scheme presented interprets three societal configuration models related to DMT development and usage, ranging from a less desirable for a more desirable configuration, achieving not only balance but also diversity.

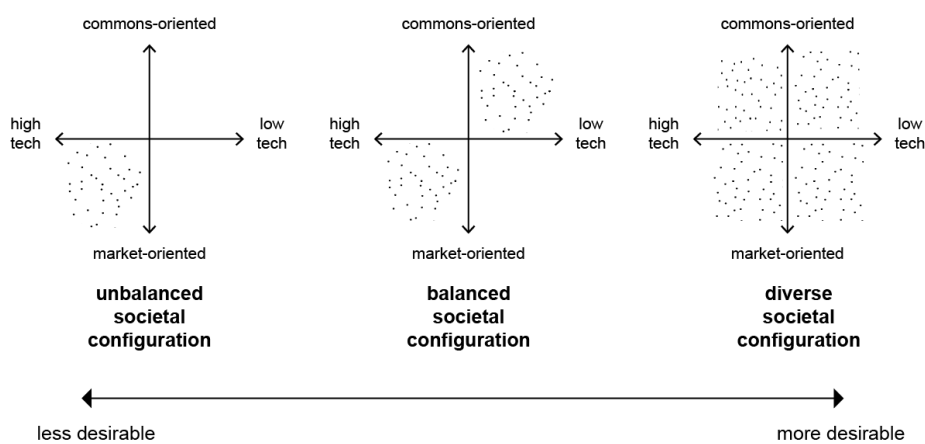


Figure 4. Three societal configurations for DMT development and usage.

In this example using two polarised situations, the DIBIS framework guides the selection and deployment of DMT solutions to ensure that transport systems are resilient, inclusive, safe, and adaptable. DIBIS aims to encourage planners and policymakers to avoid monocultural dependence on any one quadrant and instead promote a diverse mix of strategies that leverage the strengths of each quadrant in different contexts while mitigating risks, limitations, and drawbacks. By contextualising DMT strategies within this framework, we propose that adopted solutions should neither be exclusively high-tech nor low-tech. They should also balance business and citizen engagement in ways capable of promoting a holistic and dynamic approach to mobility planning.

For a broader collection of examples of mobility planning tools, [Deliverable D3.1](#) can be consulted. In that document, a section is included on qualitative methods to produce knowledge on street justice. Further recommendations and details on how to conduct interviews, participant observation, focus groups, participatory mapping, street experiments and action research are presented. In addition, syntactical methods, microscale approaches, data collection and analysis protocol as well as methods to measure road safety are also described in the document. More information on road safety and road can be found in [Deliverable D3.2](#).



4. Operationalising techno-practical wisdom with DIBIS: addressing planning polarisations

4.1 Introduction

In this chapter we outline the operationalisation of the DIBIS framework as an approach to address planning polarisations. This chapter aims at making meaningful steps in the direction of establishing a framework capable of helping mobility planners to develop actionable techno-practical wisdom capabilities. Beyond planners, this approach can also be used by urban mobility innovators, that is, people who offer novel solutions for mobility problems. The DIBIS is proposed as a means to achieve the establishment of non-polarised interventions in a given time and place, as well as non-polarised intervention mixes across various time and places. Ultimately, it can be seen as a heuristic to cultivate and deploy wisdom to address complex and fracturing situations.

As in previous chapters we presented the structure of the DIBIS, in this chapter we propose the operationalisation of the framework when facing planning decisions. Transcending the two initial polarisations presented in chapter 2, low-tech vs. high-tech and market-oriented vs. commons-oriented, we suggest the use of DIBIS to consider any other type of conflicts emerging during planning process. The concept of wisdom informs the process, considering the key moments in which having reflective, cognitive and affective capacities should enlighten decision-making.

The following section presents a flowchart to systematise the reasoning behind the DIBIS framework to deal with polarisations. In this format, the DIBIS is proposed as a procedural approach, yet not a robotic one. It is instead structured as an iterative and learning process for planners to reach better decision-making. DIBIS can be used not just to inform the final result, but also to integrate the notion of techno-practical wisdom in the entire process. The approach proposes reviewing steps for reconsidering the adopted practice and choosing other possible paths for mobility planners and innovators to stay informed throughout the decision-making procedure.

4.2 The DIBIS in practice: operationalising the application of the framework

In this section, the DIBIS framework is proposed as a way to navigate overlapping controversies. Drawing from the idea of wisdom, as presented in section 2 of chapter 1, we argue that decision-making approaches should be supported by three key capacities – reflective, cognitive and affective. Especially navigating a polarised scenario, wisdom might be fundamental to smooth tensions, anticipate and solve conflicts. Beyond methods and tools mentioned in previous sections – that can be instrumental to support decisions – we argue that a procedural approach is important for this age of polarisation. This approach proposes moments of reflection to acknowledge diversity and identify possible controversial issues throughout the process. Wisdom can indicate if solutions might be found by compromising, mobilising new elements or rethinking the process. The three dimensions of wisdom could be incorporated in the process to facilitate more efficient decisions and just outcomes for urban interventions.

As part of the DIBIS, we outline how the three dimensions of wisdom may contribute to a more structured thinking process. On one hand, the reflective dimension should help us assess if shifts occurred because people became more aware of their own beliefs, assumptions and thought process. On the other hand, the cognitive dimension helps us consider if changes in technical knowledge, or the adoption of enhanced technical approaches influenced the situation. Finally, the affective dimension contributes with the

capacity to examine the emotional aspects of navigating those polarised debates (see figure 5).

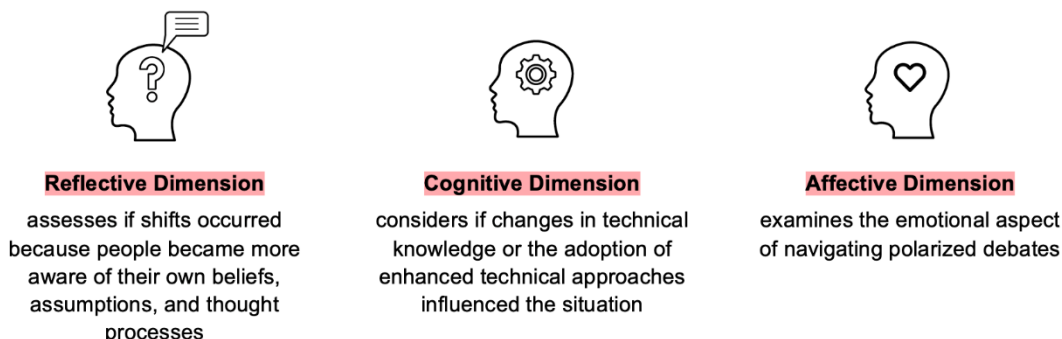


Figure 5. The three dimensions of wisdom within the DIBIS framework.

Ultimately, the DIBIS is intended as a heuristic to encourage wise, rather than merely 'smart,' decision-making. The procedural approach proposed in this chapter offers a way to address polarisation and go beyond the original idea by identifying additional challenges and conflicts within a given decision problem. Despite the availability of advanced technology, decision-making processes should remain human-centred. The purpose of the DIBIS is to look beyond technological solutions and consider their potential drawbacks and future challenges. Some of these challenges were introduced in Chapters 1 and 2. We argue that technology should not be a standalone solution; decision-makers and planners must remain aware of their choices throughout urban intervention processes.

DIBIS is proposed as a framework to improve decision-making, fostering an iterative and learning-based process. In this process, planners are invited to find a balance between identified polarisations, emerging conflicts, and possible solutions within this spectrum. As demonstrated in Chapter 2, this includes addressing technological intensity and governance levels. Identifying controversies and exploring possible solutions are essential steps toward delivering more just interventions. In this procedural approach, wisdom serves as a key concept, enabling decision-makers to make informed choices.

For a better illustration of this DIBIS process, a flowchart is presented in figure 6. The flowchart illustrates the structure and decision-making process operated within the **DIBIS as a** systematic approach to addressing polarised issues by assessing potential solutions and guiding urban intervention strategies. The process begins with sorting possible solutions to a given issue. As a first step, acknowledging polarisation is central. Planners should evaluate whether it should be taken into consideration. If polarisation is ignored, the process does not proceed further, and the next step is to consider the intervention, even though possibly the solution chosen could create conflicts between social groups and stakeholders involved in that process. However, if it is acknowledged, the framework explores strategies to manage it.

To address polarisation, the framework considers three primary approaches. The first approach is to transcend polarisation by mobilising new elements. The second approach involves addressing polarisation by mobilising controversial elements. The third approach reinforces polarisation by choosing a specific polarised side. Once an approach is selected, an assessment process follows.

If new elements are mobilised, a positive informed assessment is conducted. If the assessment is favourable, the intervention proceeds. The mobilisation of new elements



refers to identifying other types of polarisations that might be addressed. If it is unfavourable, the process undergoes review and may reattempt mobilisation. Similarly, if controversial elements are mobilised, a positive informed assessment is performed, and depending on the result, the process either moves forward or returns for further review. Mobilising controversial elements means identifying two antagonistic elements. When a specific polarised side is chosen, an acceptable compromise is evaluated. This means that, even though polarisation is acknowledged, a counterpart was not consulted or taken into consideration. However, if the compromise is deemed acceptable, the intervention proceeds; otherwise, the review process is initiated again.

Ultimately, once an appropriate pathway is identified and validated, the final step leads to intervention, ensuring that the most suitable solution is implemented. The DIBIS framework provides a structured approach to handling polarisation in decision-making by evaluating possible solutions, assessing informed perspectives, and guiding interventions that either transcend or address informed by wisdom. Through iterative reviews, the process ensures that the chosen intervention is well-assessed and balanced.

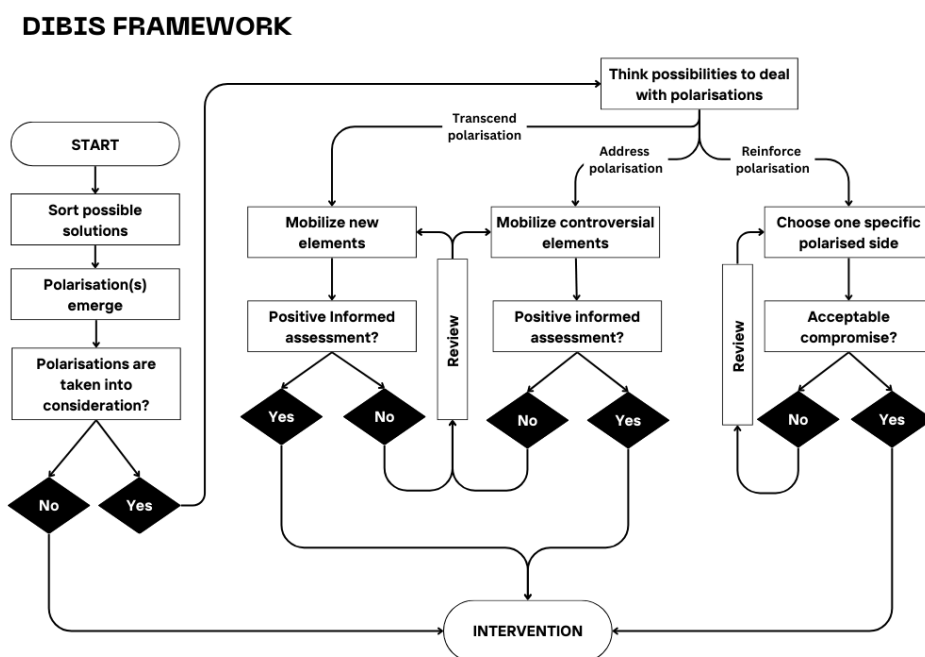


Figure 6. DIBIS framework flowchart.

4.3 Acknowledging polarisations towards more informed decision-making

Previous section presented the functioning of the DIBIS as a procedural approach, simplifying its application. An important focus was given to the consideration of polarisations emerging in a given situation. However, recognising antagonistic reactions is not always a simple task. Therefore, this section addresses some search engines to help identify relevant polarisations. Acknowledging polarisations is essential to anticipate conflicts and to help us situate ourselves in a broader debate. This step is an invitation to thinking “outside our bubble”.



To ensure a well-informed and balanced approach to decision-making, it is essential to promote public participation, particularly among those who are most directly affected by the problem or the proposed solution. In the context of school streets, for instance, this means actively engaging members of the school community, including students, teachers, parents, and staff, in discussions and decision-making processes. Their perspectives and experiences provide valuable insights that can lead to more effective and inclusive solutions.

Additionally, maintaining an ongoing engagement with public information sources that do not necessarily align with one's political views is crucial for developing a well-rounded understanding of different perspectives. This includes regularly checking what opposing viewpoints are arguing, reading newspapers and media outlets that may challenge personal beliefs, and considering alternative sources of information. Such engagement fosters critical thinking and helps counteract biases that can emerge from selective exposure to information.

Another important aspect is the analysis of policy frameworks established by various governing bodies, including state and local authorities, as well as supranational organizations such as the European Union. Understanding the regulatory landscape and the funding opportunities made available by these institutions can significantly impact the feasibility and sustainability of proposed solutions. By examining these frameworks, individuals and organizations can align their initiatives with existing policies and leverage available resources effectively.

Lastly, continuous engagement with scientific and academic literature is essential for ensuring that decisions are informed by the latest research and empirical evidence. Academic studies provide valuable data, theoretical insights, and methodological approaches that can enhance policy development and implementation. By staying informed about current research, stakeholders can make evidence-based decisions that are more likely to result in meaningful and lasting improvements.



5. Conclusion

This document has explored various tools and approaches to creating equitable, sustainable, and safe transport systems, focusing on the Diverse and Balanced Intervention Spectrum (DIBIS), the key conceptual contribution offered by this compendium. The DIBIS framework is a central element of this document and proposed that mobility planning decision-making should follow the notion of techno-practical wisdom. It is presented as an approach to address polarisations that emerge during decision-making processes. Every solution possible might raise antagonistic reactions and the acknowledgement of this polarisation is important to achieve more just and equitable outcomes.

In the first application of the DIBIS framework presented in chapter 2, we proposed categorising mobility tools along two key axes: technological intensity (from low-tech to high-tech) and governance style (from market-oriented to community-oriented). By structuring the discussion of transport modes within these quadrants, the compendium encourages planners to avoid over-reliance on one quadrant and instead adopt a dynamic mix of approaches that respond to local conditions, societal needs and the rapidly evolving technological landscape.

Moving towards a more general application of the DIBIS, chapter 3 presents an operationalisation of this approach to decision-making in general. Recognising polarities and using the concept of “wisdom” to think through a procedural approach, planners can be more well-informed about issues that can emerge during the implementation process of urban interventions. The identification of polarisations throughout this process can help anticipate problems and consider possible solutions to address them smoothly.

Yet, a contribution for mobility planners provided in this document is the importance of adaptability and diversity in policy and urban planning. Transport systems are complex and context-dependent, so a one-size-fits-all solution is rarely sufficient. Instead, various tools and approaches are needed to tackle different urban challenges, especially in the face of polarisations, growing populations, climate change, and digital transformation. Relying solely on high-tech market-led solutions, as is often the trend in contemporary situations, can lead to blind spots that limit the ability to meet the wide range of needs in the urban environment. Instead, the DIBIS framework invites planners to view innovation as a multi-layered process that balances technological advancement with grassroots endeavours and between commercial initiatives and community-led action.

The DIBIS framework is offered to support the cities that are part of the JUST STREETS consortium – Amsterdam, Braga, Cugir, Kozani, London, Milano, Riga, Vilnius, Haifa, The Londong borough of Southwark and Zaragoza – in achieving successful transformation in their urban spaces. The framework is open, simple and adaptable to address the issues raised in their living labs experiences. Many of the challenges identified are related to polarisations that emerge in their territories and become barriers to enhance active mobility and provide safer, just and equitable streets. For instance, the necessities of children, elderly and people with disabilities, the need of space for cars vs. pedestrians and bicycles, challenges to accommodate the needs of public transport of different groups, among many others. Beyond the scope of the research project, DIBIS might be used in many other contexts and by other municipalities and decision-makers.

The DIBIS framework can be used as an approach to ponder and consider multiple viewpoints during different moments of decision-making. It can be applied to consider the most suitable tool(s) during i. information, customisation and participation processes, ii. Data collection, storage and analysis and iii. simulation, monitoring and assessment. In a different phase, DIBIS can be used to understand and evaluate the possible solutions available to



propose an urban intervention. We propose that wisdom should be incorporated to decision-making to consider tools, methods and interventions that move beyond the mobility trend based on high-tech solutions.

Below some key suggestions from this document are presented for practitioners:

- **Embrace the diversity of available solutions:** Mobility challenges vary widely between cities, communities and contexts, and the tools used to address them should reflect this diversity. The compendium shows that each approach has strengths and limitations, from high-tech AI-powered predictive modelling to low-tech community mapping and storytelling techniques. By using a mix of solutions from across the DIBIS quadrants, planners can create more resilient and adaptable transport systems that serve diverse populations.
- **Promote Adaptability:** Mobility planning cannot be static in a rapidly changing world. The emergence of digital mobile technologies (DMTs), environmental concerns and shifts in social dynamics require transport systems to remain adaptable. Planners must continually evaluate and adapt their strategies based on new data, feedback and technological developments. Used tools must be constantly re-evaluated, whether through real-time monitoring systems or community-based feedback loops, to ensure that they continue to meet the needs of citizens and cities alike. Remember that the emergence of a new technology should not directly represent the need to implement it while excluding well-tested alternatives.
- **Balance technological innovation with social equity:** While market-based high-tech tools offer precision, scalability and efficiency, they also carry risks related to cost, accessibility and privacy. In contrast, commons-oriented approaches emphasise inclusivity, transparency and shared ownership but often struggle with scalability and resource allocation. Planners need to be aware of these trade-offs and actively work to balance the economic benefits of market-led innovation with the social equity goals of commons-oriented approaches. This balance ensures that mobility solutions do not exclude vulnerable groups or contribute to widening social inequalities.
- **Promote community engagement:** This compendium emphasises the role of community-led initiatives. Tools such as community data circles, participatory mapping and subversive mapping provide planners with a more nuanced understanding of local needs and preferences. By involving local communities in designing and evaluating transport solutions (as well as the tools used for such purposes), planners democratise the planning process and build stronger relationships between citizens and local authorities.
- **Address the growing dominance of market-oriented high-tech instruments:** One of the most pressing issues facing mobility planning today is the overwhelming dominance of high-tech, market-oriented solutions in the minds of policymakers, funders and even the public. While this approach is attractive because of its efficiency and scalability, it can overemphasise technological solutions at the expense of more inclusive, public-spirited or low-tech solutions. The frequent result is a transport system prioritising profit-driven innovation over community needs, often leaving underserved or marginalised populations behind. To prevent this problem, practitioners are advised to engage with the DIBIS framework. This framework offers an alternative, holistic vision for mobility planning that uses diverse tools to balance technological innovation with inclusivity, sustainability and equity.
- **Use mobility planning as a tool for social change:** This compendium challenges planners to think beyond technical and operational concerns. Mobility systems are deeply embedded in the social fabric of cities, and their design influences broader societal dynamics, from accessibility to social equity. Using participatory and



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community-oriented tools, planners can address long-standing inequalities, empower marginalised groups and promote more inclusive urban spaces. Mobility planning can thus become a vehicle for social change that challenges entrenched power dynamics and promotes equity among us all.

- **Acknowledge and face polarisations:** Cities are a place of diversity and possible conflicts. Addressing possible polarisations that can emerge during decision-making processes is essential to make sure diversity is not only represented in participatory processes but also reflected in mobility planning choices implemented.

In conclusion, this compendium calls for a mobility planning approach that combines technological innovation, community inclusion, and social justice. The Diverse and Balanced Intervention Spectrum is a versatile framework for practitioners to select and integrate solutions that address the unique needs of their cities and communities. As planners look to the future, the focus should be on flexibility, collaboration and a commitment to serving the public good in an inclusive, sustainable and equitable way.



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