

Disaffording the Pedestrian:

How can a design led approach bridge the gap between KSI and near misses to explore pedestrian safety issues in London?

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Abstract

Pedestrian safety remains a marginalised aspect of road safety research and policy, despite its relevance to sustainable cities, public health, and social equity. This thesis investigates how pedestrian safety is shaped by the wider road safety system, one that extends beyond national boundaries and is influenced by international policy frameworks, funding mechanisms, and shared strategies. Global initiatives such as Vision Zero and the Safe System approach, adopted by the United Nations and national governments including the UK, prioritise reductions in killed or seriously injured (KSI) casualty statistics. These metrics support data collection, funding allocation, and safety intervention design across all levels of the system.

This KSI-focused framing narrows the definition of safety, excluding near-misses, non-collision injuries, and the daily risks encountered by pedestrians, particularly those with protected characteristics. Through qualitative research comprising interviews, surveys, and participant observation with pedestrian groups in London, this study explores how road safety experts conceptualise safety and how those framings contrast with the lived experiences of pedestrians. Drawing on Constructivist Grounded Theory, Affordance Theory, and Research through Design, it exposes how systemic practices privilege numerical indicators of success while neglecting contextual and embodied knowledge.

The findings reveal a consistent disconnection between institutional definitions of safety and the complexities of real-world pedestrian experience. A key contribution of this research is the development of GroundMap, an Affordance-Disaffordance diagnostic tool that makes visible what standard safety audits cannot capture: the removal of safety features, the creation of new risks, and the consequences of design decisions for diverse pedestrian groups. Applied across three phases of design practice in London, GroundMap produced evidence that transport authorities acknowledged as distinct from their routine datasets, resulting in commitments to revise existing designs.

By situating pedestrian safety within a transnational system of targets, norms, and practices, the thesis calls for a broader, design-led reframing, one that engages directly with users and incorporates the diverse needs of those using public space. This work contributes to academic discourse in design, mobility, and policy studies by illustrating how international governance structures influence local safety outcomes, and how inclusive design methods can address persistent gaps in current approaches.

Keywords: pedestrian safety, Affordance Theory, disaffordance, GroundMap, wicked problems, inclusive design, Vision Zero

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xx

Author's declaration

During the period of registered study in which this thesis was prepared the author has not been registered for any other academic award or qualification.

The material included in this thesis has not been submitted wholly or in part for any academic award or qualification other than that for which it is now submitted.

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Contents

Chapter 1: Introduction	1
1.1 The Case for Pedestrians	1
1.2 Researcher Positionality	1
1.3 Defining Safety	2
1.4 Approach	3
1.5 Context and Rationale	3
1.6 Research Questions	5
Chapter Summary	5
Chapter 2: Literature Review	6
2.1 Safety Theory	6
2.2 Modelling Human Errors	9
2.3 Affording Safety	12
2.4 Road Safety in Numbers	15
2.5 Pedestrians	18
2.6 Shared Space: Design Concept	20
2.7 The Assessment Landscape	21
2.8 Human-Centred Approach	27
2.9 Wicked Problems	28
2.10 Design as Reflective Practice	29
2.11 Bringing Affordance Theory into Practice	29
Chapter Summary	32
Chapter 3: Methodology	34
3.1 Aims and Objectives	34
3.2 Ethical Considerations	36
3.3 Research Approach	37
3.4 Research Methods	38
3.4.1 Defining Near-misses	39
3.5 Approach to Knowledge	40

3.6 Research through Design (RtD).....	43
3.7 Constructivist Grounded Theory (CGT)	43
3.8 Affordance Theory	46
3.9 Methodological Triangulation	46
Chapter Summary	48
Chapter 4: Design Practice	49
4.1 Phase 1: Exploratory Design Inquiry.....	49
4.1.1 Professional Interviews	49
4.1.2 Shared Space Observations	56
4.1.3 Initial GroundMap Development.....	63
Phase 1 Synthesis	69
4.2 Phase 2: Vulnerable Pedestrian Groups.....	70
4.2.1 TfL Constructors Group.....	70
GroundMap: Affordance-Disaffordance	76
4.2.2 Design Exploration Group 2: 'Respect in Bexley' Mencap.....	82
4.2.3 Design Exploration Group 3: Kilburn Older Voices Enterprise (KOVE)	90
4.3 Phase 3: Gathering multiple perspectives.....	97
4.3.1 Survey	97
4.3.2 Shadowing	105
4.3.3 Development of Mapping Tools	107
4.3.4 Co-Design Workshop	119
4.3.5 TfL and Westminster Council Meeting	121
Chapter Summary	123
Chapter 5: GroundMap	124
5.1 The Case for a New Tool	124
5.2 Literature and Practice Foundations	125
5.3 Comparative Assessment	126
5.4 The GroundMap Tool.....	130
5.4.1 Participatory Validation	130
5.4.2 Design Thinking in Practice.....	130

5.4.3 Retrospective and Preventative Use	131
5.4.4 Intended Users and Implementation	131
5.5 Evaluation and Future Development	135
5.5.1 Validity and Reliability	135
5.5.2 Avoiding Tokenism in Practice	135
5.6 GroundMap: Contribution and Next Steps	136
Chapter Summary	136
Chapter 6: Analysis and Discussion	137
6.1 How Safety is Currently Defined	137
6.2 Stakeholders, Governance and Pedestrian Exclusion	137
6.3 Redefining Safety	138
6.4 Missing and Underreported Data	138
6.5 How KSI Shapes Design Priorities	139
6.6 Applying Affordance Theory in Practice	139
6.7 What Disaffordance Mapping Revealed	140
6.8 The Limits of Existing Frameworks	140
6.9 The London Context	141
6.10 A Self-Validating System	142
Chapter Summary	143
Chapter 7: Conclusion	145
7.1 Defining Safety	145
7.2 Contribution to Knowledge	145
7.3 London as a Case Study	147
7.4 Situating the Findings	147
7.5 Limitations	147
7.6 Recommendations	150
APPENDICES	152
Glossary of Key Terms	228
References	232

List of Figures

Figure 2.1 <i>Classification of safety models</i>	6
Figure 2.2 <i>The stochastic process</i>	7
Figure 2.3 <i>Heinrich's Domino Model of Accident Causation</i>	7
Figure 2.4 <i>Haddon's Matrix</i>	8
Figure 2.5 <i>Risk Homeostasis Model</i>	9
Figure 2.6 <i>Evolution of Safety Models and Methods</i>	10
Figure 2.7 <i>Accimap - Process and Organisational Levels</i>	11
Figure 2.8 <i>A Theoretical Field-Analysis of Automobile-Driving</i>	13
Figure 2.9 <i>Three Mile Island Control Room-2 1979</i>	14
Figure 2.10 <i>Gulf of Execution and Evaluation</i>	14
Figure 2.11 <i>The Five Pillars of Safe System Approach</i>	16
Figure 2.12 <i>Sustainable Development Goals</i>	17
Figure 2.13 <i>Criteria for collision recording STATS19 data collection</i>	19
Figure 2.14 <i>Problem Classification</i>	28
Figure 2.15 <i>Norman: Example of Poor Affordance Design</i>	30
Figure 2.16 <i>Gaver's Four Types of Affordances</i>	31
Figure 2.17 <i>Stevens: Classification of Affordances</i>	32
Figure 3.1 <i>Research methodology overview</i>	37
Figure 3.2 <i>Overall research design methodology</i>	39
Figure 3.3 <i>Grounded Theory Process</i>	44
Figure 3.4 <i>Six-step thematic analysis process within a CGT framework</i>	45
Figure 3.5 <i>Methodological triangulation framework</i>	47
Figure 4.1 <i>TfL cycle superhighway 5 - Shared Space drawing</i>	57
Figure 4.2 <i>Observation Map overlay</i>	58
Figure 4.3 <i>Near-miss at pedestrian crossing point (A)</i>	59
Figure 4.4 <i>Near-miss at Regency Street (C)</i>	59
Figure 4.5 <i>Near-miss at John Islip Street (D)</i>	59
Figure 4.6 <i>Inadequate signage at shared space entry point - cyclists</i>	60
Figure 4.7 <i>Inadequate signage at shared space entry point - pedestrians</i>	61

Figure 4.8 <i>Shared Space sign: safety affordance assessment</i>	61
Figure 4.9 <i>Pedestrian crossing blocked</i>	62
Figure 4.10 <i>Danger created for cyclists (C)</i>	62
Figure 4.11 <i>Shared Space sign; affording safety?</i>	64
Figure 4.12 <i>Objects inventory</i>	64
Figure 4.13 <i>Objects inventory map overlay</i>	65
Figure 4.14 <i>Removal of safety affordance - 'Look Left' text</i>	67
Figure 4.15 <i>Removal of safety affordance - separated pedestrian zone</i>	67
Figure 4.16 <i>Removal of safety affordance – dedicated yellow hatch box</i>	68
Figure 4.17 <i>Design unintended consequences</i>	71
Figure 4.18 <i>Hoardings creating dangers</i>	72
Figure 4.19 <i>Hoardings - problematic designs</i>	72
Figure 4.20 <i>A Colourful crossing design</i>	73
Figure 4.21 <i>Footway obstacles</i>	74
Figure 4.22 <i>Footway hazards</i>	74
Figure 4.23 <i>Inaccessible crossings</i>	75
Figure 4.24 <i>Signs & lines workshop</i>	82
Figure 4.25 <i>Shadowing participants</i>	87
Figure 4.26 <i>Walkabout with Kove in London</i>	90
Figure 4.27 <i>Hazardous footway</i>	91
Figure 4.28 <i>Abandoned hire bicycles creating hazards</i>	92
Figure 4.29 <i>Floating Bus Stop Design</i>	93
Figure 4.30 <i>Floating Bus Stop in action</i>	94
Figure 4.31 <i>Vauxhall Bridge comparative study 2</i>	98
Figure 4.32 <i>Pedestrian Survey Poster</i>	99
Figure 4.33 <i>Snapshot of initial survey results before analysis</i>	100
Figure 4.34 <i>Snapshot of initial survey theme coding results – initial themes</i>	101
Figure 4.35 <i>Development of themes</i>	102
Figure 4.36 <i>Affordance mapping: confusing tactiles</i>	105
Figure 4.37 <i>Affordances: dangers introduced</i>	106

Figure 4.38 <i>Affordance mapping: Pedestrian Crossing</i>	106
Figure 4.39 <i>Affordances: lack of design continuity</i>	107
Figure 4.41 <i>Pedestrian crossing point tactile – before and after Shared Space treatment</i>	112
Figure 4.42 <i>Additional tactile creating confusion</i>	113
Figure 4.43 <i>Shared Space artefacts installed</i>	114
Figure 4.44 <i>Disaffordance - removal of pedestrian space to cross the road</i>	115
Figure 4.45 <i>Disaffordance example – changes to tactiles</i>	116
Figure 4.46 <i>Prototype idea 1</i>	119
Figure 4.47 <i>Prototype idea 2</i>	120
Figure 4.48 <i>Prototype idea 3</i>	120
Figure 4.49 <i>Workshop ideas - improving safety affordances</i>	121
Figure 5.1 <i>GroundMap Example: Affordance-Disaffordance annotated mapping</i>	134

List of Tables

Table 2.1 <i>Existing pedestrian safety assessment tools</i>	25
Table 4.1 <i>Interview Participant Selection Criteria</i>	50
Table 4.2 <i>Overview of interviewees, their roles and experience</i>	51
Table 4.3 <i>Codes extracted from line-by-line analysis</i>	53
Table 4.4 <i>Progression to primary themes</i>	53
Table 4.5 <i>Final themes from interviews</i>	54
Table 4.6 <i>Affordance map</i>	63
Table 4.7 <i>GroundMap</i>	66
Table 4.8 <i>GroundMap - categorisation</i>	77
Table 4.9 <i>GroundMap diagnostic table: Ramp removal and disaffordance impact</i>	78
Table 4.10 <i>GroundMap diagnostic table: Colourful crossings</i>	80
Table 4.11 <i>GroundMap - Pedestrian crossing example</i>	85
Table 4.12 <i>Disaffordance from Floating bus stop example (GroundMap)</i>	95
Table 4.13 <i>Affordance Map – Disaffordances</i>	108
Table 4.14 <i>Disaffordance Analysis using GroundMap</i>	118
Table 5.1 <i>GroundMap Compared with Existing Design Assessment Tools</i>	127
Table 5.2 <i>Gaps in Existing Tools and How GroundMap Responds</i>	128
Table 5.3 <i>GroundMap Method – core components</i>	129
Table 5.4 <i>GroundMap Tool: Step-by-Step Guide</i>	131
Table 5.5 <i>Policy levels of implementation</i>	132

Chapter 1: Introduction

Walking is a vital mode of transport that supports health, accessibility, and sustainable urban living. Yet pedestrians remain one of the most vulnerable road users, experiencing disproportionately serious injury and fatality rates as pedestrian safety is often overlooked in transport systems primarily designed for motor vehicles.

1.1 The Case for Pedestrians

Pedestrian injuries and fatalities are consistently underreported in the current road safety system, and pedestrians are inadequately considered in policy-making and public space design. This marginalisation stems from limitations in data collection and fragmented transport policies that prioritise vehicle flow and cyclist safety.

Road safety is a classic 'wicked problem', ill-defined and interconnected, with no single solution, where each attempt to address it may unintentionally worsen the issue (Rittel & Webber, 1973). It forms part of a broader set of international wicked problems addressed by the United Nations Sustainable Development Goals (SDGs), which tackle complex global challenges such as climate change and road safety. This research focuses on one aspect of this wicked problem: pedestrian safety.

The UK's primary road safety reporting dataset captures only police-reported vehicle collisions, excluding near-misses, non-collision injuries, and everyday pedestrian hazards. These gaps contribute directly to pedestrian requirements being overlooked in planning and policy. This research examines how road safety is framed by professionals, referred to throughout as 'experts' and what those framings exclude, with the aim of proposing more inclusive approaches to pedestrian safety design.

1.2 Researcher Positionality

I undertake this research from two standpoints: as a researcher and as a practitioner with more than 25 years of experience in UK public transport. My experience within national transport organisations has informed my understanding of how safety problems are defined and managed.

My relationship with Transport for London (TfL) requires acknowledgement. TfL appears here both as a policy actor whose decisions are examined critically and as a participant whose staff provided access to forums, working groups, and decision-makers. Having worked for TfL, I was familiar with its operations and challenges. This insider position provided valuable access but also required managing professional familiarity as potential bias (Mercer, 2007). I have treated TfL as one actor among several, not as an authority. Its institutional priorities, the emphasis on reducing KSI metrics and improving cycling infrastructure, were not unchallenged assumptions but part of what was under study.

Three personal experiences shaped the research. Accompanying a parent who uses a wheelchair revealed what poorly designed spaces demand of users. As a driver, I witnessed unpredictable road user behaviour and near-miss incidents that go unrecorded. As a cyclist, I had to navigate dangerous infrastructure that had broken glass and potholes to maintain my safety. These experiences did not determine the findings but grounded my understanding of how different road users experience safety.

A 2017 visit to the Royal College of Art (RCA) and a conversation with Professor Ashley Hall encouraged me to explore design-led practice, bridging technical skills with real-world problem-solving. This led me to pursue and complete an MRes in Design at RCA's School of Design in 2018. My main research project focused on cyclist safety and behaviour, undertaking a case study on why cyclists did not stop at traffic lights at a major roundabout. It revealed that their behaviour was a realistic safety strategy rather than rule-breaking conduct, highlighting gaps in the initial design process and a lack of user engagement in developing the cycle path at this location. Keen to continue this research, I applied for a PhD at the School of Design in 2018 and was awarded funding through the London Doctoral Training Partnership (LDOC) scheme, followed later by the London Arts and Humanities Partnership (LAHP) scholarship to support my studies.

COVID-19 changed the research timeline. The planned six-month study (November 2019 - May 2020) was suspended during lockdown. Fieldwork resumed in 2022-23 and the site was revisited in 2024. The suspension and resumption of fieldwork produced, in effect, a longitudinal study, capturing how the space changed over time; with e-bikes, e-scooters, and post-pandemic pedestrian commuting patterns altering the environment.

I use first person throughout this thesis where describing my own judgments, interpretations, and design decisions. This reflects the constructivist position the research takes that knowledge is shaped by who produces it and in what circumstances (Guba & Lincoln, 1994; Charmaz, 2014). Reflective journaling and memoing were used throughout to surface and interrogate my own assumptions, particularly where professional familiarity with TfL and the transport sector risked becoming a blind spot rather than an asset.

1.3 Defining Safety

Safety in road safety scholarship is predominantly defined through collision outcomes (WHO, 2018; DfT, 2023a). This research adopts a broader definition: the condition in which a person can move through public space with confidence, freedom from hazard, and the environmental support needed to perceive and navigate risk. This definition is experiential as well as physical; it captures near-miss incidents and design decisions that remove the safety cues pedestrians depend on.

This definition emerged from practice. It began with a gap: existing frameworks built around collision counts and KSI metrics do not account for the pedestrian risks encountered both

personally and professionally, including near-misses, everyday avoidance behaviours, and the exclusion of users whose navigational cues have been stripped from their environment. The gap between how safety is officially measured and how it is experientially felt became the generative problem.

J. J. Gibson's (1979) affordance framework provided the means to name this gap. Gibson proposed that what an environment affords a user is not fixed but relational, emerging through the interaction between a particular person and a particular place. This directly suits the problem at hand: whether a pedestrian environment is safe cannot be answered in the abstract, only in relation to the specific capacities, perceptions, and needs of the person navigating it.

The definition of safety used in this thesis was built outward from Gibson's framework and inward from empirical evidence, consistent with the constructivist position where conceptual framework and empirical findings develop in dialogue. It is presented here because it shapes what counts as evidence, which methods were used, and what the design response developed in Chapters 4 and 5 ultimately addresses.

1.4 Approach

The approach taken in this thesis follows from the definition in Section 1.3. If safety is relational and experiential rather than a fixed measurable outcome, then accessing it requires both a theoretical framework capable of making that experience analytically legible and a methodological approach capable of generating it. Gibson's affordance framework provides the former; the research design described in Chapter 3 provides the latter.

Design theory grounds both the methodology and epistemology of this research. Buchanan (2004) and Norman (2013) argue that good design starts from human needs, not technical parameters. Cross (2006) identifies what distinguishes designers' thinking: intuition, synthesis, and creativity over linear analysis. Archer (1979) and Schön (1983) emphasise design's iterative nature: problems are framed and reframed through doing, with practitioners adjusting designs based on feedback. Simon (1969) describes design as transforming existing situations into preferred ones. Frayling (1993) categorises design research into research in, for, and through design, pointing to its methodological flexibility.

This research focuses deliberately on pedestrian perspectives, excluding vehicle driver viewpoints. It combines interviews, participant observation, and surveys with Research through Design, Constructivist Grounded Theory, and Affordance Theory to capture how pedestrians experience and navigate safety challenges.

1.5 Context and Rationale

This research departs from existing approaches by foregrounding pedestrian experience and near-miss incidents as primary data. Warnings from the WHO (2023a) point to forecasted increases in pedestrian casualties due to multiple overlapping factors:

- An ageing population;
- Growing urbanisation;
- Increasing vehicle numbers;
- The climate emergency;
- Strains on public health systems;
- Rising disabilities caused by the number of traffic collisions;
- The introduction of Autonomous vehicles into the road environment.

The WHO's (2004) earlier World Report on Road Traffic Injury Prevention highlights how older adults face vulnerability to serious injury and long-term disability, creating additional burdens on public health resources. Growing urbanisation reduces pedestrian space and may discourage vulnerable groups from walking due to safety concerns. The emergence of electric bikes and e-scooters introduces further unpredictability into shared pedestrian environments.

These challenges intersect with broader Sustainable Development Goals (SDGs) related to health, social inclusion, and equity. Pedestrian safety directly supports SDG 3 (Good Health and Well-being) and SDG 11 (Sustainable Cities and Communities) by fostering accessible, safe, inclusive urban environments (UN, 2015).

While collision impacts are well documented in reports from organisations like WHO and the UN, often using UK injury data (DfT, 2023a; WHO, 2018), this captures only part of the picture. Current data collection methods are constrained, unreliable, and incomplete, particularly for pedestrian incidents. A gap exists around unreported accidents - including non-vehicle collisions or those not causing serious injury.

This missing data is critical because it leaves substantial gaps in understanding the full scope of safety issues. Both the Health and Safety Executive (HSE, 2004) and the Institution of Occupational Safety and Health (IOSH, 2017) emphasise that near-misses serve as important indicators of more serious underlying problems. Furthermore, the scarcity of qualitative data limits contextual understanding and analysis of the circumstances surrounding non-KSI incidents, thereby restricting the development of more effective, preventative safety interventions and creating a fragmented view that limits effective safety designs. The exclusive focus on reducing killed and seriously injured numbers (KSIs) encourages solutions aimed at improving statistics rather than addressing root causes and systemic issues impacting user groups.

London was selected as the primary research site due to its exceptional complexity, shaped by organic historical growth, its fragmented governance across 32 London boroughs, and TfL's overarching transport framework; making it a demanding and analytically rich environment for studying pedestrian safety.

1.6 Research Questions

These considerations shaped the following research questions, which provide the framework for the study:

How can a design-led approach bridge the gap between KSI statistics and near-misses to address pedestrian safety issues in London?

This is explored through two sub-questions:

- What theories underpin a design approach for investigating systemic pedestrian safety issues?
- What new methods and tools need to be adopted to explore the system and mindset gaps between pedestrians and street safety designers?

Chapter Summary

The rationale for this research has outlined how pedestrian safety is a neglected dimension of road safety; systematically marginalised in data, policy, and design despite pedestrians being among the most vulnerable road users. The dominance of KSI metrics was identified as a structural problem: a measurement framework that excludes non-collision incidents, and the lived experience of diverse pedestrians, producing a cycle in which limited data generates limited insight and limited design response. Road safety can be regarded as a wicked problem, resistant to singular solutions, shaped by competing stakeholder interests, and requiring an iterative, design-led approach rather than a technical solution. The research is situated within a London context, shaped by the researcher's practitioner experience and positionality. Chapter 2 examines the theoretical and empirical literature of the study. The definition of safety established in this chapter, experiential and relational as well as physical, shapes what counts as evidence throughout the thesis.

Key terms used throughout this thesis, including concepts original to this research, are defined in the Glossary located after the Appendices.

Chapter 2: Literature Review

Road safety remains a critical public health concern globally. Ambitious initiatives such as Vision Zero (VZ) aim to eliminate traffic-related fatalities and serious injuries. However, their implementation, particularly concerning pedestrian safety, remains questioned. This chapter critically examines the theoretical and practical foundations of VZ and the Safe System approach, with a specific focus on their limitations in addressing pedestrian safety. It also probes the extent to which existing safety theories and systems models support human-centred road safety interventions.

This chapter is structured around the research questions set out in Chapter 1, examining the theoretical and practical foundations of each.

2.1 Safety Theory

As vehicles became affordable in the early 20th century, driving replaced cycling and walking as the preferred mode of transport. Infrastructure, licensing, and urban planning policies developed around the car. As a first step in providing pedestrian safety, the UK's 1931 Highway Code aimed to reduce pedestrian accidents within this increasingly car-centric environment (Ministry of Transport, 1931). International frameworks such as the Vienna Conventions (UN, 1968) and the United Nations Economic Commission for Europe (UNECE) promoted standardised traffic rules and signage.

As car ownership and accident numbers increased, theories emerged to understand accident causes and ways to develop preventative measures. Four theoretical frameworks, reviewed by Jamroz (2008), Figure 2.1 illustrate the evolution of safety thinking:

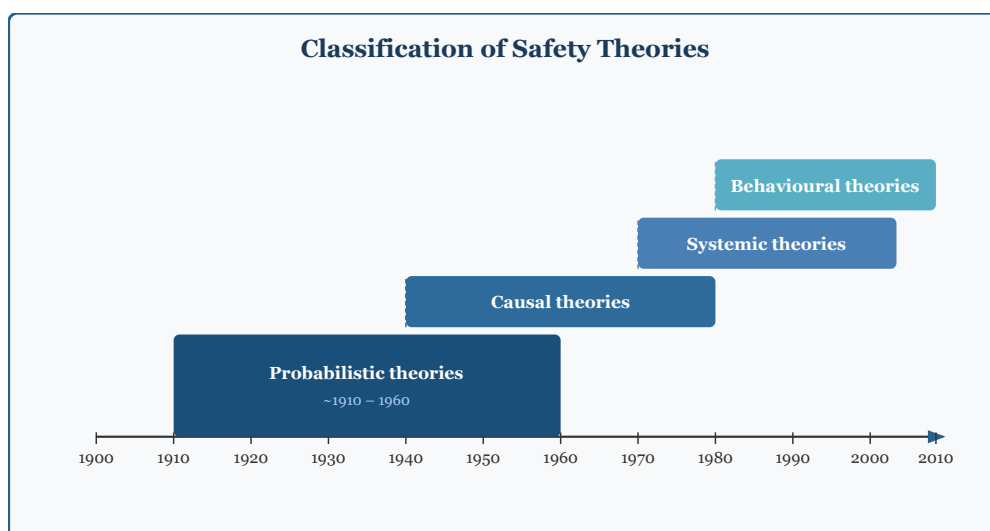


Figure 2.1 *Classification of safety models*

Note. Adapted from Jamroz (2008)

1: Stochastic theories, which view road accidents as random occurrences and emphasise statistical analysis, are rooted in Bortkiewicz's (1898, 1963) Law of Small Numbers. These theories play an important role in fields such as big data analytics, statistical genetics, and engineering, particularly in predictive modelling of random events (Figure 2.2). While effective for identifying patterns in large datasets, this purely quantitative approach excludes qualitative factors such as the circumstances of incidents and the experiences of those involved.

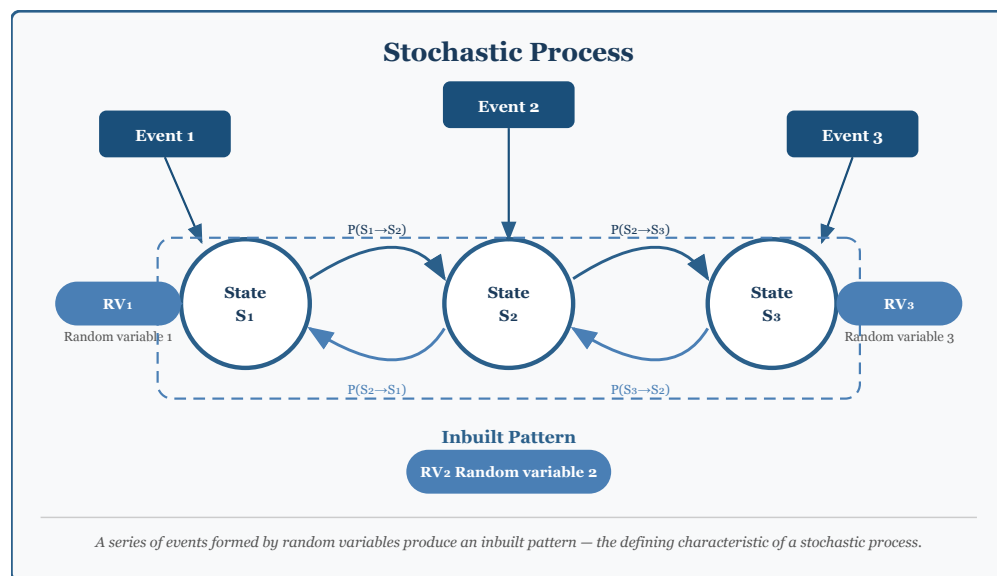


Figure 2.2 *The stochastic process*

Note. Adapted from WallStreetMojo.com

2: Causal theories prioritise identifying the causes of accidents, with a specific focus on the role of human error in the sequence of an accident. Heinrich's Domino Theory (1931) established an evaluation that examines the different levels of human factors involved in injuries (Figure 2.3). The model's linear structure suggests accidents begin with individual fault, which can lead to blame-focused analysis rather than examining broader contextual factors.

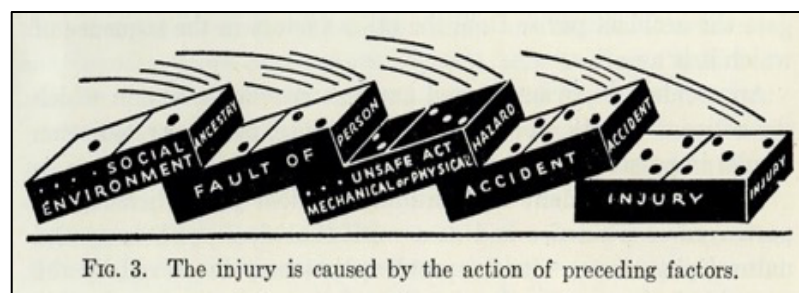


Figure 2.3 *Heinrich's Domino Model of Accident Causation*

Note. Image from Risk-Engineering.org, licensed under Creative Commons [CC BY-SA 4.0]

3: Systemic theories assert that accidents arise from deficiencies within the entire system, rather than being attributed solely to human error. A foundational model still used in public

health today is Haddon's Matrix (1968) (Figure 2.4). The grid-based system organises the actors and environmental factors present before, during, and after an incident to identify contributory risk factors. The advantage of this approach is that it allows for a broader analysis of the situation, considering more specific elements of the incident and enabling the development of preventative strategies to mitigate risks. However, a limitation of the model is that it depends on the available data for modelling and the subjective viewpoint of the person completing the matrix. Additionally, it does not incorporate feedback from the injured person's perspective when considering designing mitigating solutions.

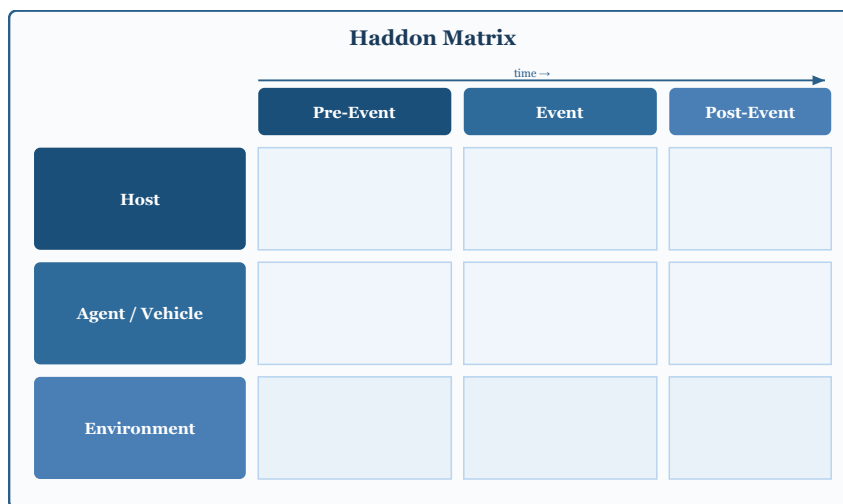


Figure 2.4 *Haddon's Matrix*

Note. Adapted from Haddon (1968)

4: Behavioural theories explore how risk perception and societal attitudes shape road safety by influencing individual risk behaviours. One notable example is the work of psychologist Gerald Wilde, who introduced a unique perspective on safety. He suggested that people adjust their behaviour based on changes in their environment, for instance, slowing down when they notice a speed camera and speeding up when they feel conditions are safe. Wilde's Risk Homeostasis Model (1982) describes the level of risk individuals are willing to accept and argues that meaningful risk reduction can only occur if society values and demands greater safety (Figure 2.5).

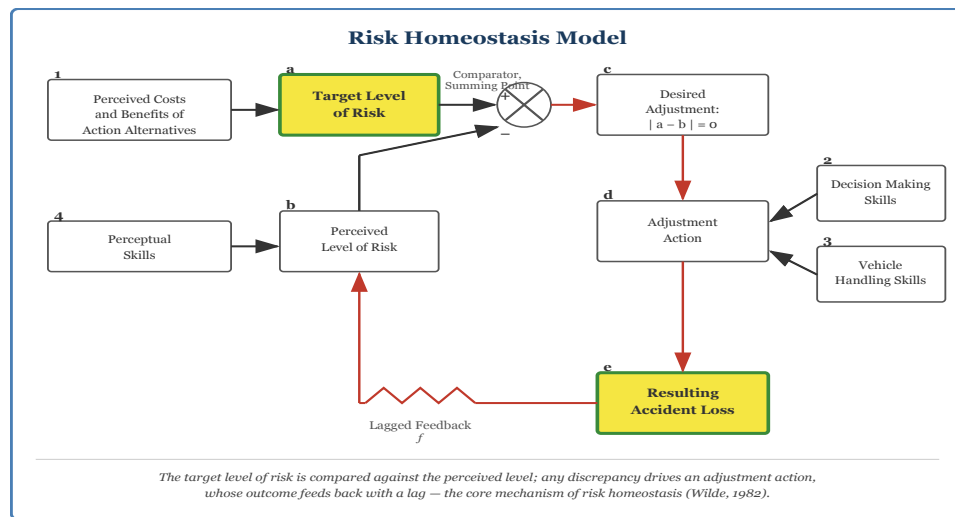


Figure 2.5 Risk Homeostasis Model

Note. Adapted from Wilde (2014)

The advantage of this type of model lies in its ability to examine behaviours and explore ways they might be changed, for example, through education programmes. However, the development of a universal approach to modify behaviours assumes a one-size-fits-all strategy being applied. This approach fails to account for contextual, demographic, or environmental variables, as well as the significance of understanding users' perspectives to examine the motivations behind their behaviours as the starting point for designing an intervention.

What these models demonstrate is that users are being designed for through a hierarchical top-down approach. They are perceived as parts of the system that must be designed for, with little input from them or awareness of their safety requirements. Therefore, decisions on how data is collected, analysed and interpreted rest with the authority specifying what data is relevant for collection, analysis and interpretation. A key limitation of the models is that because the data is of a quantitative nature, there is little information on the contextual factors of the environmental situation.

2.2 Modelling Human Errors

A 2019 Royal Automobile Club (RAC) Foundation review examined the link between human error and road collisions, evaluating analytical methods that incorporate human factors alongside conventional collision analysis techniques (Figure 2.6). While it provided a useful basis for considering future investigative processes, the report's scope was limited by its audience: it addressed those who design road safety policies rather than those who design interventions. In this respect, it mirrors the broader tendency identified in the earlier models treating users as subjects to be designed for rather than participants whose perspectives and requirements should inform the design process. As such, it reinforces a scientific and engineering orientation that prioritises changes to the physical environment infrastructure without incorporating user feedback into the diagnostic or design stages.

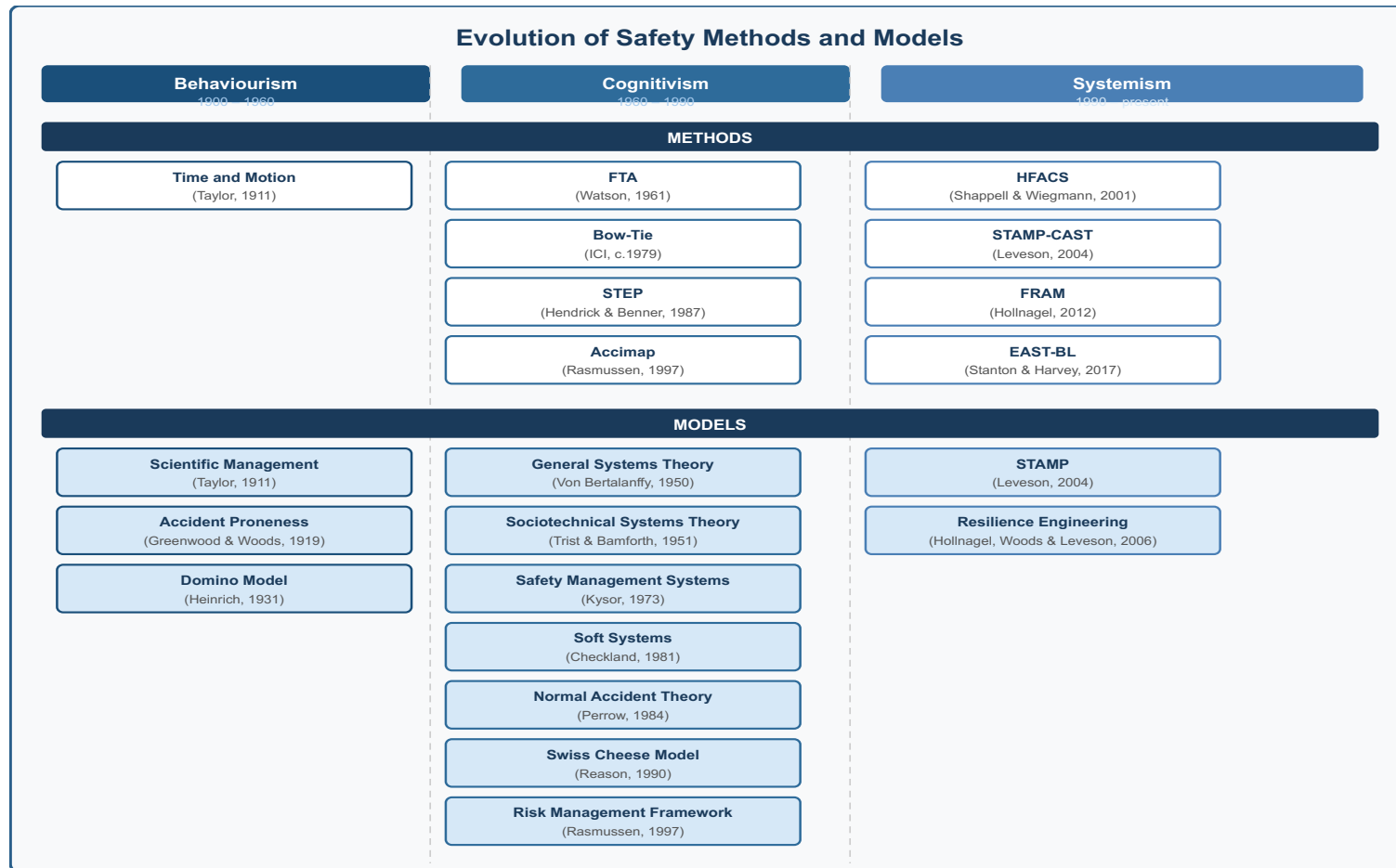


Figure 2.6 *Evolution of Safety Models and Methods*

Note. Adapted from RAC Foundation (2019)

Foundational Models in Safety Analysis

Foundational work by Haddon (1968), Rasmussen (1983), and Reason (1990) has strongly influenced accident analysis and prevention. Haddon's Matrix provided a structured way to break down accidents into three phases: pre-event, event, and post-event, while examining contributing factors across human, vehicle, and environmental domains. Rasmussen's work focused on human error within complex systems, showing that accidents often emerge from failures across multiple interacting system levels rather than a single cause. Reason's Swiss Cheese Model further developed this idea by illustrating how accidents occur when multiple latent weaknesses align across different layers of an organisation. Taken together, these models offer a structured way to understand causation and have become central to designing safety interventions.

Building on these ideas, Rasmussen's Risk Management Framework (1997) (Figure 2.7) extended systems thinking into a more applied safety management approach in high-risk industries (Read et al., 2017). It maps system actors, roles, and responsibilities, showing how decisions made at higher organisational levels shape actions at lower levels, while feedback from operational levels informs strategic decision-making (Rasmussen & Svedung, 2000). A key assumption is that safety depends on effective communication and strong connections across all levels of the system, including external influences that drive change within it. The framework visually represents these interactions as a network of interconnected relationships shaping system behaviour.

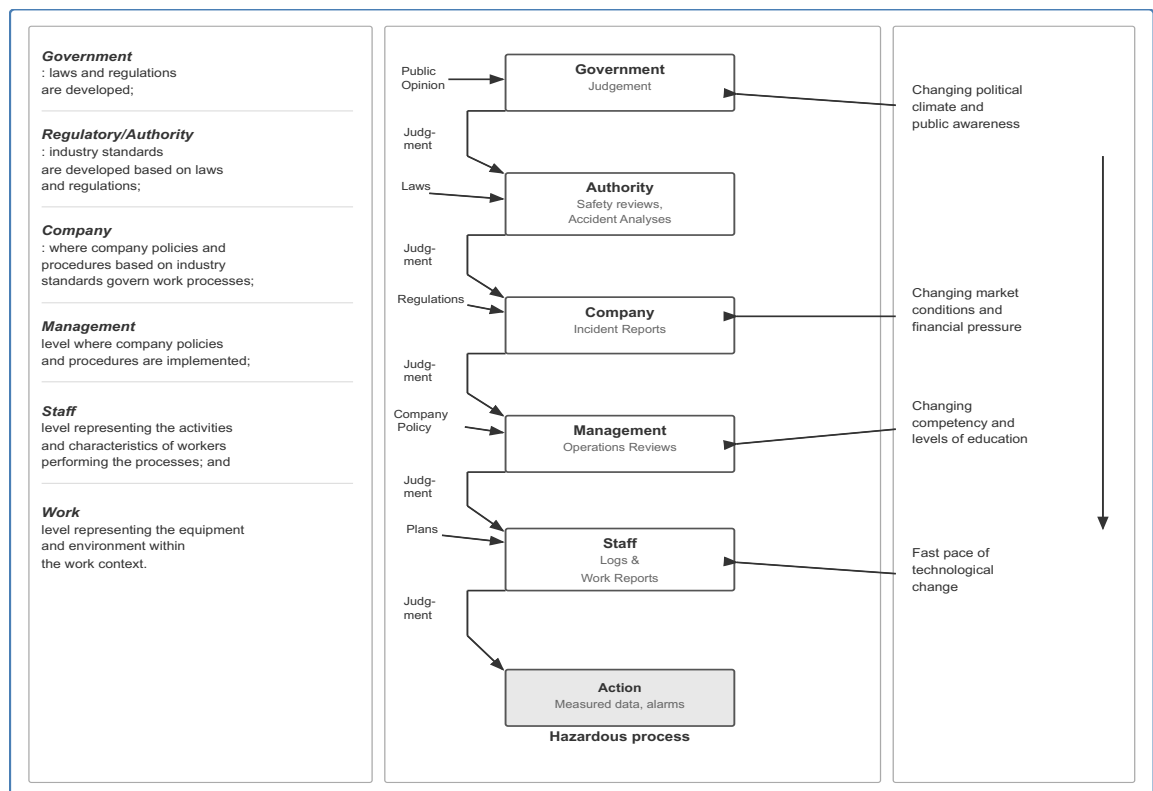


Figure 2.7 Accimap - Process and Organisational Levels

Note. Image from Rasmussen & Svedung (2000)

This work was later developed into the Accimap method (Rasmussen & Svedung, 2000), now widely used as a systems-based tool for analysing accident causation across multiple levels. While influential, Accimap has a key limitation: it only represents actors and factors within the defined system boundary. As a result, external or informal contributors may not be fully captured. This can lead to gaps in identifying potential mitigations for real-world scenarios where behaviour outside formal systems still plays a role.

Across these models, a shared limitation remains in that they are all constructed from an analytical perspective that sits outside the lived experience of the people within the system. For example, in Accimap, where multiple levels are traced, the framing still depends on predefined system boundaries. For example, pedestrian or road-user behaviour that contributes to an incident may fall outside what is explicitly mapped, meaning associated risks and mitigations can be underrepresented. In the context of pedestrian safety, this becomes important: those most affected by system design are not always fully included within the analytical structures used to assess and improve it.

2.3 Affording Safety

A different perspective on the relationships between behaviours and safety was put forward in a breakthrough paper by psychologist J.J. Gibson and electrical engineer L.E. Crooks in the United States (1938). They conducted research into understanding the behaviours present when a person is driving a car and what tasks were involved in driving which led for a safe and collision free journey. Their initial research had its roots in Kurt Lewin's Field Theory (Lewin, 1951), a psychological framework that examines how individuals engage with their environment and how their reactions to external stimuli shape their interactions and behaviour.

In Gibson and Crooks research, the relationship between a driver's field of vision, vehicle locomotion, and the road environment was examined to understand how drivers respond to obstacles and avoid collisions. They theorised that a Field of Safe Travel - which describes how an object is moved toward or away from, means a driver will maintain a safe field of travel by avoiding obstacles in their visual path and follow the road's curves. They deduced that a driver's visual perception of their Field of Safe Travel determines how they respond to the shifting field of travel.

They also found that steering the car was just one way of avoiding collisions but they could also be avoided by the driver slowing down or stopping the car and theorised that a Minimum Stopping Zone, the least amount of braking distance required to stop the car depended on a number of factors including the speed of the car, ability to brake and the conditions of the road surface, these 'semi-perceptual habits' that a driver develops through learning about the safe margins between the Minimum Stopping Zone and Field of Safe Travel lead them to developing strategies for safe driving (see Figure 2.8.) :

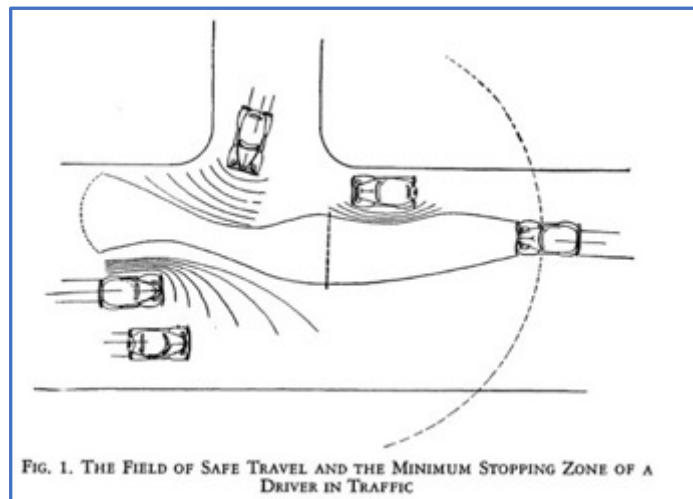


Figure 2.8 *A Theoretical Field-Analysis of Automobile-Driving*

Note. From Gibson and Crooks (1938)

Gibson and Crooks (1938) foundational work has been revisited and validated by DeLucia and Jones (2017), highlighting its continued importance for understanding driver vision and behaviour. These insights have informed autonomous vehicle development, where human-like perception and adaptive response are central to safe navigation, underscoring the ongoing relevance of their theories across both domains (Merat et al., 2014; Zhang et al., 2019; Paden et al., 2016).

This early research led Gibson to formulate his concept of affordances, which theorises that the direct visual perception of individuals within dynamic natural environments can provide insight into what those environments offer. For instance, in his 1979 study related to aviation, he examined how pilots landing an aircraft relied on their perception of the plane, its altitude, and their view of the landing strip, among other factors. He suggested that perception evolved as the aircraft navigated through space and as the landing strip drew nearer. By establishing an ecological framework that connected the individual to their surroundings and the evolving relationship of what was visually perceptible to the pilot he identified how visual perception was a key element for affording safety.

Interface Design

In another area of safety research, Donald Norman was involved in a U.S. Nuclear Regulatory Commission research team investigating the role of human error in the Three Mile Island Accident (1979), where design issues (see Figure 2.9) were documented in detail by Malone et al. (1980). The accident, which occurred at a nuclear power plant in Pennsylvania, resulted from mechanical failures compounded by operators' inability to correctly diagnose the problem within the system. Although there were no casualties, the incident prompted a detailed review of its causes. This evaluation identified several human factors issues, including poorly designed control panels, multiple similar alarm signals, and inadequate operator training in how to respond to system failures (see Figure 2.9).



Figure 2.9 *Three Mile Island Control Room-2 1979*

Note. Photograph courtesy of the U.S. Nuclear Regulatory Commission (public domain).

Understanding the importance of designing for critical systems, Norman explored human–computer interaction, focusing on how these interactions could be optimised to improve safety. His background in engineering and psychology, combined with his research involvement in the Three Mile Island Accident, paved the way for further studies with Edwin Hutchins and James Hollan in 1985 (Hutchins et al., 1985). This research led to the creation of interfaces that make systems easier to navigate and minimise the mental effort required from operators. The result was two concepts central to interface safety design: the gulf of execution and the gulf of evaluation (Figure 2.10).

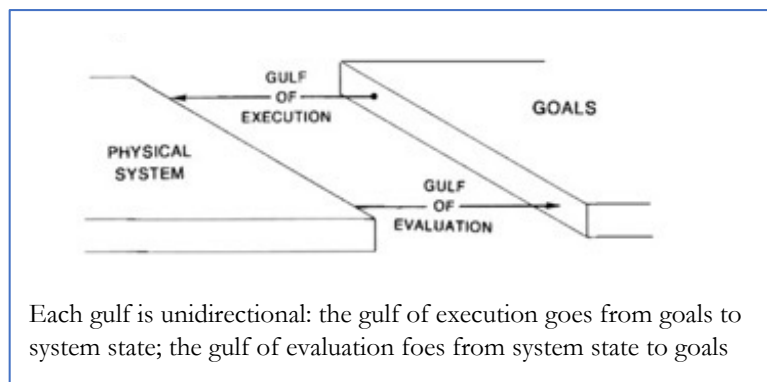


Figure 2.10 *Gulf of Execution and Evaluation*

Note. From Norman (1988)

During the 1980s, Norman continued his research on human errors in collaboration with NASA aviation pilots, examining how pilots perceived and engaged with cockpit technology to maintain flight safety. He argued that a safety concern arises from the lack of feedback from technology to the user, proposing that effective design considerations could address this issue. For example, that designs should inherently accept the possibility of errors and incorporate this acceptance into the interactions between the operator and the technology (Norman, 1988).

His understanding of the relationships between humans and technology led him to transfer Gibson's Affordance Theory into the world of design by focusing on design's role in bridging the gap in the relationship between the human and their environment. His application of the theory to design practice laid the groundwork for the development of human-computer interaction and user experience design.

Safety Models Synthesis

The theories reviewed here fall into two broad groups: traditional models (stochastic, causal, systemic, and behavioural) and accident analysis frameworks (Haddon, Rasmussen, Reason, and Accimap). These approaches analyse safety from a position external to users lived experience. They rely primarily on quantitative data, focus on post-incident analysis of what went wrong, and conceptualise users as components within a system designed for safety. While valuable for identifying patterns and systemic failures, they remain distinct from how safety is experienced in practice.

Gibson's Affordance Theory offers a different perspective, beginning with the relationship between the individual and their environment. From this view, safety is not solely a property of the system but emerges through perception and action. Building on this, Norman demonstrated how these ideas inform interface design and system safety: by focusing on what the environment affords users, reducing the gap between intention and action, and positioning human perception as central rather than peripheral.

For pedestrian safety, this distinction is substantial. This thesis adopts an affordance-based approach, treating pedestrian experience as the starting point for understanding safety, rather than as a variable to be measured after harm has occurred.

2.4 Road Safety in Numbers

One of the critical shortcomings in road safety is the lack of a standardised definition of 'road safety' (Pedersen, Elvik, Berard-Andersen, 1982). This has resulted in an overreliance on backward-looking statistical data as a descriptor of safety (Wegman, 2017). Since 2016, the UK and other UN member states have endorsed the Safe System approach, based on the Dutch Sustainable Safety framework and the Swedish Vision Zero model. This approach incorporates a range of factors including vehicles, road users, infrastructure, and socio-economic conditions (Wegman et al., 2008; ITF, 2008) and is grounded in a systemic model with the explicit long-term goal of reducing fatalities and serious injuries to zero.

The Safe System approach is structured around five interdependent pillars (UNRSC, 2011; WHO, 2009), shown in Figure 2.11: Road Safety Management, which coordinates policies to reduce crash risk; Safer Roads and Mobility, which addresses infrastructure and engineering; Safer Vehicles, which incorporates active and passive safety technologies; Safer Users, which emphasises education and shared responsibility; and Post-Collision Response, which optimises emergency and trauma care.



Figure 2.11 *The Five Pillars of Safe System Approach*

Note. Adapted from World Health Organization (2009) and United Nations Road Safety Collaboration (2011).

Road safety is integrated within an established international policy framework. The ITF, OECD, and WHO collaborate on initiatives such as Towards Zero: Ambitious Road Safety Targets and the Safe System Approach (ITF, 2008), supported by funding mechanisms including the Global Road Safety Facility (GRSF), to which the UK contributes. In parallel, UN member states have committed to the Sustainable Development Goals (see Figure 2.12), which explicitly include road safety: SDG 3.6 targets a 50% reduction in global road deaths and injuries by 2030, while SDG 11.2 commits to safe, affordable transport for all, with specific attention to vulnerable groups, including older adults and disabled people. According to WHO (2023b), road traffic deaths and injuries remain a major global health challenge: for every recorded fatality, at least 23 injuries require hospitalisation, with vulnerable groups facing disproportionate risk. Beyond physical harm, road accidents have destructive impacts on victims, families, and public health systems, including disabilities caused by traffic accidents (Palmera-Suárez et al., 2015). Vulnerable groups such as women, children, pedestrians, cyclists, and individuals from lower socioeconomic backgrounds face disproportionately higher risks due to factors like limited access to safe infrastructure, greater exposure when walking and reduced access to medical care. Yet without disaggregated data on pedestrian-specific incidents or consultation with vulnerable user groups, the intent of SDG 11.2 to prioritise these populations remains only partially realised.

In the UK, these commitments are articulated through the DfT's *Working Together to Build a Safer Road System* (2015b), which endorses the Safe System's five-pillar approach and Vision Zero, forms a core component of the London Mayor's Transport Strategy (2018). STATS19 data underpins the UK's contributions to international reporting, including the WHO's *Global Status Report on Road Safety* (WHO, 2023b) and the UN Decade of Action Global Plan (UNRSC, 2011), and supports local Vision Zero initiatives funded through the DfT's Safer Roads Fund. The gap between these aspirational targets and the lived experience of pedestrians on London's streets is what this research addresses.



Figure 2.12 *Sustainable Development Goals*

Note. From United Nations (2023)

The Global Picture

The lack of integration between health and collision data extends beyond the UK, posing challenges for global road safety analysis. The limitations and inconsistencies within systems like STATS19 can distort global comparisons and policy recommendations from bodies like the WHO and OECD. Many countries face similar problems: incomplete data, minimal qualitative input, and underreporting of near-misses or non-fatal injuries.

Framing the issue as a public health emergency, the WHO has referred to road traffic deaths as a global ‘epidemic’ (WHO, 2015), prompting the widespread adoption of Vision Zero as a strategic response, despite unresolved data challenges that hinder meaningful cross-national learning and progress.

Vision Zero (VZ) has earned global recognition for its goal of eliminating road fatalities and serious injuries, but its feasibility and implementation have drawn sustained critique. Long (2012) argues that the zero-fatality target is unrealistic in complex, real-world contexts. Similarly, Fahlquist (2006) describes Vision Zero as a “toothless tiger”, citing its non-binding nature and limited enforceability.

A further issue lies in goal setting. Abebe et al. (2022) identify challenges in establishing evidence-based targets, while Andersson and Pettersson (2008) criticise the framework’s rigidity, noting that policymakers often disregard alternative safety models, thus stifling innovation.

A deeper limitation of the Safe System model underlining VZ involves the rationale behind intervention choices. Wegman (2017) notes that the mechanisms behind successful safety measures and interventions remain poorly understood. The Global Road Safety Facility (GRSF, 2022) similarly acknowledges that while some initiatives show promise, overall evidence is limited. This creates several knock-on effects:

- Weakens justification for design decisions;
- Reduces confidence among stakeholders;
- Hinders evaluation and discontinuation of ineffective interventions;
- Erosion of Safe System principles.

The evidence on Vision Zero outcomes is mixed. Roughly half of 32 European nations have reduced road fatalities; others have stagnated or seen increases (ETSC, 2020). Sweden and the Netherlands; seen as models in the field, have themselves seen safety trend reversals, attributed to stakeholder gaps, institutional conflict, and fragmented governance (Elvik, 2019a). The UK has seen fatality reductions plateau alongside a rise in serious injuries (DfT, 2023a) - a pattern Marsden and Reardon (2017) link directly to institutional constraints.

Despite these issues, Vision Zero remains a cornerstone of UK road safety policy, particularly in relation to vulnerable road users. However, some of its propositions remain contested. Claes Tingvall, the architect of Vision Zero, has notably suggested that motorcycles may not align with the framework's objectives and could be excluded from the road system. His assertion that "motorcycles are incompatible with Vision Zero" (Tingvall, as cited in Bany, 2024/2013, p. 8) illustrates the tension between the framework's aspirational goals and the practical realities of transport systems.

Safety Culture

The Haddon-Cave Review (Haddon-Cave, 2009), commissioned after the Nimrod aircraft crash, offers a cautionary lesson. It exposed how superficial safety cultures and over-reliance on checklists without systemic thinking, led to fatal consequences within the Ministry of Defence and BAE Systems. The parallels with VZ show how focusing narrowly on statistics can obscure deeper institutional failures and marginalise user-specific needs.

Road safety policymaking is also shaped by powerful stakeholders with competing agendas. In the WHO Pedestrian Safety Manual, the FIA's contribution reflects a car-centric approach that prioritises protecting pedestrians through vehicle design, rather than designing the system around pedestrian needs (WHO, 2023a). This framing may limit the adoption of more holistic approaches that focus on pedestrian experience.

2.5 Pedestrians

Data Limitations

The current dominant focus on KSI (Killed and Seriously Injured) statistics narrows the understanding of pedestrian safety. This research adopts a broader perspective, including near-miss incidents absent from official data. These near-misses (defined fully in Chapter 3) reveal a persistent gap between expert definitions of safety and pedestrians' lived experiences.

Official UK datasets like STATS19 capture only police-reported vehicle collisions (see Appendix Q). Two criteria determine whether an incident is recorded: (1) Did the collision occur on a

public highway? (2) Was a moving vehicle involved? If either is “no”, the incident is excluded, despite possibly appearing in hospital records (Figure 2.13).

Although STATS19 remains the UK's most consistent national road safety dataset (DfT, 2023a), its limitations are well-documented. Contributory factors are often vague (e.g., 'Failed to look properly'), potentially masking deeper issues like visual impairments (Hawley et al., 2015). STATS19 is not linked to Hospital Episode Statistics (HES) (DfT 2023b), which capture medical outcomes. Without connecting these sources, poor data integration obscures the scale of risk (ITF, 2012; Schepers et al., 2017), contributing to systemic underreporting and hindering responsive design.

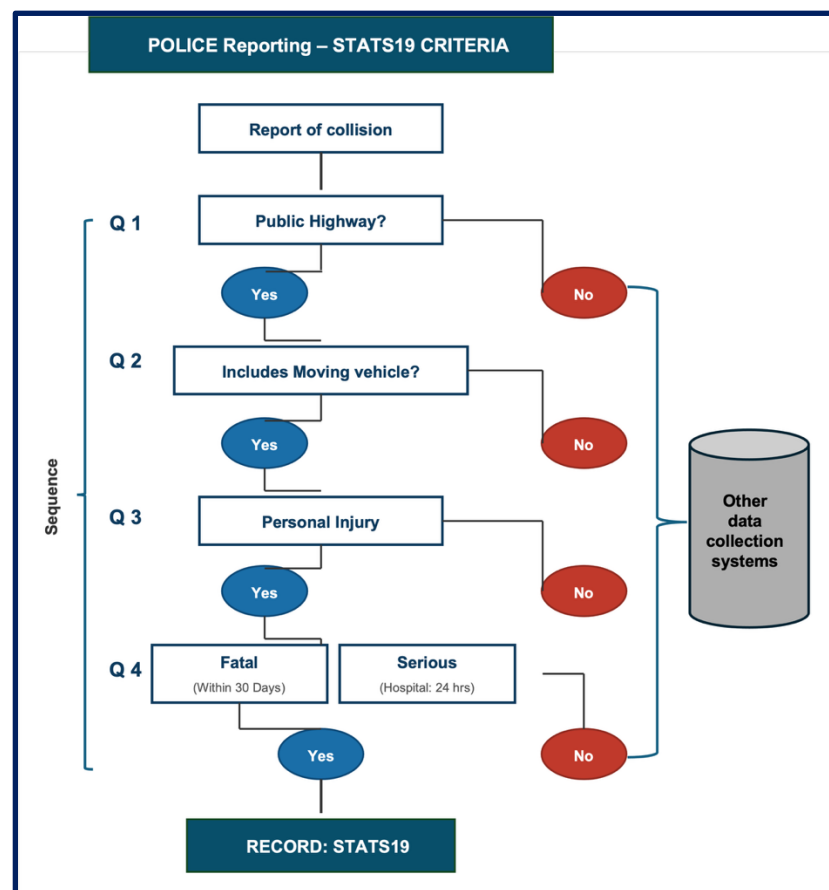


Figure 2.13 Criteria for collision recording STATS19 data collection

Policy and Governance

Pedestrian interests are poorly represented in transport governance. Unlike cyclists or motorists, pedestrians lack dedicated advocacy or institutional focus, and responsibilities are fragmented across transport, safety, health, and environmental bodies (ITF, 2008), leading to incoherent strategies. Vulnerable users, including older adults, children, and people with impairments, often have little influence in design or policymaking processes. This institutional marginalisation is reflected directly in the built environment: investment in infrastructure, and design decisions that prioritise motor vehicles, resulting in narrow pavements, poor lighting, and unsafe crossings that restrict mobility and increase exposure to harm (Living Streets, 2023;

WHO, 2023a). Safety for pedestrians, comfort, and psychological well-being remain secondary considerations.

Pedestrians in the Safe System

The Safe System approach often treats pedestrians as a homogeneous group with equal capacity to follow rules (Pooley, 2020). This assumption ignores variations in age, ability, cognition, and mobility. Vulnerable users may be disproportionately affected by design solutions that assume uniform behaviour and place emphasis on compliance and personal responsibility.

Pedestrian Safety Design Treatment

Pedestrians are frequently treated as passive elements in road design, with safety framed in terms of collision avoidance. This limits consideration of environmental hazards and user experience. It ignores how pedestrians actively negotiate complex environments, responding to uneven surfaces, poor lighting, or proximity to traffic, all of which shape real and perceived risk.

Hidden Problems

Pedestrian safety sits at the margins of a road safety system built around vehicle collisions and KSI data. Many incidents, such as falls and non-collision injuries go unrecorded (ITF, 2012). Injury categories in police reports are often too narrow to capture the full scope of harm (Imprialou & Quddus, 2019). These data omissions distort risk perceptions and impede inclusive safety strategies (Schepers et al., 2017; Methorst et al., 2016).

Falls are more frequent than vehicle-pedestrian collisions and account for a large share of fatalities, especially among older adults (Schepers et al., 2017; Oxley, 2018). Yet many are excluded from official statistics, despite occurring in public spaces (Methorst, 2021; Elvik & Mysen, 1999). These incidents not only cause physical harm but can reduce confidence and social participation (Wijlhuizen et al., 2007). Addressing them requires inclusive design approaches and improved data integration (WHO, 2021).

2.6 Shared Space: Design Concept

Hans Monderman's 'Shared Space' approach (Monderman et al., 2006) emerged in the Netherlands as an alternative street design strategy. It challenged conventional practice by introducing environmental ambiguity and prioritising direct negotiation between drivers and pedestrians over signage, with the aim of slowing vehicles and improving safety. It showed encouraging results in reducing vehicle speeds by up to 40% in the Netherlands. However, UK adaptations where pedestrians and cyclists share spaces, diverge from these principles. Cyclist needs tend to be prioritised, despite recent updates to the Highway Code reaffirming pedestrian priority (DfT, 2022). Guidance such as Manual for Streets (DfT & Ministry of Housing, Communities & Local Government [MHCLG], 2007) and the National Model Design Code (MHCLG, 2021) endorses pedestrian design yet the practice often lags. Affordance Theory helps explain this gap, showing how the environment invites certain behaviours and can either enable or limit safety navigation, particularly for vulnerable users.

Road safety interventions rely on historical KSI data, lagging indicators that offer limited insight into emerging risks or diverse user needs. The Safe System approach, while emphasising system-level factors such as infrastructure, often neglects user behaviour and the real-world complexity of pedestrian experiences. Moreover, qualitative data capturing perceptions, barriers, or lived experience are rarely integrated into safety assessments, resulting in solutions that fail to address everyday pedestrian challenges.

A further concern is the wholesale adoption of models like Vision Zero and Safe System across varying contexts. While effective in countries such as Sweden or the Netherlands, these frameworks are rooted in specific demographic, cultural, and infrastructural conditions. Applying them universally risks overlooking important local and regional differences, stifling innovation and responsiveness.

The framework's 'Safe User' pillar, in particular, places responsibility on individuals to comply with rules, assuming all pedestrians have the capacity to do so. This fails to account for varying cognitive or physical abilities and shifts attention away from the systemic need for inclusive design.

These problems are compounded by a persistent lack of pedestrian-specific data. With insufficient information on non-collision incidents, falls, or near-misses, policymakers cannot fully understand pedestrian risk, undermining both interventions and progress toward road safety-related Sustainable Development Goals (SDGs).

2.7 The Assessment Landscape

To contextualise the methodological choices made in this research, this section evaluates the principal tools and frameworks used in transport safety and pedestrian environment assessment. The aim is to situate the approach taken within the broader landscape of available methods and to explain, with reference to their design and purpose, why each would not have met the aims of this research.

Systems-Level Tools

Systems-thinking approaches shifted road safety analysis away from individual behaviour and engineering solutions towards examining how safety is governed across institutions and where that governance breaks down.

STAMP (Systems-Theoretic Accident Model and Processes), developed by Leveson (2004), conceptualises accidents as arising from inadequate control structures and feedback within complex sociotechnical systems, rather than from single points of failure. Applied to road safety, it is used to map interacting actors across different levels, from national government through to local authorities, and to identify where safety control processes fail or become ineffective.

Staton et al. (2022) applied this approach at city level in Cambridgeshire and examined how formal and informal partnerships between actors shape safety management. A subsequent

study (Staton et al., 2023) used STAMP-CAST to analyse ten fatal collisions and found that approaches focused on individual error can limit learning across the wider system.

STAMP provides a useful lens for understanding how road safety decisions are structured and implemented, and it is relevant to the stakeholder dynamics discussed in Chapter 4. In particular, it helps show how institutional arrangements influence decision-making processes. However, it operates primarily at the level of systems and institutions rather than lived experience. It does not account for what it is like for a pedestrian to navigate a specific environment, which is central to the focus of this research. For this reason, a STAMP-based approach would not have been suited to the research questions pursued here.

Accimap, developed by Rasmussen and Svedung (2000), takes a related approach by tracing multi-level causal factors in specific incidents. Like STAMP, it is useful for understanding systemic failure across different levels of a system. However, its system boundary typically focuses on institutional and organisational actors, which limits the extent to which public actors, including pedestrians, are explicitly represented. As a result, it is less suited to research requiring an understanding of pedestrian experience within the system, and would not have addressed the participatory and experiential questions this research pursued.

Expert-Led Task Analysis

Hierarchical Task Analysis (HTA), developed by Annett and Duncan (1967) and widely used in human factors research, decomposes a complex goal such as crossing a road into a sequence of subtasks, identifying where errors or breakdowns may occur at each stage. The strength of HTA lies in its structured decomposition of complex tasks and its ability to surface points of failure in human-system interaction.

HTA functions primarily as an analyst-centred tool. It represents how a pedestrian should perform a task based on expert analysis, rather than how diverse pedestrians actually experience and navigate real environments. Contextual and experiential factors, for example the confusion caused by ambiguous signage or the anxiety experienced by older adults at poorly marked crossings, are not fully captured within its framework. The research questions pursued here required a method for generating knowledge with pedestrians rather than about them, which pointed toward participatory and observational approaches described in Chapter 3, rather than an analyst-centred framework like HTA.

Assessment Approaches in Practice

A third category of tools is used by practitioners - such as local authorities, transport planners, and road safety auditors - to evaluate the safety and quality of existing pedestrian environments.

Road Safety Audits (RSAs) are a formal UK requirement for new road schemes, conducted by specialist teams to identify potential safety issues before and after construction. RSAs apply established engineering criteria and identify issues assessable against technical standards. However, they are conducted by experts rather than users, focus primarily on collision risk

rather than perceived safety, and are not designed to capture the subjective, embodied experience of diverse pedestrians (CIHT, 2018).

Equality Impact Assessments (EqIAs), required under the Public Sector Equality Duty, are intended to ensure that equality considerations are integrated within policy and project development processes from the outset (Equality and Human Rights Commission, 2020, 2022). In principle, this should support the inclusive design of pedestrian environments for people with protected characteristics. In practice, however, as Chapter 4 of this research found, EqIAs are frequently completed as compliance exercises after key design decisions have already been made, with limited involvement from affected users. This reflects broader concerns in the literature regarding the procedural nature of equality and participation in policy processes (Campbell et al., 2020, Manfredi et al., 2018).

The Healthy Streets Check (TfL, 2017) is a framework promoted across London for evaluating how well streets support health and active travel, including ten indicators such as 'people feel safe.' The framework is widely cited in Mayoral reports and planning documents as evidence of pedestrian-centred design. However, as Chapter 6 discusses, the check is typically scored by professionals without user validation, lacks specificity for pedestrian safety in mixed-use environments, and has no mechanism for capturing non-KSI incidents or the experiences of users with protected characteristics. Informal conversations with urban designers and transport planners during this research confirmed that the tool is often deployed rhetorically - cited in strategy documents but not implemented with the depth of community engagement its indicators imply.

DREAM (Driving Reliability and Error Analysis Method) and Conflict Analysis are observational methods used in traffic research to record vehicle-pedestrian interactions and near-miss events at specific sites. Conflict Analysis involves counting and classifying pedestrian-vehicle conflicts at junctions and crossings, providing quantitative measures of near-miss frequency. Both are established protocols in traffic safety research and represent the closest existing methods to the observational work undertaken in this study.

However, evaluated against the aims of this research, neither method was suited to the approach required. Both rely on categorising events according to predefined schemes developed by researchers, rather than examining how those events are experienced by the pedestrians involved. DREAM in particular requires trained inter-rater coding and systematic post-hoc review, conditions that were not compatible with the real-time, lone-observer fieldwork conducted here. Beyond these practical constraints, the density and simultaneity of near-miss activity at the study sites made discrete event-by-event logging difficult to sustain, a methodological issue discussed in Chapter 3. More fundamentally, neither method was designed to capture the experiential and spatial dimensions of pedestrian safety that this research sought to surface. The approach taken here therefore combined observational fieldwork with participatory methods, including shadowing, surveys, and workshops, enabling

the capture of experiential dimensions of pedestrian safety that event-counting alone cannot reach.

The following table summarises the key tools and frameworks evaluated here, including those applied to pedestrian environments.

Table 2.1 *Existing pedestrian safety assessment tools*

Criteria	EqlA	RSA	Healthy Streets Check	STAMP	HTA	DREAM / Conflict Analysis
Primary Purpose	Legal compliance	Road user safety	Public realm quality	Map institutional control structures	Decompose user tasks to identify error points	Observe and count pedestrian-vehicle conflicts
Conducted By	Policy officers / planners	Independent auditors	Urban designers	Expert analyst / researcher	Expert analyst	Researcher
User Engagement	Indirect (post-design)	None	Minimal	None	None	None
Timing	Mid to late stage	Late (post-design)	Mid-stage	Post-incident or audit	Design or audit phase	Site observation
Lived Experience Representation	Rarely integrated	Absent	Inferred	Absent - institutional focus	Absent - analyst constructs task model	Absent - counts events only
Subjective Safety Consideration	Minimal	Limited	Some	Not applicable	Partial - task errors only	Not captured
Captures Near-misses?	No	No	No	No	No	Yes - as conflicts [see note 1]
Feedback Loop	Weak	Weak	Limited	None - analytical output	None - analytical output	None - data collection only
Output Usefulness	Procedural	Technical	Strategic scoring	Systemic diagnosis (institutional)	Task error identification	Conflict frequency data
Adopted in this study?	No	No	No	No	No	No

Note: EqIA prioritises legal compliance over participatory engagement. RSA and DREAM/Conflict Analysis do not involve pedestrians directly in assessment. Healthy Streets Check uses aspirational indicators without validation against lived experience. STAMP operates at institutional scale only and is applied post-incident rather than as a design tool. HTA constructs task models analytically without user observation. Collectively, these tools reveal a consistent gap: the absence of methods that integrate pedestrian lived experience throughout the design process. This gap structures the methodological approach developed in Chapter 3.

Note 1: "conflicts" in this context means near-miss events as categorised by the DREAM protocol, not near-misses in the broader sense used in this thesis. O

Gap in Existing Methods

What this landscape reveals is a consistent structural gap rather than isolated methodological shortcomings. Systems-level tools such as STAMP and Accimap operate at an institutional scale and do not extend to the level of street experience. HTA describes what pedestrians should do but does not engage with how they experience those tasks in real environments. RSAs and EqIAs focus on compliance and procedural requirements, with limited direct involvement of affected users. The Healthy Streets Check sets out evaluative criteria but its application does not consistently incorporate lived experience. Conflict Analysis and DREAM quantify near-miss events but do not capture how those events are experienced by those involved.

Taken together, these methods do not directly involve diverse pedestrians in participatory, real-world contexts, nor do they consistently capture both what a space affords and what it constrains. They are also typically applied at discrete stages of planning or post hoc, rather than iteratively throughout the design process.

This consistent gap - across both the tools used during this research and those evaluated here - is what the GroundMap Tool, developed through the design practice described in Chapter 4 and presented in full in Chapter 5, is designed to address. The tool is not proposed as a replacement for the methods outlined above, but as a complementary approach that seeks to incorporate pedestrian lived experience into processes that currently underrepresent it.

2.8 Human-Centred Approach

Design thinking offers a different methodological starting point: beginning with user experience rather than technical specification, working iteratively rather than sequentially, and treating collaboration as central to the design process. It enables the identification of latent needs and supports the development of context-sensitive interventions that extend beyond the limits of conventional engineering or policy-led approaches. In this context, design functions as a strategic method for addressing systemic safety issues through a human-centred perspective that incorporates lived experience as a key component.

The Helen Hamlyn Centre for Design at the Royal College of Art (RCA) exemplifies this approach in practice. Focused on inclusive, human-centred design, the Centre develops solutions that enhance quality of life, particularly for those marginalised by age or ability (Strantz, 2022). Its work, alongside interdisciplinary forums such as the Healthy City Design International Congress, demonstrates how stakeholder-driven design processes can align diverse interests to produce holistic strategies for safer public spaces.

The value of this approach in safety contexts is evidenced by the Lloyd's Register Foundation Safety Grand Challenge (2017), which funded interdisciplinary design research at the RCA aimed at improving safety in complex, unpredictable environments including the River Thames and open sea (Hall et al., 2018, 2021; Ferrarello et al., 2019). Through participatory design and

action research, teams of designers, engineers, social scientists, and industry partners addressed deeply embedded safety challenges by surfacing informal practices, lived experiences, and underreported risks through co-design. Key outputs included a Designing for Safety framework, interventions to reduce boarding and navigation risks, and insight into the social dynamics of safety culture and informal workarounds. The lesson for road safety is that design research can bridge the gap between system-level decisions and real-world user experience in ways that compliance-based approaches cannot.

2.9 Wicked Problems

Road safety exemplifies wicked problems as defined by Rittel and Webber (1973). It involves multiple stakeholders with conflicting priorities, resists simple definition, and has no clear endpoint. Unlike ‘tame problems’ addressed by traditional engineering where solutions can be tested and verified, wicked problems are ambiguous, value-laden, and shaped by evolving values and contexts. Each attempt to address them can generate new and unforeseen consequences elsewhere.

Super Wicked Problem

Alford and Head (2017) move beyond the simple wicked/tame dichotomy by examining both the nature of the problem and the roles of stakeholders. Their framework considers technical complexity, problem clarity, distribution of knowledge, conflicting interests, and power dynamics to categorise problem types requiring tailored collaborative strategies (Figure 2.14).

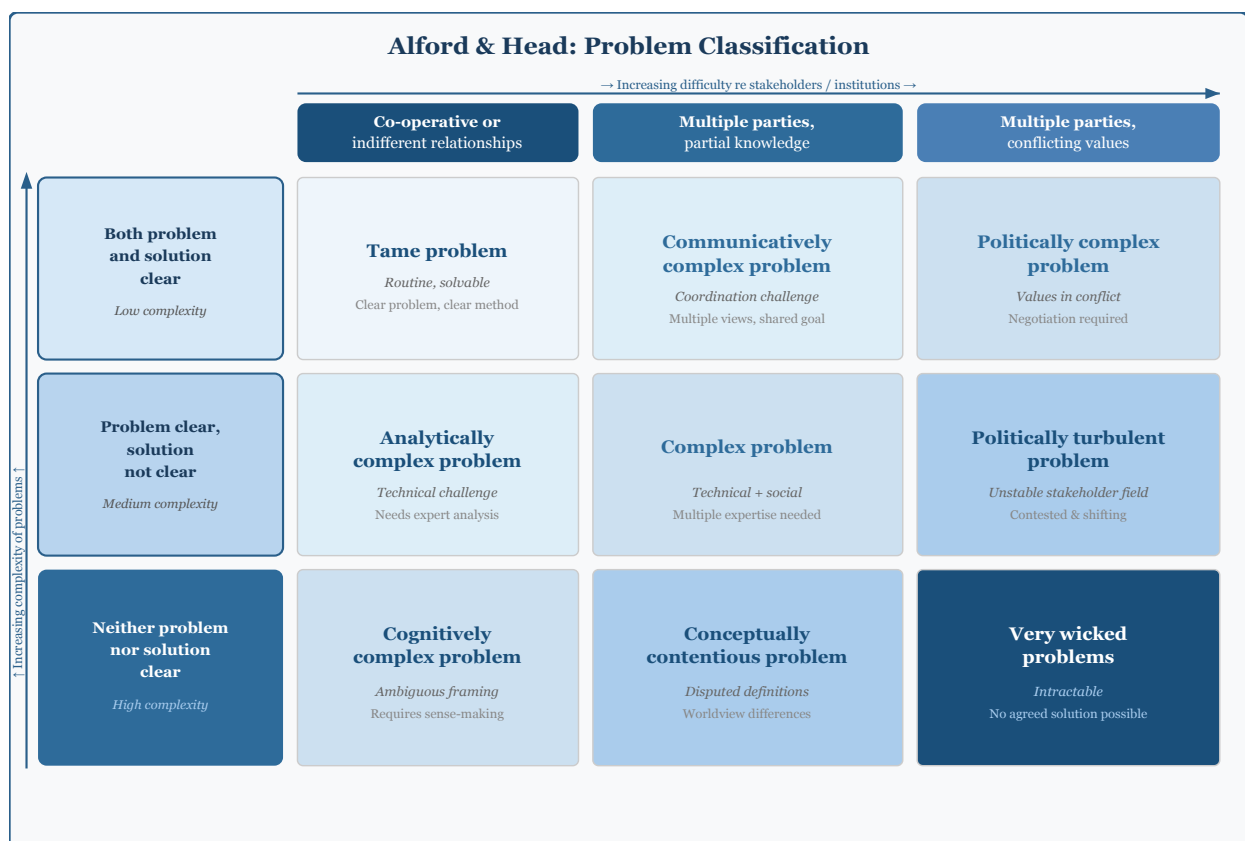


Figure 2.14 Problem Classification

Note. Adapted from Alford and Head (2017)

Applying this framework to pedestrian road safety suggests it can be understood as a super wicked problem characterised by fragmented knowledge, competing institutional priorities, and complex interactions between infrastructure, behaviour, policy, and technology. From this perspective, a human-centred, design-led approach does not seek to reduce complexity to a single technical solution. Instead, it engages with complexity through iterative, adaptive processes that break problems into manageable components while maintaining sensitivity to context. Focusing on pedestrian experience and interactions with the built environment can support collaboration and shared understanding, helping to avoid overly simplified or purely technical responses.

2.10 Design as Reflective Practice

Design-led inquiry is particularly suited to wicked problems, as it does not require a fixed problem definition at the outset and generates understanding through iterative engagement with real-world contexts (Cross, 2006; Schön, 1983). Research through Design (Frayling, 1993) functions both as methodology and epistemology, generating knowledge through dialogue with real-world constraints and stakeholders. The reflexive stance supports engagement with complex pedestrian safety issues by seeking contextual, incremental, and user-informed responses rooted in design's role in framing problems.

Design Expertise and Wicked Problems

Buchanan (1992) argued that wicked problems are fundamentally design problems: indeterminate, value-laden, and resistant to fixed solutions. Designers bring particular strengths to these contexts, including empathy, iteration, and the ability to frame problems rather than simply solve predefined ones (Irwin et al., 2022; Jones, 2014; Junginger, 2017). In road safety, where problems are simultaneously technical, social, and political, these capabilities are not supplementary to expert knowledge but essential for engaging with dimensions that are not fully addressed by quantitative frameworks.

2.11 Bringing Affordance Theory into Practice

The connection between design and Affordance Theory has gained popularity within design disciplines focused on user experience and interaction. Originally introduced by Gibson (1979), affordances describe “what the environment offers the animal, what it provides or furnishes, either for good or ill” (p. 127). Gibson conceptualised affordances as a relationship between an organism and its environment, focusing on how environmental features offer possibilities for action.

Gibson

Gibson argued that affordances arise from the relationship between the perceiver and the environment rather than residing in the environment independently. They emerge through the

interaction between organism, environment, and context, and represent actionable possibilities available to the perceiver, whether or not they are consciously perceived. Importantly, affordances exist independently of perception or use; they are properties of the environment–organism relationship that may or may not be actualised.

Norman

Building on Gibson’s foundation, Norman (1988, 2013) shifted the focus emphasising mental models and perception rather than solely physical action capabilities. Norman distinguished between *affordances* as the action possibilities of an object and *perceived affordances*, which are the cues that indicate how an object should be used. He further introduced the concept of *signifiers*, design elements that communicate where and how action should take place, whether through visual or auditory cues that guide user behaviour. For example, a fire alarm combines visual and auditory signals to prompt a specific response. Norman also discussed *anti-affordances*, design features that prevent or discourage certain actions, such as a pane of glass that allows visibility but restricts physical access. Overall, Norman’s approach emphasises that effective design depends on making action possibilities both perceivable and meaningful, while avoiding ambiguous or misleading cues (see Figure 2.15)

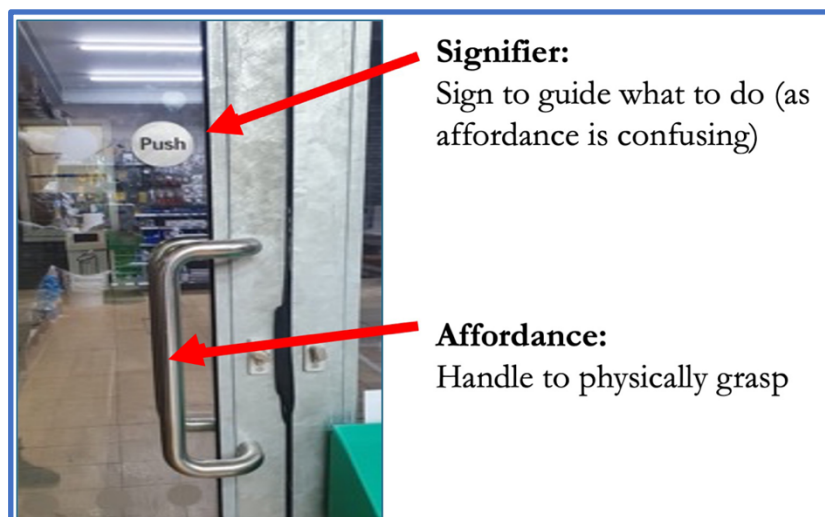


Figure 2.15 Norman: Example of Poor Affordance Design

Gaver

William Gaver (1991) further refined Affordance Theory by emphasising that affordances are inherent properties of the environment, existing independently of perception. He distinguished between physical affordances and the informational cues that accompany them, outlining four types of affordance information (Figure 2.16). The first type is available perceptual information, which includes direct cues that users can easily perceive, for example, a door handle that clearly indicates it should be pulled. The second type is hidden (know-how) information, referring to actions that require prior knowledge, such as turning a key in a lock. The third type, false affordances, involves misleading cues that suggest an impossible action, like a handle that appears to invite pulling when only pushing is possible. Lastly, correct rejection refers to objects

that neither afford nor suggest any action, such as a handle that does not invite either pulling or pushing.

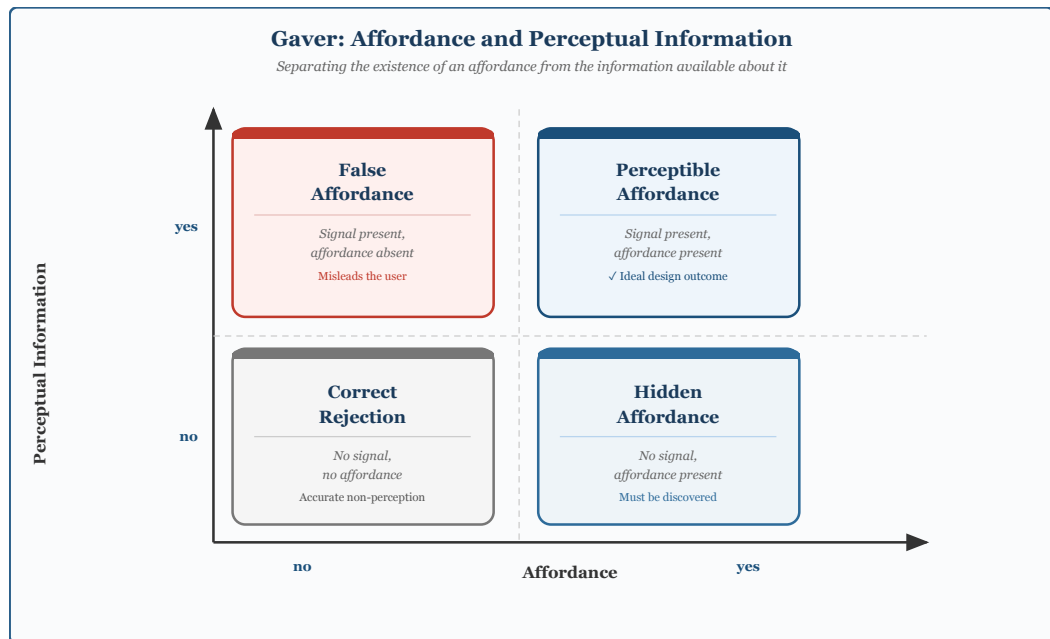


Figure 2.16 Gaver's Four Types of Affordances

Note.Adapted from Gaver (1991)

Both Gaver (1991) and Norman (2013) emphasise the importance of making affordances perceptible for usability, highlighting the designer's role in understanding users' needs and ensuring systems provide clear, perceptible cues.

Burlamaqui and Dong

From a design perspective, Burlamaqui and Dong (2015) extended Gibson's theory by proposing a five-element framework comprising the artefact, the agent, the environment, the agent's perception of affordances, and the potential actions enabled by that perception. This framework is particularly useful for drawing attention to unintended consequences of design: the same environment that affords safe passage for one user may present risk for another, depending on their perception and capabilities.

Applications Across Disciplines

Maier and Fadel (2001) applied affordance theory within engineering design, developing systematic approaches for identifying negative affordances early in the design process. Maier et al. (2009) extended this into architectural theory and practice, arguing that affordances provide a conceptual framework for understanding the relationship between environments and occupants in terms of both form and function. Crucially, they demonstrate that the meaning of any architectural element depends on the individual's past experiences, beliefs, and preferences - not on the designer's intention alone. In architectural practice, they propose that affordance analysis can bridge the gap between design intention and how spaces are actually

used, providing a tool for identifying and avoiding common design failures. More recently, Stevens et al. (2024) examined affordances in public space, highlighting challenges arising from dynamic environments, multifunctionality, cultural diversity, and multi-sensory perception. They propose a framework that categorises affordances as:

Enabling: designer and user intentions align

Constraining: design restricts user action (e.g., sealed-off areas)

Improvised: users create unintended affordances (e.g., locking a bike to a signpost)

Serendipitous: actions not anticipated by designers or users (e.g., sitting on a statue)

Stevens et al. also argue for the use of assemblage thinking and Actor–Network Theory (Latour, 2005) to better understand affordances within complex urban systems (see Figure 2.17).

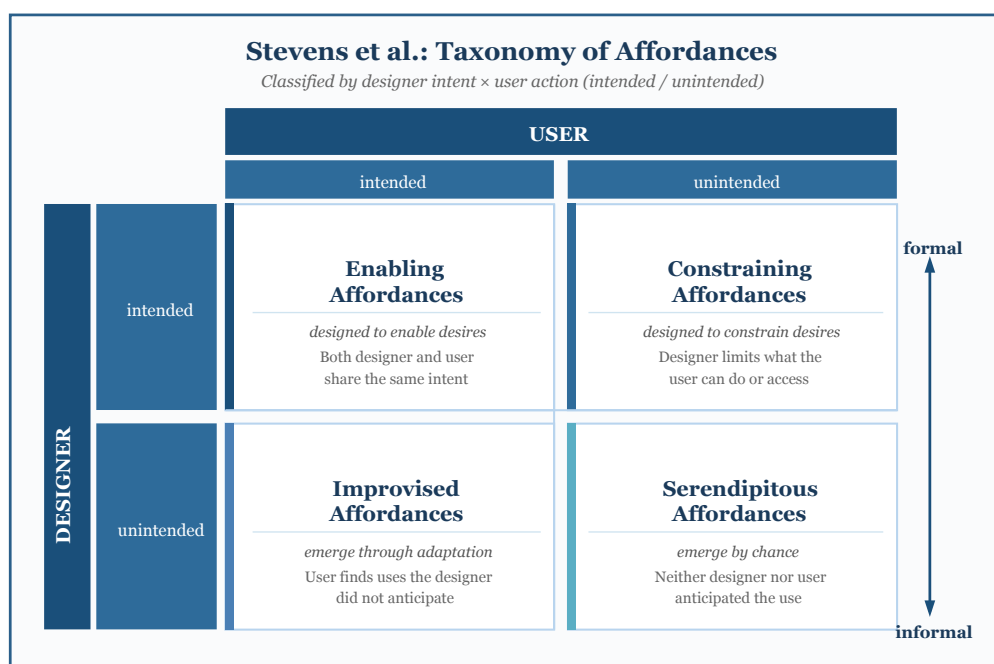


Figure 2.17 Stevens: Classification of Affordances

Note.Adapted from Stevens et al. (2024); building on Gaver (1991)

Taken together, these approaches demonstrate the versatility of Affordance Theory in addressing complex, real-world design challenges. In this research, it is applied to pedestrian safety as both a theoretical lens and an analytical framework, enabling an examination of how diverse users perceive and interact with infrastructure. This shifts the focus from abstract safety standards towards situated, lived experience, treating pedestrian perception as the starting point for design.

Chapter Summary

This chapter reviewed the theoretical foundations underpinning pedestrian safety research. It identified a progression from traditional safety models and accident analysis frameworks towards approaches that conceptualise safety as a systemic and relational phenomenon. While

established models provide valuable analytical structure, they largely operate from a top-down perspective, relying on quantitative data and positioning users as objects of analysis rather than active participants.

In contrast, Affordance Theory offers an alternative lens that frames safety through the relationship between people and their environment. Tracing its development from Gibson through Norman and subsequent design applications, the chapter highlighted its relevance for understanding how safety is experienced and enacted in context.

The chapter also identified a gap between policy frameworks and lived experience, where safety measurement is largely based on collision data and formal reporting systems, leaving limited visibility of near-misses and everyday interactions. Existing assessment approaches were found to vary in scope but generally offer limited direct engagement with diverse pedestrian experience.

Chapter 3 outlines the methodological response to this gap, adopting a qualitative, design-led approach combining Research through Design, Constructivist Grounded Theory, and Affordance Theory.

Chapter 3: Methodology

The literature reviewed in Chapter 2 reveals an ongoing emphasis on quantitative data that, while essential for measuring outcomes, fails to capture how pedestrians perceive safety, interpret environmental cues, or adapt their behaviour in response to risk. This gap has direct implications for design practice and policymaking, which frequently overlook the social, emotional, and environmental dimensions of pedestrian experience. A qualitative, design-led approach addresses this directly to surface contextual and experiential dimensions of safety that quantitative data alone cannot reach (Pink et al., 2017; Aldred, 2012).

3.1 Aims and Objectives

The overarching aim of this research is to develop a deeper, more situated understanding of pedestrian safety challenges in London and to explore how a design-led, qualitative approach can reframe the problem and identify new opportunities for intervention. The specific objectives are to:

- Examine how pedestrian safety is currently defined, framed, and measured, particularly through the dominance of quantitative data, and to critically assess the implications of this framing for design practice and policy;
- Highlight the viewpoints of pedestrians themselves, capturing the social, emotional, and environmental dimensions of how they experience safety and risk;
- Generate a theory grounded in qualitative engagement with participants using Constructivist Grounded Theory methods;
- Produce designs and prototypes that reflect and respond to pedestrian insights, employing Research through Design as both a generative and reflective practice;
- Apply Affordance Theory as an interpretive lens to identify what kinds of safety features and interactions the built environment affords pedestrians.

Participant Group Selection

One methodological decision requiring explanation is the choice to engage with specific pedestrian groups defined by protected characteristics under the Equality Act 2010, rather than recruiting from the general public.

The “general public” is not a neutral category in the context of pedestrian safety. Road safety data, policy frameworks, and design processes often treat pedestrians as a broadly homogeneous group, and it is this assumption that this research seeks to challenge.

Pooley (2020) demonstrates that pedestrians are frequently aggregated into a single category to be designed for, rather than meaningfully differentiated within research and design processes. This can result in the marginalisation of specific needs within aggregated datasets.

Recruiting a general cross-section of pedestrians would risk reproducing this homogenisation within the data itself, privileging majority experiences while potentially obscuring the safety

challenges faced by more vulnerable users. This is the structural issue this research is designed to surface.

The exclusion of different pedestrian experiences from official data and design practice is well documented. Methorst et al. (2016) and Schepers et al. (2017) show that omissions in official reporting distort risk perceptions and systematically impede inclusive safety strategies, making it more difficult for the experiences of vulnerable users to inform design. Imrie (1996) argues more broadly that the built environment is shaped around an assumed able-bodied norm, with disabled and older users routinely marginalised in both planning processes and spatial outcomes, a critique that applies directly to pedestrian infrastructure design. The WHO (2021) and ITF (2012) both identify meaningful engagement with vulnerable pedestrians as important for addressing pedestrian safety, yet this remains limited in standard practice.

Three participant groups were selected: older adults, people with learning disabilities, and participants with protected characteristics engaged through relevant advocacy and professional networks. Each group represents pedestrians whose experiences of the built environment are shaped by design decisions in ways that conventional safety assessments often fail to capture.

Engagement with these groups preceded the broader public survey in Phase 3 for reasons that emerged from the research itself. Major international reports encountered early in the study explicitly identified vulnerable road users - older adults, visually impaired pedestrians, and those with mobility impairments - as groups whose needs should be central to pedestrian safety design. Design guidance and legislation such as the Equality Act 2010 reinforced this in principle. Yet the shared space observations revealed designs that appeared to contradict that stated concern entirely. This raised a fundamental question: were these groups actually being considered in practice, or only on paper? Existing frameworks are stated but rarely enforced, and crucially they do not begin from the pedestrian's perspective - they are constructed around compliance, metrics, and institutional process rather than lived experience. Engaging directly with vulnerable groups allowed that gap to be tested through their own accounts, providing qualitative evidence of the distance between what policy prescribes and what design actually delivers. This is precisely the kind of wicked problem that design thinking and qualitative research are well placed to unearth - where the answer cannot be found in data alone but requires listening directly to the people the system claims to serve, and observing how they navigate and experience the spaces designed around them. Only then was it appropriate to test those emerging findings against a broader range of pedestrian perspectives in Phase 3.

Professional Interviewee Selection

A related methodological decision concerns the selection of professional interviewees. The sample was drawn primarily from within London's institutional road safety landscape, through existing professional networks, and this requires some justification.

The aim of the professional interviews was not to produce a nationally representative survey of road safety governance. It was to understand how safety professionals frame pedestrian risk and what their framing systematically excludes. For that purpose, a sample concentrated within London's institutional context, where TfL's Vision Zero commitments, the Mayor's Transport Strategy, and active engagement with pedestrian advocacy organisations create a well-documented policy environment, is appropriate to the research questions being asked.

The participants recruited represent a range of positions within the road safety system, including local authority safety teams, national policy bodies, academic researchers, road safety charities, and transport planning professionals. This coverage captures the main professional perspectives that shape how pedestrian safety is defined, measured, and acted upon in London.

The geographic concentration in London is a deliberate feature of the research design rather than a limitation of convenience. London was selected as the primary research site because it concentrates governance complexity, a diverse pedestrian population, and explicit institutional safety commitments within a clearly bounded context. The professional participants reflect that institutional landscape. As Yin (2017) notes, stakeholder selection within a defined case study is appropriately evaluated against whether it captures the range of positions relevant to that case, rather than against external representational norms.

Staton et al. (2022), mapping road safety stakeholders in Cambridgeshire using STAMP, identified actors spanning national government, local authorities, emergency services, highway authorities, and community organisations, illustrating the breadth of institutional positions that can shape road safety governance across a defined area. Compared with that landscape, the professional sample here is concentrated within London's transport planning and local authority sphere, with less representation from emergency services and national policy bodies. This reflects both the London focus of the research and the access opportunities that arose through existing professional networks and conference contacts. Flick (2018) argues that purposive sampling in qualitative research is appropriately evaluated against theoretical relevance rather than statistical representativeness. On that basis, the sample captures the institutional actors most directly involved in the design decisions examined, and the geographic and sectoral concentration is acknowledged as a constraint of the research context and addressed in the limitations discussion in Chapter 7.

3.2 Ethical Considerations

Ethical conduct was embedded throughout the research. Participants were informed of the aims and scope of each phase and provided informed consent. Anonymity and confidentiality were upheld, particularly when addressing sensitive issues or lived experiences. Special care was taken when working with vulnerable groups to ensure all activities were inclusive and accessible. The research adhered to the ethical guidelines of the Royal College of Art.

3.3 Research Approach

This chapter is structured around the research questions set out in Chapter 1, which explore how a design-led approach can bridge the gap between KSI data and near-miss experience in pedestrian safety, and what theoretical and methodological frameworks are required to do so.

For this purpose, three complementary approaches are combined, Research through Design (RtD), Constructivist Grounded Theory (CGT), and Affordance Theory, to generate insights that are both theoretically grounded and practically applicable. This triangulated approach not only explores what pedestrian safety problems exist but critically examines how these problems are constructed and how they might be reimaged through design (see Figure 3.1).

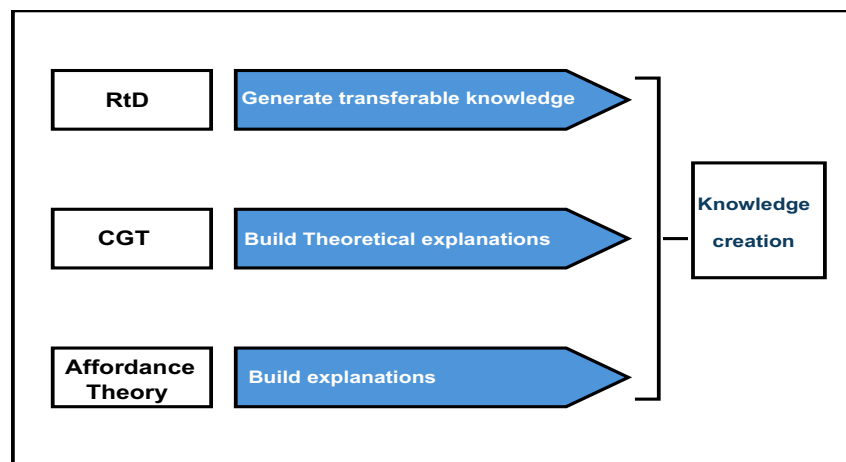


Figure 3.1 *Research methodology overview*

London as Research Site

London was selected as the primary research site for several interconnected reasons. With approximately 10.9 million residents and millions more daily commuters and visitors, the city generates a scale and diversity of pedestrian experience that makes it a rich context for design-led inquiry.

Unlike cities planned around formal spatial frameworks such as New York's grid or Haussmann's Paris, London evolved organically over centuries, its street network shaped by medieval pathways, parish boundaries, Victorian expansion, and successive waves of post-war reconstruction. The result is complex streets designed in unconventional traffic routes, and a built environment that layers historical form with contemporary urban designs. For pedestrians, this means navigating a landscape that is physically unpredictable as well as culturally layered, making London a demanding rather than merely convenient research site.

This is heightened by governance structures: London is administered across 32 boroughs, each with its own planning authority and highways team, resulting in considerable variation in practice. Cycle lane design, pavement treatments, signage, and junction layouts can differ markedly from one borough to the next, even where TfL's overarching policy framework nominally applies. TfL holds responsibility for road safety strategy, infrastructure, and data

collection across the network, providing a defined set of stakeholders, priorities, and data frameworks against which the research findings can be positioned. For pedestrians crossing borough boundaries, this variation produces inconsistent design languages and uneven safety conditions.

London was also chosen for reasons of access and positionality. As set out in Section 1.2, the researcher's background in London transport provided direct familiarity with the institutional landscape examined here. This insider knowledge, acknowledged as a source of potential bias in the positionality statement, also enabled meaningful interpretation of field observations and engagement with practitioners. While London's specific policy context means findings cannot be straightforwardly generalised, the methodological framework is designed to be transferable to other urban environments.

3.4 Research Methods

A range of design research methods was used across different stages of the study (see Figure 3.2), including field observations, semi-structured interviews, surveys, workshops, and prototyping. These were complemented by reflective journals to capture an evolving understanding of the research context, with insights informing both the process and its outcomes.

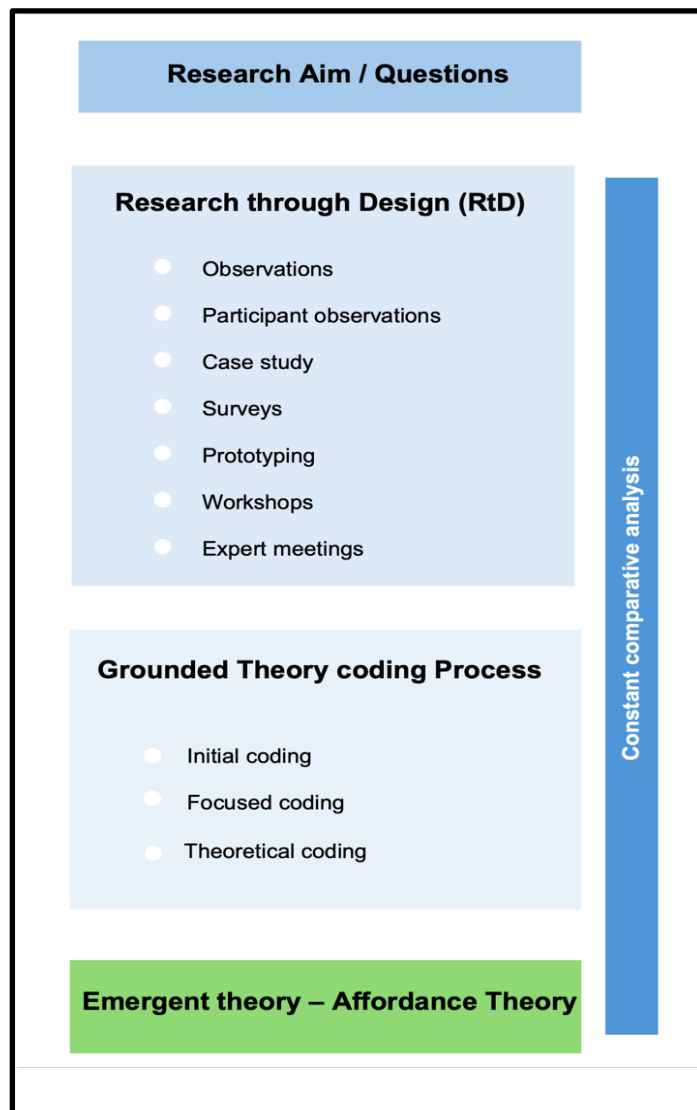


Figure 3.2 *Overall research design methodology*

3.4.1 Defining Near-misses

Near-miss incidents are systematically excluded from official road safety data, a structural gap identified in Chapter 2. This research treats them as primary evidence rather than supplementary anecdote.

For the purposes of this study, a near-miss is defined as any incident in which a pedestrian was exposed to a realistic risk of injury, but where no harm occurred, whether through evasive action, the response of another road user, or chance. This definition is adapted from aviation and healthcare safety literature (IOSH, 2017), where near-misses are treated as leading indicators of systemic risk. It extends beyond the STATS19 collision framework to include pedestrian-cyclist conflicts, trips on uneven surfaces, and risk avoidance behaviours.

Near-miss incidents were identified through two routes: structured observation at each site and participant self-reporting. During observation sessions, incidents were recorded in real time, noting location, timing, and the road users involved. See Appendix R.1 for a journal extract documenting this methodological decision in the field. Participants reported near-misses

through survey responses, verbal accounts during shadowing, and workshop discussions, with all material analysed using the Constructivist Grounded Theory coding process described later in this chapter.

Across all phases, near-misses were recorded qualitatively rather than as discrete counts; the reasons for this are set out in the following section.

An Adaptive Observational Approach

The observational methodology was not fully prescribed in advance. Consistent with the Constructivist Grounded Theory (CGT) approach of this research, the intention was to enter the field without a fixed observational framework, allowing the method to be shaped through engagement with the environment rather than imposed a priori.

Early site visits indicated that formal event-by-event logging was impractical. The pedestrian environments under study, particularly the shared space at Vauxhall Bridge Road, involved conditions that conventional observational protocols are not designed to capture: simultaneous interactions between multiple user groups, risk emerging from ambiguity rather than discrete conflict, and a density of activity that made sequential recording unreliable. As a result, observation shifted toward qualitative recording, focusing on the nature, context, and significance of incidents rather than attempting to enumerate them.

This approach aligns with the epistemological position of CGT. Charmaz (2014) positions the researcher as entering the field with theoretical sensitivity rather than a fixed analytic frame, allowing categories and methods to emerge through engagement with data. The observational strategy adopted here followed this principle, being developed through field engagement rather than pre-specified design.

Logging Near-misses

At the study sites, near-misses were not isolated occurrences that could be neatly separated from routine activity; they were frequent, overlapping, and often simultaneous. For example, a pedestrian crossing at lights while a cyclist threads between pedestrian groups can involve multiple risks that do not resolve into a single, clearly bounded event. Near-misses were therefore recorded qualitatively, focusing on their nature, context, and meaning. The density of near-miss activity is treated as a descriptive feature of the environment rather than a countable variable. Incidents occurred multiple times per session throughout the study period, indicating a persistent and recurring pattern rather than isolated occurrences.

3.5 Approach to Knowledge

Ontology

Ontology concerns the nature of reality and how it is understood to exist. The dominant ontological position in traffic engineering and road safety is positivist ontology, which adopts a narrow view of knowledge production focused on what can be measured and observed, often prioritising casualty and collision data. In this view, reality is treated as external to the

researcher and knowable through objective measurement (Patton, 2017). The aim of positivist approaches is to produce replicable findings while minimising researcher subjectivity (Burawoy, 1998).

In contrast, this research adopts an interpretivist ontological position, which understands reality as socially constructed and meaning dependent. From this perspective, the researcher is not separate from the phenomenon being studied but is instead implicated in the production of knowledge through interpretation of data and engagement with participants (Grix, 2004; Flick, 2004).

Epistemology

Epistemology concerns how knowledge is produced, represented, and understood. This research is grounded in a constructivist and interpretivist epistemology, in which knowledge of pedestrian safety is understood as co-produced through experience, interpretation, and situated engagement rather than derived from an objective system. From this perspective, there are multiple forms of knowledge: safety may be experienced, described, and interpreted differently by pedestrians, policymakers, and designers depending on context.

This position informs the choice of a qualitative, design-led methodology. Knowledge is understood as partial and socially constructed, emerging through interaction between researcher and participants rather than being objectively extracted. Constructivism emphasises meaning making as an active process of interpreting experience within specific contexts (Guba & Lincoln, 1994). Interpretivist approaches similarly prioritise understanding phenomena through the perspectives of participants, rather than imposing external analytical categories (Cohen, Manion & Morrison, 2007).

This epistemological stance aligns with theoretical perspectives that understand knowledge as situated and relational. Latour (2005) conceptualises knowledge as distributed across networks of actors, systems, and materials rather than located in a single source. Ingold (2011) frames spatial understanding through movement and embodied engagement, emphasising “wayfaring” as a mode of knowing the environment. Haraway (1988) further highlights the importance of situated, embodied knowledge, arguing that all knowledge is partial and positioned.

Together, these perspectives support an epistemological position in which pedestrian safety is understood as relational, contextual, and experienced in practice rather than as an objective and fixed condition.

Research Engagement

This research involved active engagement with academic and design research communities, including Living Streets London, Hassell, and the Helen Hamlyn Centre for Design through the Healthy City Design Conference (2022). It also included presentations at the Mobility Metamorphosis Symposium (IMDC, Royal College of Art) in 2022 and the EU Safety Conference in Reykjavik in 2023.

In 2023, the researcher contributed to the advisory group for the project *Streets for Diversity: Exploring how neurodivergent people experience streets* (Gaudion & Phillips) (see Appendix A). Across these engagements, participation in presentations, workshops, and collaborative discussions provided iterative feedback that informed and refined the direction of the research.

Building on the epistemological position outlined above, this research adopts a qualitative, design-led methodological strategy to investigate pedestrian safety.

Three approaches were used in combination: Research through Design, Constructivist Grounded Theory, and Affordance Theory. These were not applied as sequential phases but operated concurrently as mutually informing components of the research process. Research through Design and Constructivist Grounded Theory provided the generative and analytical structure of the inquiry, while Affordance Theory functioned as a conceptual lens, keeping the central question of what the environment affords pedestrians present throughout the research.

Together, these approaches supported the development of a contextual understanding of pedestrian safety from which design implications could be derived. Rather than following a fixed linear process, the research evolved iteratively, with insights from each stage informing subsequent activities. Sub-research questions were developed at the outset of each design activity and refined in response to emerging findings. In this way, knowledge was produced as an outcome of the interaction between methods, participants, and design activity.

Methodological note on data records

Across all phases, observational and participatory sessions were typically two hours in duration, conducted during peak pedestrian hours. Phase 1 observations at Vauxhall Bridge Road took place across 21 sessions between November 2019 and February 2020, during morning and evening commuting periods (7 - 9am, 2.30 - 4.30pm, 5 - 6.45pm), in autumn and winter conditions. Phase 2 group sessions ran from November 2019 to September 2022 (TfL Constructors Group), February to October 2023 (MENCAP), and March 2023 to January 2024 (KOVE). Data were captured through field notes, video, photographs, and GroundMap mapping. Near-miss incidents were recorded qualitatively throughout; the frequency and simultaneity of incidents at the study sites made discrete event counting impractical, as discussed in Section 3.4.1. Full session records - including specific dates, locations, participant numbers, and recording methods - are provided in the appendices. Keeping this detail there rather than in the main text reflects the nature of the research itself: a process that evolved through practice rather than following a predetermined plan.

Observations at Vauxhall Bridge Road took place across autumn and winter months, when reduced daylight, lower ambient temperatures, and wet surfaces are typical. No sessions were abandoned due to weather, and no extreme conditions were recorded in the session log (Appendix E). It is acknowledged, however, that these seasonal conditions may have stifled pedestrian footfall on some days and affected the visibility of ground-level markings and tactile

features, factors treated as a contextual limitation of the observational dataset rather than grounds for excluding sessions.

3.6 Research through Design (RtD)

Research through Design (RtD) generates transferable knowledge through design practice, emphasising creative making as a means of inquiry (Yee, 2017). The approach drew on the foundational work of both Archer (1981) and Frayling (1993), who distinguished between research through, into, and for design, establishing design practice as a legitimate mode of academic inquiry. RtD integrates practice-based research into academic discourse. Bang et al. (2012) describe RtD as “design being done on the basis of design practice”, that is, creating artefacts, processes, or interventions to generate knowledge. A key advantage of RtD lies in its capacity to engage with “messy situations with unclear or conflicting agendas” (Koskinen et al., 2011). Gaver (2012) further highlights its ability to focus on situations selected for theoretical and topical potential.

The philosophical underpinnings of RtD connect closely with Lewin’s assertion that “If you want truly to understand something, try to change it” (Lewin, as cited in Tolman, 1996, p. 31). Simon (1969, p. 111) similarly framed design thinking as a science of “changing existing situations into preferred ones”, emphasising design as both inquiry and intervention.

RtD produces knowledge through iterative engagement with practice, including prototyping and co-design activities that generate interaction-based insights. These interactions provide observable material for reflection and interpretation.

RtD positions design as an active mode of inquiry used in this research to prototype, test, and reflect on pedestrian safety interventions through iterative practice.

Limitations of RtD

The limitations of RtD lie in the difficulty designers may have in articulating tacit knowledge, as they may not be able to fully account for how they know what they know (Pedgley, 2007, p. 466). Schön (1983) describes this as intuitive understanding grounded in action. This can make it challenging to articulate how insights are produced within research contexts. Time constraints may also limit engagement with broader design contexts, potentially affecting the depth of decision-making analysis (Dorst, 2003).

3.7 Constructivist Grounded Theory (CGT)

To complement the interventionist nature of RtD, Constructivist Grounded Theory (CGT), as articulated by Charmaz (2006, 2014), was used. CGT provides a systematic, inductive approach for developing theory grounded in empirical data, particularly suited to complex and context-dependent phenomena such as pedestrian safety.

CGT guided the iterative analysis of interviews, observations, and co-design activities through constant comparison, enabling themes to emerge from lived experience rather than predefined categories. Theory is treated as constructed through engagement with data rather than discovered independently of it (Charmaz, 2014; Glaser & Strauss, 1967; Dey, 2007).

Reflexivity was central to the process. Memo-writing and reflective journaling supported transparency and ongoing critical reflection, enabling continuous interrogation of assumptions and positionality (Charmaz, 2006), (see Figure 3.3).

CGT is particularly useful for generating interpretive, contextually grounded theory rather than statistically generalisable findings (Birks & Mills, 2015). It is therefore well suited to exploratory research where theoretical frameworks are not predetermined.

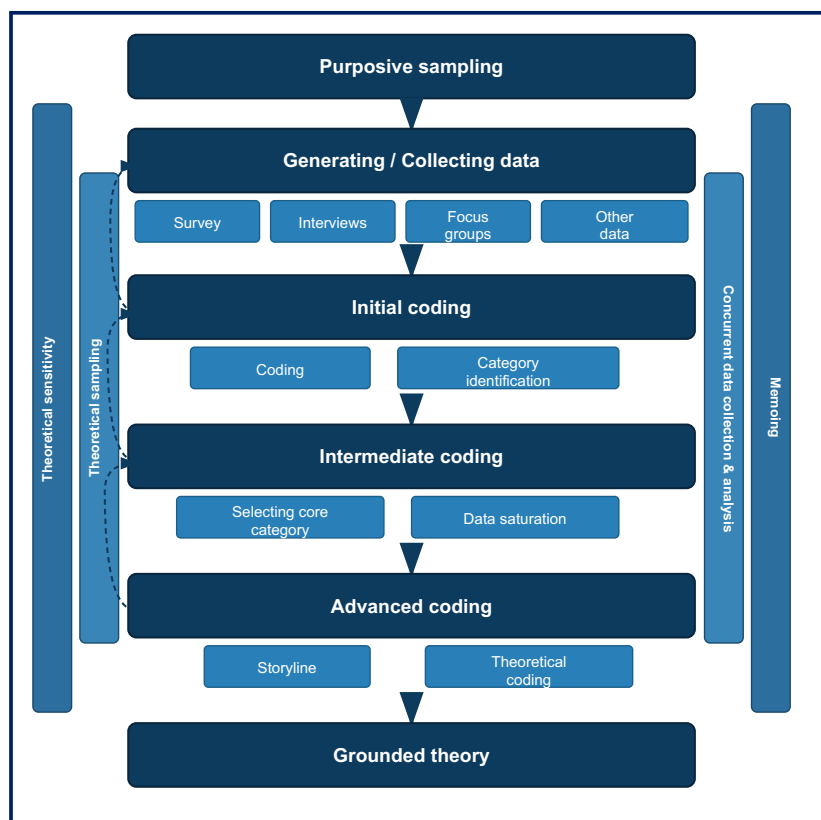


Figure 3.3 *Grounded Theory Process*

Note.Adapted from Charmaz (2014)

Memoing and Reflective Practice

In addition to formal memo-writing within CGT, reflective journaling was combined throughout the research process. Drawing on Schön's theory of reflective practice (1983) and Berger's (2013) emphasis on continuous critical self-evaluation, a dedicated logbook captured evolving interpretations, methodological decisions, and reflexive insights. This practice aligns with Braun and Clarke's (2013) and Charmaz's (2014) recognition of subjectivity as integral to qualitative inquiry and supported the development of contextually grounded theory.

Thematic Analysis

Thematic analysis was used as a practical analytic tool within the Constructivist Grounded Theory (CGT) process, supporting the identification of recurring concepts across interviews, observations, and survey data. Braun and Clarke's (2006) six-step framework provided the initial analytical structure, while constant comparative analysis (Charmaz, 2014) operated throughout, enabling iterative refinement of codes and the development of higher-order themes. It enables the recognition and interpretation of patterns or themes, which can reveal intrinsic meaning and lead to new insights (Boyatzis, 1998; Elliott, 2018; Thomas, 2006; Braun & Clarke, 2006; Liebenberg et al., 2020; Xu & Zammit, 2020). This process is illustrated in Figure 3.4 and detailed in Appendix B.

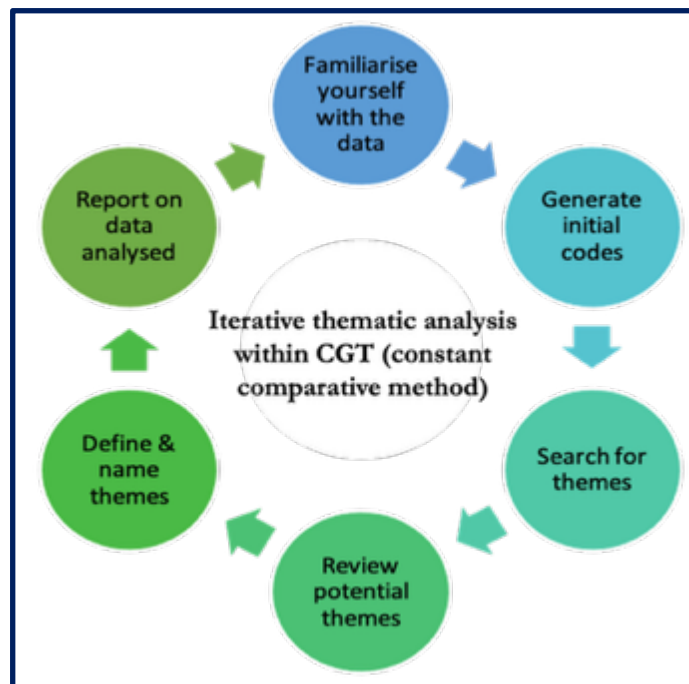


Figure 3.4 *Six-step thematic analysis process within a CGT framework*

Data Analysis Approach

The analysis followed an iterative abductive approach consistent with the constructivist epistemological foundations of the research. Data collection and analysis occurred simultaneously, guided by the constant comparative method (Glaser & Strauss, 1967). Memoing was employed throughout the research process to capture reflections and emerging insights. Theoretical sensitivity shaped the evolving analysis, while theoretical sampling directed data collection based on emerging concepts (Corbin & Strauss, 2015) and to gather additional data that could enrich these categories (Polacsek et al., 2019).

Patterns and insights were developed through cycles of reviewing qualitative data, clustering themes visually through diagrams, engaging in reflective discussions with participants, and refining prototypes in response to feedback.

This generative process supported the exploration of a complex, context-dependent problem through design practice, using design activities as both modes of inquiry and forms of data generation. Together, these approaches supported iterative knowledge construction and the development of abstract interpretations of relationships within the data (Brydges & Batt, 2023; Charmaz, 2014).

Limitations of CGT

CGT's strength in generating theory from lived experience also requires sustained reflexive awareness of researcher influence. The iterative processes of coding, memo-writing, and theoretical sampling are time-intensive and may limit breadth of data collection in practice-based research. These constraints were managed through structured reflexive practice.

3.8 Affordance Theory

Affordance Theory aligns with the constructivist orientation of this research, as both treat meaning as relational and context dependent. Constructivism asserts that meaning is actively constructed through experience and interpretation, while Affordance Theory views affordances not as fixed properties of objects but as relational phenomena shaped by individual intentions, perceptions, skills, and context (Gibson, 1979; Krippendorff, 2006). Constructivism legitimises the subjective and context-dependent interpretations of these affordances, supporting a design research approach that understands safety as co-constructed through embodied and social engagement.

Building on Gibson (1979), affordances were used as a lens to examine relationships between pedestrians and their environments throughout the design practice. By mapping safety-related objects such as signage, Affordance Theory facilitated bridging divergent perspectives between designers and users, revealing how the design of infrastructure either supports or constrains pedestrian safety.

Limitations of Affordance Theory

Affordance Theory's relational nature means findings are context-dependent and not directly generalisable. What an environment affords one user may differ for another. The identification of affordances also involves researcher interpretation, which introduces subjectivity that can only be managed through reflexive practice.

3.9 Methodological Triangulation

The three approaches were used concurrently rather than sequentially, with each informing and refining the others as the research developed. Triangulation, as Denzin (1989) describes, involves deploying multiple methods to examine the same phenomenon, reducing the risk that findings reflect the limitations of any single approach. Patton (2015) extends this, arguing that triangulation strengthens credibility not by seeking identical results across methods but by building a more

complete picture through their combination. Flick (2018) similarly argues it enables a richer understanding than any single method could produce alone.

Each approach generated distinct but complementary forms of knowledge. RtD produced practice-based knowledge through making, prototyping, and iterative design activity. CGT produced interpretive theory through systematic inductive analysis of qualitative data across all three phases. Affordance Theory provided a consistent relational lens for interpreting how interactions between users and environments either support or undermine pedestrian safety (see Figure 3.5).

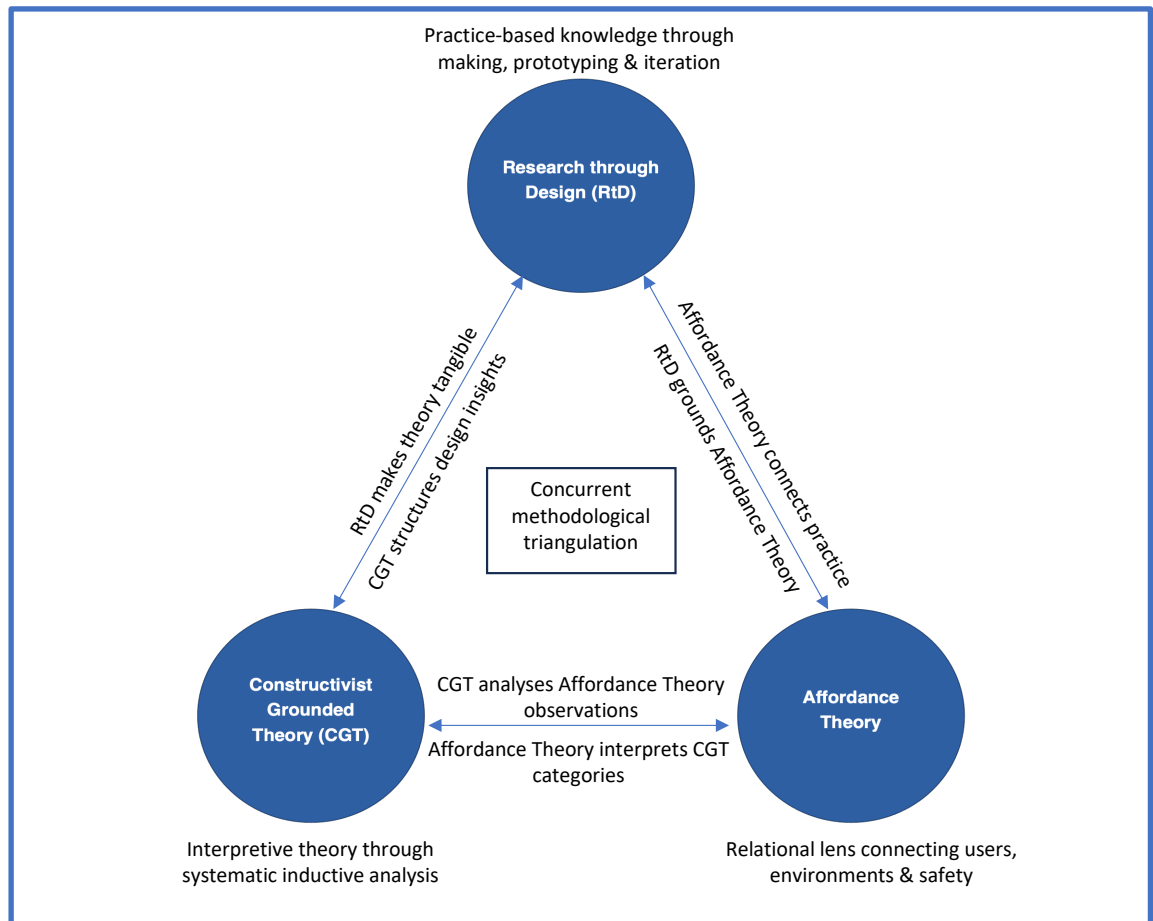


Figure 3.5 *Methodological triangulation framework*

Note: After Denzin (1989), Patton (2015), Flick (2018)

Used together, these approaches address each other's limitations. RtD makes abstract theory tangible through practice; CGT structures and clarifies the insights that practice generates; and Affordance Theory provides the interpretive framework that connects both to the research questions. The convergence of findings across methods - professional interviews, field observations, participatory group work, and survey data - strengthens the credibility of the conclusions without claiming statistical generalisability. All three approaches are grounded in the constructivist and interpretivist epistemological position set out in Section 3.5.

Chapter Summary

This chapter established the methodological foundations of the research: a qualitative, designed inquiry combining Research through Design (RtD), Constructivist Grounded Theory (CGT), and Affordance Theory, within a constructivist and interpretivist epistemological position that treats knowledge as co-produced through situated engagement rather than extracted from an objective system.

London was selected as the research site due to its organic street network, fragmented governance, and borough-level complexity. Key methodological decisions include treating near-miss incidents as primary data – different from the DREAM/Conflict Analysis method, allowing the observational protocol to emerge iteratively through fieldwork, and focusing engagement on pedestrians with protected characteristics as those most exposed to gaps between design intent and lived experience. The three methodological strands were used in triangulation to strengthen credibility and address the limitations of each approach individually.

Chapter 4 documents how this methodology was applied in practice.

Chapter 4: Design Practice

This chapter documents the three phases of design practice through which the research was conducted. Each phase built on the last, combining qualitative engagement, observational fieldwork, and design activity to develop a grounded understanding of how pedestrian safety is experienced and where current approaches fall short.

The study aimed to explore the different perspectives of road safety professionals and pedestrian groups regarding safety design interventions in public space. To uncover these perspectives, qualitative research methods were employed across three primary phases of practice – 4.1, 4.2 and 4.3. The objective throughout was to adopt a design-led approach to identify opportunities for improvement.

4.1 Phase 1: Exploratory Design Inquiry

4.1.1 Professional Interviews

To situate the research within current professional practice, I attended road safety and transport conferences in London. My background in London transport organisations shaped both the access and the interpretive lens I brought to these events. As Mercer (2007) notes, insider positioning enables candid engagement but requires active management of professional familiarity as potential bias.

Key conference materials examined contained reports from international bodies such as the OECD and WHO, notably the *Road Safety for the Decade 2021–2030* strategy (WHO, 2021), which advocate comprehensive safety approaches. Nationally, the DfT's *Gear Change* report (DfT, 2020) and *Moving Britain Ahead* strategy (DfT, 2019) outlined ambitious objectives, including the ambition to eliminate all Killed or Seriously Injured (KSI) casualties.

These goals align with the United Nations' Global Plan for Road Safety (UN, 2011) and the Sustainable Development Goals (UN General Assembly, 2015).

Prominent initiatives discussed included specific safety interventions in London, such as the Mini-Holland schemes to promote segregated cycle infrastructure, and the Shared Space concept, integrating pedestrian and cyclist zones.

Methods

To deepen understanding of how safety professionals approach pedestrian safety design, the research employed a qualitative methodology, utilising semi-structured interviews to capture rich, contextually embedded data (Kvale & Brinkmann, 2015; Charmaz, 2014).

Fifteen participants were purposively sampled, chosen using my existing contacts within the transport industry and contacts developed through conference attendance. This sampling strategy aimed to encompass a broad range of knowledge across diverse roles within the transport and road safety sectors, thereby enabling a comprehensive understanding of the field.

The selection process was informed by established qualitative research practices (Rudestam & Newton, 2015; Patton, 2017). Table 4.1 outlines the inclusion and exclusion criteria applied during participant recruitment.

Table 4.1 *Interview Participant Selection Criteria*

	Criteria used	Rationale
Inclusion	Road safety professionals- London & UK transport industry. From academia London Boroughs – safety teams Members of organisations working with road safety in the UK Safety groups (charities) involved in research and guiding government policy on road safety and design interventions. Charities - vrus	Expertise and operational knowledge in Road Safety. Wealth of research information into cause and effects of accidents. Connections with national and international groups
Exclusion	Police forces, insurance companies, hospitals, court systems. Public Emergency Services Other Vrus; cyclists, motorcyclists, 2 wheel	Different professions, using different reporting systems – complicated data sets. Outside of researchers expertise. Data protection laws = inaccessibility. COVID-19 restrictions – limited contact with the public

Interviewees represented a range of organisations integral to road safety and pedestrian planning, including the Department for Transport (DfT), the Greater London Authority (GLA), various London Boroughs such as Westminster City Council (WCC), the Chartered Institute of Highways and Transportation (CIHT), and Transport for London (TfL). Academics and researchers from associated disciplines such as public health and traffic engineering were also included to provide interdisciplinary perspectives on pedestrian safety (Yin, 1994). This diverse participant pool enabled inquiry into the processes, methods, and tools employed in safety planning and pedestrian design. (see Table 4.2).

Table 4.2 *Overview of interviewees, their roles and experience*

Organisation	Role	Type of experience
Westminster City Council (WCC)	Safety Authority	3 x Safety Officers with multiple years leading safety teams and implementing safety initiatives
(WCC)	Local Councillor	Safety lead for local safety schemes
Lambeth Borough Council	Safety Authority	Two x safety officers with multiple years' experience
TfL	Sponsor	Major projects Sponsor cycling & walking
TfL	Sponsor	Sponsor: Strategic Operations
Urban Design Organisation	Urban Designer,	local government schemes
Westminster City Council	Lead master planner	Master planner & Urban Designer for TfL safety initiatives
DfT	Head of Traffic Signs & Street Design Policy	Multiple years leadership experience - DfT Traffic and Technology Division
UK Academic	Professor of Sociology	Expertise in Sociology of public health. Recent research: mobility, transport systems & health. Expertise related to UN Sustainable Development Goals
Transport Research	Chief Scientist	Consulting - government, industry & research institutions : transport & mobility.
ROSPA	Road Safety Researcher	Experienced Research and Evaluation Officer: road safety policy team.
RAC Foundation	Head of Research	Lead author for road safety research reports and UK Road Safety schemes.
Living Streets	Chairperson	Chair of charity for road safety initiatives

The participant sample skewed toward mid-career and senior professionals, and was predominantly male, reflecting the demographics of the sector rather than a deliberate sampling decision. The goal was to understand the underlying dynamics of professional practice in this complex field. However, a limitation of the professional interview sample is that participants were recruited through existing networks and professional contacts, making the sample convenient rather than systematically representative of road safety stakeholders more broadly. The participant sample in this research skewed towards local authority and transport planning professionals, with limited representation from emergency services or national policy bodies. The sample was also geographically concentrated in London, which has a distinct institutional context, including TfL's remit and Mayoral transport strategy, that may not reflect road safety governance structures elsewhere in the UK.

An overview of interview participants including organisation, their role and experience is provided in Appendix C.

Interviews were guided by sensitizing concepts adapted from Blumer (1969), focusing on three primary thematic areas:

- Safety
- Vulnerable road users, with particular attention to pedestrians
- Design

These concepts provided flexible interpretive frameworks to identify emergent patterns and refine subsequent lines of inquiry (Creswell, 2013).

Interviews were conducted between January and March 2020. To support consistency across interviews while accommodating participant-led elaboration, a questionnaire template was developed to serve as an interview guide (see Appendix D). This phase did not use a standardised data collection template, consistent with the Constructivist Grounded Theory approach adopted. The analytical process through which themes were extracted is described in the next section.

Analysis of Interviews

Initial Coding showed a recurrent theme where respondents discussed the aim of “meeting targets”. These targets varied depending on organisational and governmental objectives which were often overlapping and influenced participants’ conceptualisation of ‘safety’. For instance, “improving safety” was commonly equated with reducing KSI casualty numbers.

In vivo codes, terms used verbatim by participants reflecting insider perspectives, were incorporated into the analysis. For example, ‘AccStats’ referred to the widely recognised DfT STATS19 accident statistical datasets. (see Table 4.3)

Table 4.3 *Codes extracted from line-by-line analysis*

Interviews	Interviews (in vivo)	Initial Codes
WCC team (3 people)	WCC have highest KSIs, influenced by: population expands daily due to commuter numbers.	DATA = ksi statistics
	Vision Zero goals adopted. Producing road danger reduction strategy	Producing road danger reduction strategy to meet VZ. Targets = ksi statistics
	Safety metrics – ACCSTATS police STATS19 database.	Stats 19 – is the key definition. SAFETY = METRICS
Urban Designer	conflict of who to design for as diff disabled have diff requirements. Can technically model for pedestrians but cannot predict behaviours. Pedestrian microsimulation: for every person takes 3-6 months to develop and costly.	Conflict in design requirements. No universal standard to suit all. Design: no standard

Refining Codes into Themes

Data collection and analysis were conducted concurrently throughout the research process, employing an iterative review of the data to derive codes and identify categories until theoretical saturation was achieved. This approach ensured that recurring patterns within the data were detected and analysed (Glaser, 2001). Table 4.4 illustrates the progression from initial codes to focused codes and primary themes.

Table 4.4 *Progression to primary themes*

Initial Codes	Focused Codes	Primary Themes
Impacts on KSIs	Meeting Mayoral targets. Political challenges Design decisions Meeting targets and goals for internal & external groups.	Targets/Goals

Primary Themes and Theory Creation

The development of the final theoretical explanation involved identifying and refining themes that structured the study's findings. Thematic analysis played a central role in shaping a clear theoretical framework within design practice. This process began with an initial stage focused

on theme identification, with theory emerging progressively throughout the research rather than being predetermined. Systematic comparison of themes allowed identification of similarities and contrasts, culminating in a set of final themes (Braun & Clarke, 2006). Table 4.5 summarises the refinement from primary to final themes.

Table 4.5 *Final themes from interviews*

Primary Themes	Final Themes
Terminology	Definitions
Targets/Goals	Targets/Goals
'Safety'	Safety
Safety interventions	Design
Stakeholders: Politics	Stakeholders
Vulnerable users	Pedestrians

Key Themes from Interviews

The main findings from the interviews are presented as themes below, reflecting insights into how safety professionals understand and approach pedestrian safety.

Safety

Safety was variously defined among participants. The predominant definition described was KSI data statistics. One participant observed that there is “no singular definition” of safety, while another described it as “surrogate safety,” noting that safety is often only quantified retrospectively after crashes occur. One person commented that “perception of safety is not about engineering, it’s about education” and also believed this was a “transfer of risk onto the pedestrian”.

Criticism was raised regarding the limited adoption of comprehensive Safe Systems approaches by agencies such as Highways England, where traffic engineers reportedly dominated safety design processes.

Targets and Goals

The interviews highlighted the importance of meeting targets such as VZ goals to reduce KSI numbers to meet national and local goals set by the DfT and TfL as well as meeting SDG goals. Participant A said that: “Vision Zero goals were adopted, and team are producing a road danger reduction strategy to meet these goals”. Much of their practice was focused on reducing KSI’s such as participant B who stated, “Accident statistics are used as a measure for 'perception of safety' and that ‘STATS19’ is a baseline for checking street safety”, with participant C saying: “Meeting Mayoral targets was a key objective”

Multiple and Competing Stakeholders

The role of stakeholders became a prominent theme, one participant says of stakeholders “it’s largely a political thing what strategy the boroughs adopt”. Influential stakeholders played a role according to one participant where “political landscapes are driven by KSI figures”. Another explained: “high-network individuals who are quite politically powerful have a say in the road layout and initiatives, like the previous Cycling Commissioner”. Another participant mentioned the role of London Cycling Committee and Sustrans as a “strong lobbying group” and “critical friend” with “a strong voice” in how policies were developed, initiated and put into practice. As a “political driver” of strategies, one participant made a comment about the need to “lobby TfL” to get designs through the design process.

Design

The term “design” brought up a variety of interpretations among the participants, with urban design and traffic engineering design being the main ones depending on the discipline of the participant. One participant said there was “no standardisation of design”. Implementation of design had varying interpretations, one participant explained: “designs were implemented to facilitate traffic flow not people”. Another said: “Design decisions were influenced by lobbyists and politician’s stakeholder groups, NOT based on what people want or would make it safer”. The Vision Zero initiative was widely recognised as a key influence on design interventions.

Designing for Pedestrians

The interviews revealed a consistent pattern: pedestrians are treated as additional to the design process. One participant described trying to “undo 50 years of car-centric planning”; another noted that their organisation “only started modelling for pedestrians in the last 5 years.” Disabled pedestrians fared worst. Participants acknowledged that inclusive design rarely went beyond minimum compliance: “disabled groups are not catered for” and “there’s a lack of research on pedestrians” were recurring observations. One safety team admitted they “don’t know how to communicate with pedestrians”, acknowledging a gap in engagement they had not yet addressed.

These findings reflect what the literature review identified as a structural problem. As highlighted in the literature review (Chapter 2), authoritative bodies like the WHO and UN advocate for road safety systems such as the Safe System approach that explicitly incorporate pedestrian needs within their frameworks. However, even within the Safe System’s five pillars, the Safe User pillar places responsibility on pedestrians to follow rules regardless of their capacity to do so, shifting accountability from design onto individual behaviour. The interviews confirmed this pattern in practice: pedestrian safety tends to be subordinated to cyclist safety targets, partly because pedestrians lack the institutional representation that cycling advocacy groups have developed.

Building on this, the findings shed light on important themes regarding how safety interventions are prioritised in road design. There is a tendency to overlook pedestrian safety in favour of meeting specific targets, which shapes how safety is defined and designed. Political pressures

and stakeholder interests frequently influence these priorities, often resulting in greater emphasis on cyclist safety because addressing pedestrian needs comprehensively is more complex and costly.

Pooley (2020) argues that pedestrians are treated as a homogeneous group in policy, designed for rather than engaged with, effectively rendering them voiceless in the design process. The interviews confirmed this directly: professionals acknowledged they did not know how to communicate with pedestrians, let alone involve them in design. Wegman & Schepers (2023) add that even within this already marginalised group, the needs of older adults, disabled people, and children differ noticeably and require tailored approaches that current frameworks do not provide.

4.1.2 Shared Space Observations

Since 2001, every London Mayor has worked to lower the number of road collisions whilst at the same time developing sustainable transport policies to address environmental challenges by reducing vehicle traffic. Mayor Khan has emphasised that the establishment of Low Traffic Neighbourhoods, and the implementation of School Streets (TfL, 2021) have contributed to increased safety and the achievement of VZ objectives as outlined in DfT annual reports. Simultaneously, the goal has been to encourage walking and cycling among citizens to improve their health that aligns with the strategy. A proposed design concept to use as a safety intervention is Shared Space, which is derived from Monderman's Shared Space framework (Monderman et al., 2006); outlined in the Literature Review in Chapter 2, the adaptation employed within the UK differs in that the space shared is jointly used by cyclists and pedestrians, excluding motor vehicles, unlike Monderman's initial conception.

This concept, in which cyclists and pedestrians share what was previously a pedestrian-only area was promoted as a solution to improving safety and encouraging cycling. This concept was deliberately chosen in the research to investigate how this safety measure is practically implemented, what the effects of the design are on pedestrians, and to identify potential opportunities for enhancing pedestrian safety. The observation study at a London site was observed through the lens of Affordance Theory in a practical way to map the relationship between a pedestrian and their environment by mapping safety artefacts designed to provide safety at the site and ask the question: What safety is afforded the pedestrian?

Study Location

This location of the main study site is in the Borough of Westminster on Vauxhall Bridge Road/Pimlico which is an area in Westminster where the population swells by 2 million people daily due to commuter and visitor traffic which has a clear impact on the use of public space and amount of commuter traffic (WCC team member, personal communication, 2020). This site was selected for observation due to its redesign into a shared space area for both pedestrians and cyclists in 2015. This was part of a Mayoral initiative known as 'Cycle Superhighway 5' (CS5), which was a part of the broader Cycle Superhighway program (Figure 4.1). It featured

infrastructure changes that included new segregated cycle tracks, priority for cyclists and junction realignments to provide more space for cyclists. Its stated aim was to encourage more people to cycle and to make cycling safer (Greater London Authority, 2013).

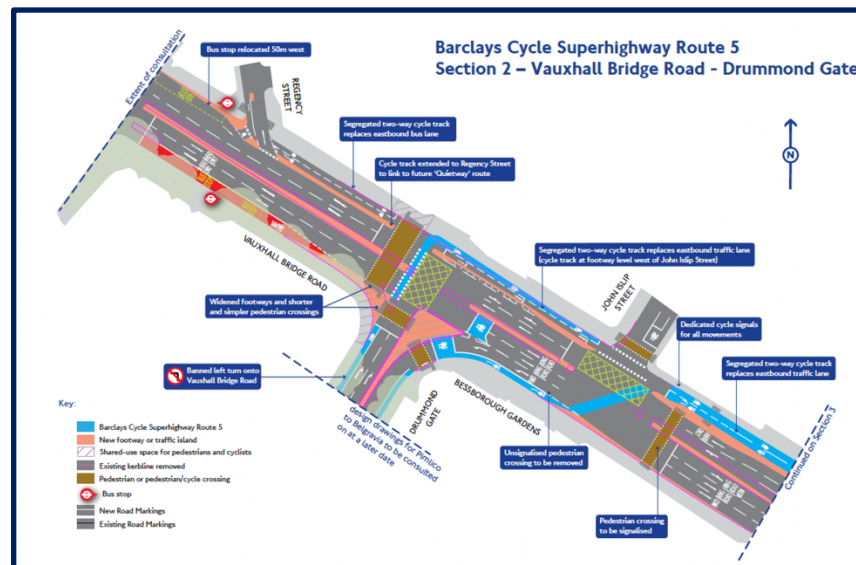


Figure 4.1 TfL cycle superhighway 5 - Shared Space drawing

Note. From TfL (2015)

The original proposals outlined the design intent for cyclist safety to be prioritised (Transport for London, 2015). The benefits of the scheme would provide:

- safer and more direct journeys for cyclists
- reduce KSI and casualty numbers.
- improve safety (and perception of safety) to attract more potential cyclists by improving design standards.
- increase cyclist numbers, reduce car use.

The key success indicator of the scheme would be reflected primarily by a reduction of cyclist KSI casualties. The assumed benefits listed for pedestrians would be improved 'pedestrian facilities and urban realm'.

Observation Approach

The inquiry aimed to determine how the space was used and as described by Stokes and Wall (2017), this method was the most practical way to investigate this phenomenon and offer contextual insights into a real-world scenario (Patton, 2017). It is also consistent with the Grounded Theory approach, which builds data from the ground up to illustrate the research problem landscape (Walliman, 2021). Drawings, videos, and photos were made to create 'plausible narrative' (Charmaz 2014) and to collect information that illustrated the scenario's complexities (Yin, 2017; Gaver & Bowers, 2012).

At the outset of the research, a cross-sectional study was planned for observations to take place over a period of 6 months (November 2019 - May 2020) followed up by surveys conducted with pedestrians over the following 6 months (June 2020 - November 2020) however

the plan changed to a longitudinal study due to the COVID-19 pandemic and had to be postponed until 2024 when a pattern of commuters using the space resumed.

Observations Points and Schedule

The main observation point (A) was outside the White Swan public house, facing the pedestrian crossing. Additional observations were conducted at Regency Street (B), Causton Street (C), John Islip (D) and Drummond Gate (E). Observations took place between November 2019 and February 2020 during peak commuting hours (see Figure 4.2). Full session details, including dates, times, and recording method, are provided in Appendix E.

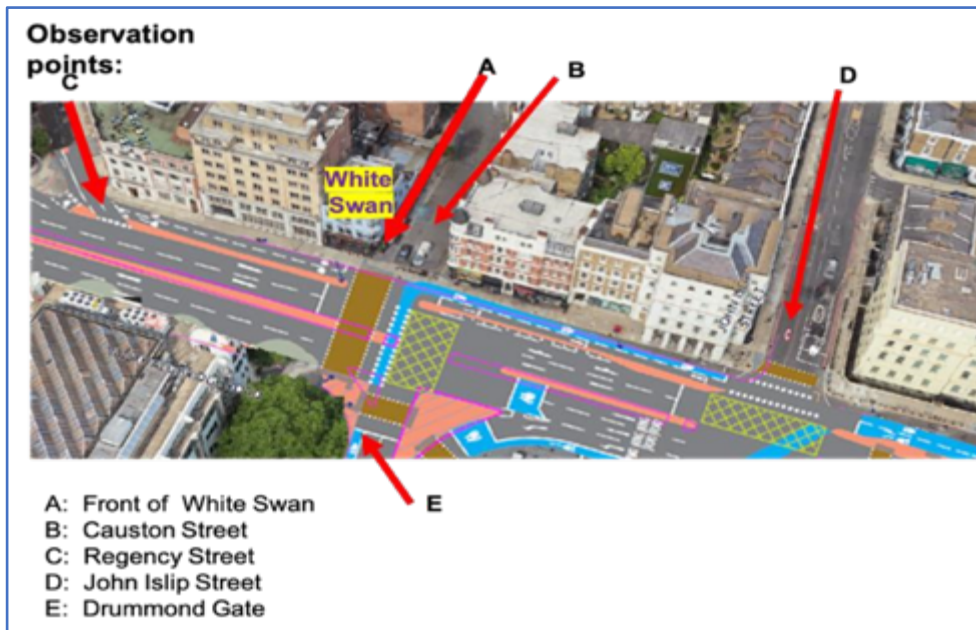


Figure 4.2 *Observation Map overlay*

Observation Findings

Near-misses

A repeated pattern emerged at point A. Pedestrians regularly stopped and waited for cyclists to pass before crossing to the pedestrian facility, a behaviour indicating that the design of the space created uncertainty about priority (Figures 4.3, 4.4, 4.5). The pattern recurred at Regency Street (C) where the cycle lane ends. At the John Islip Street junction (D), the absence of a pedestrian crossing facility forced pedestrians to negotiate a busy intersection without a designated safe passage.



Figure 4.3 Near-miss at pedestrian crossing point (A)



Figure 4.4 Near-miss at Regency Street (C)



Figure 4.5 Near-miss at John Islip Street (D)

Conflicts

At the intersection of the cycle path and pedestrian crossing at point A, conflict between the two groups was frequent. Pedestrians, often unaware of the cycle path, approached the crossing expecting priority at the lights, while cyclists behaved as though they had right of way and rarely slowed or stopped. The result was a contested space, characterised by frequent verbal exchanges between users.

Communication

Signage at the crossing points failed to communicate clear instructions to either group. Cyclists were advised to slow but were given no indication that pedestrians might enter their path from the side road (Figure 4.6). Pedestrians approaching the crossing were not alerted that they were about to cross a cycle path or warned of potential conflict (Figure 4.7). While signage denoting shared space was present, it did not clarify priority, reducing its effectiveness as a safety communication tool. (Figure 4.8).



Figure 4.6 *Inadequate signage at shared space entry point - cyclists*



Figure 4.7 *Inadequate signage at shared space entry point - pedestrians*



Figure 4.8 *Shared Space sign: safety affordance assessment*

Dangers

Vehicles were observed blocking pedestrian movement at the Vauxhall Bridge Road crossing, forcing pedestrians to walk around stationary cars and exposing them to risk should a vehicle moved suddenly. In addition, there was often insufficient space to cross safely, particularly for those using wheelchairs or prams, or travelling with children or others. (Figure 4.9)

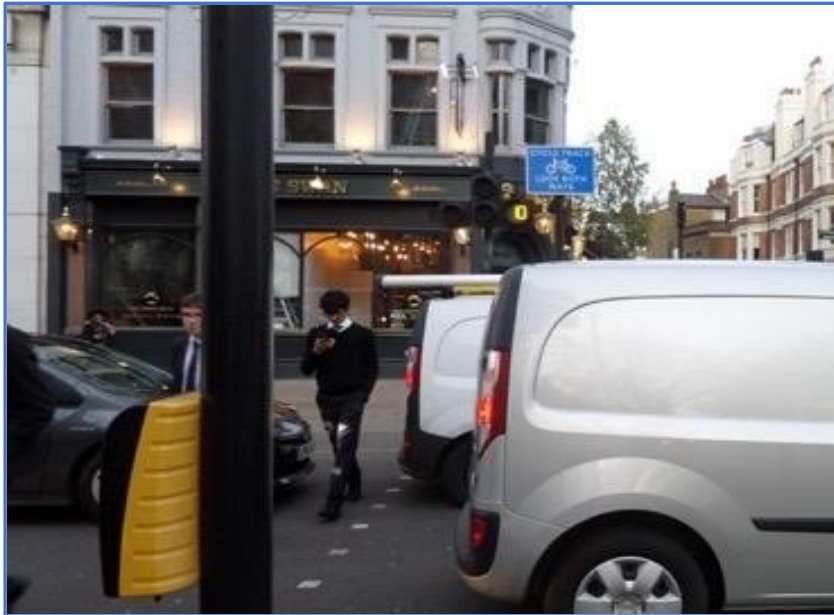


Figure 4.9 *Pedestrian crossing blocked*
Infrastructure

Although cyclist safety was given priority in the redesign, several risks emerged. At Regency Street (Location C), the cycle path ended unexpectedly at a one-way side street, leaving cyclists facing oncoming vehicle traffic (Figure 4.10) and exposing them to danger. What had previously been a pedestrian zone now included a cycle path, requiring pedestrians to understand and cross a new layout without clear guidance – mirroring the risks the design had inadvertently created for cyclists.

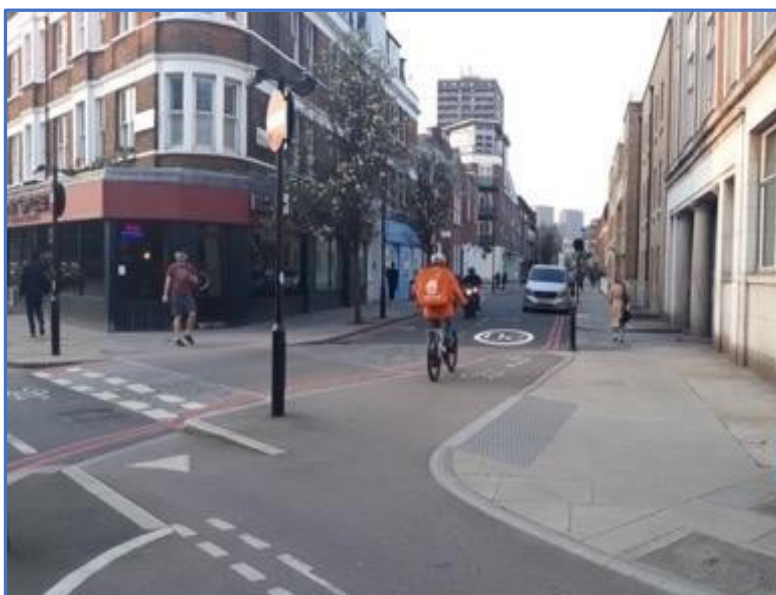


Figure 4.10 *Danger created for cyclists (C)*

4.1.3 Initial GroundMap Development

First Iteration: Affordance Mapping

Existing evaluation tools such as the TfL Pedestrian Comfort Guidance (2010a) provided spatial guidelines for designers but little insight into how pedestrians actually interact with their environment. Field observations revealed a consistent pattern where infrastructure changes made for safety purposes routinely overlooked or removed established safety features pedestrians depended on for navigation.

In response, a method informed by Gibson's Affordance Theory (1979) was developed to record and assess how design features afford pedestrian safety at this site. The original plan was to compare site features against TfL spatial guidelines, but many elements did not comply with guidance, or the guidance itself was non-binding. A more grounded approach was needed: one that evaluated the environment from a pedestrian perspective rather than against a compliance checklist.

This led to the first version of the GroundMap affordance mapping tool, built around three elements: the actor (the pedestrian), the object (signage, tactiles), and the environment (location and site context) see Table 4.6. The method documents not just what is physically present, but what it affords in terms of pedestrian safety, capturing the relationship between a person and the environment in which that object is encountered.

Table 4.6 *Affordance map*

Actor	Environment	Object
Human	Location/site	Artifact

Each element shapes how the pedestrian interprets and responds to the environment. The shared space sign between the cycle path and pedestrian crossing illustrates this (Figure 4.11). At over 12 feet tall, it sits outside a pedestrian's natural eye level. Its blue background, conventionally associated with guidance or mandatory instructions for drivers and cyclists, does not function as a warning and fails to communicate a clear behavioural cue to provide safety. In line with Norman's (2013) principle of effective signifiers, the sign offers no clear action pathway.

In consultation with Margaret Calvert, co-designer of many UK road signs since 1965 including the Children Crossing pictogram, I learned that increasing visual signage can inadvertently raise distraction and reduce safety (M. Calvert, personal communication, October 2022). This challenged my initial assumption that more signs would improve safety and whether they were being used as signifiers of safety.



Figure 4.11 *Shared Space sign; affording safety?*

The Ground Inventory: Second Iteration

As part of developing GroundMap, a comprehensive site inventory was conducted during early fieldwork (Appendix E), documenting street objects through photographs, measuring their physical dimensions and proximity to other features, and categorising them by purpose: guidance, warning, or boundary. The aim was to understand what safety each object afforded pedestrians and why it had been placed where it was (Figure 4.12). The inventory was then overlaid onto a Google Map of the area, linking physical design elements to specific site locations and making spatial relationships visible (Figure 4.13).

Icon	Description	Purpose
	Black Bollard	?
	Drain/manhole cover/ gas/ water point	Utility companies
	Lamppost	DfT, Highways - legal
	Sign	TfL - ??

Figure 4.12 *Objects inventory*



Figure 4.13 *Objects inventory map overlay*

Using the inventory, the tool was refined to explicitly evaluate whether each object afforded pedestrian safety, adding two columns to the map format: one for purpose, one for safety affordances for pedestrians (Table 4.7). This process exposed unintended design consequences that would otherwise have remained invisible, for example, inconsistent tactile placement, signage above pedestrian eye level, and discrepancies between design intention and pedestrian experience.

Table 4.7 *GroundMap*

Actor	Environment/ Site	Object	Purpose	Safety Affordances (for pedestrians)
Pedestrian	Shared Space	Cycle Path	Cyclist safety Protect cyclists KSI focus	No. Does not offer specific safety for pedestrians.
		Shared space: Sign	Guidance: legal requirements	No
		Tactiles	Guidance for visually impaired	Yes
		Lines/text	Traffic guidance for cyclists	No

Google Maps historical imagery was used to reveal how several safety affordances had been removed during the redesign: painted ground markings including 'Look Left' text (Figure 4.14), separated pedestrian zones were now replaced by shared zones (Figure 4.15), and yellow hatch boxes at crossing points that had previously provided a protective space were absent in the redesign (Figure 4.16). These changes removed safety cues that had enabled pedestrians, particularly vulnerable users, to interpret and navigate the space.



Figure 4.14 *Removal of safety affordance - 'Look Left' text*

Note.: from Google Maps



Figure 4.15 *Removal of safety affordance - separated pedestrian zone*

Note. from Google Maps



Figure 4.16 *Removal of safety affordance – dedicated yellow hatch box*

Note.: from Google Maps

GroundMap as a Diagnostic Tool

GroundMap enabled analysis not just of how spaces are designed but of how they function for pedestrians in practice. By combining a conceptual model of actor, object, and environment with grounded observational data and affordance evaluation, the tool shifts focus from regulatory compliance to how an environment communicates its intentions. Applied here, it identified overlooked design flaws, particularly the removal of safety affordances and their consequences for pedestrian navigation, that standard audits had not captured.

Inclusive Design Guidance

The redesigned space complied with formal engineering standards but lacked grounding in user experience. The Chartered Institution of Highways and Transportation (CIHT, 2018) and the Disabled Persons Transport Advisory Committee (DPTAC, 2018) both highlighted the risks that shared spaces pose to vulnerable pedestrians, concerns that ultimately led to a suspension of new shared space schemes in London. Similar approaches continue to be implemented elsewhere in the UK. For example, the London Road improvement scheme in Brighton includes new cycling infrastructure incorporating shared space between pedestrians and cyclists (Brighton & Hove City Council, 2024), a design approach discussed later.

Affordance Mapping in Practice

Affordance mapping provided a practical, site-specific means of identifying how environmental changes affect pedestrian experience. The removal of 'Look Left', for instance, eliminated a safety cue that pedestrians, particularly tourists unfamiliar with UK traffic direction, had relied on. As Norman (2013) argues, designers are responsible for ensuring safety cues are perceivable and actionable. Affordance mapping assessed whether that responsibility had been met.

Phase 1 Observations: Key Findings

My background in engineering and prior experience with TfL shaped both the approach to the interviews and their interpretation, helping establish rapport with participants and providing insight into the professional and political dynamics influencing design decisions.

Suspecting the influence of vested interests, I conducted a Situational Analysis (Clarke, 2005) using Grounded Theory's Social Worlds/Arenas framework (see Appendix F), producing situational, social worlds and positional maps to understand the broader context shaping design decisions. This analysis revealed marked stakeholder imbalance: cycling advocacy groups held considerable influence during TfL consultations, while disability organisations, despite articulating serious safety concerns, had comparatively limited impact.

The observations supported the interview findings: at the shared space site, the redesign had not undergone adequate safety evaluation from a pedestrian perspective. Design decisions appeared to be shaped more by cycling advocacy than by inclusive design principles or the requirements set out in the Equality Act 2010. This power dynamic helps explain the final design outcome and highlights the competing priorities shaping safety decisions.

Phase 1 Synthesis

Phase 1 revealed a clear disconnect between how safety is conceptualised within professional practice and how it operates in the built environment.

Interview findings showed that safety is predominantly understood through quantitative metrics, particularly KSI statistics, and shaped by institutional targets such as Vision Zero. Design decisions were influenced by political priorities, stakeholder dynamics, and established engineering frameworks, with limited emphasis on pedestrian experience. Pedestrians were consistently positioned as secondary users, with consultative engagement described as minimal.

Field observations revealed how these approaches manifest in practice. The environment was characterised by uncertainty and frequent conflict between pedestrians and cyclists, with near-misses and ineffective signage indicating that the space did not function as safe or legible for pedestrian movement.

Together, these findings point to a gap between design intention and lived experience that existing safety frameworks do not adequately capture. Phase 2 therefore shifts focus to direct engagement with pedestrians, particularly those with diverse and protected characteristics, to better understand how safety is experienced and negotiated in everyday contexts.

4.2 Phase 2: Vulnerable Pedestrian Groups

4.2.1 TfL Constructors Group

Phase 1 revealed that safety design was driven more by stakeholder agendas than by principles enshrined in legislation such as the Equality Act 2010 or inclusive design guidelines. This finding motivated Phase 2 to focus more closely on pedestrian lived experiences, particularly those of people with additional needs and protected characteristics to understand the impact of these decisions.

Following Phase 1, networking with conference attendees and TfL contacts led to attending a 2020 TfL conference on 'Accessibility in Transport'. There, meetings with professionals advocating for pedestrian safety opened opportunities to join them as a participant observer within working groups focused on vulnerable pedestrian needs, providing access to how vulnerable users navigated and experienced space in everyday contexts. This reflects Whyte's (1993) understanding that trust and access develop through sustained relational engagement rather than formal research protocols. As Williams (1988) notes, however, participant observation still raises questions of power and interpretation, including the researcher's positioning relative to participants.

The central question remained: what aspects of safety were being afforded to pedestrians?

Ethics

In line with the RCA ethics guidelines prior to participating with these groups, I obtained individual participants consent and gatekeepers' consent for those leading participant groups and responsible for caring duties. (Appendix G). Names were anonymised and pseudonyms given for participants who were shadowed.

Inclusive Design in Construction

London remains one of the UK's largest centres for construction activity (Office for National Statistics, 2024). To prevent maintenance and construction projects from infringing on the rights of disabled people by introducing risks or causing excessive discomfort the DfT has emphasised the significance of inclusive design planning (2013). The barriers that these schemes establish must guarantee that users are in a well-designed and accessible environment.

MB, the TfL safety lead, invited me to join a working group he led after an earlier meeting, where my research into pedestrian safety aligned with his concerns about the impact of construction on pedestrians in London. The group brought together developers, constructors, highway authorities, pedestrian advocacy groups, safety professionals, and people with protected characteristics. Forums addressed the challenges of implementing inclusive working practices, with meetings and site visits arranged to highlight access issues affecting pedestrians. Participants shared personal experiences through photos and walkabouts to

illustrate the real-world impact of poorly considered designs and discuss how constructors could improve pedestrian safety.

Physical site visits took place between 2019 and 2020 and resumed in 2022 - 2023, with online meetings continuing during the pandemic. Participants were encouraged to document unsafe conditions disadvantaging pedestrians and provide photographic evidence for discussion.

Full session details are provided in Appendix H.

Thematic Findings

The following themes emerged from participant observations.

Safety practices

There were recurring problems with inconsistent safety practices where it could not be guaranteed that guidelines would be followed consistently. An example of this was the lack of having a wheelchair ramp at a kerb near a construction site, without this a wheelchair user could not cross the road. Participant A described where a missing ramp near a construction site 'meant I had to return home as I could not cross the road. It was devastating for me as it was the one day during the fortnight that I got to socialise at my club'.

Another example of a safety feature producing the opposite of its intended effect was the provision of a braille information board, described by one participant as: "great to see braille in use - but it's behind a glass panel!" (Figure 4.17)



Figure 4.17 *Design unintended consequences*

Hoardings

Across the many construction sites operating in London, a recurring issue was the lack of consistency in hoarding design. This inconsistency raised several concerns, particularly for vulnerable populations such as people living with dementia - approximately 850,000 in the UK (Alzheimer's Society, 2021). For example, dark-coloured hoardings were reported to cause confusion or distress, as they could be perceived as holes, potentially inducing fear and disorientation. (Figure 4.18)



Figure 4.18 *Hoardings creating dangers*

Colour schemes created problems for other groups too. MB noted that "primary colours with complicated patterns can lead people with autism to react and experience distress" - around 700,000 individuals in the UK (National Autistic Society, n.d.). These unintended consequences highlight how certain visual features can be exclusionary or harmful for neurodivergent users (see Figure 4.19).



Figure 4.19 *Hoardings - problematic designs*

The impact of such inconsistencies created risks along with psychological impacts. One participant observed that "people might cross the road at a dangerous place to avoid these hazards," suggesting that poor design choices may lead to unsafe navigation decisions, particularly for vulnerable pedestrians.

Colourful Crossing Concept

In 2015, TfL commissioned art installations in collaboration with Better Bankside as part of its 'Future Streets Incubator Fund' (Better Bankside, 2015). This initiative was linked to a global project called Asphalt Art, aiming to attract visitors to central London while improving neighbourhoods and improving safety. The design involved applying artistic installations to the area between the studded pedestrian crossing surfaces. (Figure 4.20)



Figure 4.20 *A Colourful crossing design*

However, this design raised concerns among several forum members. Many pedestrians found the new, non-standard feature confusing and felt unsafe using it. Rather than improving safety, the colourful crossing removed a familiar pedestrian safety affordance, effectively creating hazards.

Obstacles - Signage

A recurring concern raised by the group was the widespread and indiscriminate placement of construction signage on pavements. These signs were often positioned directly in the path of pedestrians, creating multiple obstacles. This careless placement particularly impacted people with visual impairments. One participant who regularly uses a guide dog shared an example of a hazard she faced: "A warning A-frame sign was placed on the pavement to alert drivers to route changes. It led toward a partially built hoarding - my dog would have tried to walk under it, which could have taken me straight into a construction site."

Another participant recalled a frightening incident: "I hit my head on a metal sign attached to a lamppost that wasn't at the correct height. I didn't realise what had happened until a woman rushed out from a nearby shop to help me and call an ambulance. I was concussed and bleeding."

Wheelchair users were also affected by obstructed sightlines caused by pavement signage. One participant described their experience: “I can’t see over the signs placed on pavements, so I have no idea what’s ahead.”

Overall, the placement of these signs in pedestrian areas impacted their journeys and sense of safety. Additionally, issues arose when signage was left abandoned and unattended when not in use, leaving trip hazards in place and increasing risk. (Figure 4.21)



Figure 4.21 *Footway obstacles*

Infrastructure

When safety measures were implemented, inconsistencies emerged. For example, wheelchair ramps varied based on the organisation’s design, leading to varying installation and securing methods. As a result, ramps were often not properly fixed. One participant says, “They can move when a wheelchair goes onto it.” Another problem with this design, was the potential dangers for those using a stick, a participant said, “their stick could get caught in the ramp, causing someone to fall over the ramp and the stick could go into their chest.” (See Figure 4.22).

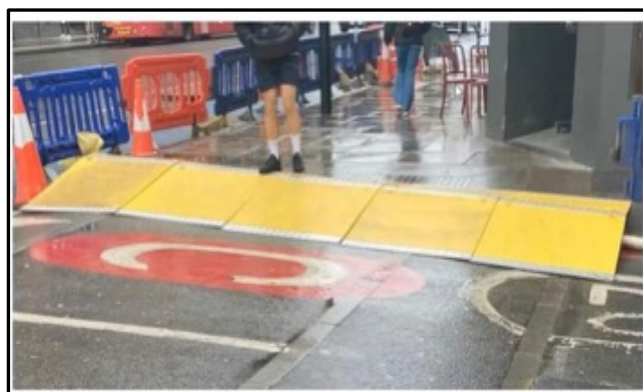


Figure 4.22 *Footway hazards*

Inaccessible Features

Another issue discussed was the temporary installation of pedestrian lights and crossing facilities that lacked safety features to ensure safe crossing. In some cases, there was no designated crossing point at all, forcing pedestrians to navigate unsafe areas. One participant highlighted the risks of this, noting that it “makes routes longer for elderly people to walk and they may take chances and cross at a dangerous point.” Wheelchair users also frequently raised concerns about accessibility, pointing out that temporary crossing setups were often not accessible for them. One participant complained that she “couldn’t access the pedestrian button to cross the road and had to wait for someone else to push the button,” (See Figure 4.23). illustrating how these temporary designs can create real barriers and safety issues and discriminate against vulnerable users.



Figure 4.23 *Inaccessible crossings*

Shadowing

The impacts of these inconsistencies became evident during open discussions and site visits with the group. To provide context and deepen understanding among all participants, a series of shadowing exercises was led by MB, these are detailed in Appendix H.

Shadowing is a qualitative method that involves closely following a participant through their everyday environment, observing behaviours, constraints, decisions, and emotions as they interact with real-world settings. McDonald (2005) argues that shadowing enables researchers to move beyond abstract accounts into tangible lived realities, providing a narrative that reflects a participant’s embodied experience. This is especially valuable in inclusive research, where participant voice and agency are central, but traditional data collection methods may be exclusionary or insufficient (van der Weele & Bredewold, 2021).

During these site visits, visually impaired pedestrians or wheelchair users took the lead, guiding the group through their experiences navigating around construction works. These first-hand demonstrations brought the safety issues to life, sparking rich conversations about how constructors could eliminate these risks and improve overall safety practices.

GroundMap: Affordance-Disaffordance

What these observations made visible was not simply the absence of safety features, but the consequences of their active removal. A missing ramp, a blocked crossing, a removed tactile surface: each created a new barrier, a new risk, for the people who had previously relied on it. This distinction required a new analytical concept.

I define this as **disaffordance**: a design decision that removes a safety feature previously supporting safe pedestrian navigation, thereby creating new risk or barrier. Where Gibson's (1979) affordance framework describes what an environment enables, disaffordance names what is lost - and what is introduced in its place - when that support is removed. This term and concept are original to this research, developed directly from the fieldwork observations described here.

To capture this systematically, the GroundMap diagnostic table was developed as a structured framework for mapping how design decisions either enable or disable pedestrian movement and safety (Table 4.8).

Table 4.8 *GroundMap - categorisation*

Actor	Environment – site	Object	Purpose	Safety Affordances (pedestrian)	Reason for Removal	Disaffordance created	Consequence

The following examples show the table applied in practice.

GroundMap in practice: Ramp removal

In Figure 4.22, a wheelchair ramp had been removed due to construction works. Originally it afforded safe access between road and pavement for disabled users; its removal created a disaffordance - a safety removal with direct exclusionary consequences, as shown in Table 4.9.

Table 4.9 *GroundMap diagnostic table: Ramp removal and disaffordance impact*

Actor	Environment – site	Object	Purpose	Safety Affordances (pedestrian)	Reason for Removal	Disaffordance created	Consequence
Pedestrian	Construction sites	Wheelchair ramp	Access to roads, pavements	Yes	Development works	Yes	Inaccessible route Equality Act unenforced Inclusive design not heeded Cannot travel

GroundMap extended: Colourful Crossings

The colourful crossings example extended the analysis further. While promoted as an aesthetic intervention, the redesign removed established safety cues, causing uncertainty and avoidance behaviours particularly among pedestrians with sensory sensitivities or visual impairments.

Table 4.10 maps the broader consequences: erosion of trust in design consistency, increased collision risk, and the loss of dedicated pedestrian safety zones - systemic issues that KSI data alone would not capture.

Table 4.10 *GroundMap diagnostic table: Colourful crossings*

Actor	Site	Object	Purpose	Affordances	Reason	Disaffordance	Consequence	Wider
Pedestrian	Colourful crossings	Pedestrian crossing	Art	NO	Promotion	Yes	Risk Fear Hazard Danger Potential collision – near-misses	Dangers introduced Loss of trust in using space Loss of trust in design standards Loss of trust in consistent protective zones Lack of consistency in providing dedicated safety protection Issues not identified due to KSI focus Neglect of pedestrian safety perspective

These examples demonstrate that removed safety features do not leave a neutral gap - they actively create hazards. Participants described heightened stress, disorientation, and fear, particularly among those with mobility challenges, sensory sensitivities, or neurodivergence. The alignment between mapped disaffordances and participant experiences confirms the real-world safety risks embedded in seemingly minor design decisions.

TfL Group Summary

Inconsistent designs consistently undermined pedestrian safety. DfT inclusive design standards, particularly around construction works, proved unenforceable in practice, with novel colour palettes, unfamiliar safety conventions, and inconsistent product styles negatively impacting pedestrian navigation - contradicting both the Mayor's stated safety goals and DfT guidance on clear pedestrian routes (DfT, 2015a).

The Colourful Crossings exemplified this. In 2021, Mayor Khan paused existing installations and halted further schemes following campaigns by Transport for All and RNIB (Transport for All, 2021; RNIB, 2021), after evidence showed adverse impacts on pedestrians with protected characteristics: avoidance of crossings in favour of unsafe alternatives, interference with safety cue recognition, and sensory overload causing stress, particularly for guide dog users.

Forum discussions revealed that pedestrian safety concerns extended beyond technical compliance into social and emotional territory. Design guidance was not legally binding and Equality Act obligations were frequently unenforced, with professionals often unaware of the unintended consequences of their decisions.

The gap between how professionals and pedestrians define safety was apparent throughout. Engineers and planners focused on vehicle flow, while pedestrians prioritised freedom from hazard - a disconnect that Clarkson et al. (2003) and Imrie (2012) identify as a structural barrier to inclusive outcomes. The removal of an audio signal might appear minor to a safety designer but was described as "making me unsure what to do" by one participant. User-led evidence is therefore essential in uncovering the unanticipated consequences of design decisions that technical frameworks alone do not capture.

Two tensions emerged clearly. Pedestrian groups defined safety as freedom from hazard supported by established standards, while constructors focused primarily on vehicle driver safety through their own guidance frameworks. Yet both groups showed willingness to cooperate and learn, and for constructors, these sessions opened practical opportunities for improvement.

GroundMap offered a means of surfacing these issues earlier. Had it been applied during the Colourful Crossings project, many of the disaffordances subsequently identified could have been caught before installation.

4.2.2 Design Exploration Group 2: 'Respect in Bexley' Mencap¹

This phase explored the experiences of a group identified by both the UN and the DfT as requiring explicit inclusive design attention. This project focused on how people with learning disabilities navigate public spaces and the safety implications that arise in everyday environments (UN, 2006; DfT, 2015a).

Methods

At the 2022 Valuing People conference on Transport: Accessibility and Mobility for Disabled Pedestrians, a meeting with JM, the Self-Advocacy Partner for Mencap, led me to joining their monthly workshops in Bexleyheath. The group advocates for individuals with learning disabilities to speak out about issues affecting them. Collectively, essential concerns were identified around:

- Pedestrian crossings
- Road signage
- Wheelchair accessibility

In February and October 2023, two workshops were held with 8–12 participants consisting of a mix of males and females. Photographs of problem areas were reviewed, which helped surface recurring themes. (see Figure 4.24)



Figure 4.24 *Signs & lines workshop*

Full session details, including dates, duration, and recording method, are provided in Appendix I.

¹ *Respect in Bexley* is the main self-advocacy group for Mencap, Bexley - where people with a learning disability work together to make the community better for people with learning disabilities.

Themes Identified

The following section presents the main themes that emerged from the workshops, based on participant discussions and analysis of photographic evidence. These themes highlight recurring safety issues and lived experiences related to navigating public spaces, along with the group's suggested interventions.

Vehicle Speed

Participants expressed anxiety about cars speeding. One person remarked that speed cameras should be installed to address cars going too fast, while others supported the introduction of speed bumps. Overall, the group shared that excessive speed made crossing roads particularly stressful. Suggested interventions included installing signage to warn drivers to slow down, and increased police presence.

Signage and Communication

Clearer visual communication to drivers was widely requested. One suggestion included installing a red-hand signal alongside signage to prompt drivers to stop.

Pedestrian Crossings

The removal of audio signals at crossings caused confusion and uncertainty. Members requested the return of audible beeps and suggested making the green man bigger, as they felt unsure about when it was safe to cross. Suggested interventions included more zebra crossings, repositioning existing crossings, and reinstating audible alerts.

Pavements and Infrastructure

Concerns were raised about narrow footpaths, especially near bus stops, which prompted calls for wider pavements and improved wheelchair accessibility. Suggested interventions included prohibiting parking on pavements, using consistent surface colours for paths, installing pedestrian signage, and adjusting pavement camber for accessibility.

Discussion

Overall, additional safety features were identified as necessary. The removal of pedestrian space for walking or wheeling presented a major challenge for some users, while the removal of audio cues created safety disaffordances that negatively impacted their sense of safety and confidence.

GroundMap Analysis

Using the GroundMap method, an Affordance-Disaffordance map was produced in conjunction with the group to highlight the impacts of these designed-out features using the example of an audio alert at a pedestrian crossing. This process involved the GroundMap mapping exercise, where changes were documented and visually represented through photos and diagrams to better capture the spatial and sensory challenges experienced by users. An example of the

resulting GroundMap tool - the Affordance-Disaffordance checklist - is presented in Table 4.11, illustrating the practical application of the framework.

Table 4.11 *GroundMap - Pedestrian crossing example*

Actor	Site	Object	Purpose	Affordances	Reason	Disaffordance	Consequence	Wider
Pedestrian	Pedestrian crossing lights	Audio alert	Green light to cross	No	Change to urban design palette	No cues – Can't 'read' message Can't 'hear' message	Loss of directional information Lack of confidence in safety Risk taking Sense of fear/ danger Conflict between users Potential future KSIs	Loss of trust in using space Loss of trust in design standards Loss of trust in consistent protective zones Lack of consistency in providing dedicated safety protection Issues not identified due to KSI focus Neglect of pedestrian safety perspective Discrimination

Limitations

As the group met at two different locations, arranging for physical walkabouts of the area was not possible without additional carers. To mitigate this, a shadowing exercise was conducted, similar to the one with the TfL group. One participant and her family agreed to participate in an activity which I could observe the safety issues encountered during the exercise.

Shadowing

Shadowing is a qualitative method that involves closely following a participant through their everyday environment, observing behaviours, constraints, decisions, and emotions as they interact with real-world settings, as outlined in Section 4.2.1. Beail & Williams (2014) emphasise that research with people with intellectual and physical disabilities must be designed around ethical inclusion, sensitivity to power dynamics, and awareness of communication barriers. Shadowing provides a more accessible and participatory approach, allowing individuals to communicate through action, emotion, and environmental interaction rather than formal interviews or written responses.

Full details of the shadowing session are provided in Appendix I.

Ethical Considerations

Prior to the shadowing exercise, ethical approval was obtained through the RCA Ethics Committee. Full informed consent was provided by the participant's family, who also acted as facilitators during the session. Pseudonyms are used throughout to protect the identity of those involved.

Shadowing Observations

The shadowing exercise was conducted in June 2023 and involved 'Bea', a woman with a learning disability who uses an electric wheelchair, and her sister and brother-in-law, May and John. The observation accompanied them on a routine journey to Bea's local library where she volunteers fortnightly. The journey, though relatively short in distance, offered a rich context for observing the barriers and safety issues experienced along the way.

Using a combination of observation, audio commentary (recorded by Bea), and video footage (captured with the family's consent), the challenges faced across various types of terrain and interaction points were documented. My observer role remained unobtrusive, interjecting only to ask clarifying questions when appropriate. As researchers such as Bartkowiak-Theron and Sappey (2012) note, this balance between observation and interaction is critical to ensuring ethical presence and avoiding researcher imposition.

Findings from the observations came under the main themes listed below:

Navigational

Navigating uneven and narrow pavements presented a consistent challenge for Bea and her carers. John's comment, "this wheelchair is quite difficult to manoeuvre on narrow pavements and at crossings," highlights how design features such as kerb height and pavement camber,

can create cumulative barriers that limit movement. May explained that “certain cambers pull the electric wheelchair toward the road,” posing a critical safety risk. These created emotional barriers too. Bea was visibly hesitant when negotiating certain stretches of pavement. In one instance, Bea verbally expressed concern while crossing a sloped kerb near a side road, acutely aware of the danger.

Inaccessibility of Routes

Where pavements had been closed due to construction, or where access ramps were missing, the family was forced to reroute or plan alternative journeys. May remarked that “last year we couldn’t bring Bea to the library because the pavements were out of use,” illustrating how temporary changes can completely sever access for vulnerable users.

The need to constantly pre-plan journeys emerged as imperative. John noted, “We need to research places before we go. Can we park there? Can we enter the building?” - a level of logistical preparation that would not be necessary if inclusive design were the norm. This planning was not only time-consuming but emotionally taxing, especially as both carers are ageing.

Psychosocial Impacts

Shadowing also revealed the emotional and social impact on carers. John expressed, “we’d do anything for her – it’s just a shame our lives are limited.” May raised deeper concerns about Bea’s future, including the emotional trauma experienced by individuals with disabilities when they lose their carers and may be institutionalised due to a lack of independence. She shared an example of someone who, after losing both parents, was placed into care and consequently lost their home and daily routines - resulting in emotional distress. These examples highlight the value for individuals to maintain independence and have accessible environments that support their agency and social networks.



Figure 4.25 *Shadowing participants*

This shadowing session provided invaluable insight into the everyday obstacles experienced by disabled pedestrians, which are often invisible in traditional safety audits or transport design processes. It exposed not only design failures, inaccessible routes, and poorly maintained pavements but also the emotional and social consequences of exclusion. These include increased reliance on caregivers, diminished independence, and the constant need to stay alert and assess risks during everyday trips.

While data on accidents and injuries are routinely collected, there is no measure for the types of impacts caused by inaccessible infrastructure. Therefore, shadowing serves not merely as a data collection method but as a means to cultivate empathy and gain inclusive insights. As van der Weele and Bredewold (2021) highlight, research that focuses lived experience can challenge and reshape design practices that often overlook the diversity of users.

Discussion

The findings from the workshops and shadowing exercise expose a consistent gap between design intent and lived experience for disabled pedestrians. Policy frameworks, such as the Equality Act 2010, and the DfT's Inclusive Transport Strategy (DfT, 2018) establish clear expectations for accessible and inclusive design. What the evidence shows is how rarely those expectations translate into practice.

Workshop participants described confusion when audio cues were absent or erratic. In the shadowing exercise, uneven pavement cambers and inaccessible crossings produced anxiety, detours, and withdrawal from social activity. Small oversights in isolation became combining barriers in practice, accumulating to create systemic barriers to access, safety, and participation.

Affordance mapping connected those experiences directly to design decisions, showing how interventions removed existing cues without accounting for the sensory and cognitive needs of disabled pedestrians. The absence of co-design or pre-installation testing process was a consistent pattern and a direct failure to meet inclusive design principles that existing policy already requires (UNCRPD, 2006; DfT, 2018). This raises questions about how often design processes overlook critical user engagement stages, even when guidelines exist.

The shadowing case showed that the impacts extend beyond the individual. Bea's experience affected John and May directly: the planning, the physical strain, and the anxiety about what happens when they can no longer provide support. These interpersonal consequences reinforce findings from disability studies that stress the relational and systemic nature of disability (Oliver, 1996; Shakespeare, 2006), and signal a lack of systemic thinking in infrastructure planning where the absence of accessibility provisions affects not only the individual but their entire support network.

To effectively address these challenges, inclusive design must go beyond lip service and become standard practice. Effective design requires continuous cycles of iteration, ideation, prototyping, testing, and feedback, ensuring that user needs are consistently integrated

throughout development (International Organization for Standardization [ISO], 2019). Disabled people need to be involved as active co-designers, not consultees brought in after decisions are made. This aligns with broader calls for participatory and user-centred design approaches (Heylighen & Bianchin, 2013) and reflects a fundamental rather than optional requirement for inclusive outcomes. Despite existing policy and advocacy, disabled pedestrians continue to be excluded from the design process and underserved by its outcomes.

4.2.3 Design Exploration Group 3: Kilburn Older Voices Enterprise (KOVE)

Understanding the experiences of older pedestrians, identified as a vulnerable group by the World Health Organisation (WHO, 2018), was a key focus of this phase. KOVE is a London-based organisation that has been advocating for older adults' needs for over 20 years, championing change in their neighbourhoods on issues including access to public spaces and transportation. Their recent successful campaign to install community benches in their local area, agreed by their local council, is one example of their impact. This demographic is of particular concern to the WHO given projections of a rapidly ageing global population (WHO, 2021). O'Neill (2010) highlights the need for more research examining the relationship between pedestrian accidents and older adults' willingness to walk, a factor believed to be influenced by non-inclusive and poorly designed environments (Wijlhuizen et al., 2007). One objective of collaborating with this group was to gain insight into their navigation experiences in public spaces, the challenges they face, and the improvements they suggest based on their lived perspectives.

Methods

The group conducts regular walkabouts as part of their social walking activities, during which they identify safety issues. Participation in two walkabouts led by the group leader (LB) occurred in March 2023 and January 2024. The group ranged in age from 67 to 93 years old and was predominantly female, with some members using walking sticks and others mobility scooters. Unstructured interviews were conducted, allowing members to share their safety concerns (see Figure 4.26).

A safety affordance mapping exercise was carried out to visually capture and analyse these issues. The findings draw on insights from the walkabouts, participant discussions, and the GroundMap tool, which systematically identified both safety affordances and disaffordances. Full session details, including dates, duration, and recording method, are provided in Appendix J.



Figure 4.26 *Walkabout with Kove in London*

Findings

Key themes highlighted by the group in the physical environments they navigate daily were:

Hazards

Hazards such as rubbish bins left on footpaths were commonly cited as obstacles that impacted pedestrian mobility and safety. These environmental barriers forced individuals, particularly older or mobility-impaired people, into the carriageway, exposing them to traffic. Participant A shared, “The street I use every day is filled with piles of rubbish bags, mattresses, fridges... sometimes they’re left there for several days.” Participant B added, “All the wheelie bins, they’re just left on the pavement. I couldn’t get past and had to walk on the road.” Highlighting the dangers introduced when pavements become blocked and alternative routes are unsafe. (see Figure 4.27).

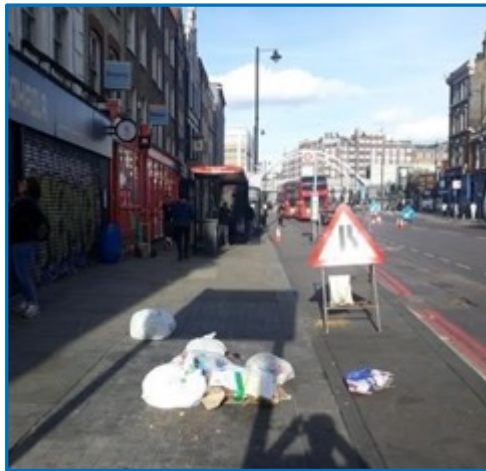


Figure 4.27 *Hazardous footway*

Pavement Infrastructure

Broken, uneven or obstructed pavements were seen as a critical risk factor. Small flaws in design or maintenance were perceived as having serious implications for older pedestrians, whose stability, visibility, and reaction time may already be compromised.

Participant C noted, “The tiniest little paving stone out of line can trip you up.” This seemingly minor defect takes on greater significance when considering the fragility of aging bodies and the serious, long-term consequences that falls can cause. Participant D added, “There are places where shops push their displays out illegally. That leaves hardly any space for walking, and you end up in the road.” Highlighting the lack of enforcement which effectively shifting risk onto vulnerable pedestrians.

Other Pedestrians as Hazards

Interactions with other pedestrians, especially fast-moving or unpredictable ones, were also a cause for concern. These situations added stress and demanded constant vigilance. Participant E explained, “Joggers are a problem, they run past quickly without warning and often don’t wear

anything reflective. It gives me such a fright.” Participant F observed, “At school times, children rush ahead of their parents. You have to do hopscotch to get through.”

Abandoned E-Bikes and Scooters

The emergence of shared mobility devices such as e-scooters and hire bikes has introduced new unexpected hazards. Many participants highlighted the risks posed when these devices are carelessly left on pavements. Participant G shared, “I almost fell over a scooter someone had dumped on the pavement yesterday.” Participant H added during the walkabout, “Look at this, bikes just abandoned everywhere. You’ve got to walk around them into the road.” These observations reveal that as new mobility services are introduced, the consequences for pedestrian space are not being adequately considered by the authorities responsible for managing it. (see Figure 4.28).



Figure 4.28 *Abandoned hire bicycles creating hazards*

Road Crossings

Crossing roads was frequently described as challenging due to poor traffic light synchronisation and short green phases. Participant K explained: "You have to wait for two sets of lights, it's confusing and takes forever" - illustrating how poor design creates additional challenges for older people who may already feel uncertain navigating busy junctions. Participant L added: "You don't get enough time to cross. It causes panic and then people rush. It's really dangerous. When there's not enough time to cross and the layout is confusing, even a simple crossing can become really stressful."

Impacts of Design

Participants often linked environmental hazards and poor design to a deeper fear: losing independence through injury or anxiety about going outside. Participant M said, "After I fell, I was so nervous. I was terrified to go out again until my confidence came back." Participant N shared, "A friend of mine had a fall and had to be hospitalised. Since then, her family's taken over everything. She's lost all her confidence to go out." These accounts illustrate how unsafe environments impose consequences that extend well beyond physical harm, affecting mobility, mental wellbeing, and independence.

Prioritisation of Cyclists

A clear theme emerged around the perception that public safety design increasingly favours cyclists, often at the direct expense of pedestrian safety. Participant O commented, "It feels like it's all designed for bikes now. No one asked us what we needed." Participant P reflected, "It's like they swapped cars for bikes, but pedestrians are still last in line." These remarks point to a sense of imbalance in urban planning priorities, with changes introduced without meaningful engagement with pedestrians as key stakeholders.

Floating Bus Stop Design

Another design intervention frequently highlighted as a serious danger was the floating bus stop (Figure 4.29). This design routes the cycle lane between the bus stop and the kerb, requiring pedestrians to cross the cycle lane to board or alight. While intended to improve cyclist safety, it places a fundamental cognitive burden on pedestrians, who must understand the layout and navigate it safely under time pressure.

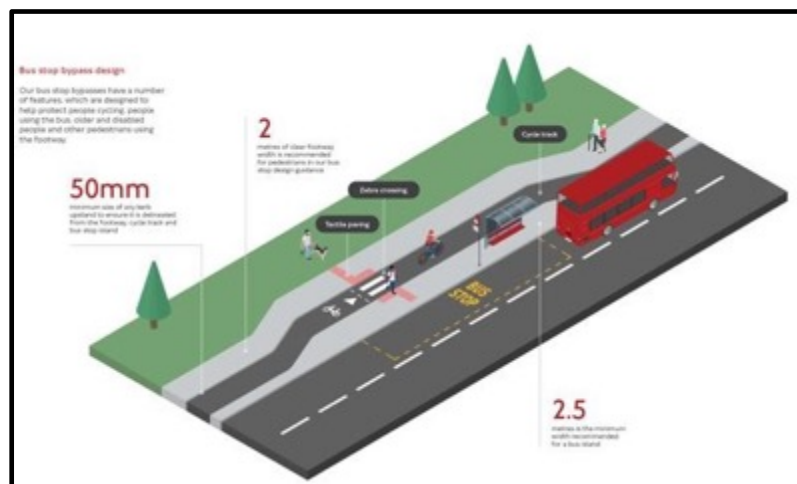


Figure 4.29 *Floating Bus Stop Design*

Note. From TfL

Pedestrians alighting from buses face uncertainty and increased collision risk. One participant recalled, "I was almost knocked over by a bike when I was stepping off the bus," while another questioned, "Did the designer ever try to use this?" These accounts illustrate how the floating bus stop disrupts established pedestrian safety affordances by removing a previously protected pedestrian space.



Figure 4.30 *Floating Bus Stop in action*

Note. From TfL

GroundMap

Table 4.12 presents a GroundMap Affordance-Disaffordance analysis of this intervention.

Table 4.12 *Disaffordance from Floating bus stop example (GroundMap)*

Actor	Environment/ Site	Object	Purpose	Safety Affordances provided (for pedestrian)	Reason for Removal	Disaffordance Created	Consequence	Wider Consequences
Pedestrian	Floating bus stop	Pedestrian zone + cycle lane bypass	Improve cyclist safety Improve cyclist KSI numbers	No	Facilitate cyclists	Yes: Removal of established protected pedestrian zone.	Potential near- misses Risk Fear Hazard Danger Potential collision	Conflict between groups Dangers introduced Loss of trust in using space Loss of trust in design standards Loss of trust in consistent protective zones Lack of consistency in providing dedicated safety protection Issues not identified due to KSI focus Neglect of pedestrian safety perspective Discrimination

These concerns were justified in 2024, when TfL paused floating bus stop installations due to pedestrian safety issues (TfL, 2024). Notably, TfL defended the design by citing a lack of KSI data, stating that the risk of pedestrians being injured was very low - a reliance on injury data that distorted the problem by failing to capture the full spectrum of pedestrian experience. The National Federation of the Blind UK petitioned the Mayor to halt the scheme, supported by Transport for All, the RNIB, and Guide Dogs UK, all highlighting the exclusionary and unsafe nature of such designs. TfL agreed to review the intervention and promised increased stakeholder engagement, though stopped short of abandoning the scheme entirely.

KOVE Summary

The walkabout and forum discussions revealed that pedestrian safety concerns extend well beyond technical compliance into social and emotional territory. Participants consistently described how poorly considered design decisions - abandoned mobility devices, inadequate crossing times, floating bus stops - generated anxiety, loss of confidence, and reluctance to walk, mirroring the social exclusion that car-centric urban design produced in the 20th century.

A clear pattern emerged in which cycling infrastructure improvements were delivered through engineering-led interventions that reduced risk for one group while introducing new hazards for another, particularly older and visually impaired pedestrians. The underlying assumption appeared to be that pedestrians would adapt, when many found these spaces confusing, unpredictable, and physically dangerous. As Clarkson et al. (2003) and Imrie (2012) identify, this reflects a structural barrier to inclusive outcomes when user needs are not adequately considered in the design process.

The threat to independence was a recurring and powerful theme. Participants linked falls and unsafe environments directly to social isolation, hospitalisation, and loss of autonomy. This resolve to maintain independence motivated the group's advocacy efforts, with participants expressing determination to continue engaging with local councils and opposing designs implemented without prior consultation.

GroundMap proved effective in making these impacts visible and legible. Applied to the floating bus stop, it surfaced disaffordances that KSI data alone would not have captured, demonstrating its value as a diagnostic tool for identifying how design decisions affect pedestrian safety in practice.

4.3 Phase 3: Gathering multiple perspectives

The findings from Phase 2 reflected the perspectives of participants selected for their specific experiences and advocacy positions. To test whether these findings resonated more broadly, I returned to Vauxhall Bridge Road to survey the general public who used the space, gathering their perceptions of safety and suggestions for improvement. A comparative study was also conducted at a nearby location at Vauxhall Bridge Cross, which featured a similar design treatment as part of the Cycle Superhighway 5 scheme, to broaden the scope of feedback and reduce site-specific bias.

4.3.1 Survey

Methods

A series of surveys were conducted at both sites on multiple dates and at varying times to capture a diverse range of pedestrian experiences and perceptions of safety, as part of a triangulation approach to strengthen validity (Denzin, 1989). The survey combined quantitative perception questions with open-ended prompts, with the emphasis on qualitative, descriptive responses, allowing participants to describe their feelings and experiences in their own words (Braun & Clarke, 2013). Affordance Theory guided the analysis of how the physical space offers opportunities or constraints for safe pedestrian movement.

The survey was specifically designed to understand pedestrians' experiences and perceptions of safety across two project sites. Its purpose was to gather detailed information about how safe pedestrians felt when using these spaces, identify factors that undermined their sense of safety, and solicit suggestions for improvements directly from users.

Study Sites

Two sites were selected. Site 1 at Vauxhall Bridge Road was revisited in 2024, where the environment had changed considerably since the original redesign: increased bicycle use, e-scooters, delivery riders, and population growth had altered conditions significantly (WCC team member, personal communication, 2020). Site 2 at Vauxhall Bridge Cross served as a comparative site within the same CS5 scheme (Figure 4.31), enabling systematic comparison of pedestrian experiences across two locations with similar design treatments (Goodrick, 2014).

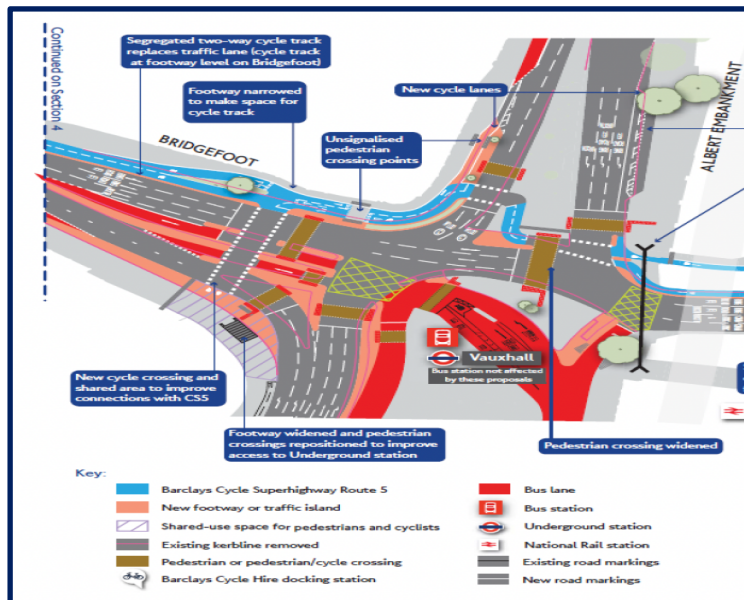


Figure 4.31 Vauxhall Bridge comparative study 2

Note.. From TfL

The rationale for using a comparative case study design (Goodrick, 2014) was its methodological approach to systematically compare pedestrian experiences across two project sites. Observational studies were conducted at both sites to directly record pedestrian behaviours and interactions within the environment, alongside the survey distribution.

Pilot Testing

Before finalising the survey, several pilot versions were developed and tested with researchers at the RCA Helen Hamlyn Centre, and refined based on feedback from colleagues and peers.

Final Survey Structure

The survey was designed to gather pedestrians' perceptions of safety, reasons for concerns, obstacles they faced, and suggestions for improvement. Four main questions addressed:

- Pedestrians' perceptions of safety within the space
- Identified nuisances or hindrances affecting safety
- Suggested improvements to enhance safety
- Optional open-text comments for additional feedback

Full details of survey administration, including session dates, times, and site locations, are provided in Appendix L along with the full survey instrument.

Observational studies were conducted at both sites to directly record pedestrian behaviours and interactions within the environment.

Survey Dissemination and Participants

The survey was promoted locally through posters displayed in community locations, incorporating a QR code and contact email (Figure 4.32). Paper flyers were also distributed during peak hours to maximise engagement.

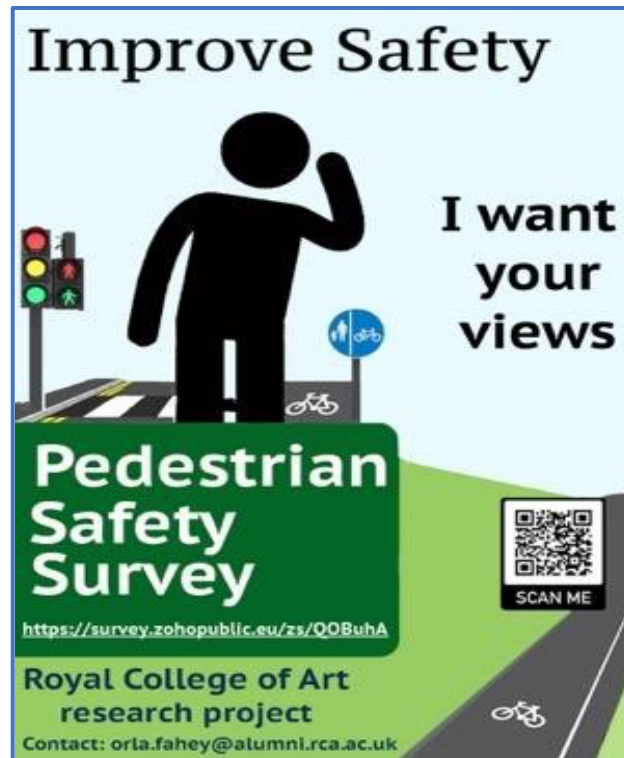


Figure 4.32 *Pedestrian Survey Poster*

A total of 230 responses were collected across both sites via in-person and online channels. Of these, 135 were obtained in person (116 from Site 1 and 19 from Site 2), and 95 online (51 from Site 1 and 44 from Site 2). Incomplete surveys were excluded to maintain data quality, though attrition was minimal and did not materially affect the overall sample size.

Ethical Considerations

All research was conducted in accordance with the RCA Ethics Policy guidelines. Participants were informed that their responses would remain anonymous, and that all data collected would be stored securely. They were also made aware that their participation was entirely voluntary and that they could withdraw from the study at any time up until June 2024.

Limitations

Researcher presence during in-person surveys may have introduced bias. To address this, reflective journaling (Schön, 1983) was used. The limited timeframe for data collection, along with weather and environmental conditions, could have affected response rates. Survey design constraints, including limited duration and potential variability in respondent numbers, may also have influenced participant responses.

Data Analysis

The collected data were analysed using Braun & Clarke's (2006) six-phase thematic analysis process. I approached the data inductively, manually coding responses into spreadsheets from the online and physical surveys. Survey responses were initially organised by study and method

(online vs in-person), then analysed separately. After identifying main themes, findings were consolidated according to the dominant themes from Project Study 1, which had the largest response volume as the primary study location. In-person responses from both studies were analysed separately and then combined using the same thematic approach.

Themes were identified from both open-ended and multiple-choice questions, then refined and categorised to capture patterns related to pedestrian safety perceptions.

Survey Findings

Analysis revealed inconsistencies, for example, in responses to Question 1, which asked participants if they felt safe walking in the area. Some individuals answered “Yes”, yet in Question 2 identified various reasons for their lack of safety (see Figure 4.33). This highlighted the complexity of pedestrian safety perceptions.

Thematic coding began by sorting responses to Question 2, which asked what the greatest hindrance or nuisance was when using the shared space. Initial codes were created related to “cyclist behaviour” and “enforcement” themes, such as education regarding rules of the road. Through iterative refinement, responses were grouped into four overarching themes that recurred across both project sites and were evident in both quantitative data and open-ended comments (Figure 4.33):

- Physical Infrastructure
- Behaviour
- Communication
- Enforcement

ID	Date	time	Q. 1 Do you feel safe walking here	Explain	Q. 2 What is the greatest hindrance or nuisance for you?	What 3 things could improve your safety?	What 3 things could improve your safety?	What 3 things could improve your safety?
61	April	8.40 am	no	cyclist don't stop at the zebra crossing	the lack of awareness of cyclists, mopeds, scooters to pedestrians	zebra crossing near pret as cyclists go through both sides of pavement.	light signal at the zebra crossing for bikes only	some penalty for misuse.
63			no	cyclists. Design of system	slowing cyclists	cyclist traffic light		
64			yes	it is a main road. Many lights and people going through	bicycles; the bike lane is a bit confusing, probably occupies too much pavement.	I don't feel sas safe in the night due to the drunk peopl more security from pubs/clubs	more signs to know where to walk	speed limit for bikes
65			no	due to scooters on the pavement & in the cycle lane	electric scooters	scooter lane	scooters wearing dayglow/hi-vis gear	cyclists off footpath when there is a cycle lane.
66			no	cyclists. Design of system	design for red lights/peds	slow cyclists down	awareness of ped safety	
67			yes	really well laid out	non			
68			no	busy road. Have to look out.	more ped friendly lights	less noise		

Figure 4.33 Snapshot of initial survey results before analysis

An initial sorting of themes began, with an example shown in Figure 4.34

	recurring theme: problems	recurring theme; specifics	main theme
bad design	bad design	hazards	redesign
aggressive cyclists	behaviour - cyclist	behaviours	design infrastructure
barriers to slow cyclists down	behaviour - cyclist speed	behaviours	design infrastructure
stop cars blocking ped crossing	cars blocking crossing	enforcement	enforcement tools
remove cyclists from pavement	cycle lane removal	design infrastructure	design infrastructure
cycle lane colour	cycle lane markings	design infrastructure	design infrastructure
cyclist behaviour - shouting at people	behaviour - cyclist - aggressive	behaviours	ped priority
cyclist assumes priority	behaviour - cyclist		
cyclist behaviours - careless	behaviour - cyclist		
cyclist speed	cyclists speed	dangerous	enforcement tools
slow down cyclist	cyclists speed	speed restrictions	rumble strip
awareness of diff mobilities	education - awareness	inclusive design	design
rules of the road	education - awareness	enforcement	enforcement tools
long term effects on well being	wellbeing	education	communication
install cameras, lights, fines	education - awareness	enforcement	enforcement tools

Figure 4.34 Snapshot of initial survey theme coding results – initial themes

Initial codes were sorted into key themes (Figure 4.35):

INITIAL CODES		1ST CODES	KEY THEMES	KEY THEMES	KEY THEMES	
			1	2	3	
cycle lane textured surface	physical infrastructure - potential solution	physical infrastructure	communication		communication	13
control signals cycle lane	physical infrastructure - potential solution	physical infrastructure			behaviours	12
cycle lane - remove	physical infrastructure - potential solution	physical infrastructure			physical infrastructure	79
seating	physical infrastructure - potential solution	physical infrastructure			enforcement	13
improve cycle lane	physical infrastructure - potential solution	physical infrastructure				
reconfigure layout	physical infrastructure - potential solution	physical infrastructure				
improve roads for cycles scooters	physical infrastructure - potential solution	physical infrastructure	communication			
education - awareness		communication				
separate cycle lane pavements	physical infrastructure - potential solution	physical infrastructure				
cyclist follow rules		cyclist behaviour - following rules				
deterrents	physical infrastructure - potential solution	cyclist behaviour - slowing/stopping	behaviours			
braille on crossing button	physical infrastructure - potential solution	physical infrastructure	behaviours	physical infrastructure		
slow cars	physical infrastructure - problematic	enforcement				
cars blocking crossing	physical infrastructure - problematic	enforcement	physical infrastructure			
cameras	physical infrastructure - potential solution	enforcement	physical infrastructure			

Figure 4.35 Development of themes

The four primary themes emerged across both project sites and were reflected in both quantitative responses and open-ended comments:

Physical Infrastructure

A common suggestion was to install traffic lights on the cycle lane that are synchronised with the traffic lights on the road, so pedestrians can cross both the road and cycle lanes to the footpath more safely. One participant suggested “speed bumps to slow cyclists down”. To mitigate the conflicted crossing intersection, another participant suggested red marking paint where the cycling lane intersects the pavement. One participant shared, “I was once nearly hit by a cyclist as I didn’t realise there was a cycle lane on part of the pavement.” Another explained, “The cycle lane and pedestrian flow is not well planned so you can’t treat it like a pavement.” Beyond this, participants also raised concerns about the condition of the pavements themselves. For example, one remarked, “The walkways are not flat, lots of pavements have caved in, a tripping hazard,” while another noted the problem of “uneven pavements.” These infrastructure challenges were often highlighted alongside the perception that pedestrian space feels marginalised, with one participant stating, “The main road is made for cars; pedestrian space feels marginalised. This is a hazard now and harms wellbeing long term.”

Behaviours

Unsafe behaviours, particularly by cyclists, emerged as the second most common theme. One participant noted, “Some cyclists don’t or won’t acknowledge that they must give way to pedestrians.” Another described the behaviour as provocative, saying, “Cyclists can be aggressive; they stand on their pedals and get huffy if a pedestrian is in their way. They are entitled and arrogant.” This view was reinforced by comments such as, “Safety is compromised. Cyclists can be rude and not considerate of others and pedestrians.” Another participant shared a personal experience: “I cross this road twice a day and it’s shocking how often cyclists don’t stop. I’ve seen lots of near-misses.”

Communication

Confusion over right of way and unclear markings were raised as communication issues. One respondent observed, “The bike lanes and pavements merge on either side and it’s not always clear who has right of way.” Another highlighted that “cycle line on pavement with no indications to cyclists that people may cross here and to be careful makes it difficult for some, particularly those with mobility impairments to be quick enough to cross the cycling line.” This was described as a “conflicted area” by one participant. Several also admitted that they “didn’t realise there was a cycle lane on part of the pavement,” underscoring the lack of clear signage or differentiation between pedestrian and cyclist zones.

Enforcement

A general concern was the lack of enforcement around cyclist behaviour. Multiple participants pointed out that “cyclists ignore pedestrians and the give way signs,” and noted “people

breaking rules.” One respondent described witnessing “cyclists race through junctions, fail to follow give way signs to pedestrians on pavement/cycleway, and jump the road crossing”.

Suggested Improvements

Participants offered a range of suggestions aimed at enhancing safety and usability. These recommendations clustered around the above themes, each reflecting different aspects of their experience. The following explores these themes highlighting the specific improvements proposed by participants.

Infrastructure Changes

A common suggestion was to install traffic lights on the cycle lane synchronised with road traffic lights, so pedestrians can cross both the road and cycle lanes to the footpath more safely. To mitigate the conflicted crossing intersection, one participant suggested installing red paint where the cycling lane intersects the pavement.

Enforcement of Rules

Suggested improvements included fining cars that park across pedestrian crossing

Changing Behaviours

There was a particular emphasis on changing cyclist behaviour. One respondent suggested cyclists should have more care and regard for pedestrians. Another suggested teaching cyclists about rules.

Improving Communication

A large amount of suggestions focused on communicating pedestrian priority. One participant suggested making it clear that pedestrians have right of way over cyclists. Another proposed clear markings for cyclists with crossing signs to signal that this is a pedestrian crossing point. Changing colours at the pedestrian crossing along with signs and markings were felt to be an effective way of managing the space.

Survey Findings Summarised

The survey revealed a consistent pattern across both sites: pedestrians frequently feel unsafe where pedestrian crossings intersect with cycle lanes. Of 230 respondents, 58% at Site 1 and 70% at Site 2 reported feeling unsafe, with the merging of cycle and pedestrian routes identified as the primary cause.

Unsafe cyclist behaviour was a recurring concern, with participants describing cyclists failing to yield, acting aggressively, and disregarding traffic rules. Unclear or absent signage compounded these difficulties, particularly for those with mobility impairments. Taken together, the findings suggest that a more inclusive and contextually grounded approach to consultation prior to scheme implementation could have surfaced many of these issues before they became fused in the design.

The survey data, combining quantitative responses with personal accounts, provides a robust picture of pedestrian experience at these sites. The research then moved to shadowing, to observe how a person with protected characteristics navigates the shared space in practice.

4.3.2 Shadowing

Having conducted shadowing exercises in earlier phases with pedestrians with protected characteristics, this method was applied at this location (McDonald, 2005)) on 15 July 2024. This approach allowed for an embodied, situated perspective that would not be accessible through observation alone.

Frida, who is partially sighted and uses a long cane (and often a guide dog), and who works as a transport professional, was asked to conduct the shadowing exercise. She did not know the area and asked not to be briefed in advance. Her audio commentary and video recordings created a detailed record of how the space was navigated and experienced in real time by her.

The goal of this method was to understand potential risk and uncertainty from a perspective often excluded from both design and evaluation processes.

The shadowing exercise revealed several safety concerns and communication failures that directly affected the ability to navigate the shared space confidently. Analysis of the audio and video data revealed three main themes outlined as diary entries at specific high-risk points on the journey: Infrastructure issues included confusing and contradictory tactile cues. Communication failures arising from contradictory cues. New hazards introduced by obstructions on pedestrian routes.

Infrastructure

At the pedestrian crossing on Regency Street, confusing and conflicting tactile cues created problems. Tactile indicators intended to guide her crossing the road were overlapped with cycle lane cues. This, she pointed out would also confuse her guide dog and create danger. (Figure 4.36).



Figure 4.36 *Affordance mapping: confusing tactiles*

At the junction of Vauxhall Bridge and Regency Street, this issue became critical. Frida was puzzled due to overlapping tactile messages. (Figure 4.37)



Figure 4.37 *Affordances: dangers introduced*

Communication Issues

A serious danger encountered was the absence of an audio alert at the pedestrian crossing which meant it was unclear whether it was safe to cross with the pedestrian green signal. (Figure 4.38)



Figure 4.38 *Affordance mapping: Pedestrian Crossing*

At John Islip Street, tactile paving and dropped kerbs suggested a pedestrian crossing existed - yet no corresponding pedestrian traffic lights were present making it difficult to cross without taking a risk. (Figure 4.39)



Figure 4.39 *Affordances: lack of design continuity*

New Hazards

Frida encountered multiple physical obstructions including A boards from retail premises, rubbish bags, and street clutter that narrowed the pedestrian path and forced unpredictable navigation. Vehicles stopping across pedestrian crossings created further confusion about right of way. At the intersection of cycle lanes and pedestrian paths, these obstructions created additional hazards and potential conflicts.

4.3.3 Development of Mapping Tools

Building on the affordance mapping developed during Phase 1 and 2, this stage extended the GroundMap method to formalise the relationships between removed physical features, the disruptions they caused, and their wider consequences for pedestrians. Table 4.13 presents this as a structured affordance map, capturing how specific design changes, such as the removal of tactile paving and directional signage, created disaffordances that rippled outward into emotional, social, and safety consequences.

Table 4.13 Affordance Map – Disaffordances

Actor	Environment/ Site	Object	Purpose	Affordances	Reason for Removal	Disaffordance	Consequence	Wider
Pedestrian	Shared Space	'Look Left' surface text	Traffic direction guidance	Yes	Change to urban design palette	No cues on traffic direction Uncertainty Potential injury Potential near- miss risk	Loss of directional information Lack of confidence in safety Risk taking Sense of fear/danger Conflict between users Potential future KSIs	Loss of trust in using space Loss of trust in design standards Loss of trust in consistent protective zones Lack of consistency in providing dedicated safety protection Issues not identified due to KSI focus Neglect of pedestrian safety perspective Discrimination
		Tactiles	Comms tool	Yes	Changed design of space: changed communication message	Unclear message Unreadable information	High risk of exposure to danger Risk of injury to person and guide dog	As above PLUS:

						Risk for person Risk for guide dog	Puts person at risk of collision Confusing for cyclist & drivers if person steps into road Impacts personal freedom – mobility Confidence Fear Long term fear	Impact on person; lack of confidence using public space Fear of injury to self, dog and others Bad reputation for design and designers Upset for pedestrian advocacy groups – especially with protected characteristics Marginalisation of pedestrian Discrimination through design imposed Potential social isolation Erosion of trust in transport authority, safety provision, inclusive design principles Links to SDGs impacted
--	--	--	--	--	--	--	---	---

Visualising Disaffordance

While the Affordance map provided a structured analytical framework, it remained abstract without a means of communicating its findings to decision-makers. To address this, a visualisation component was developed as an extension of the GroundMap tool, using historical imagery and site photography to make disaffordances visible in concrete, spatial terms.

Figures 4.40 to 4.44 present before-and-after comparisons of key interventions within the Shared Space scheme. These images directly illustrate how environmental changes, including the removal of pedestrian refuges, yellow hatch boxes, and tactile paving, transformed spaces that previously offered clear safety affordances into ones that introduced confusion, risk, and exclusion.

For example, Figure 4.40 shows the removal of a pedestrian crossing point, where a clearly demarcated space was absorbed into the shared zone. Figure 4.41 documents changes to tactile paving at the same location, while Figure 4.42 shows how additional tactiles introduced following the redesign created further confusion rather than resolving it. Figures 4.43 and 4.44 illustrate how the removal of the protected pedestrian zone, replaced by a shared cycling and pedestrian surface, created a disaffordance through the removal of protection. Figure 4.45 provides a further before-and-after comparison of tactile changes, showing how the redesign process disrupted a key communicative device used for pedestrian safety.

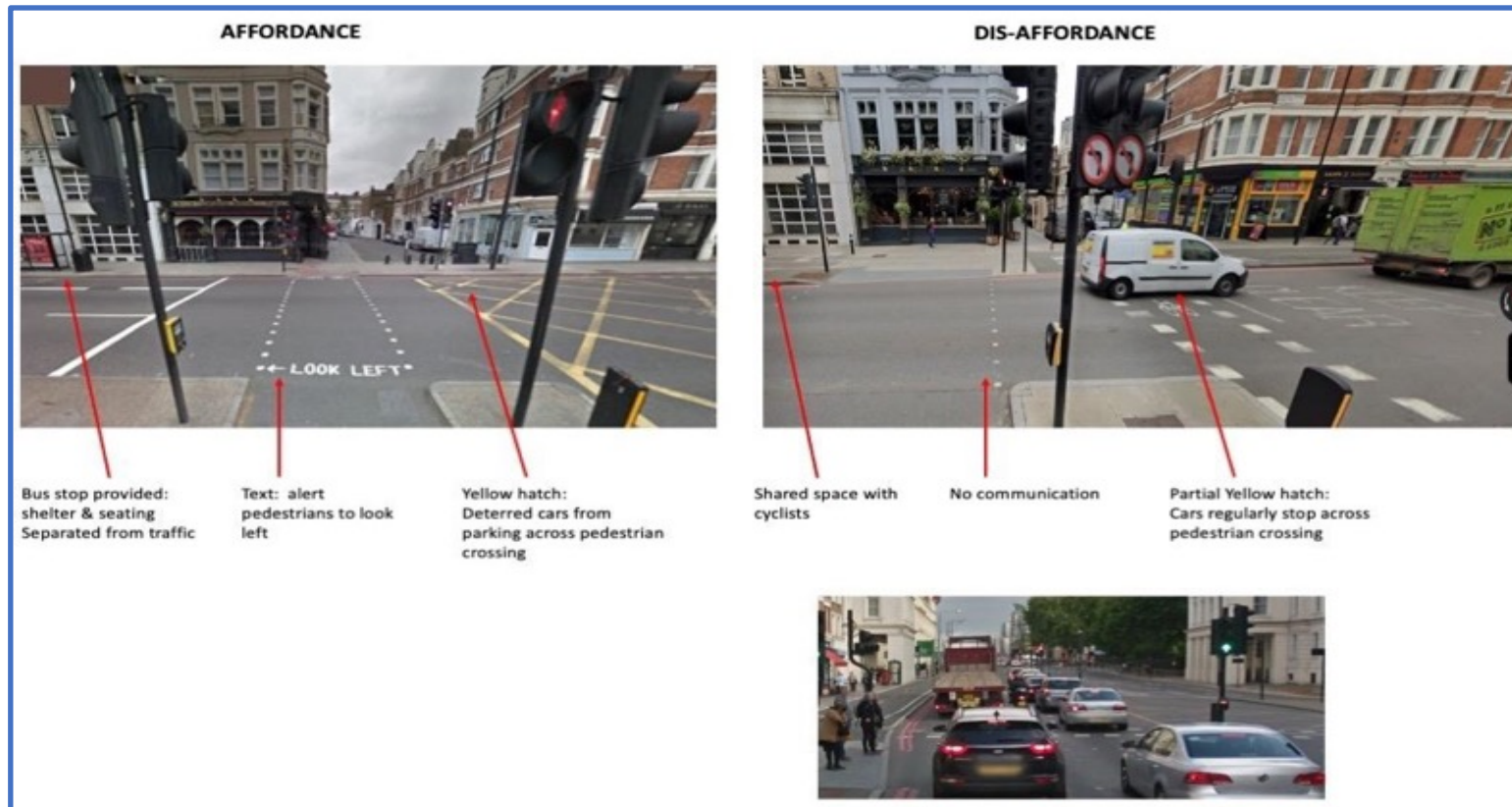


Figure 4.40 Pedestrian crossing point - before (safety affordance provided) and after (disaffordance created) Shared Space treatment.

Note. From Google Maps



Tactile: communicating crossing point



Contradictory tactile: communicating crossing point -& cycle path



Figure 4.41 *Pedestrian crossing point tactile – before and after Shared Space treatment*

Note. From Google Maps

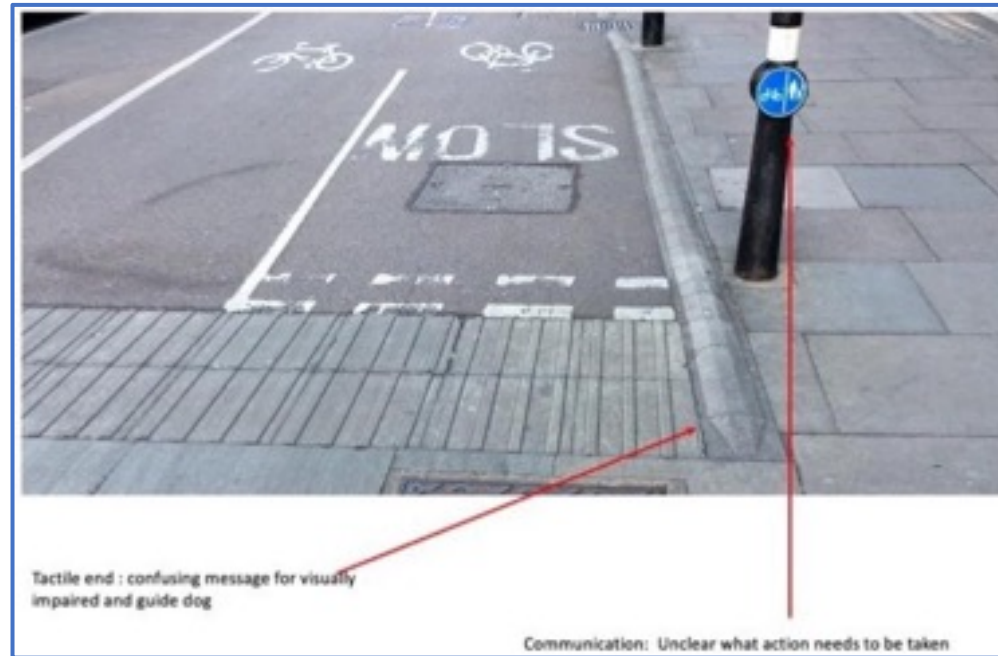


Figure 4.42 *Additional tactile creating confusion*



Figure 4.43 *Shared Space artefacts installed*

Figure 4.43 illustrates the affordance provided for cyclists within the Shared Space scheme. The installation of shared space artefacts marks the removal of what was previously a pedestrian-only zone, creating a disaffordance through the loss of that protected status.



Figure 4.44 *Disaffordance - removal of pedestrian space to cross the road*

Note. From Google Maps

The disaffordance created here is the removal of the dedicated pedestrian crossing space, which has been absorbed into the shared surface.



Figure 4.45 *Disaffordance example – changes to tactiles*

Note. From Google Maps

From Google Maps

Figure 4.45 documents the before and after changes to tactile paving following the Shared Space redesign, illustrating how the removal and alteration of these features created disaffordances for pedestrians.

Disaffordance Analysis

Before-and-after photography captured the physical transformation of the space, but did not fully convey the chain of consequences that followed. To address this, disaffordance analysis was integrated directly into the GroundMap method, linking specific design changes to their effects on pedestrian behaviour, confidence, and trust.

Table 4.14 illustrates this through a focused example: the removal of the yellow hatch box at a busy junction shown in Figure 4.44.. What had previously provided a protected waiting space for pedestrians crossing the highway was replaced with an unmarked shared surface. Mapped through the GroundMap framework, this single change reveals a cascade of effects, from immediate unsafe crossing conditions and vehicles stopping across the crossing point, to longer-term consequences including risk-taking behaviour, loss of trust in protective design, and the neglect of pedestrian safety perspectives.

Table 4.14 *Disaffordance Analysis using GroundMap*

Actor	Environment/ Site	Object	Purpose	Safety Affordances	Reason for Removal	Disaffordance	Consequence	Wider
Pedestrian	Shared Space	Yellow hatch box on main highway	Stop cars entering hatch	Previously	Changed to urban design palette	Loss of protected space for pedestrians to cross at junction. Unsafe to cross	Vehicles stopping across pedestrian crossing Risk taking Sense of fear/danger Potential future KSIs	Loss of trust in consistent protective zones Neglect of pedestrian safety perspective

By integrating visualisation with the structured mapping framework, GroundMap moved beyond documentation to become a communication tool, one capable of making the human consequences of design decisions clear to those responsible for them. The tool made visible what survey responses and shadowing observations had revealed: that the removal of pedestrian safety features did not simply change a space, but actively constructed new forms of risk, exclusion, and harm.

4.3.4 Co-Design Workshop

By the end of this phase, several recurring suggestions were emerging from both the surveys and the shadowing exercises. To build on this, participants who had indicated an interest in further involvement (via the survey form) were contacted and invited to take part in a design workshop to collaboratively explore how the space could be reimagined to better support pedestrian safety. A co-design workshop was held on 30 May 2024 at Pimlico Library. The aim was to translate the findings into tangible design ideas. Seven participants took part, four attending in person and three joining online.

The session used Photoshop mock-up photos based on site photographs taken during observations. These mocked-up images acted as prompts for discussion, enabling participants to engage with visual possibilities and suggest how the space might be redesigned to improve safety.

Full session details are provided in Appendix M.

Suggestions included the use of contrasting colours to distinguish pedestrian areas from cycle lanes and the use of clearer tactile surfaces. These user-informed design suggestions were developed into a series of visual prototypes (see Figures 4.46, 4.47 and 4.48).



Figure 4.46 *Prototype idea 1*



Figure 4.47 *Prototype idea 2*



Figure 4.48 *Prototype idea 3*

Two main outputs emerged from the workshop:

- A set of digital mock-ups participants agreed could improve safety.
- A list of proposed solutions - such as clearer signage warning pedestrians about the cycle path ahead.

In line with Orngreen and Levinsen (2017), the workshop served both as a space for co-design and a valuable data collection event. As Flyvbjerg (1998) notes, working closely with participants helps generate rich, experience-based knowledge, creating a feedback loop between lived insights and further refinement of the research. The workshop built directly on earlier shadowing and survey findings, enabling participants to shape design responses based on their own experiences, while also serving as a form of validation as participants recognised and expanded on themes previously identified.

4.3.5 TfL and Westminster Council Meeting

To present these findings to the authorities responsible for the site, I organised a meeting on 6th June 2024 with safety representatives from TfL and Westminster City Council, with whom I had established working relationships during the course of the PhD. During the meeting I shared the research findings using photographs from site observations, survey responses, and workshop prototypes, using GroundMap to exemplify the claims and present potential design interventions that could improve safety for pedestrians (Figure 4.49).



Figure 4.49 *Workshop ideas - improving safety affordances*

My prior work with TfL positioned me as an insider (Mercer, 2007), enabling more candid dialogue. One of the first questions raised was: what are the KSI statistics for this site? This confirmed how safety is understood by professionals. Using CrashMap (DfT collision data), I demonstrated that there were no KSIs for cyclists in the years prior to the shared space installation, the very metric on which the design decisions had been made. Yet the design had been approved regardless, revealing a fundamental flaw in the reliance on KSI data alone (see Appendix O for full CrashMap analysis).

The main purpose of the meeting was to demonstrate how this KSI focus directly contrasted with the lived experience of pedestrians. Using the disaffordance and GroundMap tools, I showed spatially how safety affordances had been removed, and how this was reflected in both observed behaviours and user feedback. The workshop prototypes provided a basis for discussing practical solutions.

Appreciation was given for the qualitative research undertaken, which representatives noted was different from the datasets they rely on for design decision-making. They acknowledged the

value of capturing pedestrian experience directly, noting that as a researcher I was better positioned to undertake this kind of engagement than they were, and that the research was producing evidence they lacked the resources to generate themselves. They also acknowledged that their current approach does not include engagement with pedestrians prior to or after redesign installation.

They agreed the findings were valuable and provided evidence for revising the existing design as part of wider safety improvements in the area.

Commitments

As a result of the meeting, the following commitments were made by the TfL and WCC representatives:

- Agreement to revise the current design of the study site based on the findings and suggestions presented.
- An invitation to collaborate with the TfL design team as part of the redesign process.
- An invitation to be included as a design stakeholder in future projects.
- Interest in piloting the engagement approach with disabled and older network groups as part of their future safety design process.

Full session details are provided in Appendix N.

Phase 3 Summary

Phase 3 moved from evidence gathering into design response and stakeholder engagement, demonstrating what becomes possible when pedestrian experience is placed at the centre of safety evaluation.

The surveys and shadowing exercises established a broad and consistent picture of how the Shared Space scheme was experienced on the ground. The disaffordance mapping and GroundMap tool then made those experiences legible in spatial and analytical terms, linking specific design changes to their consequences for pedestrian behaviour, confidence, and trust. The co-design workshop translated those findings into design proposals shaped by the people most affected, and the TfL meeting tested whether that evidence could carry weight in professional decision-making. The commitments that followed confirmed that it could.

Taken together, the phase revealed two significant shortcomings in current safety design practice: the absence of meaningful pedestrian engagement at the earlier stages of the design process, and the lack of a standardised approach to evaluating designs against user safety requirements. The continued reliance on KSI data as the primary metric sits at odds with how safety is actually experienced. The Shared Space scheme was approved on that basis despite generating new risks for pedestrians, risks that earlier and wider engagement could have identified before installation.

GroundMap provided a means of bridging that gap. By layering observational, survey, and shadowing data, it enabled an assessment not just of what had been designed, but what had been lost. In doing so, it reframed safety evaluation around lived consequence rather than intended function, and produced evidence of a kind that transport authorities acknowledged they were not currently equipped to generate themselves.

Chapter Summary

This chapter documented three phases of design practice. Phase 1 established the professional landscape through interviews and observational fieldwork at a Shared Space site on Vauxhall Bridge Road. The findings revealed the dominance of KSI metrics in professional decision-making and the systematic marginalisation of pedestrian experience in design. The first iteration of the GroundMap affordance mapping method emerged from this phase, initially as a site inventory, then as a structured diagnostic tool for recording what the environment affords and disaffords pedestrians.

Phase 2 deepened this inquiry through participatory observation with three groups identified as particularly vulnerable. Across all three groups, a consistent pattern emerged: design interventions conceived primarily around cyclist safety or engineering compliance were generating disaffordance that created ongoing risks and hazards, particularly for pedestrians with protected characteristics.

Phase 3 widened the evidential base through surveying a broad range of pedestrians at two sites, confirming that concerns surfaced through participatory observation were shared across a broad public. Four themes recurred consistently: physical infrastructure issues, unsafe cyclist behaviours, communication inconsistency, and inadequate enforcement of rules of the road.

Chapter 5 presents the GroundMap tool in its final form, situating it within the tool landscape established in Chapter 2.

Chapter 5: GroundMap

This chapter presents GroundMap, an Affordance-Disaffordance diagnostic tool developed through the three phases of design practice described in Chapter 4. It sets out the case for why a new tool was needed, how GroundMap was designed and structured, and how it performs against the existing frameworks it was developed to complement.

5.1 The Case for a New Tool

Existing safety assessment methods each serve specific purposes, but they share a common position: they are designed, conducted, scored, and evaluated by professionals, against professional criteria. The people most affected by design decisions, disabled pedestrians, older adults, and those with cognitive or sensory impairments, are largely absent from these processes.

Chapter 2 mapped the landscape of existing tools in detail. The key findings from that analysis directly explain why GroundMap was developed.

Tools such as Equality Impact Assessments, Road Safety Audits, and the Healthy Streets Check are widely used by major transport and infrastructure authorities in the UK, including TfL, the Chartered Institution of Highways and Transportation, and local government planning bodies. They are adopted primarily to meet governance, funding, or legal compliance requirements: EqlAs to demonstrate adherence to the Equality Act 2010, RSAs to satisfy road safety regulations, and the Healthy Streets Check to align with strategic policy goals around active travel and public health. However, despite their widespread use, these assessments fall short in delivering inclusive design outcomes.

The first and most consequential shortcoming is timing. These tools are typically applied mid-stage or late in the design process, after key decisions have already been made. Though public consultation is often required, it occurs too late to meaningfully influence outcomes. This sequencing reinforces a reactive rather than preventative approach, where potential disaffordances go unaddressed until problems emerge post-implementation. The evidence from this research confirms this pattern directly: at the Vauxhall Bridge Road shared space site, the removal of key pedestrian safety features was not identified through any formal audit process; it was only surfaced through observation and survey responses.

The second shortcoming is engagement. EqlAs rely heavily on abstract legal compliance and disaggregated demographic data but seldom engage directly with those affected. The result is a process that can become bureaucratic and compliance-driven, with limited substantive impact, and vulnerable to tokenistic implementation (Fredman, 2011; Hepple, 2011). RSAs focus on objective safety criteria and are conducted by specialist teams but overlook the subjective and emotional dimensions of pedestrian safety, comfort, perceived threat, and navigational stress, that this research found to be central to how pedestrians experience safety in practice. The

Healthy Streets Check, while aligned with contemporary urban design principles, is typically scored by professionals without user validation, limiting its ability to capture how spaces are experienced differently by individuals based on ability, age, or cognitive capacity.

Systems-level tools extend these limitations further. STAMP and Accimap operate at an institutional scale and do not extend to street-level pedestrian experience. Hierarchical Task Analysis describes what pedestrians should do based on expert analysis, rather than how diverse pedestrians actually navigate real environments. As the fieldwork in Chapter 4 demonstrated, the contextual and experiential factors that most affect pedestrian safety, such as the challenges faced by wheelchair users at floating bus stops, are not captured by analyst-centred decomposition of tasks. DREAM and Conflict Analysis quantify near-miss events but do not capture how those events are experienced by the pedestrians involved. The density and simultaneity of near-miss activity such as those observed at the study sites made discrete event-by-event logging unworkable in practice, as discussed in Chapter 3 and unsuitable for using these methods.

Taken together, these tools share a common limitation: they were not designed to involve diverse pedestrians directly in participatory, real-world contexts, to capture both what a space affords and what it disaffords, to be applied iteratively throughout the design process, or to record the consequences of removing safety features as a category of unintended consequences in its own right.

These gaps are not incidental but structural, reflecting the professional and compliance-driven purposes for which the tools were originally developed. GroundMap was developed specifically to address them, prioritising the pedestrian perspective, requiring direct engagement with pedestrians during design rather than post-implementation, and treating the removal of safety affordances and the creation of disaffordances as a primary object of analysis.

5.2 Literature and Practice Foundations

To establish GroundMap as a novel contribution supported by existing research and practice, the methodology draws on and extends several key bodies of literature.

It builds on Affordance Theory (Gibson, 1979; Heft, 1988; Norman, 2013) to operationalise environmental affordances and disaffordances specifically in the context of pedestrian safety, extending foundational concepts of how users perceive and interact with their surroundings. The concept of disaffordance: a design decision that removes a safety feature, introduced and theorised in this thesis as an extension of Gibson's framework, was developed through the fieldwork described in Chapter 4.

It integrates participatory and inclusive design frameworks (Sanders & Stappers, 2008; Heylighen & Bianchin, 2013), positioning lived experience as central to the evaluation process rather than as supplementary data gathered after decisions are made.

In response to critiques of traditional safety metrics and audit frameworks, GroundMap addresses the known limitations of relying solely on KSI data and highlights the need for qualitative, user-generated insight that can surface harms official datasets are structurally unable to record.

It also reflects emerging practice in user-centred urban design, as seen in projects by the Lloyd's Register Foundation (Hall et al., 2018, 2021), which call for more human-centred, evidence-based, and equitable approaches to safety design in complex environments.

5.3 Comparative Assessment

To situate GroundMap within the existing landscape of planning and design tools, a comparative assessment was undertaken. This allows practitioners, policymakers, and researchers to understand the key differences in purpose, process, and output between GroundMap and the tools reviewed in Chapter 2. Table 5.1 summarises this comparison across nine criteria, highlighting how GroundMap adds value through its emphasis on lived experience, inclusive participation, and subjective safety. Rather than replacing technical audits, it offers a diagnostic lens that complements and strengthens existing processes.

Table 5.1 *GroundMap Compared with Existing Design Assessment Tools*

Criteria	EqlA	RSA	Healthy Streets Check	STAMP	HTA	DREAM / Conflict Analysis	GroundMap Tool
Primary Purpose	Legal compliance	Road user safety	Public realm quality	Map institutional control structures	Decompose user tasks to identify error points	Observe and count pedestrian-vehicle conflicts	Inclusive, lived experience-led diagnosis
Conducted By	Policy officers / planners	Independent auditors	Urban designers	Expert analyst / researcher	Expert analyst	Researcher	Designers + community
User Engagement	Indirect (post-design)	None	Minimal	None	None	None	Central to process
Timing	Mid to late stage	Late (post-design)	Mid-stage	Post-incident or audit	Design or audit phase	Site observation	Throughout design process
Lived Experience Representation	Rarely integrated	Absent	Inferred	Absent - institutional focus	Absent - analyst constructs task model	Absent - counts events only	Explicit, through co-design
Subjective Safety Consideration	Minimal	Limited	Some	Not applicable	Partial - task errors only	Not captured	Core evaluation criteria
Captures Near-misses?	No	No	No	No	No	Yes - as conflicts	Yes - observed and self-reported
Feedback Loop	Weak	Weak	Limited	None - analytical output	None - analytical output	None - data collection only	Iterative, user-informed
Output Usefulness	Procedural	Technical	Strategic scoring	Systemic diagnosis (institutional)	Task error identification	Conflict frequency data	Diagnostic + participatory

Table 5.1 sets out how GroundMap differs from existing frameworks in its approach, timing, and who conducts it. However, a comparison table alone does not fully account for the specific gaps those tools leave unaddressed or explain how the design decisions within GroundMap were developed in direct response to recognised limitations. Table 5.2 addresses this directly, mapping specific gaps in existing tools against the design decisions made in developing GroundMap.

Table 5.2 *Gaps in Existing Tools and How GroundMap Responds*

Gap in Existing Tools	GroundMap Response	Feature Developed
Over-reliance on KSI and post-incident data	Emphasises affordance/disaffordance, subjective and anticipatory safety	Affordance-Disaffordance diagnostic lens
Limited inclusion of older or disabled users	Structured engagement of diverse stakeholders	Participatory template + co-mapping
Lack of method for mapping disaffordances	Systematic method to identify what's removed, introduced, or overlooked	Disaffordance identification process
No visual diagnostic record	Visual documentation of affordance loss	Photo mapping + annotation tool
No feedback loop or iteration built into tool	Tool is designed to be repeatable, reflective, and iterative	Iterative use and community re-validation
Subjective safety not considered measurable or actionable	Treats subjective safety as measurable through affordance categories	Affordance-Disaffordance tool structure

Table 5.3 sets out the core components of GroundMap, describing how each operates in practice, the gap it was designed to address, and the evidence base informing its development.

Table 5.3 *GroundMap Method – core components*

Components	How it works	Problem or gap addressed	Evidence Base
Diagnostic tool template	Audits site affordances/disaffordances by user type	Lack of inclusive, systematic tool for pedestrian design	Builds on Gibson, Norman; tested with 2 walkabouts
Participatory mapping exercise	Co-walks with users to visually annotate photos and maps	User voice often missing from design analysis	Helen Hamlyn Centre methods; aligns with Sanders & Stappers
Categorised Affordance typology	Structured analysis of crossings, surfaces, signals, etc.	Technical audits don't capture subjective safety or environment removal	Developed through thematic coding of field data
Feedback & iteration loops	Participants review annotated maps and templates	Existing tools don't allow real-time or repeated feedback	Used in multiple sites over time
Integration into design workflow	Tool outputs feed into concept or audit stages	Traditional tools come too late to change design	Piloted in Shared Space, Vauxhall Bridge (TfL, Westminster Council)

Together, Tables 5.1 to 5.3 trace the development of the GroundMap method: from a critical assessment of existing tools, through the identification of specific gaps, to the design of targeted responses to each. This progression situates GroundMap as a tool grounded in both theoretical frameworks and practice-based evidence, designed to be adaptable across different sites and contexts.

5.4 The GroundMap Tool

The following sections set out how GroundMap is applied in practice, covering the participatory validation process and the design thinking framework that structures its use.

5.4.1 Participatory Validation

GroundMap was developed through sustained engagement with people from protected characteristic groups, whose input across the three phases of practice described in Chapter 4 directly shaped the tool's features and structure. Because the tool is designed to surface access barriers and safety concerns that standard audit processes often overlook, its application depends on meaningful engagement with the people it is designed to serve. Validation with a minimum of five participant advocacy groups is recommended, including organisations such as KOVE, the Royal National Institute of Blind People, and the Disabled Persons Transport Advisory Committee, alongside equivalent pedestrian advocacy bodies. The lived experience these groups bring is essential to ensuring the tool captures what professional assessment alone cannot.

5.4.2 Design Thinking in Practice

Road safety problems are not static, and GroundMap is designed to reflect this. Rather than functioning as a one-off compliance check, the tool is structured to be used iteratively throughout the design process, with each round of application informing the next. Its five-phase structure draws on a design thinking approach:

- **Empathise:** deepen understanding of user needs through direct engagement with pedestrians
- **Define:** articulate clearly the disaffordances or barriers identified at the site
- **Ideate:** generate inclusive design responses to the problems identified
- **Prototype:** develop preliminary design interventions for testing
- **Test:** trial interventions in real-world conditions and gather user feedback

This iterative structure is what distinguishes GroundMap from the compliance-based frameworks it complements, which are typically applied at a single point in the process and do not build in mechanisms for ongoing user feedback or refinement.

Table 5.4 *GroundMap Tool: Step-by-Step Guide*

Step	Description
1. Identify feature	Select a specific environmental element (e.g. kerb, signage)
2. Define affordance	What does this feature enable? For whom?
3. Define disaffordance	What risks or exclusions arise from its absence or design?
4. Consult diverse users	Engage a minimum of 5 groups with protected characteristics.
5. Real-world testing	Observe use and test interventions in context before permanent changes.
6. Document & iterate	Record findings and feed them into the next design phase.

5.4.3 Retrospective and Preventative Use

GroundMap can be applied to existing infrastructure as well as to schemes still being designed. It uncovers hidden risks and systemic failures, especially those overlooked due to gaps in traditional safety audits and shortcomings in the design process. Had this tool been employed earlier in projects such as floating bus stops or colourful crossings, many of the risks faced by visually impaired, and neurodiverse users could have been mitigated or avoided entirely.

A blank GroundMap template for practitioner use is provided in Appendix P.

5.4.4 Intended Users and Implementation

Potential users include urban designers, architects, local authorities, researchers, and pedestrian advocacy groups. It is particularly valuable for anyone involved in planning, implementing, or assessing changes to public spaces (Table 5.5). The tool's benefits include embedding lived experience into planning processes, preventing costly remedial work, supplementing Equality Impact Assessments, and enhancing the transparency and accountability of design processes.

Table 5.5 *Policy levels of implementation*

Level	Application
Top-level	International policy makers National transport policy Public health groups SDG stakeholder groups
Middle-level	National government Local government
Ground-level	Site-specific designers Community-led participant groups Road safety advocates Public health advocates

Effective implementation requires leadership from design-led, user-centred organisations with expertise in participatory and inclusive methods. Organisations such as the Helen Hamlyn Centre for Design are well positioned for this role, given their longstanding experience in inclusive design, co-design, and cross-sector collaboration. Embedding the tool within such structured environments helps prevent tokenistic adoption and supports its intended use as a catalyst for ethical, inclusive decision-making.

At present, GroundMap remains a prototype and has not undergone formal end-user testing. Several practical considerations must be addressed before wider implementation, including dissemination strategies, data management and governance, and contextual adaptation. The documentation will need a clear glossary, as the tool is intended for practitioners, community groups, and policymakers who use very different vocabularies. Ambiguity in terminology would undermine its usefulness.

Critically, the process must remain independent and free from political or commercial influence. Without this, GroundMap risks replicating the limitations of existing frameworks which have been criticised for becoming procedural or compliance-driven exercises with limited substantive influence on decision-making and outcomes (Fredman, 2011). Empirical and audit-based evidence from the Equality and Human Rights Commission (2018), the National Audit Office (2011), and the Local Government Association (2016) further suggests that EqlAs are often inconsistently implemented, undertaken late in the policy process, and insufficiently integrated into meaningful public engagement or decision-making structures. To mitigate this risk, implementation will require explicit ethical codes, transparent funding disclosure, and active involvement of empowered community oversight bodies.

GroundMap is intended to work alongside existing audits rather than replace them. Running it in parallel with an EqlA, for example, would allow qualitative, user-generated evidence to inform

the formal assessment process throughout, moving beyond reactive compliance towards a more proactive and participatory model of design governance.

The photo-based approach, developed through the visualisation work described in Chapter 4, makes the tool accessible to non-experts and professionals alike. By annotating site photographs to highlight what a space affords and what it disaffords, GroundMap enables direct, visual conversations about what has changed in a space and what effects those changes have had. This approach is particularly effective for communicating findings to decision-makers, as demonstrated through the TfL and Westminster Council meeting discussed in Chapter 4.

Visualising Affordances and Disaffordances

Figure 5.1 illustrates this approach at the shared space site. Green outlines indicate affordances added to improve cyclist safety that altered the layout of the space. Red highlights indicate affordances that were removed, creating disaffordances for pedestrians. The installation of cycle lanes resulted in the removal of previously protected pedestrian zones (c). Similarly, the removal of the 'Look Left' text at the crossing eliminated a key navigational safety feature for pedestrians (a).



Figure 5.1 *GroundMap Example: Affordance-Disaffordance annotated mapping*

Future work will focus on piloting GroundMap with local councils and advocacy groups, using design methods to assess usability, inclusivity, and real-world consequences in urban design.

5.5 Evaluation and Future Development

5.5.1 Validity and Reliability

GroundMap was developed iteratively, with each phase generating findings tested against user experience, revised, and reapplied. Several distinct forms of validity were built into this process. The tool's theoretical foundations rooted in Affordance Theory and designed explicitly to fill the gaps that existing audit frameworks leave establish its content validity. Testing it repeatedly in real urban environments rather than in laboratories or simulations provides ecological validity. Across all phases, participants used the tool to identify what worked and what did not, and what emerged was a consistent alignment between observational and survey data gathered separately by diverse user groups, suggesting the tool is surfacing genuine safety issues rather than researcher-introduced ones.

Professional validation came through the meeting with TfL and Westminster City Council, where practitioners reviewed GroundMap outputs, found them credible and useful, and committed to further collaboration. The commitments that followed represent real-world endorsement that peer review alone cannot provide.

What has not yet been tested is inter-rater reliability, whether two researchers working independently at the same site would produce comparable results. That is the critical next step if the tool is to move from being useful in this research to being replicable across contexts. Predictive validity also requires attention: whether GroundMap can reliably identify where future incidents will occur remains to be tested. These are set out as priorities in the future research agenda in Chapter 7.

5.5.2 Avoiding Tokenism in Practice

The risk that any participatory tool becomes a procedural exercise rather than a genuine engagement is real. Linovski and Loukaitou-Sideris (2013) document how tools designed to surface lived experience can quickly become tick-boxes when implementation is not led by actors with both the expertise and the accountability to keep participation meaningful. Avoiding tokenism means keeping diverse, authentic participation central throughout the tool's lifecycle, not just at the design stage (Farr, 2018; Design Council, 2021). This fieldwork confirmed that local authorities were often unaware of how their own design changes had created new barriers reinforcing the need for ongoing, reflective practice and the value of a tool that makes those impacts visible.

5.6 GroundMap: Contribution and Next Steps

GroundMap is a prototype that has been tested in real conditions, found useful by the people it was designed with, and recognised as credible by safety professionals. The contribution it makes is a methodological one: a participatory, affordance-based diagnostic instrument that sits earlier in the design process than existing audits and is structured around the people those audits consistently fail to reach.

Beyond its immediate application, the tool offers a strategy for systemic change by placing human experience at the heart of planning and design. It provides a practical means to move beyond superficial compliance with legislation such as the Equality Act, fostering genuine accessibility and inclusion. By aligning with international frameworks such as the Sustainable Development Goals, it repositions design as a proactive force for social wellbeing rather than a reactive or compliance-driven exercise.

Future steps include inter-rater reliability testing, longitudinal tracking, and pilots with specific pedestrian groups to determine its reach and transferability. Chapter 7 sets out that agenda in full.

Chapter Summary

This chapter presented the GroundMap Affordance-Disaffordance Tool, setting out the case for its development, its theoretical grounding, and what it contributes to existing practice. Section 5.1 identified the structural gaps in current assessment frameworks, including EqIA, RSA, Healthy Streets Check, STAMP, HTA, and DREAM, showing that none directly involve diverse pedestrians in participatory, real-world contexts, none treat the removal of safety features as a category of design failure, and none are designed for iterative use throughout the design process. Section 5.2 grounded the tool in Affordance Theory, participatory design, and inclusive design frameworks. Tables 5.1 to 5.3 set out how GroundMap differs from existing tools, how each of its features responds to a documented gap, and how the method works in practice.

GroundMap is proposed not as a replacement for existing frameworks but as a complementary diagnostic instrument, one that embeds participatory, affordance-based analysis earlier and more meaningfully in the design process. Its credibility was tested in practice: safety practitioners reviewed the outputs, found them valuable and distinct from the datasets they routinely use, and committed to further collaboration.

Chapter 6 examines the systemic conditions shaping pedestrian safety in London, situating the findings within the broader policy and institutional landscape and considering what GroundMap reveals about the challenges of shifting entrenched systems, policies, and mindsets.

Chapter 6: Analysis and Discussion

This chapter brings the empirical findings of Chapters 4 and 5 into dialogue with the theoretical frameworks established in Chapter 2, examining what the research reveals about the systemic conditions that shape and constrain pedestrian safety in London. The chapter builds a cumulative argument: that the way safety is currently defined determines what evidence is collected, what evidence is collected determines what interventions are designed, and what interventions are designed is then evaluated against the same definition, a self-reinforcing cycle that this research both documents and challenges.

6.1 How Safety is Currently Defined

The research confirmed what the literature review identified: safety is defined primarily by KSI casualty numbers (DfT, 2022; TfL, 2018). This frames the problem narrowly around statistics rather than around a broader understanding of safety as freedom from danger, risk, and injury. The accepted policy response, the Safe System approach, compounds this by applying a broad, complex framework that struggles to accommodate conflicting goals or context-specific conditions, as discussed in Chapter 2.

The problem is not confined to London or the UK. STATS19 data directly underpins UK contributions to international reporting, including the WHO's Global Status Report on Road Safety and the UN Global Road Safety Plans. The structural weaknesses in UK datasets, incomplete recording criteria, the absence of near-miss reporting, data held in separate systems, and the exclusion of non-collision incidents, are therefore replicated at an international scale. As the WHO (2023b) acknowledges, many countries face comparable recording problems, yet these same flawed datasets form the evidential basis for Vision Zero targets adopted nationally and internationally. The result, as Wegman et al. (2015) argues, is a system that cannot fully understand why its interventions succeed or fail, because the data it relies on was never designed to capture that. How that limitation plays out in practice, through the stakeholder relationships and governance structures that translate data into design, is the subject of the next section.

6.2 Stakeholders, Governance and Pedestrian Exclusion

The situation is further complicated by a network of frequently conflicting international and national stakeholders, along with user groups pursuing divergent objectives. Pedestrian safety requirements, the primary focus of this inquiry, are often overlooked. Design and planning processes exclude meaningful pedestrian engagement, particularly from those with protected characteristics. Non-collision pedestrian incidents remain absent from the metrics used to assess safety. The economic relationships between key road safety funders, including the FIA Foundation, the Global Road Safety Facility, and the DfT, are mapped in Appendix F (Figure

F.5), illustrating how funding flows shape which safety priorities receive resource and whose interests are advanced within the system. Phase 1 interviews confirmed this directly: participants described how cycling advocacy groups held institutional positions that disability organisations did not, and how design decisions reflected those relationships rather than the requirements of the Equality Act 2010 or inclusive design guidance. The categories through which safety data is collected are not neutral, they reflect and reinforce the institutional priorities of those who designed them, determining in advance which harms will be visible and which will not. The question of what safety means in this context, and for whom, is taken up in the next section.

6.3 Redefining Safety

Returning to the definition of safety established in Chapter 1, London's pedestrian environment in this study consistently fell short. Marsden and Reardon (2017) attribute similar patterns in UK road safety outcomes directly to fragmented governance and institutional constraints, showing that the problem extends beyond London to the national level. While Vision Zero is aspirational, Elvik (2019b) and Wegman (2017) argue that the mechanisms through which it is pursued are not value-neutral: they embed assumptions about whose experience counts and which harms are legible. A more inclusive definition of safety is not an aspiration alongside Vision Zero; it is a precondition for delivering it.

For experts, safety is typically defined in terms of reducing KSI figures. For pedestrians, it extends beyond statistics to include a sense of safety and the lived experience of protection from hazards and obstacles. As established in Chapter 2, pedestrians are consistently treated as a homogeneous group to be designed for rather than engaged with, effectively rendering them voiceless in the design process. The research confirmed this pattern repeatedly. During consultations on Shared Space, disabled pedestrians' concerns were overridden in favour of cyclist safety priorities. The design process accommodated engineering solutions but not the people most affected by them, a gap that more contextually sensitive co-design could have addressed. This pattern was consistent across all three phases of this research, confirming the structural marginalisation of disabled and older users documented in the literature. What the data fails to capture, and why that gap is structural rather than incidental, is examined in Section 6.4.

6.4 Missing and Underreported Data

Pedestrian incidents on pavements, such as trips or falls, are frequently underreported or entirely absent from official safety databases, resulting in incomplete understandings of risk, a finding consistent with the literature review's analysis of STATS19 (Chapter 2), which found that the database records only injury collisions occurring on the public highway and involving at least one vehicle; consequently, many pedestrian-only incidents, including trips and falls, are

excluded from the official dataset (DfT, 2011). Near-miss events, which are standard reporting practice in aviation and maritime safety, remain overlooked in road safety despite their recognised value as early indicators of systemic risk (IOSH, 2017). The narrow categorisation of pedestrian injury in police reports is itself a structural barrier to understanding the full scope of harm as police collision datasets exclude many pedestrian-only incidents and therefore capture only a subset of pedestrian risk (DfT, 2011; Imprialou & Quddus, 2019; Schepers et al., 2017). The fragmented data, coupled with emphasis on KSI outcomes, obscures pedestrian risk and prevents design-led solutions from emerging. The consequence is not simply incomplete data but a design culture oriented around the problems the data can see, with direct effects on how safety priorities are set, examined in the following section.

6.5 How KSI Shapes Design Priorities

A continued focus on KSI statistics shapes policy and design in ways that consistently prioritise cyclist safety over pedestrian wellbeing. Older adults are particularly affected: the WHO (2004, 2021) notes their heightened vulnerability to serious injury and long-term disability, consequences that fall outside what KSI data captures and therefore outside what design processes typically respond to. Participatory initiatives such as the Lloyd's Register Foundation's Grand Challenge offer a different model, one that foregrounds co-design, lived experience, and near-miss data alongside collision statistics. The issue is not KSI data itself, but relying on it alone, which leaves major aspects of pedestrian risk unaddressed. This was visible throughout the research: the Shared Space scheme was justified by projected improvements in cyclist KSI statistics; the floating bus stop expansion continued until advocacy organisations mobilised evidence TfL's own datasets could not produce; colourful crossings were installed as safety improvements before users with protected characteristics demonstrated they were the opposite. In each case the design process was responding to a metric, not to the people using the space. How Affordance Theory provided a practical framework for making those people and their experiences analytically visible is the subject of the next section.

6.6 Applying Affordance Theory in Practice

By applying GroundMap in co-design with pedestrians across the research phase, Affordance Theory, developed by Gibson (1979), refined by Norman (2013), and extended to public space by Stevens et al. (2024), was used to identify removed safety features, termed **disaffordances**. This application moves beyond individual actor-object pairings to examine how the same infrastructure produces different experiences for different users. Where Gibson's framework describes what an environment enables, and Norman's refinement connects that to design intention, Stevens et al.'s (2024) extension into public space establishes the theoretical basis for applying affordance thinking to the complex, multi-user environments this research examined. The contribution of this thesis is to operationalise that framework as a diagnostic tool, one that moves from theoretical description to practical identification of specific design failures and their

consequences for specific groups of pedestrians. What that operationalisation revealed across all three phases is documented in the following section.

6.7 What Disaffordance Mapping Revealed

The Affordance-Disaffordance mapping method uncovered different types of context-specific design failures, ranging from physical obstructions to confusing and conflicting environmental messages. These disproportionately affected older and disabled pedestrians, consistent with the literature review's finding that the 'Safe User' pillar of the Safe System approach places responsibility on individuals to follow rules regardless of their cognitive or physical capacity to do so (Chapter 2). Disaffordance identification was possible only through situated mapping and GroundMap visualisation: they were invisible to STATS19, absent from Road Safety Audits, and undocumented in TfL's site monitoring. Rasmussen and Svedung's (2000) Accimap framework for example, typically excludes public actors, including pedestrians, from its system boundary. The findings here confirm that meaningful user participation is not an optional enhancement but a necessary condition for surfacing harms that expert-driven methods cannot see. If the existing frameworks cannot see these failures, the question becomes whether the tools designed to evaluate those frameworks share the same blind spots, examined in Section 6.8.

6.8 The Limits of Existing Frameworks

The Healthy Streets Toolkit is widely cited as best practice (TfL, 2017; GLA, 2018) but offers limited detail on pedestrian-specific design and lacks meaningful engagement with lived experience. In practice, its use in policy often became rhetorical, one cited in strategy documents but not implemented with adequate community involvement. Equality Impact Assessments are intended to embed equality considerations into policy development and decision-making processes from the outset (Equality and Human Rights Commission, 2020) but have been widely criticised in the literature as becoming compliance-driven exercises with limited substantive influence.

Other tools share similar limitations. Heuristic-based evaluations developed by Mindell et al. (2017) and research at UCL's PEARL Lab reflects sophisticated understanding of urban health and accessibility but are predominantly expert-driven. The PEARL Lab provides controlled environment studies, but as Schön (1983) argues, knowledge generated in controlled settings differs fundamentally from the knowing-in-action that emerges through engagement with real-world practice. Expert stakeholders including urban designers, transport planners, and policy advisors confirmed this through interviews conducted during Phase 1 -frameworks like the Healthy Streets Toolkit are aspirational but lack practical guidance for pedestrian-focused interventions.

Design interventions prioritising cyclists over pedestrians have exacerbated conflicts between user groups, structurally embedded through decisions contravening inclusive design guidance

(British Standards Institution, 2018) and the Public Sector Equality Duty under the Equality Act 2010. Both professionals and users were keen to make improvements but found the system offered no formal route for doing so - with no feedback mechanism, no means of involving users in early design development, and no structured process for testing interventions before installation. Campaigns for modifying dangerous features became costly and subject to legal challenge precisely because problems were identified after the fact rather than before.

GroundMap was developed to address these gaps directly by embedding lived experience throughout the diagnostic process. Situating these limitations within the specific governance context in which this research was conducted, and which shaped the conditions it encountered, is the function of the final section.

6.9 The London Context

The findings sit within a specific policy context that shaped the conditions this research encountered. London is not a neutral test site but a politically charged environment in which pedestrian safety is shaped by a particular configuration of Mayoral commitments, institutional structures, funding mechanisms, and advocacy relationships that have directly produced the design outcomes examined in this study.

The Mayor's Transport Strategy (GLA, 2018) and its central commitment to Vision Zero - the ambition to eliminate all road deaths and serious injuries by 2041 - represent clear political will and have produced substantial investment in cycling and pedestrian infrastructure. Yet as this research demonstrates, VZ in London is implemented through a system that operationalises safety primarily as KSI reduction. The consequence is a disparity between policy and practice gap where VZ's aspirational language about making streets safe for all users coexists with design processes that systematically marginalise the pedestrians it claims to protect.

The research site, a shared space scheme with integrated cycle infrastructure, exemplifies this tension: designed and evaluated principally through a cycling safety lens, with investment decisions justified by projected improvements in cyclist KSI statistics and success measured accordingly (GLA, 2018; TfL, 2010b). Pedestrian outcomes, as the observations and surveys in Chapter 4 demonstrate, were subordinated through a measurement framework that had no mechanism to register near-miss incidents, conflicts between user groups, or consequences for visually impaired and older users that this research documented.

The power dynamics within London's transport governance amplified this effect. As Phase 1 interviews revealed, cycling advocacy groups held strong institutional positions within TfL consultation processes during the period when this scheme was designed and implemented. Disability organisations, despite raising substantive concerns, had comparatively limited influence. This anomaly is not unique to London, but it is particularly consequential here given the speed and scale of infrastructure change. The suspension of Shared Space schemes, the halting of colourful crossings, and TfL's 2024 pause on floating bus stop installations each

represent the same pattern: safety issues highlighted by advocacy groups mobilising evidence and authorities responding belatedly.

6.10 A Self-Validating System

The preceding sections have documented the consequences of a particular way of knowing about pedestrian safety, one that is not simply limited but actively self-reinforcing. This section draws those threads together to make the structural argument explicit.

The road safety system in London, and more broadly across the UK, defines safety primarily through KSI data. That definition then determines which interventions are designed, which outcomes are measured, and which harms are recorded. When interventions are evaluated, they are assessed against the same metric that justified them. The system is, in this sense, self-validating: it can only recognise the problems it was built to see.

This circularity has direct consequences for pedestrian safety. As the literature review established, STATS19 records only injury collisions involving a moving vehicle on a public highway (DfT, 2011). Near-misses, trips and falls, avoidance behaviours, and the psychological costs of navigating uncertain infrastructure are structurally excluded. The research findings confirmed this at every phase. Near-miss incidents observed repeatedly across 21 sessions at Vauxhall Bridge Road were absent from official records. The disaffordances documented through GroundMap, removed tactile paving, absent audio alerts, floating bus stops, did not register in any dataset used to evaluate the Shared Space scheme. The colourful crossings were installed and the floating bus stop scheme expanded despite evidence of risk that the KSI framework could not record and therefore could not act on. In each case, the system was not failing to work, it was working exactly as designed. The difficulties fell outside its definition of the problem.

Wegman et al. (2015) identify a related limitation: road safety management systems cannot fully understand why their interventions succeed or fail because the data they rely on was never designed to capture that. This research provides situated, empirical evidence for that theoretical claim. The Shared Space scheme on Vauxhall Bridge Road was approved partly on the basis that there were no prior KSI incidents for cyclists at that location, yet the design went ahead and generated documented issues for pedestrians that the same metric could not subsequently record. The basis for the decision and the measure of its success were identical, and both were blind to the same things.

The implications extend beyond data gaps. When safety is operationalised as KSI reduction, design processes follow accordingly: they are structured around vehicle collisions, operated by traffic engineers, evaluated by road safety auditors, and consulted on with the stakeholders who have already established institutional access. Pedestrians, particularly those with protected characteristics, enter this system, if at all, as a secondary concern. As Phase 1 interviews confirmed, professionals acknowledged they did not know how to engage pedestrians; as

Phase 2 demonstrated, when disability organisations did raise concerns, they were overridden by cycling advocacy groups with stronger institutional standing. This is not individual failure. It is the logical outcome of a system structured around a definition of safety that does not require pedestrian engagement to function.

The pattern documented across all three phases, design interventions creating risk, concerns highlighted through advocacy, authorities responding belatedly, is not accidental. It reflects the absence of a mechanism for surfacing pedestrian experience at the point when it could change design outcomes. GroundMap was developed precisely to provide that mechanism: to make visible, before installation and in terms legible to decision-makers, what the current system structurally cannot see. The TfL meeting confirmed both the gap and the tool's capacity to fill it: safety professionals acknowledged that the evidence GroundMap generated was distinct from their routine datasets and represented knowledge they had no existing capacity to produce. That acknowledgement is itself evidence of the system's limits.

Addressing those limits requires more than better tools. It requires a shift in what counts as safety evidence, one that brings near-miss data, participatory observation, and lived experience of pedestrians with protected characteristics into the same analytical frame as collision statistics. Until that shift occurs, the system will continue to evaluate its own interventions against a definition of safety that those interventions were never designed to challenge. The system, in effect, marks its own homework: the metric used to justify interventions is the same metric used to evaluate them, making it structurally difficult to detect failures that fall outside its scope

Chapter Summary

This chapter brought the empirical findings of Chapters 4 and 5 into dialogue with the theoretical frameworks established in the literature review, examining the systemic conditions that shape and constrain pedestrian safety in London. The central argument is that the KSI-led definition of safety produces a self-reinforcing cycle: limited data generates limited insight, which produces design interventions that replicate existing problems, whose harms fall outside the metrics used to evaluate them and therefore go unrecorded. This is not a failure of individual professionals or institutions but the logical outcome of a measurement framework that was never designed to capture how pedestrians actually experience and navigate their environment.

Situating these findings within London's policy context revealed how the power asymmetry between cycling advocacy and disability organisations has directly shaped the design outcomes examined in this research. GroundMap is a practical intervention in that cycle, developed through direct engagement with the pedestrians most affected by those outcomes, and designed to make visible what current frameworks cannot see.

Chapter 7 draws these threads together, states the contribution to knowledge, and situates the findings within the broader context of pedestrian safety design.

Chapter 7: Conclusion

This concluding chapter brings together the findings from the three phases of design practice and the development of GroundMap, stating the contribution to knowledge, acknowledging the limitations of the research, and setting out the agenda for future work.

7.1 Defining Safety

What this research takes 'safety' to mean is worth stating directly, since the literature review showed it to be genuinely contested. Within the current road safety system, safety is operationalised as KSI reduction. This framing is rooted in STATS19, the Safe System approach, and TfL's Vision Zero commitments (TfL, 2018). It carries institutional authority and international consistency.

This research uses that approach as a starting point but extends beyond it, toward the broader, relational definition set out in Chapter 1 - one that is experiential as well as physical, encompassing near-misses, the burden of navigating uncertain spaces, and the effects of design decisions that remove safety cues pedestrians depend on. The GroundMap tool developed in this research is the practical expression of this understanding. By documenting what safety a place affords, what safety feature has been removed, and what disaffordances result, it translates this broader conception of safety into an assessable, actionable framework.

7.2 Contribution to Knowledge

The research contributes to knowledge in three ways, each grounded in the empirical work described in Chapters 4 and 5 and in dialogue with the theoretical landscape established in Chapters 2 and 3.

These three contributions are not independent. The empirical findings are only accessible because the methodological tool was designed to surface them; the tool only works because the theoretical concept of disaffordance gave analytical shape to what the fieldwork was producing. Together they constitute a coherent response to a single problem: that the current road safety system cannot see what this research found.

Theoretical: The Concept of Disaffordance

While Affordance Theory has been applied to product design, human-computer interaction, and urban space, its application to pedestrian safety as a systematic diagnostic framework is novel. This thesis extends that tradition in two directions.

First, it operationalises Gibson's relational concept of affordance within a real-world, multi-user urban safety context, moving beyond the individual actor-object dyad to investigate how a designed environment affects levels of safety for different types of pedestrian groups. Second, this work introduces and theorises the concept of disaffordance: where a design decision eliminates a safety feature that previously supported safe pedestrian navigation. While Gibson

and Norman focus on what environments offer, this thesis demonstrates that design choices that introduce disaffordances are equally consequential. This concept contributes to design theory by recognising such design choices as active decisions with measurable safety consequences.

Methodological: The GroundMap Tool

GroundMap is the primary methodological contribution of this thesis. It is a diagnostic framework for the systematic identification, mapping, and evaluation of safety affordances and disaffordances in pedestrian environments, combining observational fieldwork, participatory engagement with users, and visual annotation of physical changes over time.

Existing assessment tools were not designed to capture the subjective, embodied, and often invisible dimensions of pedestrian experience that this research foregrounds. GroundMap addresses that gap by embedding participatory observation, user shadowing, and co-design directly into the diagnostic process. Applied across the design practice in London, it consistently surfaced design failures and their consequences that official records did not contain.

Its practical value was confirmed through the meeting with TfL and Westminster City Council, where safety professionals acknowledged that the qualitative, user-centred evidence GroundMap generated was distinct from their routine datasets and represented information they lacked the capacity to produce themselves. Grounded in Affordance Theory and inclusive design principles, the tool is designed to complement rather than replace existing audits, offering a means of making visible what current frameworks cannot see.

Empirical: Structural Marginalisation of Vulnerable Users

The empirical findings constitute a coherent body of evidence that the current road safety design system in London structurally marginalises pedestrians, particularly those with protected characteristics.

This is not a criticism of individual designers or policymakers. The issue lies in the logic of the system itself. When safety is defined as KSI reduction and interventions are evaluated primarily against collision statistics, other dimensions of pedestrian experience, including near-misses, non-collision incidents, psychological stress, and exclusion from the design process, are simply not captured. The patterns documented were consistent: pedestrian concerns were raised at consultation stages and then overridden; disability organisations had less institutional power than cycling advocacy groups; design changes were implemented, found to be unsafe, and then halted, yet lessons were not systematically shared, meaning similar harms were replicated elsewhere.

Drawing on Foucault's (1980) analysis of discourse and institutional power, this research shows how expert-driven systems can unintentionally marginalise the very people they claim to protect. The road safety system does not exclude pedestrian experience through malice or indifference; it does so through a discourse - a set of categories, metrics, and institutional practices - that renders certain forms of harm invisible by design. KSI data is not just a measurement tool; it is a

knowledge regime that determines what counts as evidence, whose experience is recognised, and what kinds of intervention are possible. By surfacing what is excluded, this research positions design not only as a diagnostic instrument but as a vehicle for institutional critique and reform. GroundMap makes visible what the prevailing knowledge has structurally rendered invisible.

7.3 London as a Case Study

The analysis in Chapter 6 added a structural explanation to the empirical findings. The power dynamic between cycling advocacy and disability organisations within TfL consultation processes helps explain why the same pattern of harm, advocacy, and belated response recurred across all three phases of the research. This is not unique to London. The underlying logic applies wherever Vision Zero is implemented primarily through KSI-reduction targets. London's scale and speed of infrastructure change make it a particularly visible example of a wider problem. Whether GroundMap transfers to other contexts is addressed in the future research agenda below.

7.4 Situating the Findings

The findings of this thesis are in direct dialogue with the critical literature reviewed in Chapter 2. The research confirms that road safety practice is constrained by overreliance on backward-looking statistical data, and that the mechanisms behind Safe System interventions remain poorly understood, a limitation identified in the literature review and encountered directly in Phase 1. It corroborates the literature on structural underreporting of pedestrian incidents (DfT, 2024; Elvik & Mysen, 1999) through direct empirical evidence: near-misses, shared zones, and navigational failures documented across all three phases which were absent from official records. It extends the literature on pedestrian marginalisation in policy and design (WHO, 2021; Aldred, 2012; Marsden & Reardon, 2017) by demonstrating empirically what that marginalisation looks like in practice: older adults, people with learning disabilities, and visually impaired users experience the same design features in measurably different ways that a uniform pedestrian safety metric cannot record. Where this thesis goes beyond existing literature is in proposing a practical instrument, GroundMap, that translates these critiques into an actionable diagnostic framework, and in providing situated, multi-phase empirical evidence from a specific urban context that gives those critiques concrete and verifiable form.

7.5 Limitations

This research has several limitations that should be stated clearly.

Scope and generalisability

The empirical work is centred on London and the participant groups - while carefully chosen for their relevance - are not statistically representative of London pedestrians. The findings offer

rich, contextually grounded insights rather than generalisable conclusions. Whether the patterns identified here apply to outer London boroughs, smaller cities, or rural pedestrian environments requires further investigation.

Transferability of the methodological approach

As noted in Chapter 3, while London's specific policy context means that the empirical findings cannot be straightforwardly generalised to other cities, the methodological framework - combining Research through Design, Constructivist Grounded Theory, and Affordance Theory through the GroundMap diagnostic - is designed to be transferable. London's particular combination of organic street geography, fragmented borough governance, and a well-documented TfL policy framework provided conditions in which the approach could be developed and tested with rigour. Whether the same approach produces comparably rich findings in cities with different governance structures, planning histories, or pedestrian cultures remains an open question. Establishing this transferability is one of the primary objectives of the future research agenda set out at the close of this chapter.

Stakeholder selection and access

The professional interviewees in Phase 1 were recruited through existing contacts in London's transport sector, introducing a potential bias toward perspectives that were already broadly sympathetic to reform. The pedestrian groups in Phase 2 were advocacy organisations: self-selecting, motivated, and already engaged with safety questions. The survey in Phase 3 reaches a broader public, but response bias toward those who already felt unsafe cannot be ruled out.

The impact of COVID-19 on longitudinal continuity

The original observational study at Vauxhall Bridge Road was planned as a six-month cross-sectional study; it became a longitudinal study because of the pandemic. Changes in pedestrian and cyclist behaviour between 2019-20 and the 2024 revisit, including shifts in commuting patterns, are documented in Chapter 4 but cannot be fully controlled for.

Data Constraints

Observational sessions were conducted during specific time periods and weather conditions, which may not capture the full range of pedestrian experiences across different times of day, seasons, or weather conditions. Near-miss incidents were recorded qualitatively rather than quantitatively due to their frequency and overlapping nature at the study sites, as explained in Chapter 3. While this decision was methodologically justified, it means the research cannot provide statistical counts of near-miss events that would enable direct comparison with KSI data. Survey response rates varied across sites, and while 230 responses represent a substantial sample, they reflect the views of those who chose to participate rather than a randomised sample of all pedestrians using these spaces.

Researcher Positionality

Insider knowledge of TfL and London's transport sector was both an asset and a source of potential bias. There was a consistent risk of seeing what my professional background primed me to see. Systematic memo-writing and reflective journaling, described in Chapter 3, were employed to mitigate this, but the limitation should be acknowledged.

GroundMap: Validity and Reliability

The validity of GroundMap rests on several distinct layers, each established through different aspects of the research process. It is useful to distinguish clearly between what has been tested and what remains to be done.

Content validity: The tool's theoretical foundations, rooted in Affordance Theory and built explicitly to fill the gaps that existing audit frameworks leave, mean that each feature of the tool addresses a documented limitation in current practice. The tool measures what it claims to measure: the presence, absence, and safety consequences of environmental affordances for pedestrians.

Ecological validity: GroundMap was tested repeatedly across genuine urban environments with diverse user groups over three phases of research, rather than in simulations or controlled settings. The alignment between observational data and survey responses gathered independently across different sites and groups suggests the tool is surfacing real safety issues rather than ones introduced by the research process. This consistency across methods and participants provides a meaningful, if informal, form of convergent validity.

Practitioner validity: Practitioner validity was established through the meeting with TfL and Westminster City Council. Safety professionals reviewed GroundMap outputs, described them as credible and distinct from their routine datasets, and committed to design revision and further collaboration. These commitments represent direct, real-world endorsement of the tool's diagnostic and communicative value.

What has not yet been established is inter-rater reliability, whether two researchers working independently at the same site would produce comparable mappings. That is the critical next step if the tool is to move from being useful within this research to being replicable by others. Predictive validity also requires attention: whether GroundMap can reliably identify locations where future incidents are likely to occur has not yet been tested. The tool's utility for practitioners without a design research background is a further open question, the TfL meeting provided encouragement on this point, but structured usability testing with non-specialist practitioners has not been conducted.

These gaps do not undermine the tool's contribution within this research. They define the agenda for what comes next, set out in the recommendations in Section 7.6.

7.6 Recommendations

For Policy and Practice

Several practical changes follow from this evidence. Near-miss data needs to become a standard part of road safety assessment. Aviation and maritime have long treated near-miss reporting as a core safety tool, and there is no principled reason road safety should operate differently. The GroundMap tool, or an equivalent participatory approach, should be built into the design process for any intervention that significantly alters pedestrian infrastructure at the earliest stages, when ideas are still being shaped. Local authorities should also be required to engage meaningfully with pedestrians who have protected characteristics before design decisions are finalised, and to demonstrate how that engagement shaped outcomes. A coordinated national programme to link STATS19, and datasets such as hospital records, insurance data, and a method to record near-miss reports would enable a fuller picture of pedestrian risk.

The empirical work here is rooted in London, but the implications reach further. STATS19 is used by every local authority in the UK, and its absent pedestrian data affects national data reporting. Vision Zero and the Safe System are national commitments, and the critique offered here of how they become reduced to KSI targets applies wherever those frameworks are adopted. The floating bus stop case makes the point sharply: TfL paused installations in London following sustained advocacy, while equivalent designs continued to be rolled out elsewhere, without the benefit of London's accumulated evidence and learning lessons. Closing that gap is a matter for the DfT, through national design guidance and data collection standards.

A national mechanism for sharing design safety findings between local authorities is needed. TfL's pause on floating bus stop installations in 2024 was prompted by evidence that standard KSI monitoring could not produce. Without a formal channel for disseminating such findings, equivalent schemes will continue to be installed elsewhere in the UK, repeating harm that has already been identified and documented.

For Future Research

Validating and stress-testing the GroundMap tool is the most immediate research priority. Beyond that, the thesis has opened lines of inquiry that warrant independent investigation: how lobbying and institutional power shape road safety decisions in London and nationally; what pedestrian experience looks like in cities outside London where cycling infrastructure has been built at scale; how the Affordance-Disaffordance framework might apply to other complex, contested problems and what pedestrian safety design looks like as autonomous vehicles and new micro-mobility technologies emerge.

Coming to a stop

The research confirmed that pedestrian exclusion is deeply entrenched in the system. GroundMap prompts different questions: not only how many people were killed or seriously injured, but what safety does an environment afford the person who is elderly, visually impaired,

or navigating it for the first time. Safety experts can and do make changes at a local level, and the commitments made by TfL and Westminster City Council following this research are evidence that user-centred evidence can shift professional practice. Institutional change, the kind needed to fundamentally reframe how pedestrian safety is defined, measured, and designed for, will require sustained effort across policy, practice, and research. The argument this research makes, however, is that pedestrian safety is not only the absence of injury, it is the capacity to move through public space with confidence and freedom, a condition that depends on environments being designed and evaluated with the pedestrian perspective as the starting point.

APPENDICES

Letter	Title	Related Chapter	Page No.
A	Conference Presentations, Workshops, and Advisory Roles	1 & 4	154 - 155
B	Application of Braun and Clarke's Thematic Analysis	3	156
C	Phase 1: Professional Interviews on Road Safety Practice	4	157 - 158
D	Professional Interview Template	4	159 - 161
E	Phase 1: Site Observations and Physical Inventory	4	162 - 166
F	Phase 1: Social Worlds/Arenas Mapping and Economic Context	4	167 - 177
G	Participant and Gatekeeper Consent Forms	3	178 - 184
H	Phase 1–2: TfL Disability and Construction Working Group Sessions	4	185 - 188
I	Phase 2: Mencap Workshops and Shadowing	4	189 - 191
J	Phase 2: KOVE Walkabout Sessions	4	192
K	Phase 2: GroundMap Mapping Exercises Across All Groups	4 & 5	193 - 194
L	Phase 3: Public Survey (Instrument and Administration)	4	195 - 201
M	Phase 3: Co-Design Workshop and Prototype Development	4	202 - 204
N	Practitioner Validation: TfL and WCC Meeting	4 & 5	205 - 206
O	Comparative Analysis: KSI Data at Study Site	2 & 6	207 - 209
P	GroundMap Tool: Blank Templates and Development Notes	4 & 5	210 - 213
Q	STATS19 Form: Structural Limitations of Official Data	2 & 6	214 - 218
R	Reflective Journal Extracts	3	219 - 228

Appendix Introduction

This appendix documents the data collection records, instruments, and contextual information for each phase of the research. Data collection across the three phases was deliberately non-uniform, consistent with the Constructivist Grounded Theory approach adopted. Professional interviews did not use a structured recording template; themes were extracted analytically after the fact using Braun and Clarke's framework (Appendix B) and constant comparative method. Walkabout sessions were experiential rather than data collection exercises. Shadowing exercises generated data through participant accounts rather than researcher observation. Near-miss incidents across all phases were recorded qualitatively; the frequency and simultaneity of incidents made discrete event counting unworkable; see Chapter 3 for methodological discussion. Survey instruments (Appendix L) constitute the data collection record for Phase 3.

A note on figures and tables within the appendices

Figures and tables contained within the appendices are labelled by appendix letter and sequence number, for example Figure E.1 or Table J.1, and are not included in the main List of Figures or List of Tables. Where an appendix contains multiple figures or tables these are numbered sequentially within that appendix. Cross-references to appendix figures and tables in the main thesis text use the same labelling convention.

Appendix A: Conference Presentations, Workshops, and Advisory Roles

Table A.1

Group	Role	Publications / Events
Living Streets (London)	Participant	Walkabouts: How can we use creative walking? (July 2023) https://repository.uel.ac.uk/item/8q wz3
Hassell Design Studio (London)	Workshop participant & interviewee	Corridors: Designing linear infrastructure in a nonlinear world (September 2023) Helen Hamlyn Centre for Design https://www.rca.ac.uk/researchinnovation/research-centres/helenhamlyn-centre/
Helen Hamlyn Centre for Design (RCA)	Member of Advisory Board	Streets for Diversity Report Streets for Diversity project https://www.rca.ac.uk/researchinnovation/research-centres/helenhamlyn-centre/streets-for-diversity/
Intelligent Mobility Design Centre (RCA)	Conference Presenter (2022)	Mobility Metamorphosis Symposium (2022) IMDC, RCA, Battersea London SW11.
SALUS Healthy City Design Congress (6th)	Speaker	6th Healthy City Design Congress (2022), London. UK
“	Conference Presentation Poster	SALUS Global Knowledge Exchange (see Figure A.1)
EuroSafe: European Association for injury prevention and safety promotion	Conference Participant	EU-Safety Conference, Iceland (2023) https://eusafety2023.landsbjorg.is

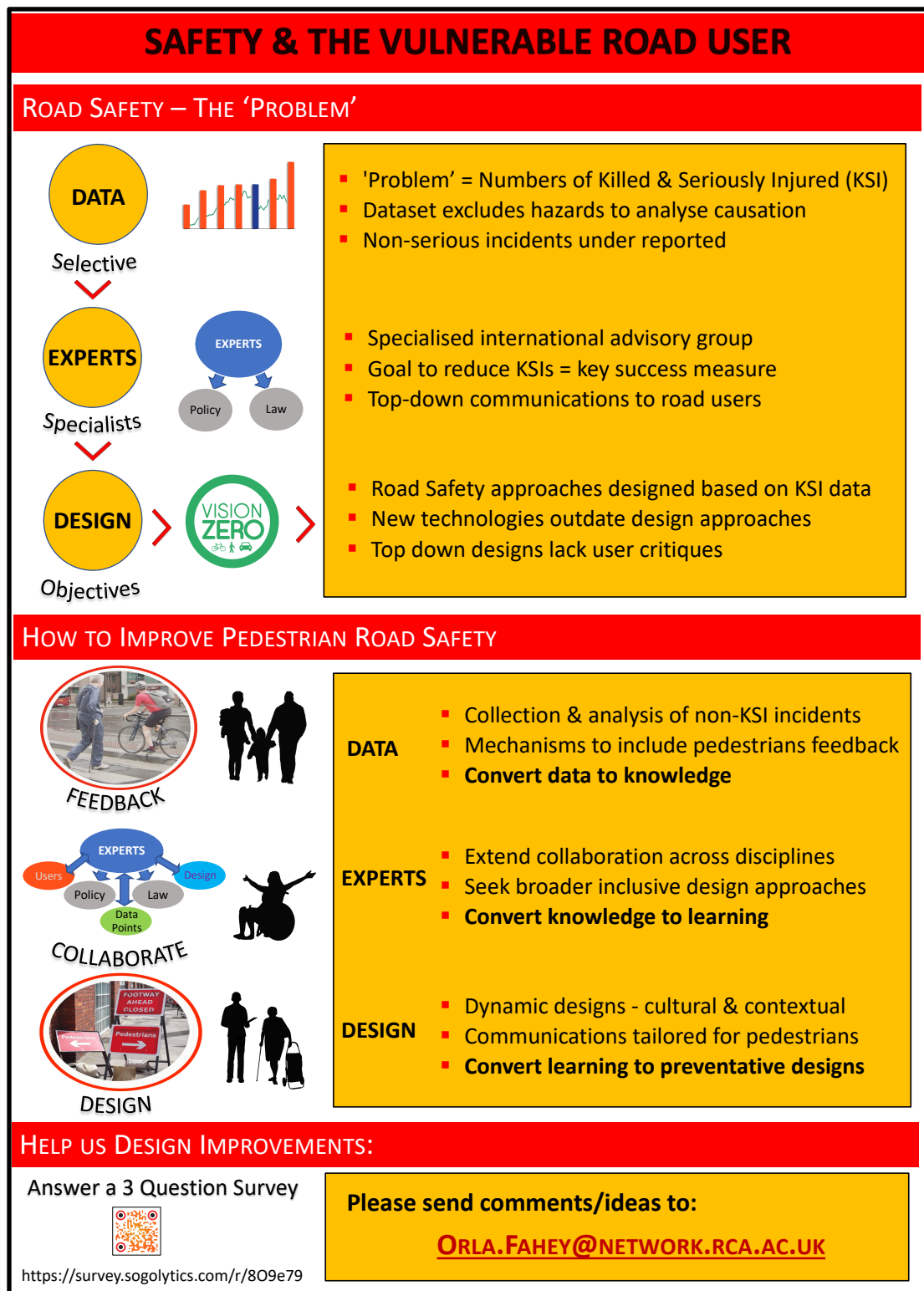


Figure A.1 Conference poster presented at the SALUS Healthy City Design Congress, London, 2022.

Appendix B: Application of Braun & Clarke's Thematic Analysis

Braun and Clarke's (2006) six-step thematic analysis framework was used as a practical tool to support early-stage coding and pattern identification across interviews, observations, and survey data. The steps were applied as follows:

Familiarisation

Interview transcripts, observation notes, and survey responses were read and re-read to develop an in-depth understanding of the dataset.

Generating Initial Codes

Line-by-line coding was undertaken to identify recurring patterns, concepts, and participant language, including in vivo codes reflecting professional terminology.

Searching for Themes

Codes were grouped into candidate themes based on shared meanings and relationships observed across the dataset.

Reviewing Themes

Candidate themes were iteratively compared against the full dataset to ensure internal coherence and consistency with the data.

Defining and Naming

Themes were refined and clearly defined to reflect their conceptual scope and relevance to the research questions.

Producing the Report

Thematic findings were integrated into the analysis and presented as part of the study's findings, contributing to the development of higher-level theoretical insights.

While Braun and Clarke's framework supported initial thematic organisation, themes were further developed through the constant comparative method associated with Constructivist Grounded Theory, allowing for iterative refinement and theory generation.

Appendix C: Phase 1: Professional Interviews on Road Safety Practice

Table C.1

Participant	Organisation Type	Role	Date	Duration	Format
A	University (KCL)	Professor of Sociology	27 September 2019	90 minutes	In person
B	Living Streets	Chairperson	25 October 2019	60 minutes	In person
C	RAC Foundation	Head of Research	14 November 2020	90 mins	In person
D	TfL	Sponsor	5 December 2019	90 mins	In person
E	TfL	Sponsor	12 December 2019	60 mins	In person
F	Urban Design Organisation, London	Urban Designer	13 February 2020	90 mins	In person
G, H, I	Westminster City Council	3 x members of safety programme team	4 March 2020	90 mins	In person
J	Transport Research Laboratory	Chief Scientist	16 March 2020	45 mins	Online
K	Lambeth Local Authority	Safety officer	20 March 2020	60 mins	In person
L	ROSPA	Road Safety Officer	15 April 2020	30 mins	Online
M *	Westminster City Council	Local Councillor	18 September 2020	90 mins	In person
N *	Westminster City Council	Lead master planner	22 September 2020	45 mins	In person
O *	DfT	Head of Traffic Signs and Street Design Policy	9 June 2021	30 mins	Online

* **Note:** Participants M, N, and O were interviewed after the initial data collection period due to COVID-19 disruption and scheduling constraints.

Interview data collection was disrupted in March 2020 by the onset of the COVID-19 pandemic; two interviews planned for in-person completion were conducted remotely. This is discussed further in the limitations section of Chapter 7.

Format: Semi-structured interviews guided by sensitising concepts around safety, vulnerable road users, and design. A questionnaire template was used as a flexible guide rather than a fixed script (see Appendix D.1).

Recruitment: Purposive sampling through existing professional contacts and conference attendance, September 2019 to March 2020.

Data captured: Professional perspectives on road safety practice, KSI metrics, stakeholder dynamics, and pedestrian design. Interviews were analysed using Constructivist Grounded Theory coding as described in Chapter 3.

Ethical note: All participants consented to participation and are anonymised throughout the thesis using letters. No identifying information is included in research outputs.

Appendix D: Professional Interview Template

The following template was used as a flexible guide during the semi-structured interviews conducted in Phase 1 (September 2019 to June 2021). The template was not followed as a rigid script, consistent with the Constructivist Grounded Theory approach described in Chapter 3, interviews were participant-led, allowing responses to develop organically and new lines of inquiry to emerge. The template provided a structural framework to ensure the three sensitising concepts of safety, vulnerable road users, and design were addressed across all sessions, while allowing the conversation to be shaped by each participant's expertise and perspective.

The template is reproduced here to provide transparency about the interview process and to demonstrate the consistency of approach across the fifteen participants documented in Appendix C.

The purpose of this questionnaire is to gain an understanding of the process, methods and tools involved in planning and designing for the safety of the vulnerable road user.

The questionnaire will be used as a method for conducting an open ended interview.

There are 5 main themes, with a total of 32 questions.

Abbreviations: vulnerable road user = vru. Vision Zero = VZ

VISION	
1	What is the vision/objective for safety of vulnerable road users (vru's).
2	What is the UK government policy – national, local – for road safety of vrus
3	Vision Zero goals : How is that translated into current design for safety.
4	How is it evaluated.
5	Who evaluates it.
6	How will VZ be used in schemes already installed
DESIGNERS	
7	Who designs the space for pedestrians/cyclists
8	How does your organisation's objective get translated into the masterplan/design plan
9	What design standards are used by your organisation
10	What process is followed
11	Who is involved in the design process
12	What discipline/qualifications are required.
13	What methods are used to evaluate the space for: • flow of people • flow of cycle traffic • forecasting (before installation of infrastructure and after) • future proofing (if design not working for end users)
14	What tools are used to design the space – e.g. AutoCAD, cloud data.....

Figure D.1 Professional Interview Template, (Page 1 of 2)

15	Are the same tools used across: the organisation, external partners (e.g. Boroughs)?
16	If not, how are designs 'read' by other parties. • Who manages the process? • Evaluates the process?
SAFETY	
17	How is 'safety' defined.
18	How is safety built into your methods and tools for design? • What method(s) are used. • What is the process.
19	Is there a form for risk assessment and safety assessments.
20	What skills (in safety/risk) do your designers have
21	Who is the governing body for design.
22	How is 'risk' defined.
GOVERNANCE	
23	Who evaluates the plan (for safety).
24	How is it evaluated.
25	What regulations/laws must be followed for design of safety.
26	Who is the authority you answer to.
27	Who provides the governance?
FOR ALL	
28	If you could make 3 changes that would improve SAFETY; what would they be
29	If you could make 3 changes that would improve RISK; what would they be
30	If you could make 3 changes that would improve DESIGN; what would they be
31	Have you seen ideas in other countries/areas that you would like to see (but have not been implemented yet)
32	If you could make changes in your system what would they be (up to 3).

Figure D.1 Professional Interview Template, (Page 2 of 2)

Appendix E: Phase 1: Site Observations and Physical Inventory

Observations were conducted across five points at the Vauxhall Bridge Road study site between November 2019 and February 2020, with a follow-up session in 2024. The observational approach was qualitative and adaptive, consistent with the Constructivist Grounded Theory methodology described in Chapter 3. Near misses were defined and recorded as set out in Chapter 3, Section 3.4.1.

Table E.1 *Data collection record – Phase 1 observations*

Session	Date	Location	Time Period	Duration	Recording Method	Weather	Near-misses
1	Nov 2019: 12, 14, 15, 18, 20, 22, 26, 28. Dec: 3, 5, 10, 12, 17. Jan: 13, 15, 17, 21, 23, 28. Feb: 4, 6, 12	Vauxhall Bridge Road (A)	Peak commuting hours 7–9am, 2.30–4.30pm, 5–6.45pm	2 hours per session	Field notes, video, photographs	Autumn and winter conditions. No extreme weather. No sessions abandoned.	Observed qualitatively, see methodological note below
2	As above	Regency Street (B)	As above	As above	As above	As above	As above
3	As above	Causton Street (C)	As above	As above	As above	As above	As above
4	As above	John Islip Street (D)	As above	As above	As above	As above	As above
5	As above	Drummond Gate (E)	As above	As above	As above	As above	As above
6	As above	All points A-E	As above	As above	As above	As above	As above
7	Spring 2024	Vauxhall Bridge Road (A)	Peak commuting hours	2 hours	Field notes, video, photographs	Mild spring conditions	Observed qualitatively

Note: Near-miss incidents were observed consistently across sessions at all five observation points. Due to the frequency and simultaneity of incidents, discrete event counting was not practicable. Incidents were recorded qualitatively through field notes and video stills. See Chapter 3, Section 3.4.1 for full methodological discussion.

Format: Structured observation at designated points, supplemented by field notes and visual documentation. The primary observation point (A) was outside the White Swan public house, facing the pedestrian crossing. During the observation sessions I moved between points A to E.

Observational approach: Consistent with the Constructivist Grounded Theory approach underpinning this research, observations were conducted without a fixed event-logging framework. Recording focused on the nature, context, and significance of incidents rather than discrete event counts, for reasons discussed in Chapter 3.

Data captured: Pedestrian and cyclist behaviours, near-miss activity, signage and infrastructure observations, photographic and video documentation.

Ethical note: Observations were conducted in public spaces. No individuals are identifiable in the research outputs. Video and photographic material is used for analytical purposes only.

Note on COVID-19 disruption and study redesign

The original study design planned observations from November 2019 to May 2020, followed by surveys from June to November 2020. The onset of COVID-19 in March 2020 required the study to be redesigned as a longitudinal study. Observations were resumed in 2024 (Session 7) once commuter patterns had stabilised, using the same methodology and observation points as the original sessions. This resumed phase also informed the survey design for Phase 3. The impact of COVID-19 on the study design is discussed further in Chapter 7, Section 7.5.

Inventory maps: Vauxhall Bridge Road Study Site

This appendix presents inventory maps of the Vauxhall Bridge Road study site produced during Phase 1 observations. The maps document the physical features and objects present in the street environment, including signage, street furniture, road markings, and infrastructure elements. They provide a baseline record of the site as it existed during the observation period and informed the subsequent Affordance-Disaffordance analysis developed in Chapter 5. Figure E.1 presents an overlay map of the full site; Figure E.2 provides a detailed inventory of specific pedestrian safety features.

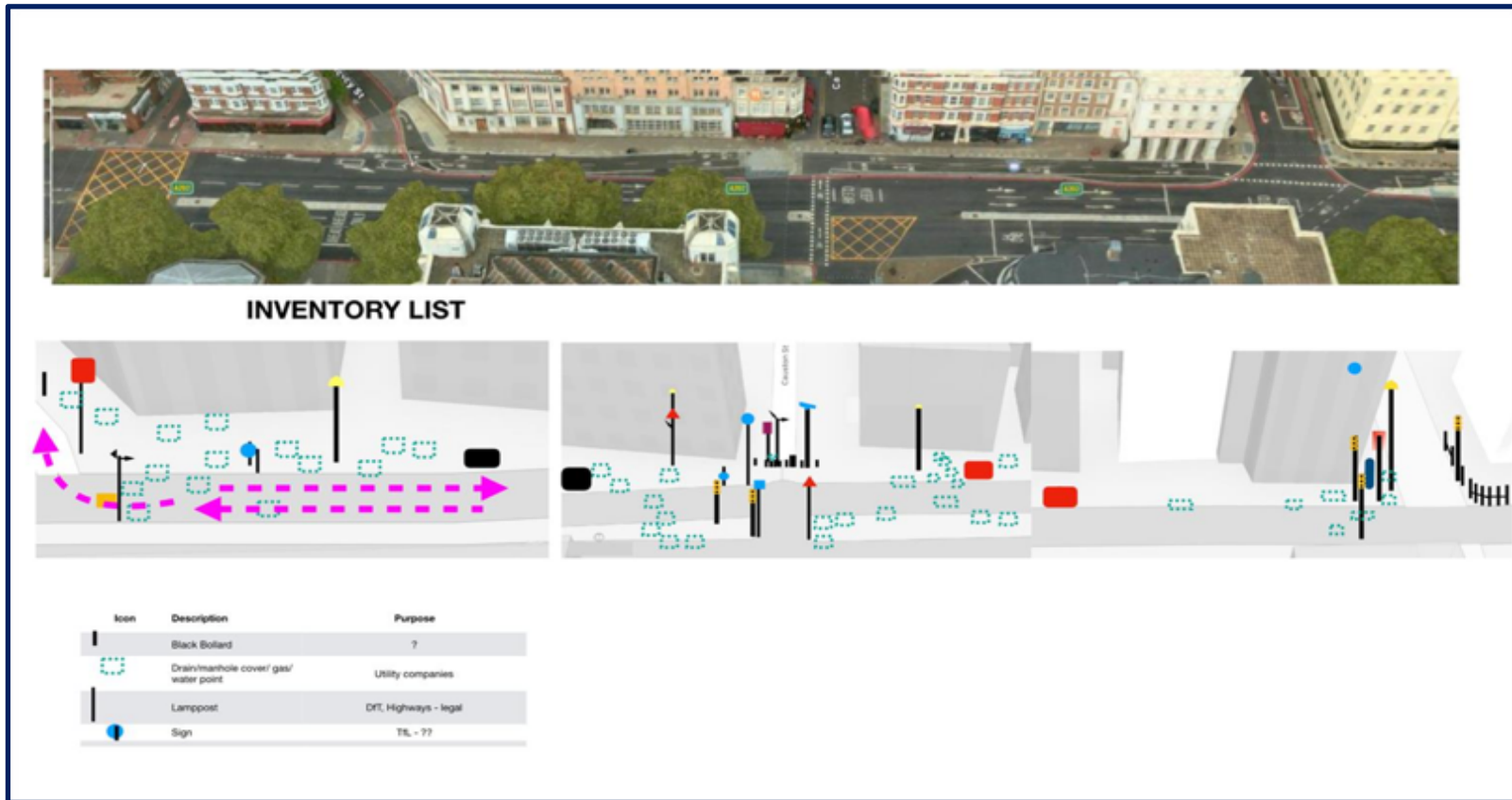


Figure E.1 – inventory overlay map: Affordance-Disaffordance inventory of the Vauxhall Bridge Road study site.



Figure E.2 – inventory map: details of examples at site inventory showing pedestrian safety features.

Appendix F: Phase 1: Social Worlds/Arenas Mapping and Economic Context

This appendix presents the situational analysis maps produced as part of the Social Worlds/Arenas framework analysis (Clarke, 2005) conducted during Phase 1. The maps are original analytical work produced by the researcher and should be read alongside the discussion in Chapter 4, which sets out the rationale for the analysis and its key findings. Three map types are presented: a situational map identifying key actors, objects, and discourses within the road safety landscape (Figure F.1); a social worlds/arenas map showing relationships between stakeholder groups (Figure F.2) and Table F.1 detailing these relationships; and a positional map displaying how stakeholders were positioned relative to competing definitions of safety (Figure F.3).

The appendix also includes the Road Safety Funding Map (Figures F.4 and F.4a) and trade data illustrating the economic scale of the automotive sector (Figure F.5), both of which contextualise the macro-level economic actors identified in the situational analysis.

Situational Mapping

A situational map distinguishes the primary human, nonhuman, discursive, and other actors in a situation to understand how they relate to and impact each other. The mapping exercise began with a working map in which keywords from literature reviews and interviews were included, terms such as 'Stats19' and 'Vision Zero' that emerged as important across the data.

This activity surfaced the wide variety of actors and stakeholders with a stake in road safety design, such as:

Human actors: London Mayor, pedestrians, cyclists, TfL, DfT, and utility companies.

Non-human elements: KSI numbers, road signs, advertising boards and vehicle traffic

Collective actors and organisations: Cycling advocacy groups, disability rights organisations, international organisations (OECD, World Bank, UN, WHO).

Discursive constructions: Social world construction of experts, disciplines, the Equality Act 2010, disability rights, and design guidance

Political and economic elements: Government parties, GLA/Mayor, lobby groups, influential leaders, SDG targets, the automotive industry

Sociocultural elements: Age, gender, cycling as priority, vehicle use

Major issues and debates: Safety of cyclists, sustainability, reducing traffic, electric vehicles.

For example, a major player in worldwide road safety is the FIA Foundation, which advocates for motoring organisations' interests while also working in road safety. This organization has published influential guidance such as 'Pedestrian Safety: a Road Safety Guidebook for Decision-Makers and Practitioners'. This dual focus suggests a potential conflict of interests

between advocacy for growing vehicle use and reducing safety risks associated with faster vehicles.

The mapping also revealed contrasting discourses. Cycling advocacy groups prioritised cyclist safety requirements whilst disability campaigners sought their enshrined rights within the Equality Act 2010 as part of their safety agenda. These competing frameworks for understanding safety shaped the design consultation process.



Figure F.1 Situational Map (initial messy map): actors, objects, and discourses identified in the road safety landscape.

Social Worlds/Arenas Mapping

Creating the situational map enabled identification of both visible and hidden stakeholders who influence design decisions. This mapping revealed relationships extending beyond UK stakeholders to include international organisations shaping policy decisions, such as Vision Zero, which influences safety policy in the UK. The mapping also revealed the relationship between cycling lobby groups and the Greater London Assembly (GLA) and Mayor's office, demonstrating how political access correlates with influence on design outcomes. This map outlines the overall social arena and interacting social worlds of London road safety practice.

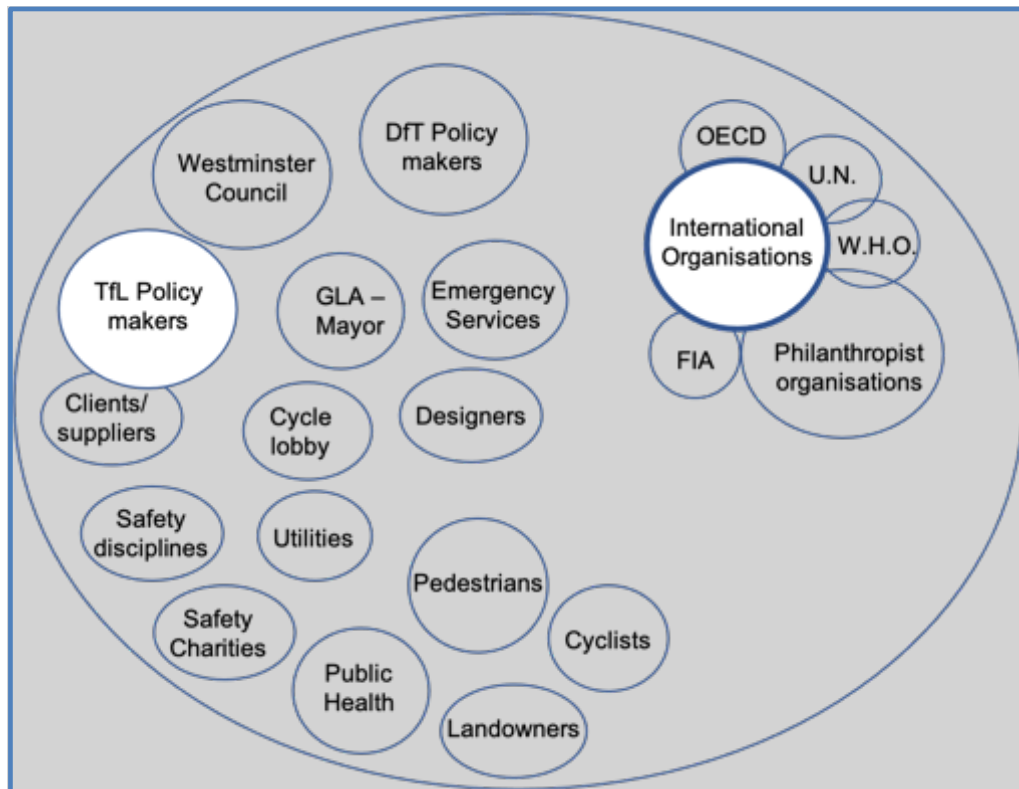


Figure F.2 *Social worlds map*

Table F.1 Ordered Situational Map

<u>Individual human elements/actors</u> Transport Minister London Mayor London Cycling Commissioner	<u>Non-human elements/actions</u> Ksi numbers Signs Lines Utility covers, boxes Advertising boards
<u>Collective human elements/actors</u> Pedestrians, cyclists TfL, DfT, CIHT London Cycling advocacy Utility Companies International lobby groups	<u>Implicated/silent actors/actants</u> Political actors Landowners and developers International policy bodies (OECD, World Bank, UN, WHO) Industry organisations (e.g. FIA) Funding bodies
<u>Discursive constructions of individual and/or collective human actors</u> Construction of “the pedestrian” Construction of “the expert” Construction of “risk” Construction of “safety”	<u>Discursive constructions of nonhuman actants</u> Social world construction of disciplines Social world construction of Equality Act 2010, Social world construction of Disability Rights Social world construction of Design guidance
<u>Political/economic elements</u> Government – party TfL Commissioner Lobby groups Influential leaders – UK and International Automotive industry	<u>Sociocultural/symbolic elements</u> Elderly, youth, gender, icons, council design palette Cycling as priority Vehicle use
<u>Temporal elements</u> New designs Seasons – environment	<u>Spatial elements</u> Dedicated space for cyclists Reduced space for cars
<u>Major issues/debates (usually contested)</u> Safety of cyclists Sustainability Health Reduce traffic Change of infrastructure	<u>Related discourses (historical) narrative and/or visual</u> Disability discourse Ageism discourse Gender/feminist Accessibility

Positional Mapping

To understand the different standpoints of stakeholders, a positional map was created. During the initial shared space consultation conducted by TfL, participants were asked to vote on whether they agreed or disagreed with the installation of a shared space intervention. The criteria used to poll for agreement were reducing cyclist KSI numbers and improving cyclist safety.

This map reveals how results were weighted in favour of the intervention and highlights the dominant perspectives shaping design decision-making in practice. The influence of a powerful cycling advocacy group affected how concerns raised by disability organisations were handled, with their political access meaning the concept was implemented despite substantive concerns raised for pedestrian safety.

Figure F.3 presents the positional map developed from the TfL consultation data, showing how stakeholder positions clustered around competing definitions of safety.

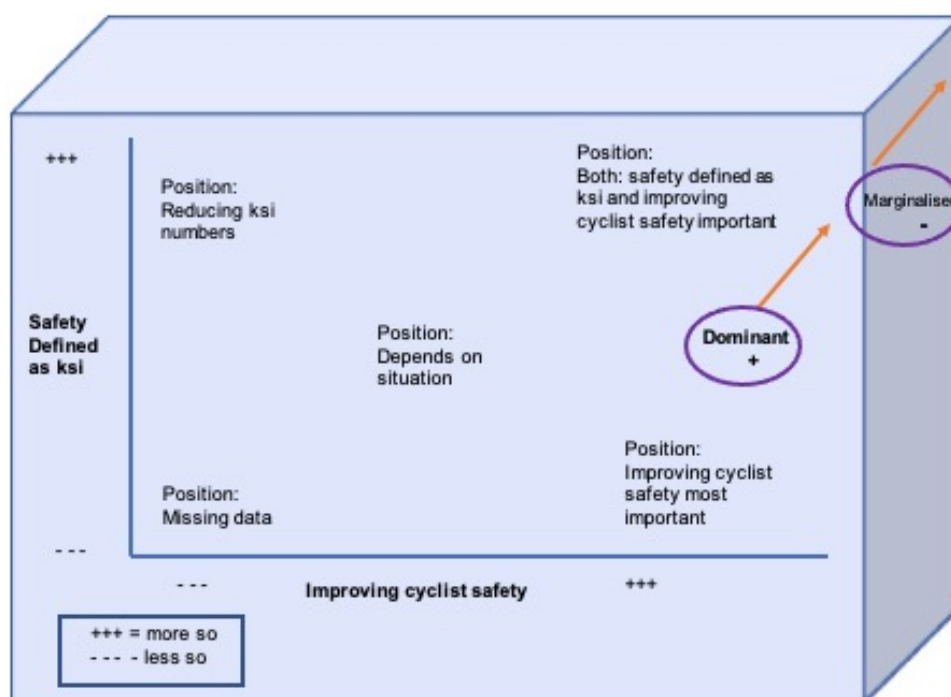


Figure F.3 *Positional Map - Consultation positions on Shared Space*

These maps revealed a clear stakeholder imbalance in the consultation process: cycling advocacy groups held considerable influence, while disability organisations articulating important safety concerns had comparatively limited impact. This analysis demonstrates how safety design decisions may be driven more by stakeholder agendas and the relative political power and influence of stakeholder groups within the consultation processes than by principles enshrined in legislation such as the Equality Act 2010 or inclusive design guidelines from the DfT (2015) and TfL (2018).

Road Safety Funding Map: Global and UK Relationships

This map documents funding relationships between key international and national road safety organisations, including the FIA Foundation, the Global Road Safety Facility (GRSF), and the Department for Transport (DfT). It represents original analytical work undertaken as part of the situational analysis for this research.

Within a Situational Analysis framework (Clarke, 2005), funding flows represent a form of structural power: they determine which safety priorities receive investment, which research gets commissioned, and whose interests are advanced within the road safety system. The dominance of vehicle-focused and KSI-reduction funding streams helps explain the relative marginalisation of pedestrian-focused research and the persistence of car-centric planning paradigms identified in the professional interviews (Chapter 4) and the literature review (Chapter 2).

This analysis complements the Social Worlds/Arenas Map (Figure F.2) by adding an economic dimension to the situational analysis of London road safety practice.

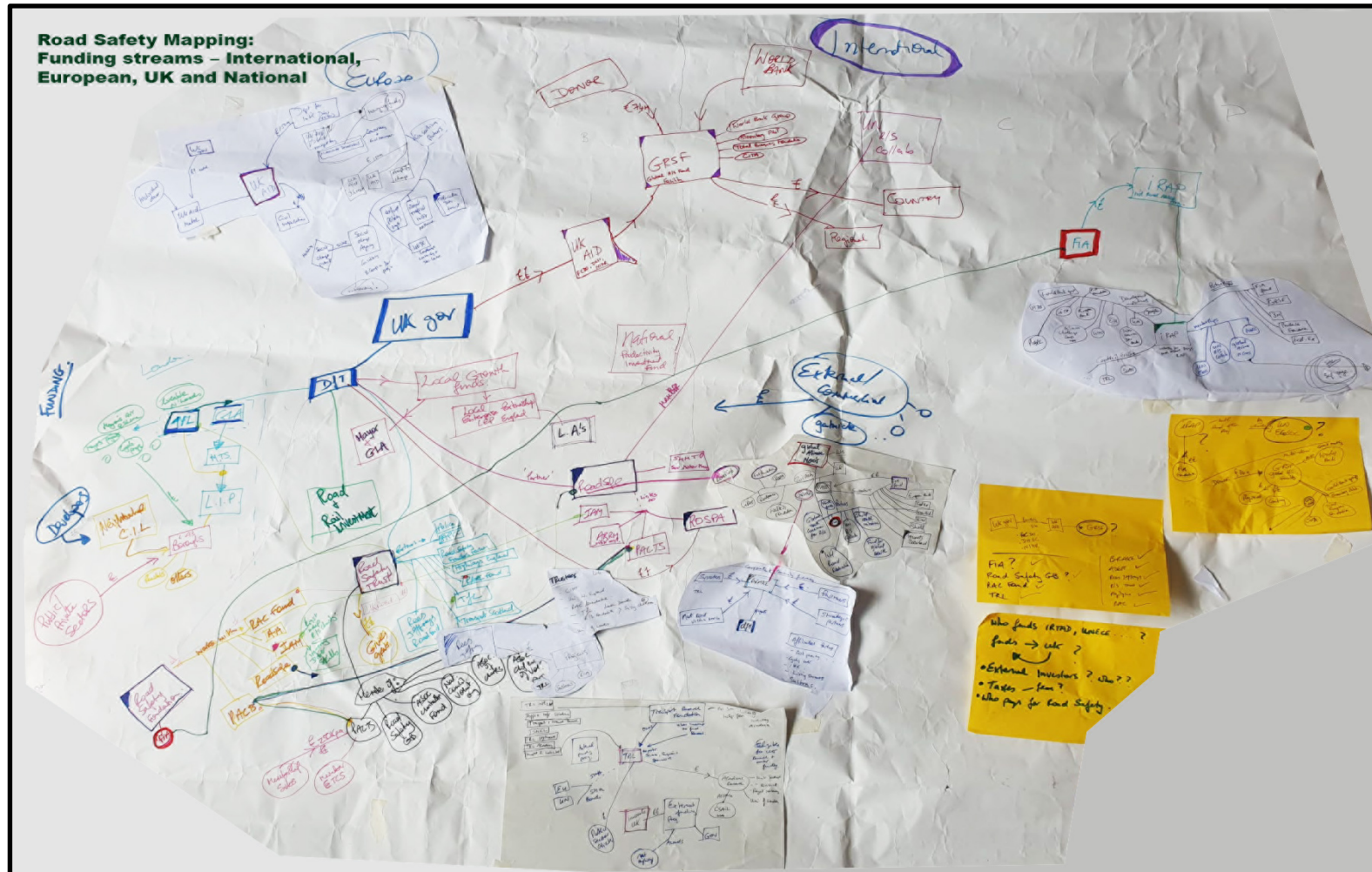


Figure F.4 Road safety funding map, global and UK relationships

Note. Full map. A detail showing FIA funding relationships is shown in Figure F.4a.

[illegible]

Note. Close-up of Figure F.4.

Macro-Level Economic Actors

Within a Situational Analysis framework (Clarke, 2005), this positions the automotive industry as a powerful macro-level actor, exerting structural influence over transport policy, infrastructure investment, and safety priorities. The scale of its economic contribution reinforces its role as a key stakeholder in decision-making processes, often prioritising vehicular mobility, efficiency, and growth. This economic weighting helps explain the persistence of car-centric planning paradigms identified in both the literature and professional interviews, and the relative marginalisation of pedestrian needs within road safety policy and design frameworks. This dynamic is reflected in the Social Worlds/Arenas Table (Table F.1.), where the automotive sector occupies a dominant position relative to more weakly represented groups such as pedestrians and disability advocates.

Figure F.5 illustrates this economic scale directly. The 2020 trade data shows the automotive sector generating £74 billion in combined import and export activity, with £30 billion exported and £43.8 billion imported. These figures place the sector among the most economically influential in the UK, and help explain its structural weight within transport policy decisions. The contrast with the resources available to pedestrian advocacy organisations and disability charities, mapped in the Social Worlds/Arenas analysis above, is stark.

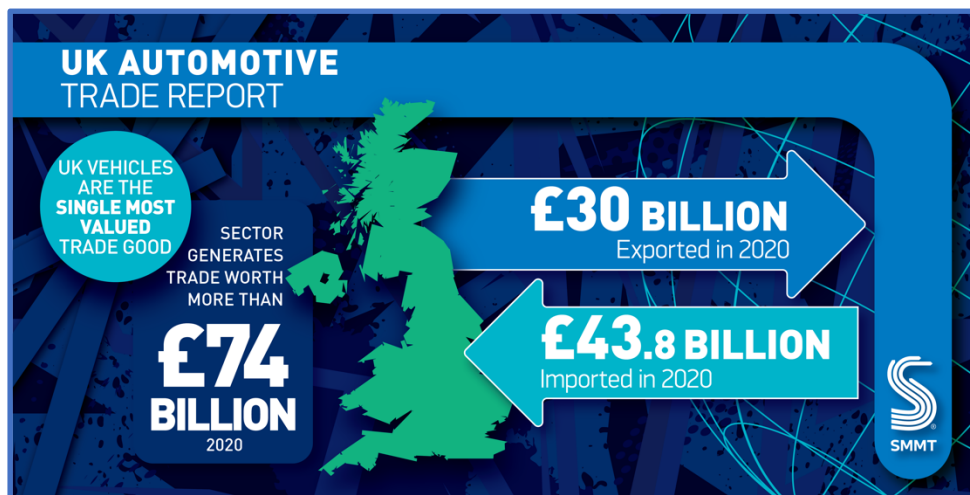


Figure F.5 *UK automotive sector trade, 2020: exports and imports*

Note. From UK Automotive Trade Report 2021: Driving Global Britain, by the Society of Motor Manufacturers and Traders, 2021. (<https://smmweb.lon1.cdn.digitaloceanspaces.com/wp-content/uploads/2025/08/SMMT-Automotive-Trade-Report-2021.pdf>). Used for academic non-commercial research purposes.

Appendix G: Participant and Gatekeeper Consent Forms

Purpose and Ethical Framework

This appendix reproduces the consent forms used throughout the research to obtain informed consent from participants. Two forms were developed: one for individual participants, and one for gatekeepers (where relevant), individuals or organisations with responsibility for participant access or welfare.

Both forms were designed to ensure participants understood the research purpose, how their data would be used, what participation involved, and their rights to withdraw. The forms were reviewed and approved by RCA Ethics Committee prior to data collection.

Participant Consent Form

The participant consent form was used across all three phases (interviews, observation sessions, workshop participation, survey completion, and shadowing exercises). It provided essential information about:

The research purpose and how findings would be used

What participation involved (time commitment, activities, recording methods)

Confidentiality and anonymity protections

Rights to withdraw without penalty

Contact information for the researcher and ethics support

Gatekeeper Consent Form

The gatekeeper consent form was used where participants accessed the research through organisations or individuals with gatekeeping responsibility. The gatekeeper form sought organisational consent for participant recruitment and ensured that gatekeepers understood the research and could vouch for its legitimacy to potential participants.

CONSENT TO PARTICIPATE IN RESEARCH

(one copy of this form should be given to the participant and one retained by the researcher)

**How can Design Improve Road Safety for the Vulnerable Road User
- Pedestrian**

Dear [name]

You are invited to participate in a research study conducted by Orla Fahey, from the School of Design at the Royal College of Art as part of my PhD. Your participation in this study is entirely voluntary. Please read the information below and ask questions about anything you do not understand, before deciding whether or not to participate.

• **PURPOSE OF THE STUDY**

The study focuses on pedestrian road safety and is interested in the experience of people using the public space. The research is concerned with identifying issues a pedestrian experience, particularly pedestrians with neuro diverse needs. As the research progresses, the aim is to consider opportunities from a design thinking approach to identify what preventative measures could be put in place to assist with pedestrian safety. Future case studies may look at safety issues relating to construction works and accessibility for pedestrians using the areas.

• **PARTICIPATION**

If you volunteer to participate in this study, you will be asked to do the following things, over the course of the study (2019 – 2025):

- Assist in giving context and background to the formalities and legalities of the infrastructure that is in place for the pedestrian.
- Give assistance in providing contacts that may provide extra guidance and future participant in the research work.
- Give advice and guidance on research topics/areas that you have experience with.

Figure G.1 Participant form (page 1 of 3)

- Conversations and further discussions with small groups chosen from your network of contacts.

There are two distinct groups:

- Those who can provide 'lived experience' as a participant within your ongoing research and participant groups.
- Professionals from safety and cross-disciplines and those who work with you to establish best practice and participate in your research and work.

• **POTENTIAL RISKS AND DISCOMFORTS**

Foreseeable risks or discomforts are limited as the researcher will follow the gatekeeper's advice in closing discussions or workshops early if participants request.

In the event of physical and/or mental injury resulting from participation in this research project, the Royal College of Art does not provide any medical, hospitalisation or other insurance for participants in this research study, nor will the Royal College of Art provide any medical treatment or compensation for any injury sustained as a result of participation in this research study, except as required by law.

• **POTENTIAL BENEFITS TO SUBJECTS AND/OR TO SOCIETY**

The benefits of this research – the identification of risks and hazards for pedestrians in the road safety system – and the personal recounting of experiences by the subjects on their experience and what they have found useful/helpful in negotiating their safety and the work we can do to design a different approach could be greatly beneficial to the participants, to other participants and to safety experts who many have not heard directly from users/pedestrians before.

The overall potential benefit of the research is an improvement in pedestrian safety that could benefit a wider group of people.

• **CONFIDENTIALITY**

Any information that is obtained in connection with this study and that can be identified with you will remain confidential and will be disclosed only with your permission or as required by law. Confidentiality will be maintained by means of coding participants names as a number/code. Data will be kept on a secure external digital drive with access to it only by researcher. Data for research purposes will be stored on the secure RCA google drive.

The workshop activities may be recorded (audio, video, photography) with access given to gatekeeper first for approval. Storage of this material will be on a secure external digital drive accessible only by researcher. The data/material will be destroyed after completion of the PhD doctoral exam – after publication of the thesis for the purpose of this examination – due by 2025.

I will follow all guidance you suggest working with your organisation.

• **PARTICIPATION AND WITHDRAWAL**

Figure G.2 *Participant form (page 2 of 3)*

You can choose whether or not to be in this study. If you volunteer to be in this study, you may withdraw at any time without consequences of any kind or loss of benefits to which you are otherwise entitled. You may also refuse to answer any questions you do not want to answer. There is no penalty if you withdraw from the study.

- **RIGHTS OF RESEARCH SUBJECTS**

The Royal College of Art Research Ethics Committee has reviewed my request to conduct this project. If you have any concerns about your rights in this study, please contact them at ethics@rca.ac.uk

PARTICIPANT CONSENT:

I (please print) have read the information above and all queries have been answered to my satisfaction. I agree to voluntarily participate in this research and give my consent freely. I understand that I can withdraw my participation from the project **and have my data deleted**, up to the point of publication or anonymisation, without penalty, and do not have to give any reason for withdrawing.

I understand that all information gathered will be stored securely, and my opinions will be accurately represented. Any data in which I can be clearly identified will be used in the public domain only with my consent.

Participant Signature.....

Researcher Signature.....

Date: 1 2 3 4 5 6 7 8 9 10 11 12

Complaints Procedure:

This project follows the guidelines laid out by the Royal College of Art Research Ethics Policy.

If you have any questions, please speak with the researcher. If you have any concerns or a complaint about the manner in which this research is conducted, please contact the RCA Research Ethics Committee by emailing ethics@rca.ac.uk or by sending a letter addressed to:

The Research Ethics Committee
Royal College of Art
Kensington Gore
London
SW7 2EU

Figure G.3 Participant form (page 3 of 3)



GATEKEEPER/AGENCY INFORMATION SHEET & CONSENT TO PARTICIPATE IN RESEARCH

(one copy of this form should be given to the gatekeeper and one retained by the researcher)

**How can Design Improve Road Safety for the Vulnerable Road User
- Pedestrian**

[ORGANISATION]

Dear [name]

You are invited to participate in a research study conducted by Orla Fahey, from the School of Design at the Royal College of Art as part of my PhD research. Participation in this study is entirely voluntary. Please read the information below and ask questions about anything you do not understand, before deciding whether or not to participate.

• **PURPOSE OF THE STUDY**

The study looks at pedestrian road safety and is interested in the experience of people using the space – what is helpful or unhelpful in terms of pedestrian safety.

• **PARTICIPATION**

If you agree for your organisation to participate in this study, I will be carrying out the following things:

Conversations and further discussions with small groups chosen from your network of contacts.

There are two specific groups:

Those who can provide 'lived experience' as a participant within your ongoing research and participant groups.

Professionals from safety and cross-disciplines and professionals who work with [organisation] to establish best practice and participate in your research and work.

Role of the Gatekeeper:

To agree consent with the participants after outlining my role and what we will discuss in workshops.

Research Office Royal College of Art Kensington Gore London SW7 2EU
t +44 (0)20 7590 4126 f +44 (0)20 7590 4542 research@rca.ac.uk www.rca.ac.uk/research

Figure G.4 Gatekeeper form (page 1 of 3)

Explain to them, that all data will be anonymised and they can leave the discussions/workshops at any time.

Discuss any queries/concerns with me.

The discussions and workshops will take place over an initial 6 month period. Longer workshops where prototypes or ideas need to be discussed at further length can be extended by mutual consent. The discussions will take place online/at gatekeepers place of work. The workshops will take place in person at an agreed location.

Discussions and workshops may be videotaped, photographed with gatekeepers agreement – all data collected will be anonymised. All data collected will be stored securely on hard-drive with access to it by researcher only.

- **POTENTIAL RISKS AND DISCOMFORTS**

Foreseeable risks or discomforts are limited as the researcher will follow the gatekeepers advice in closing discussions or workshops early if participants request.

In the event of physical and/or mental injury resulting from participation in this research project, the Royal College of Art does not provide any medical, hospitalisation or other insurance for participants in this research study, nor will the Royal College of Art provide any medical treatment or compensation for any injury sustained as a result of participation in this research study, except as required by law.

- **POTENTIAL BENEFITS TO SUBJECTS AND/OR TO SOCIETY**

The benefits of this research – the identification of risks and hazards for pedestrians in the road safety system – and the personal recounting of experiences by the subjects on their experience and what they have found useful/helpful in negotiating their safety and the work we can do to design a different approach could be greatly beneficial to the participants, to other participants and to safety experts who many have not heard directly from users/pedestrians before.

The overall potential benefits of the research is an improvement in pedestrian safety that could benefit a wider group of people.

- **CONFIDENTIALITY**

Any information that is obtained in connection with this study and that can be identified with you will remain confidential and will be disclosed only with your permission or as required by law. Confidentiality will be maintained by means of coding participants names as a number/code. Data will be kept on a secure external digital drive with access to it only by researcher. Data for research purposes will be stored on the secure RCA google drive.

The workshop activities may be recorded (audio, video, photography) with access given to gatekeeper first for approval. Storage of this material will be on a secure external digital drive accessible only by researcher. The data/material will be destroyed after completion of the PhD doctoral exam – after publication of the thesis for the purpose of this examination

Figure G.5 Gatekeeper form (page 2 of 3)

As the Gatekeeper – I will follow all guidance you provide as researcher working with your organisation.

- **PARTICIPATION AND WITHDRAWAL**

You can choose whether or not to be in this study. If you volunteer to be in this study, you may withdraw at any time without consequences of any kind or loss of benefits to which you are otherwise entitled. You may also refuse to answer any questions you do not want to answer. There is no penalty if you withdraw from the study.

- **RIGHTS OF RESEARCH SUBJECTS**

The Royal College of Art Research Ethics Committee has reviewed my request to conduct this project. If you have any concerns about your rights in this study, please contact them at ethics@rca.ac.uk

Thank you for agreeing to participate in this study

PARTICIPANT CONSENT:

I (please print) have read the information above and all queries have been answered to my satisfaction. I agree to voluntarily participate in this research and give my consent freely. I understand that I can withdraw my participation from the project up to the point of publication, without penalty, and do not have to give any reason for withdrawing.

I understand that all information gathered will be stored securely, and my opinions will be accurately represented. Any data in which I can be clearly identified will be used in the public domain only with my consent.

Participant Signature.....

Researcher Signature.....

Date:[insert]

Complaints Procedure:

This project follows the guidelines laid out by the Royal College of Art Research Ethics Policy.

If you have any questions, please speak with the researcher. If you have any concerns or a complaint about the manner in which this research is conducted, please contact the RCA Research Ethics Committee by emailing ethics@rca.ac.uk or by sending a letter addressed to:

The Research Ethics Committee
Royal College of Art
Kensington Gore
London
SW7 2EU

Figure G.6 *Gatekeeper form (page 3 of 3)*

Appendix H: Phase 1–2: TfL Disability and Construction Working Group Sessions

The TfL Disability and Construction Working Group was convened by TfL Safety Lead MB and met across two periods: 2019-2020 (Phase 1) and 2022-2023 (Phase 2). Sessions took the form of in-person forum meetings and site visits, with online meetings during the COVID-19 period. Participants included developers, constructors, highway authorities, pedestrian advocacy groups, safety professionals, and people with protected characteristics. The researcher participated as participant-observer.

This appendix presents full session records for the TfL Disability and Construction Working Group, discussed in Chapter 4, Section 4.2.1.

Table H.1

Session	Date	Location	Duration	Recording Method
1	11 November 2019	Britannia Leisure Centre, London, N1. Site Redevelopment	1 – 5pm	Field notes, photographs
2	COVID-19 period	Online meetings	12 – 2pm	Journal notes
3	9 September 2022	Olympic Park, Stratford, London. Site development	1 – 5pm	Field notes, photographs, Journal notes, photographs, GroundMap

Format: Regular forum meetings and site visits convened by TfL to address accessibility issues caused by construction works. Sessions involved open discussion, photographic evidence sharing, and walkthrough demonstrations led by visually impaired pedestrians and wheelchair users.

Facilitation: Sessions were led by MB, TfL Safety Lead, with researcher participating as observer. Discussions were open and participant-led, with members sharing lived experiences and evidence of hazards.

Data captured: Participant accounts of safety concerns caused by construction works, photographic evidence of hazards, discussion of design improvements, and GroundMap Affordance-Disaffordance mapping.

Ethical note: Participants were informed of the research purpose and consented to participation. All participants are anonymised in the thesis. Photographs are used for analytical purposes only.

Note on COVID-19 disruption: In-person meetings were suspended during the COVID-19 lockdown period. Online meetings continued during this time but limited the range of site visits possible. Full in-person activity resumed in 2022.

Shadowing Exercise

In addition to the group forum sessions, individual shadowing exercises were conducted alongside the November 2019 site visit. Shadowing involved accompanying a single participant through their everyday environment, observing behaviours, constraints, decisions, and interactions with the built environment as they arose naturally. This approach differs from the forum sessions in that it captured individual lived experience in context rather than collective discussion.

Table H.2

Session	Date	Location	Duration	Recording Method
1	11 November 2019	Britannia Leisure Centre, 40 Hyde Road, London, N1. Site Redevelopment	1 – 5pm	Field notes, photographs
2	9 September 2022	Olympic Park, Stratford, London. Site development	1 – 5pm	Field notes, photographs, Journal notes, photographs, GroundMap



Figure H.1 *Example of onsite shadowing exercise.*

Format: Participant-led navigation through the built environment without a predetermined route. The researcher observed and documented behaviours, hazards encountered, and participant responses as they naturally occurred.

Data captured: Participant navigation behaviours, verbal accounts of safety concerns, photographic evidence of specific hazards encountered, and GroundMap Affordance-Disaffordance mapping.

Ethical note: Participants were informed of the research purpose and consented to participation. All participants are anonymised in the thesis. Photographs are used for analytical purposes only and no individuals are identifiable in research outputs.

Appendix I: Phase 2: MENCAP Workshops and Shadowing

This appendix presents full session records for the MENCAP workshops and shadowing exercise conducted with Design Exploration Group 2, discussed in Chapter 4, Section 4.2.2

Table I.1

Session	Date	Location	Duration	No. of Participants	Recording Method
1	22 Feb 2023	Bexleyheath	2 hours	8-12	Journal notes, photographs, GroundMap
2	12 October 2023	Bexleyheath	2 hours	8-12	Journal notes, photographs, GroundMap

Format: Monthly group workshops reviewing photographs and accounts of problem areas in the local environment.

Facilitation: Sessions were led by JM, Self-Advocacy Partner for Mencap, with researcher participation. Discussions were unstructured, allowing participants to raise issues in their own terms.

Data captured: Participant observations, verbal accounts of safety experiences, photographic evidence of problem areas, and group-identified themes and suggested interventions.

Ethical note: Participants were informed of the research purpose and consented to participation. All participants are anonymised in the thesis.

Examples of workshop activities and problem areas identified by participants. No participants are identifiable in the images.



Figure I.1 *Workshop 1 activities*



Figure I.2 *Workshop 2 activities*

Shadowing

Shadowing involved accompanying a single participant through their everyday environment, observing behaviours, constraints, decisions, and interactions with the built environment as they arose naturally. This approach captured individual lived experience in specific contexts that had been discussed in the group workshops.

Table I.2

Session	Date	Location	Duration	Participant	Recording Method
1	14 June 2023	Bexleyheath area	120 mins	Bea (anonymised)	Field notes, photographs, GroundMap

Format: Participant-led navigation through the built environment without a predetermined route. The researcher observed and documented behaviours, hazards encountered, and participant responses as they naturally occurred. Family members accompanied participants where relevant and contributed observations.

Facilitation: No structured interview guide was used. The researcher observed and noted experiences as they arose, with participants narrating their experiences informally as they moved through the space.

Data captured: Participant navigation behaviours, verbal accounts of safety concerns and experiences, photographic evidence of specific hazards encountered, and GroundMap Affordance-Disaffordance mapping of the environment.

Ethical note: Participants and accompanying family members were informed of the research purpose and consented to participation. All participants are anonymised in the thesis. Photographs are used for analytical purposes only and no individuals are identifiable in research outputs.

Appendix J: Phase 2: KOVE Walkabout Sessions

This appendix presents full session records for the Kilburn Older Voices Enterprise (KOVE) walkabout sessions conducted with Design Exploration Group 3, discussed in Chapter 4, Section 4.2.3

Table J.1

Session	Date	Location	Duration	No. of Participants	Recording Method
1	15 March 2023	Kilburn area, London	2 hours	Approx. 8 – 10	Field notes, photographs, GroundMap
2	23 January 2024	Kilburn area, London	2 hours	Approx. 8 – 10	Field notes, photographs, GroundMap

Format: Social walking group walkabouts led by group leader LB, during which participants identified safety issues encountered along their regular routes.

Participant profile: Age range 67-93 years, predominantly female, some participants using walking sticks or mobility scooters.

Facilitation: Unstructured interviews conducted during the walkabouts, allowing members to raise safety concerns in context as they arose. Researcher participated as observer.

Data captured: Participant observations and verbal accounts of safety experiences in context, photographic evidence, and GroundMap Affordance-Disaffordance mapping of the environment.

Ethical note: Participants were informed of the research purpose and consented to participation. All participants are anonymised in the thesis.

Appendix K: GroundMap Exercises Across All Groups

This appendix presents full records of the GroundMap and affordance mapping exercises conducted across all participant groups in Phases 1 to 3. The iterative development of the tool across these sessions is discussed in Chapter 4, Sections 4.1.3, 4.2.1 to 4.2.3, and 4.3.3.

Table K.1

Session	Phase	Group	Date	Location	Recording Method
1	Phase 1	Initial Affordance Mapping (pre-GroundMap)	November 2019 to February 2020 *	Vauxhall Bridge Road	Photographs, annotated maps, field notes
2	Phase 2	MENCAP	22 Feb 2023, 12 October 2023 14 June 2023 (shadowing)	Bexleyheath	Photographs, annotated maps, field notes
3	Phase 2	KOVE	15 March 2023, 23 January 2024	Kilburn area	Photographs, annotated maps, field notes
4	Phase 2	TfL Construction Group	11 November 2019 9 September 2022	London sites	Photographs, annotated maps, field notes
5	Phase 3	Survey participants	See Appendix L for dates and times	Vauxhall Bridge Road	Photographs, annotated maps, field notes

Note: Session 1 represents the initial affordance mapping activity conducted during Phase 1 observations. At this stage the tool had not yet been formalised as GroundMap, the mapping was conducted as a site inventory exercise that later informed the development of the tool. See Appendix R (Reflective Journal Extracts) and Appendix P for documentation of the tool's development.

Format: Each mapping exercise involved participants and the researcher jointly documenting the pedestrian environment using the GroundMap tool. Participants identified features of the environment that they perceived as affording or disaffording safe navigation, which were recorded photographically and annotated on the GroundMap. The exercise was participatory rather than researcher-directed, with participants leading the identification of relevant features.

Development across phases: The GroundMap tool was developed iteratively across these sessions. Early sessions used a simpler site inventory approach, with the tool becoming more structured as patterns emerged across phases. Each session informed the next, consistent with the Constructivist Grounded Theory approach described in Chapter 3.

Data captured: Participant-identified affordances and disaffordances, photographic documentation of specific environmental features, annotated maps, and verbal accounts explaining the significance of identified features and impacts

Appendix L: Phase 3: Public Survey (Instrument and Administration)

This appendix reproduces the survey instrument used during Phase 3 to gather public perspectives on pedestrian safety at the Vauxhall Bridge Road study sites. The survey was administered in person during peak commuting hours at two sites in 2024: Vauxhall Bridge Road, Pimlico (Site 1) and Vauxhall Bridge Cross (Site 2). It was designed to be accessible to a general public audience without specialist knowledge of road safety terminology. The survey was available in two formats: a printed handout flyer (Figure L.1) and an online version (Figure L.2).



Pedestrian Safety Survey Vx1

Have your say! 4 Questions



* 1. Do you feel safe walking or wheeling in this location/space?

☐ Yes
☐ No
☐ Other (Please specify)

* 2. What is the greatest nuisance or hindrance for you?

3. What 3 things could improve your safety?

1.

2.

3.

Any comments:

0 / 30000

* 4. What best describes your journey:

☐ Commuter
☐ Visitor
☐ Taking children to school
☐ Caring for someone
☐ Tourist
☐ Resident
☐ Other (Please specify)

Any other comments or suggestions:

0 / 30000

If you would like to participate in this research further, please include your email:

Thank you for participating.

All data collected will be kept confidential, anonymised and stored on an encrypted server available only to the researcher.

If there's any other comments or experiences you think are relevant to this research - please let me know:

Your name:

Any other comments:

·

Submit

ⓘ Never share any password-related information in this survey

Powered by  **Zelus Survey**

Create unlimited online surveys for free

If you find any sensitive information in this survey that may cause harm, please [report here](#)

Figure L.1 *Online version of survey*



4 x Question survey
Part of a research project at
The Royal College of Art, London



Or answer overleaf

<https://survey.zohopublic.eu/zs/QOBuHA>

All data collected will be anonymized and kept confidential –
used only for this project.

Contact: orla.fahey@alumni.rca.ac.uk

1. Do you feel safe walking here?

☐

Yes.

☐

No.

Why:

2. What is the greatest nuisance or hindrance for you?

3. What 3 things could improve your safety?

1.

2.

3.

4. How would you describe your journey? (Select one)

☐

A commuter

☐

Tourist

☐

Taking children to scho

☐

Leisure

☐

A carer for someone

☐

Other _____

Thank you!

If you would like to participate further, please let
know!: orla.fahey@alumni.rca.ac.uk

Figure L.2 Flyer handout of survey

Survey: Instrument and Administration

Survey Overview

Survey data was collected across two study sites in 2024: Site 1 at Vauxhall Bridge Road, Pimlico (revisited from Phase 1) and Site 2 at Vauxhall Bridge Cross (comparative site). A total of 230 responses were collected across both sites. Surveys were administered in person during peak commuting hours using both paper and digital formats. Sessions were distributed across morning and afternoon periods; on several dates the researcher alternated between both sites within the same day.

Table L.1

Session	Date	TIMES	Location	Duration
1	12 March 2024	6.30 – 8.30 am	Vauxhall Bridge Road	4 hours
2	28 March 2024	3.30 – 6.30pm		
3	25 April 2024	8.40 – 10.50 am		
4	29 April 2024	3.45 – 6.30 pm		
5	1 May 2024	6.30 – 8.00 am		
6	1 May 2024	3.00 – 6.15pm		
7	14 May 2024	4 – 6.30 pm		
8	15 May2024	7.45 – 9.15 am		
9	25 April 2024	8.40 – 10.50 am	Vauxhall Bridge Road	4 hours
10	29 April 2024	3.45 – 6.30 pm		
11	1 May 2024	6.30 – 8.00 am		
12	1 May 2024	3.00 – 6.15pm		
13	14 May 2024	4 – 6.30 pm		
14	15 May2024	7.45 – 9.15 am		

Survey Purpose

Phase 2 involved intensive work with specific groups. While this provided rich, detailed understanding of safety concerns from participants with particular expertise and lived experience, it raised a key question: were these concerns shared more broadly, or were they specific to advocacy group members?

The survey was designed to gather perspectives from a general pedestrian population using both study sites, without prior involvement in the research. This approach provided a wider, more diverse respondent base against which to validate the themes identified in Phase 2 and to test whether safety concerns were consistent across different user groups.

Survey Design

The survey was developed iteratively through pilot testing with a small group of pedestrians. This process ensured questions were accessible to a general public audience without requiring specialist knowledge of road safety terminology, and that response options captured meaningful variation in pedestrian experience.

The final survey structure was informed by the themes identified in Phase 2 and was designed to gather comparable data from a wider audience:

- Frequency of site use, to understand the regularity and patterns of pedestrian engagement with the spaces
- Perceived safety, to gather subjective safety assessments and compare across user groups
- Experience of near-miss incidents, to validate Phase 2 observations about the frequency and nature of pedestrian-vehicle conflicts
- Specific infrastructure concerns, to identify which features were perceived as problematic (e.g., signage, markings, cyclist behaviour)
- Suggested improvements, to gather user-generated design ideas consistent with the participatory methodology

Administration

Surveys were distributed in person at the study sites during peak commuting hours and through local community networks to reach a broader range of pedestrian users. Both paper and digital formats were offered to maximise accessibility.

Response Profile

Responses were received across both sites. Response rates varied between sites. The sample reflects pedestrians who chose to participate and should not be read as a randomised or statistically representative sample of all users of these spaces, consistent with the qualitative orientation of the research. This limitation is acknowledged in Chapter 7.

Ethical note: Participation was voluntary. Respondents were informed of the research purpose prior to completing the survey. No identifying information was collected. Data was stored securely and used for research purposes only.

Near-Miss Summary Across All Phases

Note: Near-miss incidents across all phases of this study were recorded qualitatively rather than as discrete counts. In practice, the frequency and simultaneity of near-miss activity at the study sites made event-by-event enumeration unworkable, a finding discussed as a methodological reflection in Chapter 3. Observed and reported incidents are therefore described in context in Chapter 4 rather than summarised as totals here. Survey respondents described incidents in open-ended responses; these are treated as supporting qualitative evidence rather than a separate quantitative dataset.

In addition to paper and digital formats, surveys were distributed in person at the study sites during peak commuting hours. This approach allowed direct engagement with pedestrians in context and provided opportunity to clarify questions about the research. The photographs below document in-person survey administration at both Vauxhall Bridge Road (Pimlico) and Vauxhall Bridge Cross sites.



Figure L.3 *In-person survey distribution at Vauxhall Bridge Road during peak commuting hours.*

Appendix M: Phase 3: Co-Design Workshop and Prototype Development

This appendix presents full records of the Phase 3 co-design workshop and the prototype development that followed it, discussed in Chapter 4, Section 4.3.4.

Table M.1

	Detail
Date	30 May 2024
Location	Pimlico Library, Westminster, SW1V.
Duration	2 hours
No. of Participants	7 (4 in person + 3 online)
Recording Method	Field notes, photographs, workshop outputs/prototypes

Format: A structured co-design workshop in which participants worked collaboratively to review findings from the survey and shadowing phases and develop design responses to the safety issues identified. The workshop used visual and hands-on methods, including photographs, maps, and prototyping materials, to make abstract safety issues concrete and accessible.

Facilitation: The researcher facilitated the session, presenting findings from earlier phases as stimulus material and inviting participants to respond, critique, and develop ideas. Participants were not given predetermined design solutions but were supported to generate their own responses based on their experience of using the sites.

Data captured: Participant observations and verbal contributions, design ideas and prototypes developed during the session, photographic documentation of workshop outputs, and participant responses to earlier phase findings used as validation of themes identified.

Dual role of the workshop: The workshop served two complementary purposes. Generatively, it produced design ideas and prototypes that were later presented to practitioners. Analytically, it validated Phase 2 and Phase 3 findings: participants recognised and expanded on themes already identified through observation and survey, confirming their credibility through their own experience.

Ethical note: Participants were informed of the research purpose and consented to participation. All participants are anonymised in the thesis. Workshop outputs including photographs and prototypes are used for analytical and presentational purposes only.

The following photographs document the co-design workshop activities and prototyping activity. No participants are identifiable in the images.

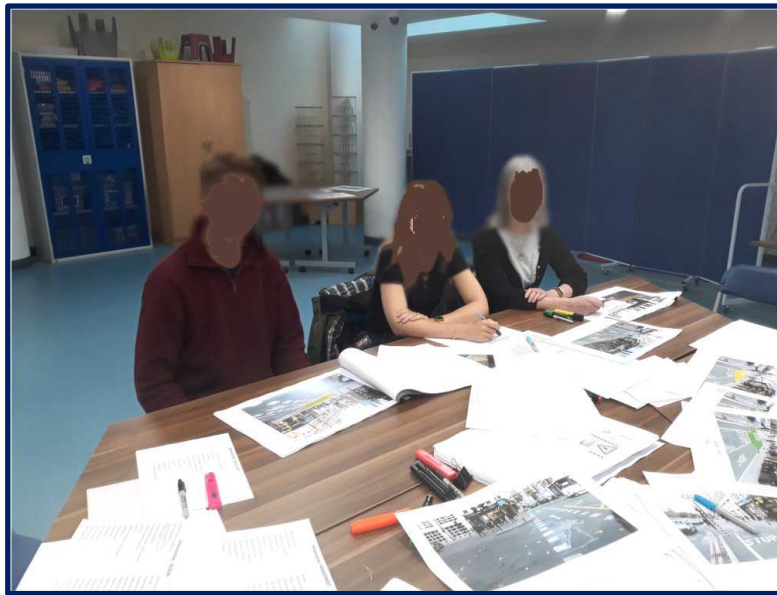


Figure M.1 *Co-design workshop: participant prototyping activity, 30 May 2024, Pimlico Library.*



Figure M.2 *Co-design workshop: participant-generated design proposals for improving pedestrian safety at the study site.*

Table M.2

Session	Date	Location	Format	Recording Method
1	30 May 2024	Co-design workshop: Pimlico Library, Westminster, SW1V.	Hands-on prototyping with participants and iteration and refinement	Photographs, field notes

Format: Prototype development took place primarily within the co-design workshop described above, with participants generating design ideas in response to the safety issues identified across the research phases. Low-fidelity prototypes, sketches, annotated photographs, and physical models, were developed collaboratively rather than by the researcher alone.

Purpose: Prototypes served two roles within the research. First, they were used as design thinking tools, making abstract safety improvements tangible and discussable. Second, they were used as communication tools in the TfL and Westminster City Council meeting, allowing safety professionals to engage with proposed design interventions in concrete rather than abstract terms.

Data captured: Prototype outputs, photographic documentation, participant contributions during development, and feedback from TfL and WCC representatives during the subsequent meeting.

Ethical note: All prototype development took place with informed participant consent. Outputs are used for analytical and presentational purposes only.

Appendix N: Practitioner Validation: TfL and WCC Meeting

Overview and Significance

This appendix documents a meeting held on 6 June 2024 with Transport for London (TfL) and Westminster City Council (WCC) representatives to present and discuss research findings from all three phases. The meeting served as a form of practitioner validation: an opportunity to share qualitative, user-centred evidence with the safety professionals responsible for design decision-making, and to test whether the findings were recognised as credible and relevant to practice.

The meeting was important because it demonstrated real-world impact: practitioners acknowledged the value of the GroundMap approach and user-centred evidence, and made explicit commitments to revise the Vauxhall Bridge Road design based on the findings. This represents a tangible outcome beyond the academic thesis.

Meeting Details

Date: 6 June 2024 Location: Westminster City Council Head Office, London Duration: Approximately 90 minutes Format: In person

Attendees

Researcher

Transport for London: Programme Sponsor (anonymised)

Westminster City Council: Transport Programme Manager (anonymised)

Purpose

The meeting was convened to present research findings from the three phases of design practice described in Chapter 4, with particular focus on the Vauxhall Bridge Road shared space site. The presentation drew on photographic evidence from site observations, survey responses, workshop prototypes, and GroundMap Affordance-Disaffordance analysis to demonstrate the gap between the design intent of the scheme and the lived experience of pedestrians using it.

Summary of Presentation

The research findings were presented using the GroundMap tool to spatially illustrate how pedestrian safety affordances had been removed through the shared space redesign, and how this was reflected in both observed behaviours and user-reported experience. CrashMap collision data (DfT) was used to demonstrate the absence of prior KSI data for cyclists at the site, the primary metric on which the design decision had been based, and to highlight the contrast between official data and the near-miss activity and pedestrian conflict documented through the research. Workshop prototypes developed with participant groups were shared to illustrate potential design improvements.

Response from Attendees

Both representatives engaged constructively with the findings. They acknowledged that the qualitative, user-centred evidence presented was distinct from the datasets their organisations routinely use for design decision-making, and noted the value of capturing pedestrian perspectives and lived experience for which they stated they lacked the resources or methods to gather independently. They acknowledged the limitations of their current approach, which does not include structured engagement with pedestrians prior to or following redesign installation, and agreed that the findings provided evidence to support revising the existing design as part of wider safety improvements in the area.

Commitments Made

The following commitments were made verbally during the meeting and subsequently confirmed by email:

Agreement to revise the current design of the Vauxhall Bridge Road study site based on the findings and suggestions presented

An invitation to collaborate with the TfL design team as part of the redesign process

An invitation to participate as a design stakeholder in future projects

Interest in piloting the engagement approach with disabled and older network groups

The commitments made verbally during this meeting were subsequently confirmed in writing by both representatives via email correspondence (June 2024). This written confirmation is retained by the researcher but is not reproduced here as it was not provided with explicit consent for publication. It is available for review by the examining committee on request if required.

Significance for the Research

This meeting provided practitioner validation of the GroundMap tool and its findings. The recognition by safety professionals that the qualitative, affordance-based evidence generated through this research was both credible and distinct from existing datasets represents meaningful real-world endorsement of the tool's diagnostic and communicative value. The commitments that followed demonstrate that the findings had direct impact on professional practice, extending beyond the academic context of the thesis.

Appendix O: Comparative Analysis: KSI Data at Study Site

This appendix presents CrashMap data (based on DfT collision statistics) used to examine Killed or Seriously Injured (KSI) incidents at the study site before and after the implementation of the shared space scheme. The analysis was undertaken in response to the emphasis placed on KSI metrics by professionals during Phase 1. It provides supporting evidence for the claim made in Chapter 4 that KSI data alone does not capture pedestrian safety as experienced in practice.

Pedestrian KSIs

CrashMap data indicates no recorded pedestrian KSIs at the study site between 1999–2014 (pre-intervention), and this trend continues post-implementation (2015–2023).

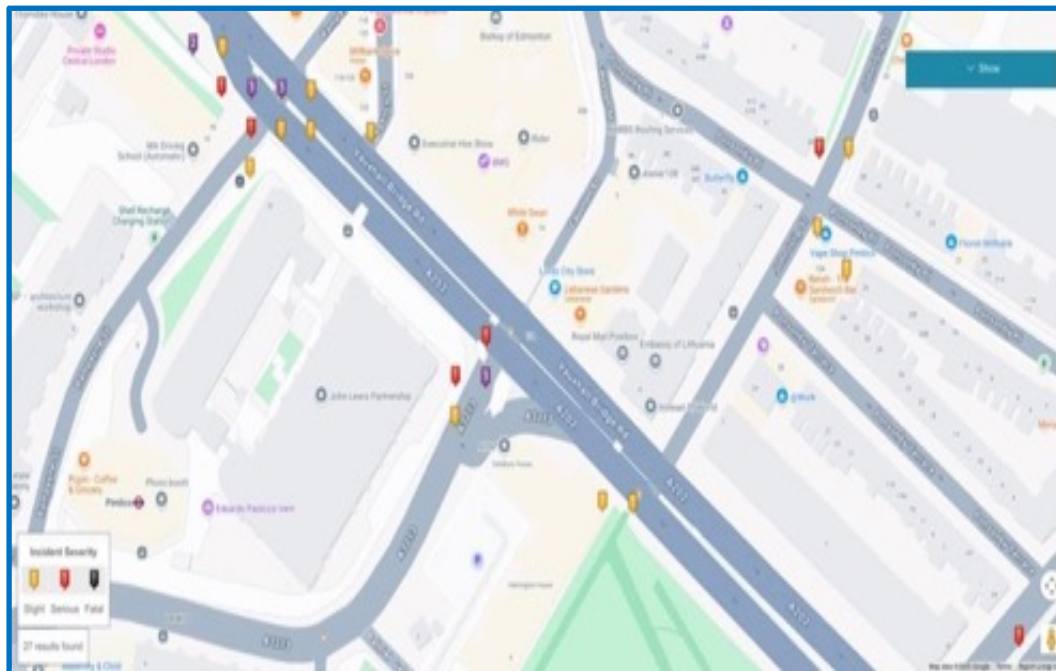
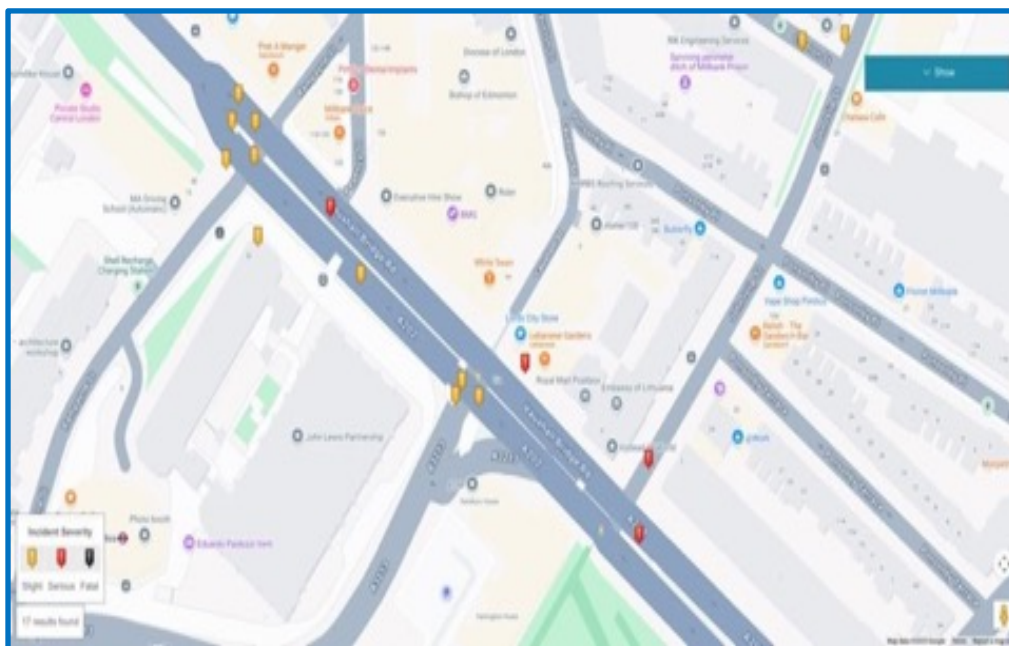
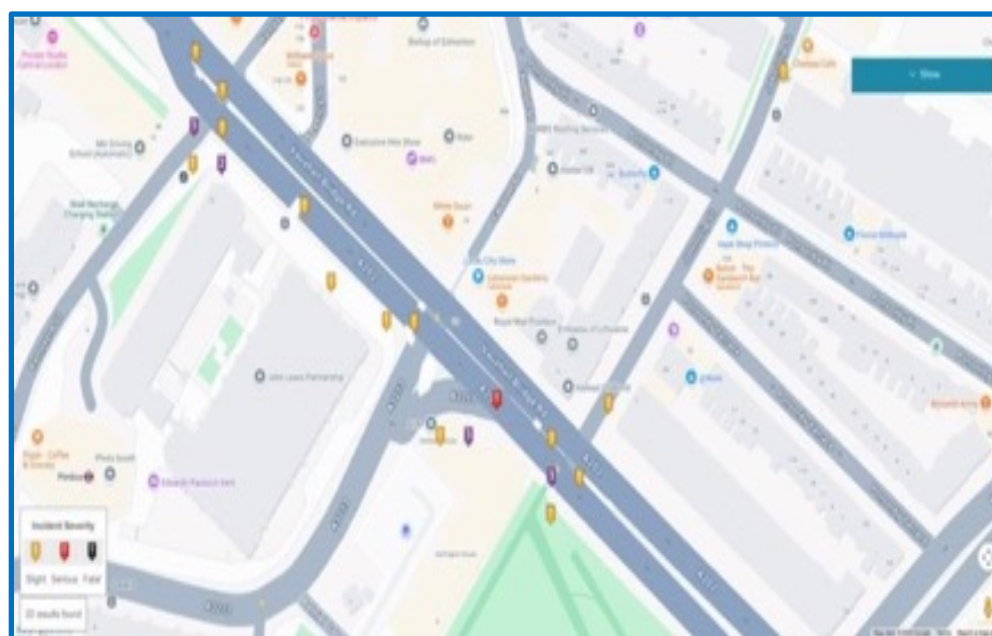


Figure O.1 – *Pedestrian KSI data (1999–2014, pre-Shared Space)*



Cyclist KSIs

Similarly, cyclist KSI data shows no substantial recorded incidents prior to the scheme, despite the intervention being justified on safety grounds.



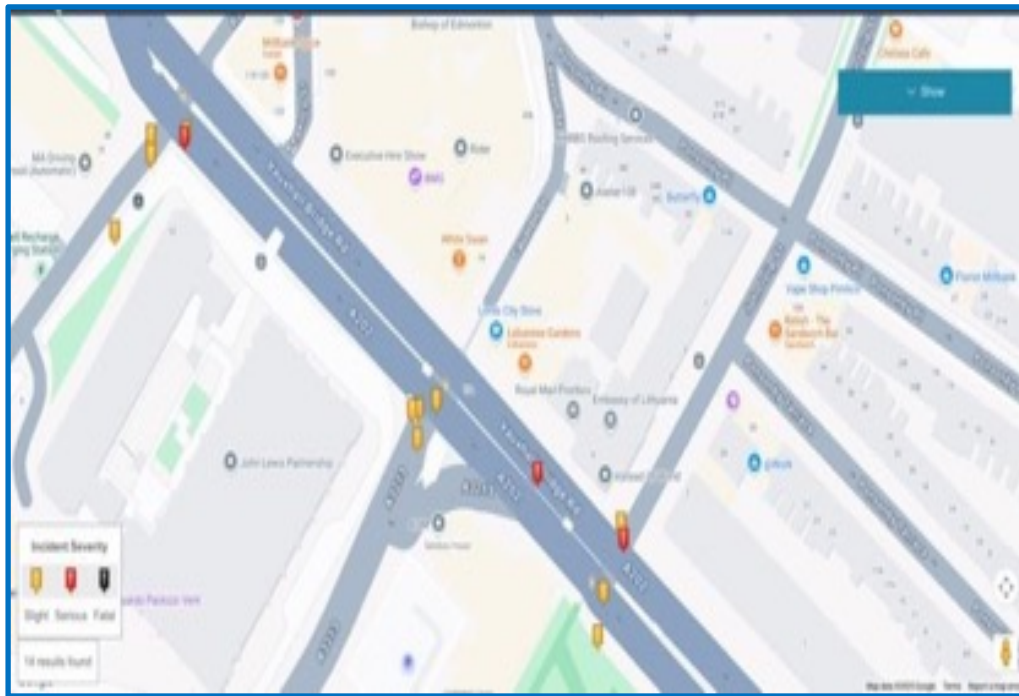


Figure O.4 – Cyclists (2015–2023)

These findings support the argument in Chapter 4 that reliance on KSI metrics alone is insufficient for evaluating pedestrian safety, as they fail to capture everyday risk, uncertainty, and near-miss conditions observed on site.

Appendix P: GroundMap Tool: Blank Templates and Development Notes

Purpose and Overview

GroundMap is a participatory mapping tool developed through this research to systematically identify and record safety affordances and disaffordances in pedestrian environments. Unlike traditional design audits that focus on infrastructure compliance, GroundMap captures lived experience: what features pedestrians actually perceive as safe or unsafe, and the consequences of design decisions from a user perspective.

The tool was developed iteratively across Phase 2 fieldwork. It evolved from early site inventory mapping into a structured framework that could be applied consistently across different user groups and sites, documented photographically, and used as both an analytical and communicative device.

How to Use GroundMap

For each environmental feature under assessment, complete one row of the template (Table P.1):

Actor: Identify the pedestrian user group affected (e.g., older adults, people with visual impairments, wheelchair users, general pedestrians)

Environment – site: Record the location and context

Object: Name the specific environmental feature (e.g., dropped kerb, road marking, street furniture)

Purpose: What is this feature intended to do?

Safety Affordances (pedestrian): What does this feature currently enable in terms of safe pedestrian navigation?

Reason for Removal: If the feature was removed or altered, record why

Disaffordance created: What safety risk or constraint resulted from the change?

Consequence: What happened as a result? How did pedestrians respond or adapt?

Photographs should be used alongside this template to annotate specific features visually. A step-by-step guide to applying the tool in practice is provided in Chapter 5, Table 5.4.

Table P.1 GroundMap blank template

Actor	Environment/ Site	Object	Purpose	Safety Affordances (pedestrian)	Reason for Removal	Disaffordance created	Consequence

This template supports the systematic identification and recording of safety affordances and disaffordances in pedestrian environments, to further extend the mapping, wider consequences can be assessed as outlined in Table P.2.

Table P.2 GroundMap blank template extended

Actor	Environment/ Site	Object	Purpose	Safety Affordances (pedestrian)	Reason for Removal	Disaffordance created	Consequence	Wider Consequences

Table P.2 is an extended version suitable for detailed analysis or policy-facing reporting, where broader systemic impacts beyond the individual pedestrian need to be captured. Complete all columns as for Table P.1, then use the Wider Consequence column to record impacts on carers, social participation, or community accessibility more broadly.

Early Development: Initial GroundMap Layout

Tool Development

The following journal extract and sketch document the initial conceptualisation of the GroundMap tool during Phase 1 fieldwork. It illustrates how the tool emerged iteratively from observational practice rather than being designed in advance, consistent with the Research through Design methodology described in Chapter 3.

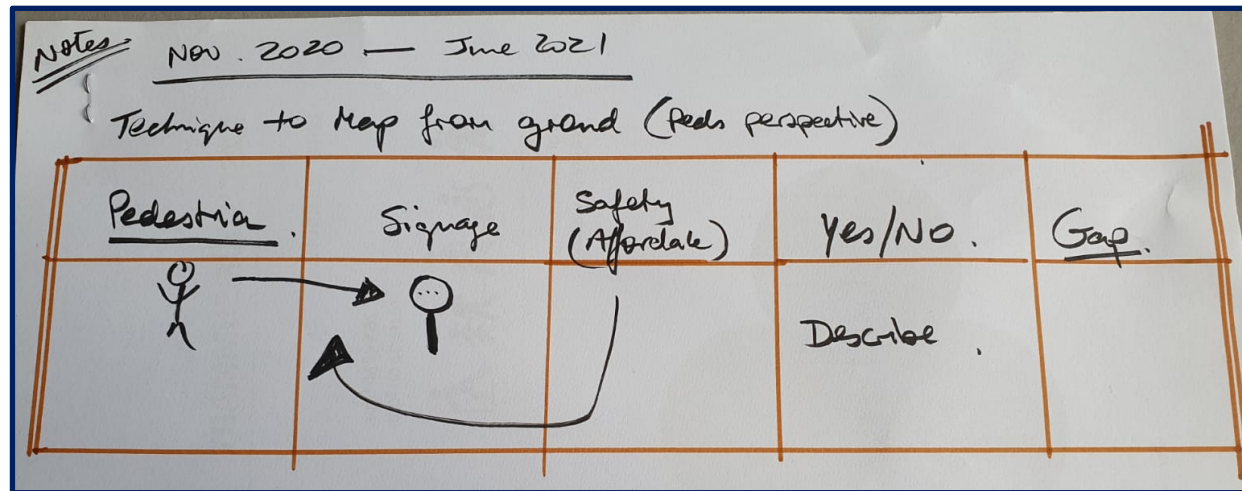


Figure P.1 Initial GroundMap sketch

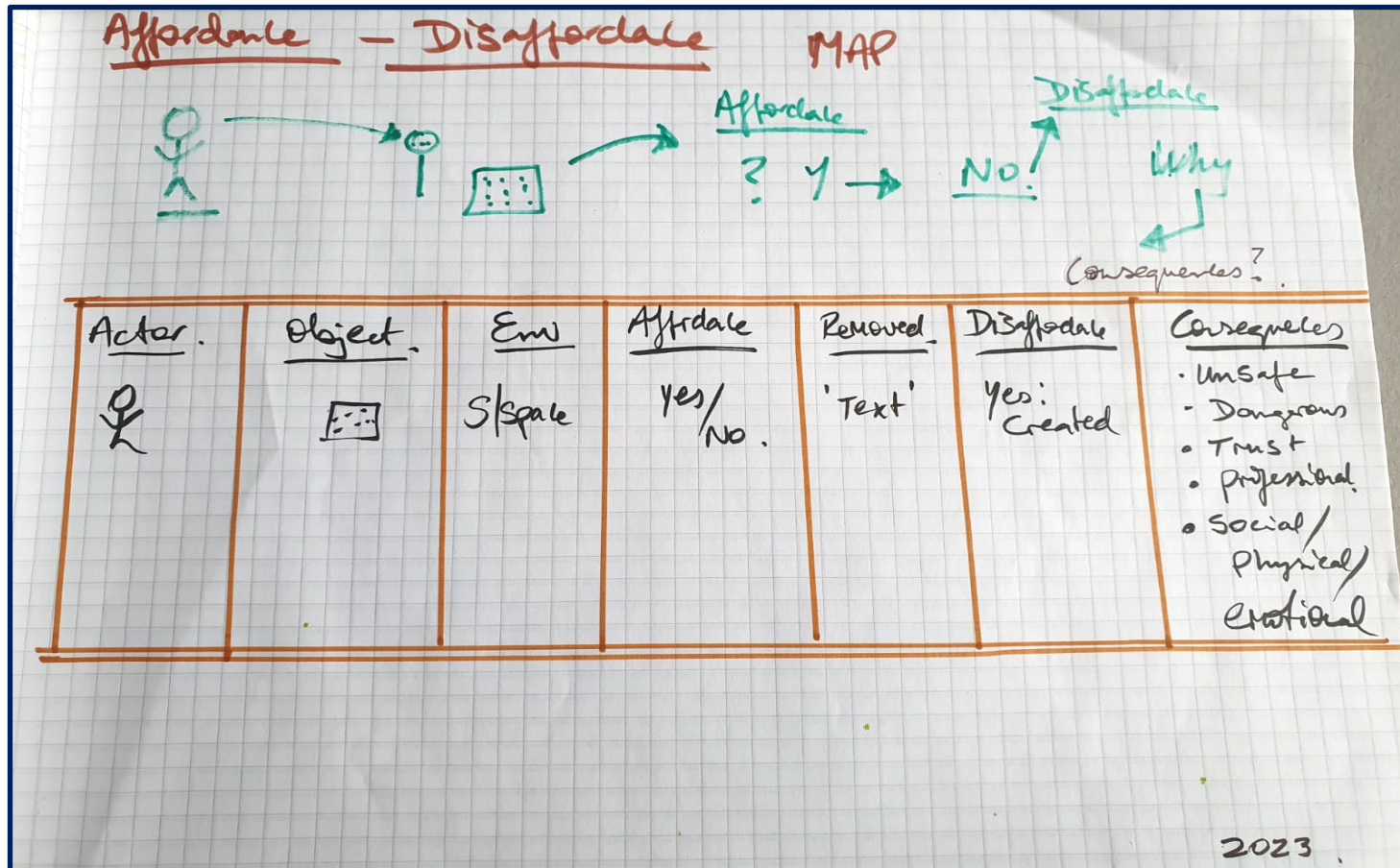


Figure P.2 Developing GroundMap

Appendix Q: STATS19 Form: Structural Limitations of Official Data

STATS19 is the national collision reporting database maintained by the Department for Transport (DfT). Completed by police officers following reported road traffic collisions, it records only incidents involving personal injury and moving vehicles on public highways. The form is designed from a vehicle-collision perspective: it captures what happened between vehicles, not how pedestrians experienced the event.

What the form cannot capture:

The STATS19 structure reveals what it excludes: there is no mechanism for recording pedestrian trips or falls on pavements, near-miss incidents between pedestrians and cyclists, or incidents where no collision occurred but where a pedestrian was exposed to realistic risk of harm. This structural limitation reflects a fundamental definition: "road safety" in this system means vehicle collisions on public roads, not the broader condition of pedestrian safety in public space.

How this shapes data:

Page 2 treats all road users; vehicles and pedestrians as mechanical objects in motion. Pedestrians are recorded by direction, location, and movement, reducing lived experience to geometric positioning. Page 3 further narrows the lens: "Pedestrian only" codes (802–810) ask whether the pedestrian contributed to the collision, not whether they felt safe or what they needed from the environment.

This structural design means official safety data captures vehicle-on-vehicle and vehicle-on-pedestrian collisions, but makes invisible the daily uncertainties, near-misses, and environmental barriers that pedestrians navigate. The implications of this data gap for design decision-making are discussed in Chapter 2 (Section 2.4) and Chapter 6 (Section 6.4).

The form is reproduced from the Department for Transport (2018) and is a public document.

MG NSRF/A

ACCIDENT STATISTICS

Incident URN

Other ref.

1.3	ACCIDENT REFERENCE

*FATAL / SERIOUS / SLIGHT

1.9 TIME H H M M

DAY* Su M T W Th F S

1.7 DATE D D M M 2 0 Y Y

1st Road Class & No.
or (Unclassified - UC)
(Not Known - NK)

1st Road Name

Outside House No.
or Name or Marker
Post No.

at junction with / or metres N S E W * of

2nd Road Class & No.
or (Unclassified - UC)
(Not Known - NK)

2nd Road Name

Town

Sector / Beat No.

County or Borough

Parish No. or Name

1.10 Local Auth No.
(if known)

1.11 Grid Reference

REPORTING Name
OFFICER

Number

BCU/Stn

1.2 Force

Tel Number

1.5 Number of vehicles

1.6 Number of casualties

1.14 ROAD TYPE ☒

Roundabout	1
One way street	2
Dual carriageway	3
Single carriageway	6
Slip road	7
Unknown	9

1.15 Speed Limit (Permanent)

1.16 JUNCTION DETAIL ☒

Not at or within 20 metres of junction	00
Roundabout	01
Mini roundabout	02
T or staggered junction	03
Slip road	05
Crossroads	06
Junction more than four arms (not RAB)	07
Using private drive or entrance	08
Other junction	09

JUNCTION ACCIDENTS ONLY

1.17 JUNCTION CONTROL ☒

Authorised person	1
Automatic traffic signal	2
Stop sign	3
Give way or uncontrolled	4

1.20a PEDESTRIAN CROSSING
- HUMAN CONTROL ☒

None within 50 metres	0
Control by school crossing patrol	1
Control by other authorised person	2

1.20b PEDESTRIAN CROSSING
- PHYSICAL FACILITIES ☒

No physical crossing facility within 50m	0
Zebra crossing	1
Pelican, puffin, toucan or similar non-junction pedestrian light crossing	4
Pedestrian phase at traffic signal junction	5
Footbridge or subway	7
Central refuge — no other controls	8

1.22 WEATHER ☒

Fine without high winds	1
Raining without high winds	2
Snowing without high winds	3
Fine with high winds	4
Raining with high winds	5
Snowing with high winds	6
Fog or mist — if hazard	7
Other	8
Unknown	9

1.23 ROAD SURFACE CONDITION ☒

Dry	1
Wet / Damp	2
Snow	3
Frost / Ice	4
Flood (surface water over 3cm deep)	5

1.21 LIGHT CONDITIONS ☒

Daylight:	1
Darkness: street lights present and lit	4
Darkness: street lights present but unlit	5
Darkness: no street lighting	6
Darkness: street lighting unknown	7

1.24 SPECIAL CONDITIONS AT SITE ☒

None	0
Auto traffic signal out	1
Auto traffic signal partially defective	2
Permanent road signing or marking defective or obscured	3
Roadworks	4
Road surface defective	5
Oil or diesel	6
Mud	7

1.25 CARRIAGEWAY HAZARDS ☒

None	0
Dislodged vehicle load in carriageway	1
Other object in carriageway	2
Involvement with previous accident	3
Pedestrian in carriageway - not injured	6
Any animal in carriageway (except ridden horse)	7

1.26 Did a police officer attend the scene and obtain the details for this report? ☒

Yes	1
No	2

Subject to local directions, boxes with a grey background need not be completed if already recorded

* Circle as appropriate
UNCLASSIFIED

Figure Q.1: STATS19 Road Accident Reporting Form (page 1 of 4)

2.26 VEHICLE REGISTRATION MARK					2.23 BREATH TEST X					VEHICLE					2.11 SKIDDING AND OVERTURNING X					VEHICLE									
Vehicle 001					Not applicable					0					No skidding, jack-knifing or overturning					0									
Vehicle 002					Positive					1					Skidded					1									
Vehicle 003					Negative					2					Skidded and overturned					2									
Vehicle 004					Not requested					3					Jack - knifed					3									
					Refused to provide					4					Jack - knifed and overturned					4									
					Driver not contacted at time of col					5					Overturned					5									
					Not provided (medical reasons)					6																			
2.35 WAS THE VEHICLE LEFT HAND DRIVE X					VEHICLE					2.24 HIT AND RUN X					2.12 HIT OBJECT IN CARRIAGEWAY X														
No					1					Not hit and run					0					None					00				
Yes					2					Hit and run					1					Previous accident					01				
										Non-stop vehicle, not hit					2					Roadworks					02				
																				Parked vehicle					04				
																				Bridge - roof					05				
																				Bridge - side					06				
																				Bollard / Refuge					07				
																				Open door of vehicle					08				
																				Central island of roundabout					09				
																				Kerb					10				
																				Any animal (except ridden horse)					12				
																				Other object					11				
2.5 / 2.5a TYPE OF VEHICLE X					2.21 SEX OF DRIVER X					2.9 VEHICLE LOCATION AT TIME OF ACCIDENT RESTRICTED LANE/AWAY FROM MAIN C'WAY X					2.13 VEHICLE LEAVING CARRIAGEWAY X														
Car					09					Male					1					Did not leave carriageway					0				
Taxi / Private hire car					08					Female					2					Left carriageway nearside					1				
Van - Goods vehicle 3.5 tonnes mgw and under					19					Not known					3					Left carriageway nearside and rebounded					2				
Goods vehicle over 3.5 tonnes mgw and under 7.5 tonnes mgw					20															Left carriageway straight ahead at junction					3				
Goods vehicle 7.5 tonnes mgw & over					21															Left carriageway offside onto central reservation					4				
Goods vehicle - unknown weight					98															Left carriageway offside onto central reserve and rebounded					5				
M/cycle 50cc and under					02															Left carriageway offside and crossed central reservation					6				
M/cycle over 50cc and up to 125cc					03															Left carriageway offside					7				
M/cycle over 125cc and up to 500cc					04															Left carriageway offside and rebounded					8				
Motorcycle over 500cc					05																								
Motorcycle - cc unknown					97																								
Electric Motorcycle					23																								
Pedal cycle					01																								
Bus or coach (17 or more passenger seats)					11																								
Minibus (8-16 passenger seats)					10																								
Agricultural vehicle (include diggers etc)					17																								
Ridden horse					16																								
Mobility scooter					22																								
Tram / Light rail					18																								
Other 1					90																								
vehicle 2					90																								
3					90																								
4					90																								
2.6 TOWING AND ARTICULATION X					2.7 MANOEUVRES X					2.10 JUNCTION LOCATION OF VEHICLE X					2.14 FIRST OBJECT HIT OFF CARRIAGEWAY X														
No tow or articulation					0					Reversing					01					None					00				
Articulated vehicle					1					Parked					02					Road sign / Traffic signal					01				
Double or multiple trailer					2					Waiting to go ahead but held up					03					Lamp post					02				
Caravan					3					Slowing or stopping					04					Telegraph pole / Electricity pole					03				
Single trailer					4					Moving off					05					Tree					04				
Other tow					5					U turn					06					Bus stop / Bus shelter					05				
										Turning left					07					Central crash barrier					06				
										Waiting to turn left					08					Nearside or offside crash barrier					07				
										Turning right					09					Submerged in water (completely)					08				
										Waiting to turn right					10					Entered ditch					09				
										Changing lane to left					11					Wall or fence					11				
										Changing lane to right					12					Other permanent object					10				
										O'taking moving veh on its offside					13														
										O'taking stationary veh on its offside					14														
										Overtaking on nearside					15														
										Going ahead left hand bend					16														
										Going ahead right hand bend					17														
										Going ahead other					18														
2.22 AGE OF DRIVER (Estimate if necessary)					2.27 DRIVER HOME POSTCODE or Code: 1- Unknown 2- Non UK Resident 3 - Parked & unattended					2.16 FIRST POINT OF IMPACT X					2.29 JOURNEY PURPOSE OF DRIVER/RIDER X														
Vehicle 001					Vehicle 002					Did not impact					0					Journey as part of work					1				
Vehicle 003					Vehicle 004					Front					1					Commuting to / from work					2				
										Back					2					Taking school pupil to/from school					3				
										Offside					3					Pupil riding to / from school					4				
										Nearside					4					Other					5				
																				Not known					6				

Subject to local directions, boxes with a grey background need not be completed if already recorded

UNCLASSIFIED

Figure Q.2 : STATS19 Road Accident Reporting Form (page 2 of 4)

2.8 DIRECTION OF VEHICLE TRAVEL 1. Using the Example shown complete the FROM and TO boxes for the vehicles concerned, indicating direction of travel FROM and TO 2. If PARKED enter '00'	Vehicle 001 FROM TO FROM TO Vehicle 002 FROM TO FROM TO Vehicle 003 FROM TO FROM TO Vehicle 004 FROM TO FROM TO
---	---

EXAMPLE
 FROM TO

CASUALTY RECORD

3.4 VEHICLE REFERENCE NUMBER Enter VEH No. which CASUALTY occupied (for pedestrians, code vehicle that struck them first) e.g. 001,002 etc. Casualty 001 0 Casualty 002 0 Casualty 003 0 Casualty 004 0 Casualty 005 0 Casualty 006 0	3.7 SEX OF CASUALTY ☒ CASUALTY <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th></th> <th>1</th> <th>2</th> <th>3</th> <th>4</th> <th>5</th> <th>6</th> </tr> <tr> <td>Male</td> <td> </td> <td> </td> <td> </td> <td> </td> <td> </td> <td> </td> </tr> <tr> <td>Female</td> <td> </td> <td> </td> <td> </td> <td> </td> <td> </td> <td> </td> </tr> </table>		1	2	3	4	5	6	Male							Female							3.20 CYCLE HELMET WORN ☒ <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th></th> <th>1</th> <th>2</th> <th>3</th> <th>4</th> <th>5</th> <th>6</th> </tr> <tr> <td>Not a cyclist</td> <td> 0 </td> <td> </td> <td> </td> <td> </td> <td> </td> <td> </td> </tr> <tr> <td>Yes</td> <td> </td> <td> </td> <td> </td> <td> </td> <td> </td> <td> </td> </tr> <tr> <td>No</td> <td> </td> <td> </td> <td> </td> <td> </td> <td> </td> <td> </td> </tr> <tr> <td>Not known</td> <td> </td> <td> </td> <td> </td> <td> </td> <td> </td> <td> </td> </tr> </table>		1	2	3	4	5	6	Not a cyclist	0						Yes							No							Not known																																																
	1	2	3	4	5	6																																																																																														
Male																																																																																																				
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UNCLASSIFIED

Figure Q.3 : STATS19 Road Accident Reporting Form (page 3 of 4)

CONTRIBUTORY FACTORS

1. Select up to six factors from the grid, relevant to the accident.
2. Factors may be shown in any order, but an indication must be given of whether each factor is **very likely (A)** or **possible (B)**.
3. Only include factors that you consider contributed to the accident (i.e. do NOT include "Poor road surface" unless relevant).
4. More than one factor may, if appropriate, be related to the same road user.

5. The same factor may be related to more than one road user.
6. The participant should be identified by the relevant vehicle or casualty ref no. (e.g. 001, 002 etc.), preceded by "V" if the factor applies to a vehicle, driver/rider or the road environment (e.g. V002), or "C" if the factor relates to a pedestrian or passenger casualty (e.g. C001).
7. Enter U000 if the factor relates to an uninjured pedestrian.

Driver/Rider Only (Includes Pedal Cycles and Horse Riders)	Road Environment Contributed	103 Slippery road (due to weather)	102 Deposit on road (e.g. oil, mud, chippings)	101 Poor or defective road surface	110 Sunken, raised or slippery inspection cover	108 Road layout (e.g. bend, hill, narrow carriageway)	107 Temporary road layout (e.g. contraflow)	109 Animal or object in carriageway	104 Inadequate or masked signs or road markings	105 Defective traffic signals	106 Traffic calming (e.g. speed cushions, road humps, chicanes)
	Vehicle Defects	201 Tyres illegal, defective or under-inflated	202 Defective lights or indicators	203 Defective brakes	204 Defective steering or suspension	205 Defective or missing mirrors	206 Overloaded or poorly loaded vehicle or trailer				
	Injudicious Action	308 Following too close	306 Exceeding speed limit	302 Disobeyed Give Way or Stop sign or markings	301 Disobeyed automatic traffic signal	307 Travelling too fast for conditions	310 Cyclist entering road from pavement	305 Illegal turn or direction of travel	304 Disobeyed pedestrian crossing facility	309 Vehicle travelling along pavement	303 Disobeyed double white lines
	Driver/Rider Error or Reaction	405 Failed to look properly	406 Failed to judge other person's path or speed	403 Poor turn or manoeuvre	408 Sudden braking	409 Swerved	401 Junction overshoot	402 Junction restart (moving off at junction)	404 Failed to signal or misleading signal	407 Too close to cyclist, horse or pedestrian	410 Loss of control
	Impairment or Distraction	501 Impaired by alcohol	502 Impaired by drugs (illicit or medicinal)	508 Driver using mobile phone	503 Fatigue	509 Distraction in vehicle	510 Distraction outside vehicle	505 Illness or disability, mental or physical	504 Uncorrected, defective eyesight	507 Rider wearing dark clothing	506 Not displaying lights at night or in poor visibility
	Behaviour or Inexperience	602 Careless, reckless or in a hurry	605 Learner or inexperienced driver/rider	601 Aggressive driving	603 Nervous, uncertain or panic	607 Unfamiliar with model of vehicle	606 Inexperience of driving on the left	604 Driving too slow for conditions or slow vehicle (e.g. tractor)			
	Vision Affected by	701 Stationary or parked vehicle(s)	703 Road layout (e.g. bend, winding road, hill crest)	706 Dazzling sun	707 Rain, sleet, snow or fog	708 Spray from other vehicles	705 Dazzling headlights	710 Vehicle blind spot	702 Vegetation	704 Buildings, road signs, street furniture	709 Visor or windscreen dirty, scratched or frosted etc.
	Pedestrian Only (Casualty or Uninjured)	802 Failed to look properly	808 Careless, reckless or in a hurry	803 Failed to judge vehicle's path or speed	801 Crossing road masked by stationary or parked vehicle	806 Impaired by alcohol	807 Impaired by drugs (illicit or medicinal)	805 Dangerous action in carriageway (e.g. playing)	804 Wrong use of pedestrian crossing facility	809 Pedestrian wearing dark clothing at night	810 Disability or illness, mental or physical
	Special Codes	901 Stolen vehicle	902 Vehicle in course of crime	903 Emergency vehicle on a call	904 Vehicle door opened or closed negligently						*999 Other – Please specify below

	1st	2nd	3rd	4th	5th	6th
Factor in the accident						
Which participant? (e.g. V001, C001, U000)						
Very likely (A) or Possible (B)						

*If 999 Other, give brief details

(Note: Only use if another factor contributed to the accident and include it in the text description of how the accident occurred)

These factors reflect the reporting officer's opinion at the time of reporting and may not be the result of extensive investigation

RESTRICTED

Figure Q.4 : STATS19 Road Accident Reporting Form (page 4 of 4)

Appendix R: Reflective Journal Extracts

The following extracts are taken from the researcher's reflective journal, maintained throughout the phases of the research. They are selected to illustrate key moments of methodological decision-making, theoretical development, and researcher reflexivity, consistent with the Constructivist Grounded Theory approach described in Chapter 3. Minor editing for clarity has been applied; the substance and sequence of entries is unchanged.

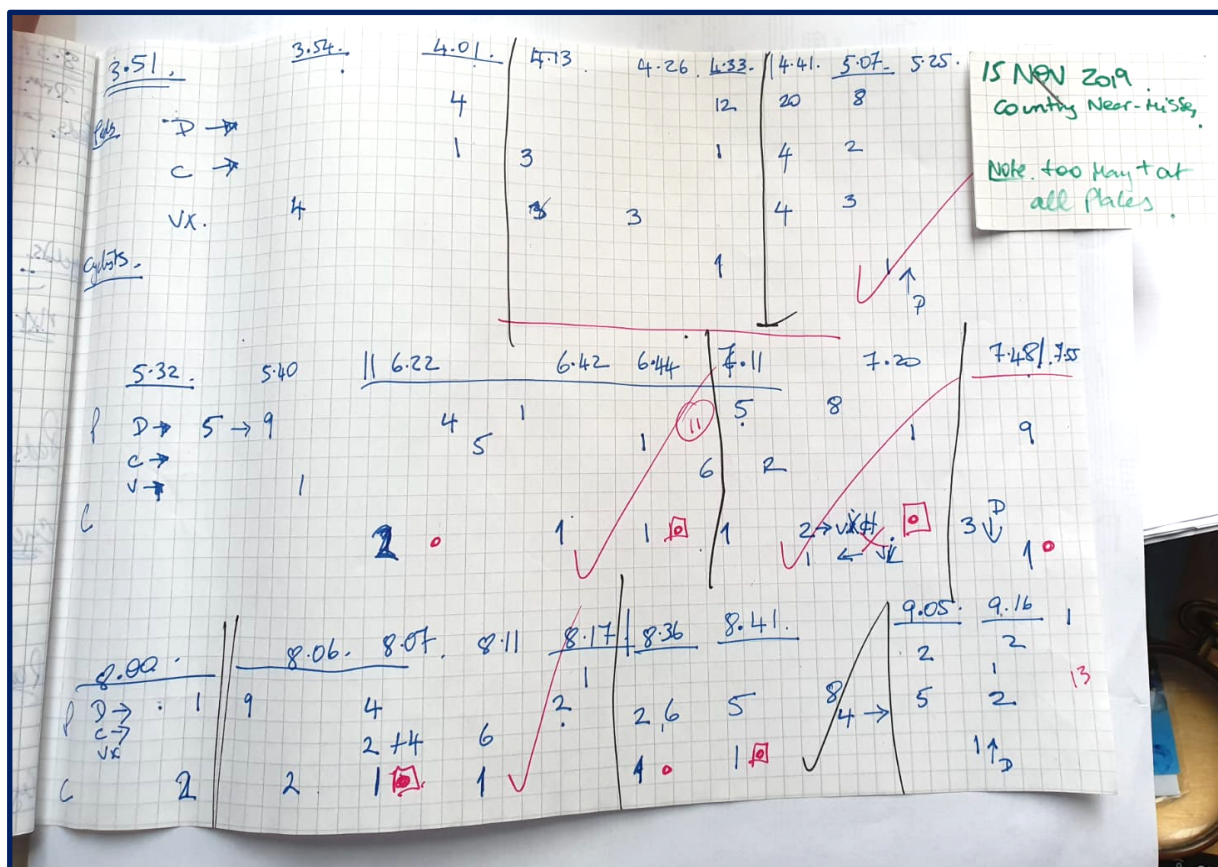


Figure R.1: November 2019. Phase 1. Initial attempt at counting near-misses

This entry records an early attempt during Phase 1 observations to log near-miss incidents as discrete countable events. The note 'too many at all places' documents the moment at which discrete counting was abandoned in favour of qualitative recording, a methodological decision discussed in Chapter 3, Section 3.4.1.

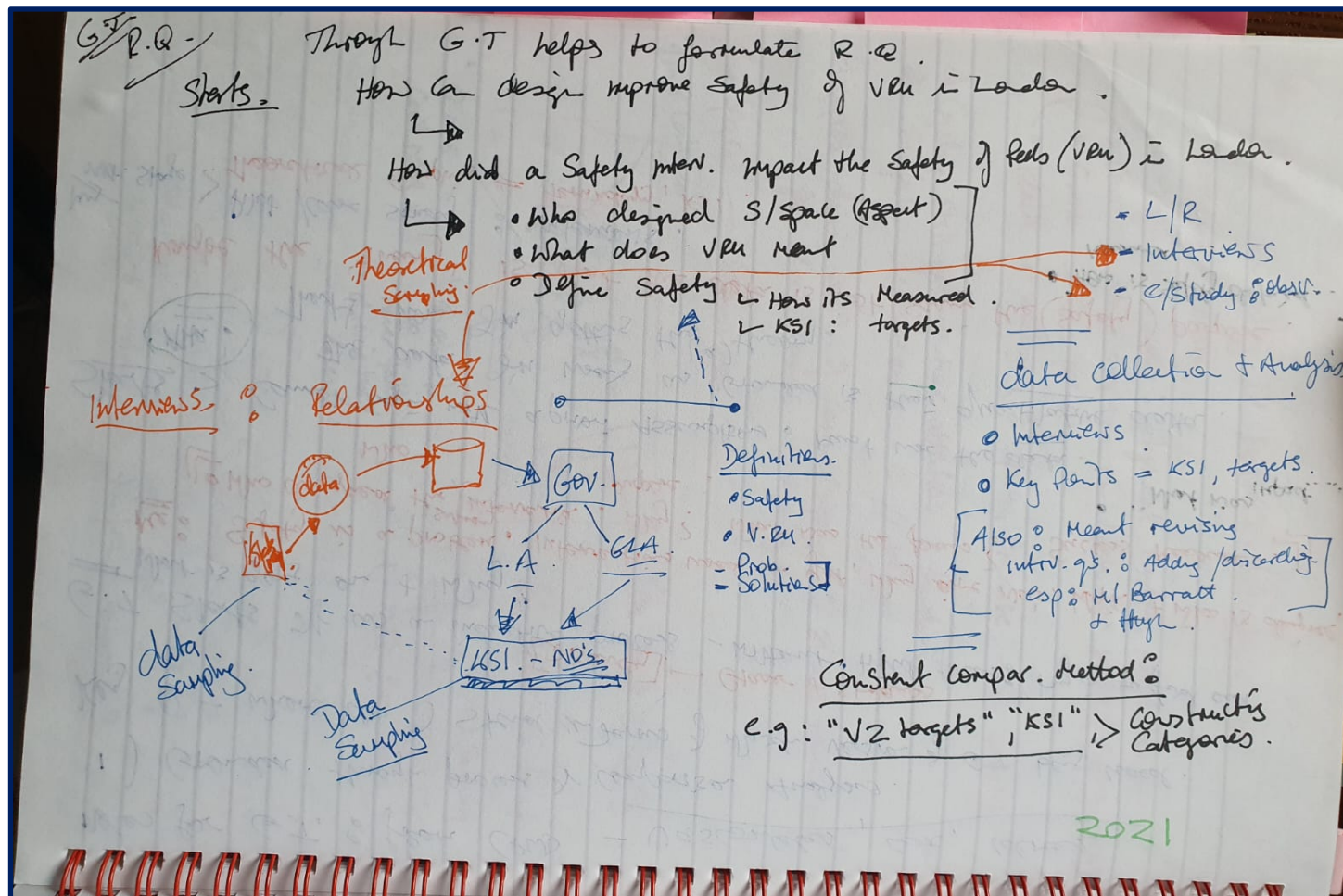


FIGURE R.2: Phase 2: Developing Grounded Theory (i)

This entry documents early-stage thinking around the application of Constructivist Grounded Theory, recording how the analytical approach was developed iteratively in response to emerging data.

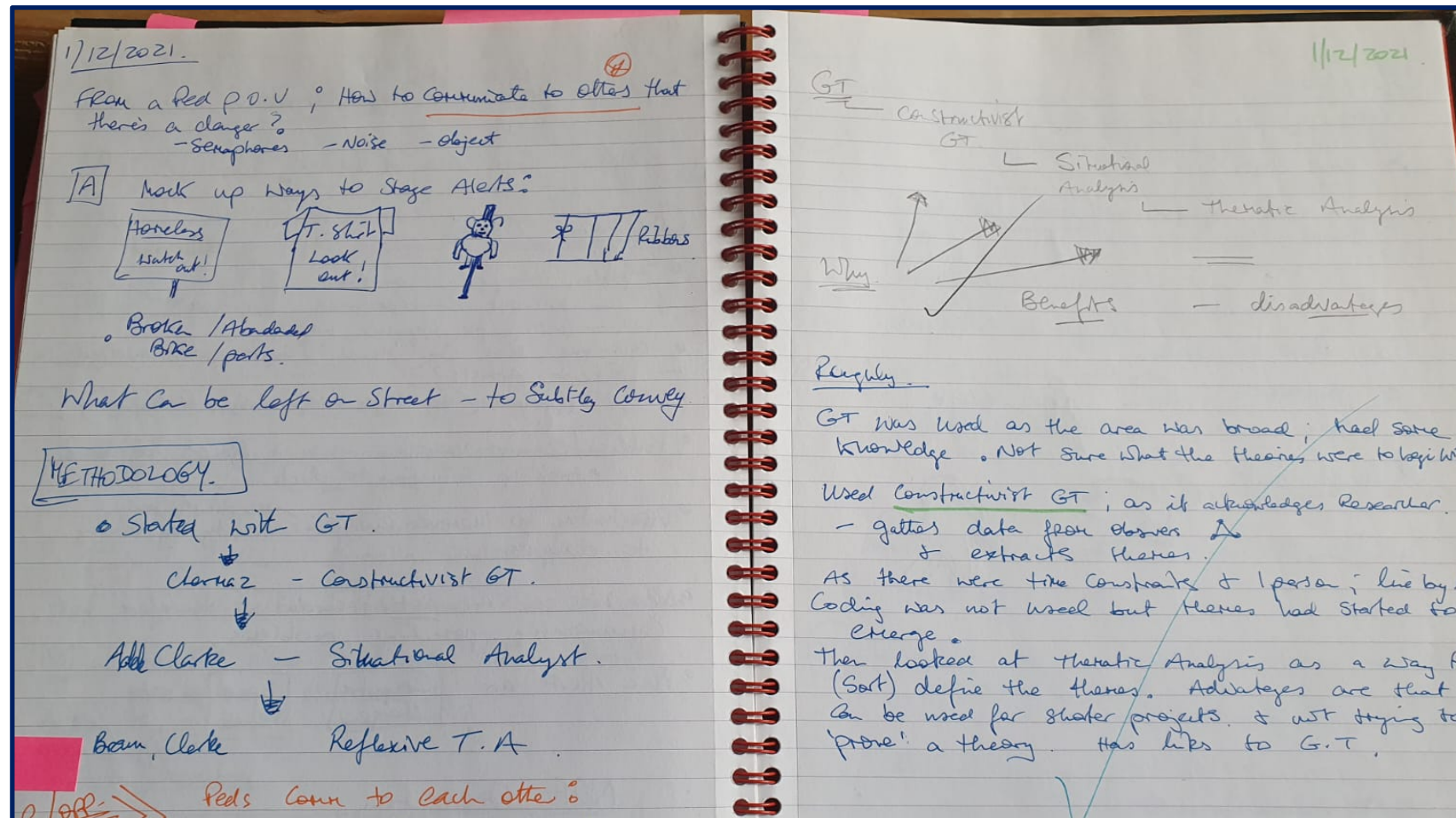


Figure R.3 : Phase 2: CGT analytical notes

These entries document the application of Constructivist Grounded Theory.

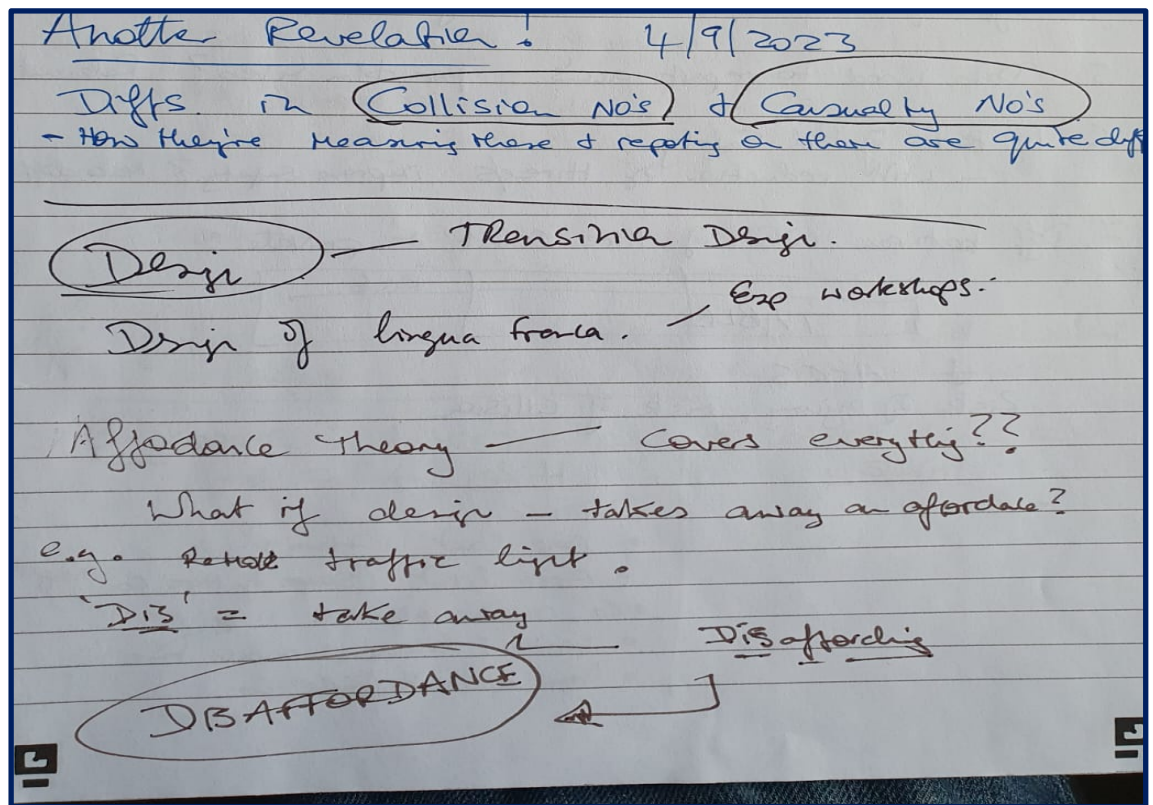


Figure R. 4: Phase 2: First formal use of disaffordance concept

This entry records the first use of the term disaffordance in the research journal, emerging from reflection on Phase 2 fieldwork. It documents how the concept developed from observational practice.

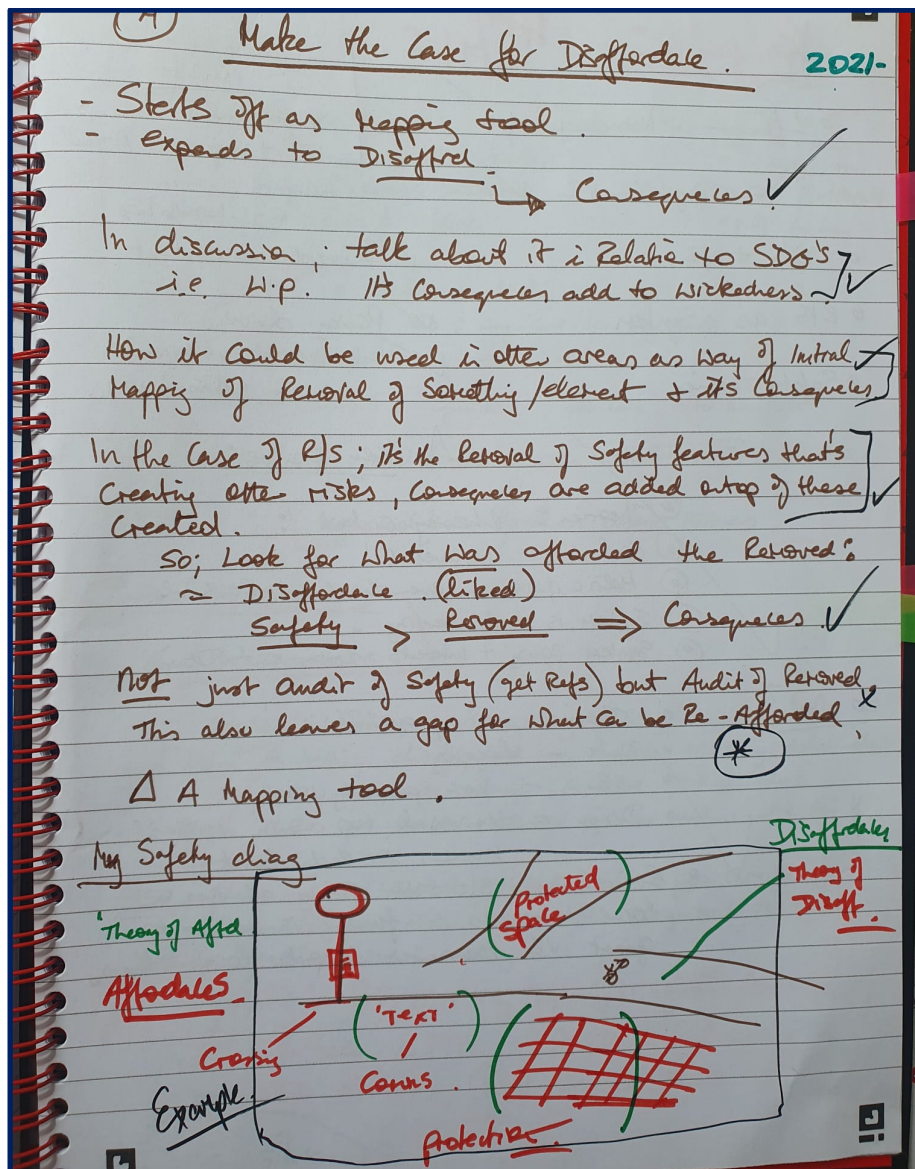


Figure R.5: Making the case for disaffordance as an analytical concept and theory in its own right.

This entry documents the analytical reasoning behind the development of disaffordance as a concept, recording how the term emerged from reflection on observed pedestrian experiences rather than from existing theoretical literature.

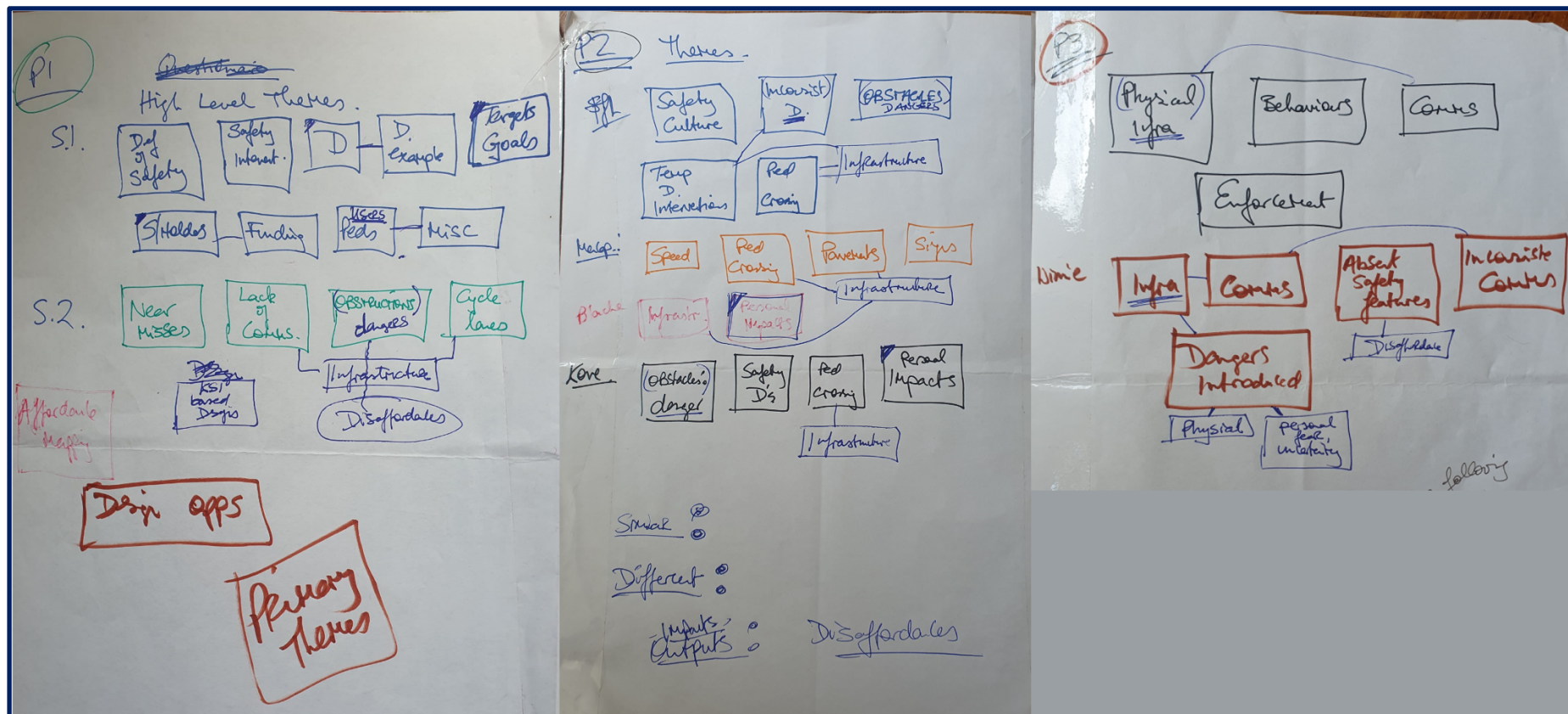


Figure R.6: Phase 3. Hand-sorting of survey responses, early-stage analysis.

These entries document the initial hand-sorting of survey responses during Phase 3 analysis, prior to the formal coding process shown in Figures 4.37 to 4.39 in Chapter 4. They illustrate the early-stage analytical thinking that preceded the iterative refinement of themes through the Constructivist Grounded Theory constant comparative method described in Chapter 3.

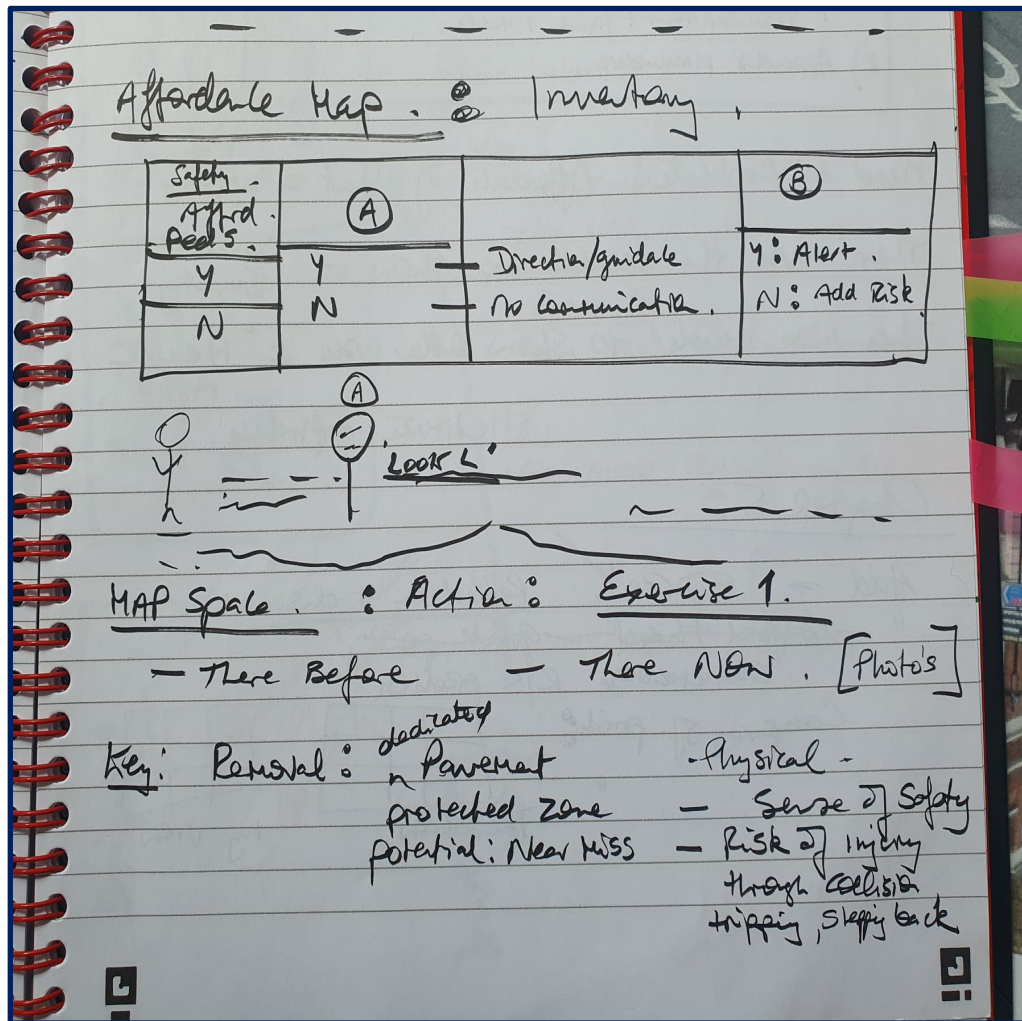


Figure R.7: Phase 1. Early affordance mapping exercise.

This entry documents an early version of affordance mapping during Phase 1 fieldwork, prior to the formalisation of the GroundMap tool. It illustrates how the mapping approach developed iteratively from observational practice, consistent with the Research through Design methodology described in Chapter 3.

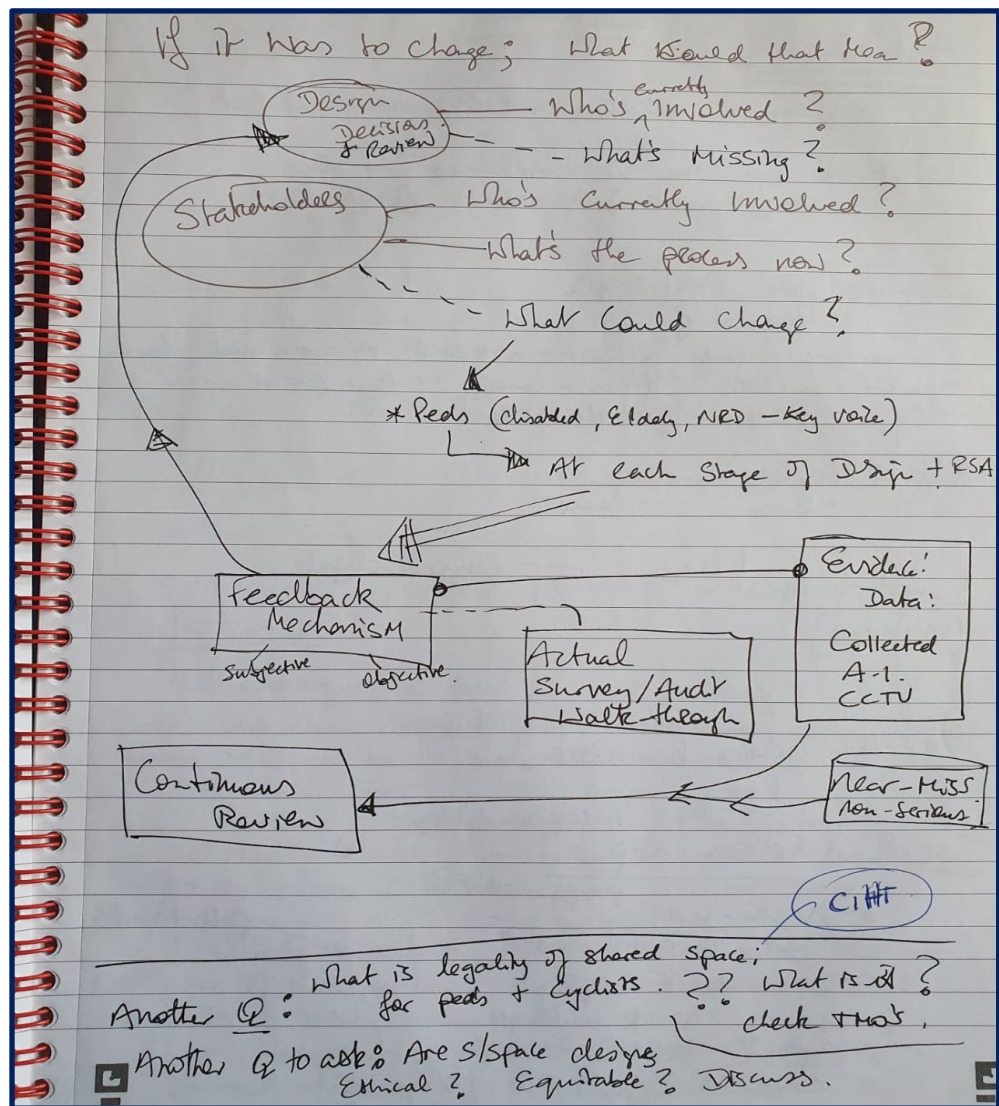


Figure R.8: June 2024. Phase 3. Journal notes post meeting.

Glossary of Key Terms

This glossary defines key terms, acronyms, and concepts used throughout the thesis. It is intended as a reference for readers unfamiliar with road safety, design research, or disability studies terminology, and to clarify terms that carry specific meanings within the context of this research. Where a term has been introduced or extended by this research, this is noted in the definition. Full references for all cited works are provided in the reference list.

Affordance A property of an environment that enables or supports a particular action for a particular user. The concept originates with Gibson (1979) and was developed for design contexts by Norman (2013). In this thesis, affordances refer specifically to features of the pedestrian environment that support safe navigation.

Affordance Mapping A method of visually documenting and analysing the affordances and disaffordances present in a specific environment. Used in this research as a core component of the GroundMap method to record what a site enables, what has been removed, and what risks have been introduced.

CGT (Constructivist Grounded Theory) A qualitative methodology developed by Charmaz (2014) in which theory is constructed iteratively from data through constant comparison. The researcher is positioned as an active participant in knowledge construction rather than a neutral observer. Used as a primary methodological framework in this research.

CIHT (Chartered Institution of Highways and Transportation) The professional body for transport and highways professionals in the United Kingdom.

CrashMap A publicly accessible tool providing visualisation of Department for Transport collision data at specific locations across the UK. Used in this research to examine KSI records at the study site before and after the shared space intervention.

Co-design A collaborative approach to design in which users and other stakeholders work alongside designers as active contributors throughout the design process, rather than being consulted after decisions have been made.

CS5 (Cycle Superhighway 5) A segregated cycling infrastructure scheme implemented by Transport for London on Vauxhall Bridge Road as part of the broader Cycle Superhighway programme. The primary study site for this research.

DfT (Department for Transport) The UK government department responsible for national transport policy, road safety strategy, and the STATS19 collision reporting database.

Disaffordance A term introduced in this thesis to describe a design decision that removes a safety feature previously supporting safe pedestrian navigation, thereby creating new risk or

barrier. An extension of Gibson's affordance framework developed through the fieldwork described in Chapter 4.

EqIA (Equality Impact Assessment) A statutory assessment required under the Public Sector Equality Duty to evaluate how policies and projects affect people with protected characteristics under the Equality Act 2010. In practice, frequently completed as a compliance exercise after key design decisions have already been made.

Floating Bus Stop A bus stop design in which cyclists pass between the stop and the kerb, requiring pedestrians to cross the cycle lane to board or alight from buses.

GLA (Greater London Authority) The strategic citywide government for London, headed by the Mayor of London. Responsible for the Mayor's Transport Strategy and the Vision Zero commitment.

GroundMap An Affordance-Disaffordance diagnostic tool developed in this research for the systematic identification, mapping, and evaluation of safety affordances and disaffordances in pedestrian environments. Developed iteratively through three phases of design.

Healthy Streets Check A Transport for London framework for evaluating how well streets support health and active travel, built around ten indicators including people feeling safe. Widely cited in Mayoral strategy documents.

Insider Researcher A researcher who shares characteristics, experiences, or institutional affiliations with the participants or context being studied. Insider positioning enables candid access and contextual understanding but requires active management of potential bias, as discussed in Chapters 1 and 4.

IOSH (Institution of Occupational Safety and Health) A professional body for health and safety practitioners. Cited in this research for its guidance on near-miss reporting as a leading indicator of systemic risk.

KOVE (Kilburn Older Voices Enterprise) A London-based organisation that has been advocating for older adults' needs for over 20 years, including access to public spaces and transportation. One of three participant groups in Phase 2 of this research.

KSI (Killed or Seriously Injured) The primary metric used in UK road safety data collection and policy evaluation. Recorded through the STATS19 database and used as the principal indicator of road safety performance by transport authorities including TfL and the DfT.

MENCAP A UK charity supporting people with learning disabilities. In this research, specifically the Respect in Bexley group facilitated by MENCAP, which participated in Phase 2 workshops.

Near-miss For the purposes of this study, any incident in which a pedestrian was exposed to a realistic risk of injury but where no harm occurred, whether through their own evasive action, the response of another road user, or chance. Adapted from aviation and healthcare safety literature where near misses are treated as leading indicators of systemic risk (IOSH, 2017).

OECD (Organisation for Economic Co-operation and Development) An international organisation providing policy research and guidance across member countries. Cited in this research for its Road Safety for the Decade 2021 to 2030 strategy.

Participatory Design A design approach that actively involves all stakeholders, particularly end users, in the design process to ensure outcomes reflect their needs and experiences.

Protected Characteristics The nine characteristics protected under the Equality Act 2010: age, disability, gender reassignment, marriage and civil partnership, pregnancy and maternity, race, religion or belief, sex, and sexual orientation. Pedestrians with protected characteristics are a primary focus of this research.

Research through Design (RtD) A methodology in which the design process itself generates knowledge, treating making and doing as forms of inquiry rather than as applications of pre-existing theory. One of three methodological frameworks underpinning this research, alongside Constructivist Grounded Theory and Affordance Theory.

RNIB (Royal National Institute of Blind People) A UK charity supporting blind and partially sighted people. Referenced in this research in relation to advocacy against floating bus stop installations.

RSA (Road Safety Audit) A formal independent examination of a road scheme, conducted by specialist teams to identify potential safety issues before and after construction. Required for new road schemes in the UK. Conducted by experts rather than users and focused primarily on collision risk rather than lived experience.

Safe System An international road safety framework built around five pillars: safe roads, safe speeds, safe vehicles, safe road users, and post-crash care. Widely adopted internationally and underpinning Vision Zero.

SDGs (Sustainable Development Goals) A set of 17 global goals adopted by the United Nations in 2015 as part of the 2030 Agenda for Sustainable Development. Road safety features under SDG 3.6 (halve global road traffic deaths) and SDG 11 (sustainable cities and communities).

Shadowing A qualitative research method involving close observation of a participant through their everyday environment to understand their behaviours, decisions, and experiences in context.

Shared Space A street design concept that removes formal separation between pedestrians, cyclists, and vehicles, relying on social negotiation rather than physical barriers or signals to manage movement.

Situational Analysis A methodology developed by Clarke (2005) as an extension of grounded theory, using mapping techniques to analyse the social, institutional, and discursive conditions shaping a research situation.

STATS19 The UK police collision reporting database maintained by the Department for Transport. Records road traffic collisions resulting in personal injury on public highways. Excludes incidents not involving a moving vehicle.

Super Wicked Problem An extension of the wicked problem concept characterised by four additional features: time is running out, those seeking to solve the problem are also causing it, there is no central authority, and policies irrationally discount the future.

TfL (Transport for London) The integrated transport authority responsible for most aspects of London's transport network, including roads, cycling infrastructure, and bus services. A key institutional actor in this research.

Triangulation The use of multiple research methods, data sources, or theoretical perspectives to cross-check and strengthen findings.

Vision Zero A road safety strategy originating in Sweden, adopted by Transport for London, aiming to eliminate all road deaths and serious injuries. In London, implemented primarily through KSI reduction targets, which this research argues fails to capture the full scope of pedestrian safety as experienced in practice.

Vulnerable Road User (VRU) A category used in road safety policy and research to describe road users who are at greater risk of injury in the event of a collision, typically including pedestrians, cyclists, motorcyclists, and those with mobility impairments. In this research, the term is used with specific attention to pedestrians, particularly older adults, disabled people, and those with cognitive or sensory impairments.

WCC (Westminster City Council) The local authority for the City of Westminster, London.

Wicked Problem A problem that is difficult or impossible to solve because of incomplete, contradictory, or changing requirements that are often difficult to recognise. Coined by Rittel and Webber (1973).

WHO (World Health Organisation) A specialised agency of the United Nations responsible for international public health. Cited extensively in this research for its road safety data, its identification of pedestrians as a vulnerable group, and its projections for an ageing global population.

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