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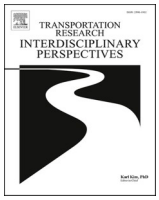

Defining the interface between city logistics and urban design: a systematic literature review

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ABSTRACT

Logistics services have become crucial in shaping urban spaces and influencing urban dynamics. However, despite growing scholarly and policy attention in recent years, their implications for urban design remain unevenly addressed and insufficiently integrated across themes and methods. Addressing the challenges of urban freight transport does not rely solely on transportation perspectives but instead requires interdisciplinary collaboration. This study conducts a systematic literature review following the PRISMA protocol to examine city logistics through an urban design lens, guided by a framework of six urban design dimensions. The main objectives are to introduce an urban design perspective into the urban freight transport discourse, identify existing research gaps, and propose a framework for future studies. A total of 83 publications were reviewed. A descriptive bibliometric analysis shows that scholarly attention to this topic has significantly increased in the past two years. An inductive thematic analysis reveals four thematic clusters: (1) problematisation, (2) analysis of traffic conflicts, (3) curbside design and management, and (4) freight facility integration. By synthesising these thematic patterns, the study proposes research opportunities within each urban design dimension to guide future investigation. The paper contributes to the literature by offering a comprehensive understanding of freight transport from an urban design perspective, conceptualising urban design as distinct from other urban research fields, and outlining cross-disciplinary pathways that can bridge city logistics and urban design.

1. Introduction

Over the past two decades, rapid urbanisation and the rise of e-commerce have expanded city logistics activities and have intensified the footprint on public spaces. By 2035, urban logistics activity in Dutch cities is expected to have grown by 19%, influenced by population growth and the diversification of logistics flows (CBRE, 2024). Similar trends can be observed globally, where urban logistics services, particularly those related to last-mile delivery and warehousing, are experiencing rapid expansion as cities grow and e-commerce continues to increase. The World Economic Forum projects a 78% increase in urban last-mile deliveries by 2030 compared to 2020 levels (World Economic Forum, 2021).

Consequently, urban freight transport has put growing pressure on urban spaces, through congestion, frequent delivery moments, intensive use of space and reduced liveability (Cruz-Daraviña and Bocarejo Suescún, 2021; He et al., 2018). Delivery vehicles and handling operations increasingly compete with pedestrians and cyclists for limited street and curb space, contributing to double-parking and blocked cycle lanes. In high-intensity city centres, loading and unloading activities disrupt traffic flow. On mixed streets, interactions between large freight vehicles and other road users raise acute safety concerns. Importantly, these pressures from logistics are not static but intensifying as new logistics technologies and practices emerge. Platformed delivery, automation (e.g. sidewalk robots), and use of active modes (cargo bikes) are reconfiguring when and where logistics happens (Le et al., 2025), turning sidewalks, bike lanes, alleys, and building frontages into contested intersections. Examples of responses to these pressures include experiments with curbside and street-space interventions, such as designated and time-windowed loading bays and the integration of lower-emission modes, some of which explicitly frame the curb as a managed, multi-use asset (NACTO, 2021). These frictions arise at the scale of individual citizens, around whom the interactions between logistics operations and the urban built environment take place, highlighting the need for a design-aware, micro-scale understanding of city logistics.

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Scholars have been emphasising the significance of connecting city logistics with urban studies over the last decade (Cui et al., 2015). However, most research still operates at metropolitan policy or network-management scales, leaving the spatial design of streets, curbs and facilities thinly theorised and rarely evaluated. Much of this research has focused on macro-level perspectives, for instance land distribution and governance (Dablanc and Heitz, 2024; Fisher-Holloway and Mokhele, 2023), which may intersect more with urban planning than design. While the role of urban planning in logistics has been explored by several review papers across various research domains, the literature lacks a review of studies addressing urban design and city logistics together. This gap also has practical consequences: neglecting design yields avoidable delivery delays, burdens enforcement, and decreases public-realm quality for residents and businesses.

Underlying this gap is a longer disciplinary separation between city logistics and urban design. City logistics in this paper refers to urban freight transport, which involves the movement of goods of all types within inner-city areas, with an emphasis on last-mile delivery. Historically, city logistics has been examined alongside urban planning, embedded within broader land-use and transport frameworks, while the specific contribution of urban design has only recently been acknowledged and remains underdeveloped. As disciplines, urban design and city logistics have evolved largely in parallel, each adhering to its own set of paradigms, frameworks, and specialised terminologies (Boussauw, 2023). In other words, much of today's urban fabric, design interventions and street standards were introduced before the rapid growth of e-commerce and last-mile delivery. The spaces where contemporary freight activities now happen were therefore under-considered arenas when urban design decisions were made. To address the problems generated by city logistics, it is not sufficient for freight researchers alone to take actions. We also need to diagnose the issues as urban design problems, for instance, understanding how movement, form, social inclusion, user experience, time patterns and visual legibility shape logistics conflicts and opportunities at the neighbourhood and street levels.

This study responds to the above gap by bringing an explicit urban design perspective to the urban freight literature. The objectives are to review the existing literature, identify gaps, and propose a framework for future research. The study is guided by the question: How has city logistics been studied, seen through the lens of urban design? Specifically, this study pursues three questions:

- What patterns emerge when city logistics topics are examined through an urban design lens?
- Where are the scientific research gaps?
- What agenda follows for future research and practices?

In this paper, we perform a systematic literature review along the lines of the PRISMA method (Page et al., 2021). We combine bibliometric analysis with inductive thematic analysis, introducing an analytic matrix for reading city logistics through an urban-design lens. On that basis, we enrich the city logistics research and practice agenda from an urban design perspective, proposing directions for future research and practices. The review addresses the needs stated in the 2030 Agenda for Sustainable Development (United Nations, 2015), most directly SDG 11 (sustainable cities and communities) and SDG 9 (resilient infrastructure), through its focus on public-realm, environmental functionality, and urban liveability. This review is timely given the rapid growth of last-mile activity and the accelerating pace of municipal policy and design interventions, such as curbside management, zero-emission logistics policies, and emerging delivery technologies, which reshape how street space is allocated and experienced. By introducing urban design dimensions, this study opens new ways of thinking in city logistics research. In summary, we aim to contribute to the literature by (1) offering transport researchers a richer understanding of the urban design challenge, (2) providing urban design scholars a consolidated view of city logistics issues in their language, and (3) outlining cross-disciplinary research opportunities that help to bridge the two fields.

The next chapter defines urban design with a conceptual framework that will guide our review. Chapter 3 describes the approach and methods for the review in more detail. Chapters 4 and 5 present and discuss the analytical results, respectively. Chapter 6 identifies research gaps and outlines future research opportunities. Chapter 7 concludes with main findings and recommendations for science and practice.

2. Conceptualisation of urban design

Since its emergence in the late 1950 s in North America, the notion of urban design has been shaped by a range of theoretical perspectives that highlight its multifaceted nature, as well as by practical perspectives that situate the field within the urban context (Krieger, 2013). Urban design has evolved through various theoretical ideas reflecting different views on what constitutes a good city. According to Steinø (2004), these theories can be grouped into three categories: societal, formal, and environmental, represented respectively by Ebenezer Howard's Garden City (Howard, 1902), Colin Rowe's Collage City (Rowe and Koetter, 1984), and Kevin Lynch's five elements of the city (Lynch, 1964). Despite these framings, urban design remains a poorly defined and contested discipline (Abd Elrahman and Asaad, 2021). Ongoing debate exists over its conceptual ambiguity and scholars frequently note the overlaps between urban design and its adjacent fields such as architecture and urban planning. Nevertheless, there is broad agreement that urban design operates as a bridge between planning and architecture, occupying a distinct position at the intersection of the two disciplines (Belof and Kryczka, 2024; Gunder, 2011; Palermo and Ponzini, 2012). Whereas architecture traditionally focuses on the design of individual buildings, urban design extends its scope to encompass public spaces, streetscapes, building interfaces, and urban forms of neighbourhoods. In contrast, urban planning prioritises policy, zoning, infrastructure, and social governance, often treating form as secondary to regulation and use.

Urban studies can be classified according to their physical context. In planning and design, the form of cities is often analysed at different scales, each shaping the built environment in distinct ways. These scales are typically categorised into three levels: macro, meso, and micro (Ho et al., 2021; Wu et al., 2025). The micro scale usually focuses on small, localised areas, such as individual blocks or streets, where urban designers, architects, and landscape architects shape human-centred environments that emphasise functionality, aesthetics, and economic considerations. The meso scale refers to broader areas like neighbourhoods or districts, defined by street layouts and landscape patterns, where larger design elements such as skylines and public spaces come into play. The macro scale involves even larger units, such as precincts or entire cities, and typically addresses issues related to urban agglomeration, planning, and policymaking. Micro and meso scales are often three-dimensional and physically tangible, directly influencing people's spatial experience. In contrast, macro-level studies typically rely on two-dimensional frameworks such as land-use patterns or zoning maps (Lang, 2017). The scales are equally relevant and complementary in supporting overall urban functionality and coherence.

To navigate this conceptual diversity, we adopt the framework of the six dimensions of urban design proposed by Carmona (2021). These relate to the morphological, perceptual, social, visual, functional, and temporal aspects of design. Table 1 introduces these dimensions including its key components and examples. Carmona's framework is positioned in the literature as a foundational synthesis of key dimensions of urban design theory and practice (Othmani and Ammar, 2026), and has been used extensively to structure empirical studies (see e.g. Bambó Naya et al., 2023; Dastjerdi and Lak, 2023; Ding et al., 2024; Quintana et al., 2025; Zhu et al., 2026; Shinbira, 2025). However, it has not been applied before in the context of urban freight transport.

Table 1
The 6 dimensions of urban design, synthesised from Carmona (2021) and author's interpretation.

Dimension	Description	Key design components	Example references
Morphological	The physical form and shape of settlements, structures, and the layout of urban areas, encompassing the arrangement of streets, buildings, and open spaces.	1. Land use patterns 2. Building structures 3. Plot patterns 4. Cadastral (street) patterns	(Perry, 1929) (Rowe and Koetter, 1984) (Conzen, 1960) (Barnett, 1974)
Perceptual	The psychological experience of a space, focusing on how people perceive, navigate, and interact with urban environments, primarily through four sensory perceptions: vision, hearing, smell, and touch.	1. Legibility (wayfinding) 2. Sense of place 3. Place distinctiveness 4. Place theming	(Lynch, 1964) (Canter, 1977) (Hannigan, 2005) (Tuan, 1975)
Social	The role of public spaces in facilitating social interactions, promoting inclusivity, and fostering a sense of community among residents and visitors.	1. Relationship between people and space 2. Concept of the public realm 3. Neighbourhoods 4. Safety and security 5. Access and exclusion of public space6. Equity and inclusiveness	(Jacobs, 1961) (Banerjee, 2001) (Burton and Mitchell, 2006) (Rishbeth, 2001)
Visual	The aesthetics, harmony, and visual identity of the urban landscape, including the use of materials, colours, and proportions, all of which contribute to how it appears, feels, and integrates with its surroundings.	1. Aesthetic appreciation (patterns and kinaesthetic experience) 2. Visual qualities of space 3. Design of visual elements of space (architecture, façade, floor scape, street furniture, landscape)	(Cullen, 2012) (Sitte, 1965) (Nasar, 1990)
Functional	The utilisation of public places to enhance their capacity to optimise and efficiently accommodate services, utilities, and daily activities, improving both their quality and functionality.	1. Movement (vehicular and pedestrian) 2. Connectivity and accessibility 3. Design with environmental considerations 4. Providing healthier environments	(Hillier, 1996) (Alexander, 1977) (Richards, 2012) (Burton et al., 2003)
Temporal	The ability of public places to evolve and undergo incremental changes, reflecting their time-thickened qualities and adaptability to seasonal, daily, or long-term transformations, which contribute to their robustness and sustainability.	1. Time cycles and the time management of activities in space 2. Continuity and stability 3. Obsolescence 4. Conservation	(Lynch, 1976) (Matos Wunderlich, 2008) (Kreitzman, 1999)

3. Methodology

We adopted a systematic literature review methodology following the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines including the steps of identification of literature, title and abstract screening, full-text screening, and inclusion (Page et al., 2021). Following the selection process, descriptive bibliometric analysis and content analysis were conducted to provide an overview of the included publications and obtain insights into thematic foci and literature gaps. The summary of this process, including search terms, is shown in Fig. 1. We describe the steps below.

3.1. Identification of literature

We used the Web of Science and Scopus databases to identify primary publications. Trial searches were conducted to refine keywords for relevance. The final search strategy grouped terms into two concept blocks: (1) city logistics and synonyms and (2) urban design-related terms. For the latter, we found that component-specific terms (e.g., streets) did not yield additional relevant studies beyond those captured by the term "urban design", while neighbouring terms including "urban planning" and "architecture" did. Consequently, the following search string was adopted. The Boolean operator "AND" was applied between two search groups, while "OR" was used to connect terms within each group. While our review focuses on work contained in scientific publication repositories, readers should be aware of material available in practitioners' circles, especially on the topic of curbside management, which also addresses freight transport concerns. Examples include McCormack et al. (2019), NACTO (2021), and AIA New York (2022).

The search string used for identification is:

("city logistics" OR freight* OR "logistics traffic" OR "supply chain" OR "urban logistics" OR "last mile logistics" OR "logistics trip" OR "last mile delivery*" OR "last mile distribution*" OR "first mile logistics" OR "first mile delivery*" OR "parcel delivery*"OR "goods movement*" OR "cargo transport" OR "goods distribution*" OR "logistics transport*" OR "logistics facility*") **AND** ("urban design" OR "spatial design" OR "public space*" OR "built environment*" OR "urban form*" OR "urban structure*" OR "built up area*" OR "urban planning" OR "architecture design" OR "city planning" OR "spatial planning" OR "urban configuration*" OR "urban landscape*" OR "space design" OR "urban morphology" OR urbanism OR "town planning" OR townscape* OR "space allocation*" OR "urban development*" OR "spatial pattern*").

The initial search began in November 2024 and underwent iterative revisions of search strategies, followed by the final search on both databases in December 2024. By using the "title, abstract, and keywords" engine, 1860 records were found on Scopus. Meanwhile, the search conducted on Web of Science, under the "Topic search" engine, provided 1451 records. After removing duplicates, 2628 publications were screened. With an additional 38 identified through snowballing (conducted in May 2025), the screening process resulted in a final set of 83 studies for analysis.

3.2. Eligibility criteria

All papers underwent a two-step screening process, following the PRISMA protocol. This included a title and abstract screening, followed by full-text screening, as illustrated in Fig. 1. We did not set limitations on publication years or disciplines, to ensure comprehensive results that represent both historical and categorical diversity. For the same reason, language was only applied as a criterion during the full text screening. Inclusion decisions were based on predefined eligibility criteria. The criteria applied at each stage are summarised in Table 2.

3.3. Selection process and snowballing

Following the identification stage, the screening process, comprising

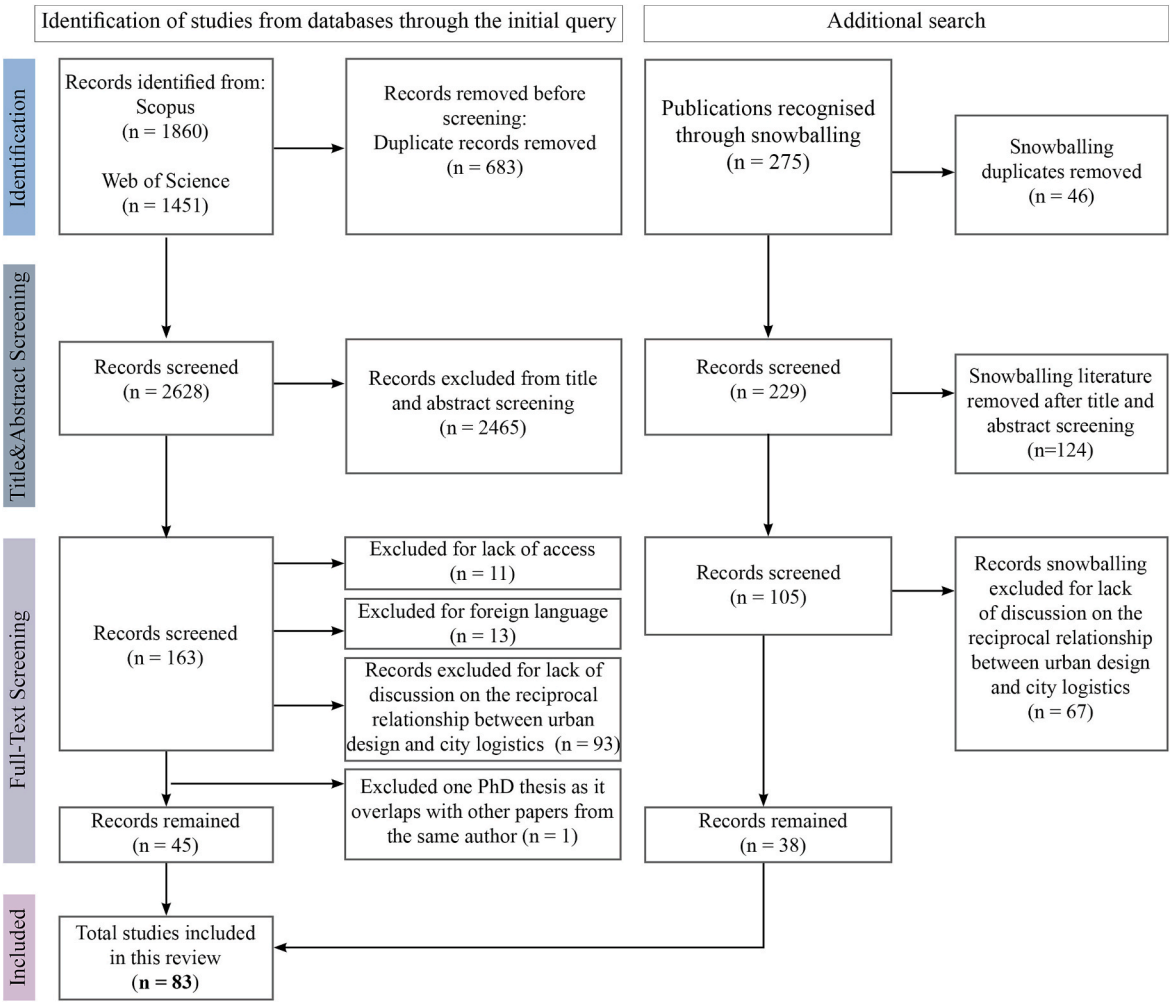

Fig. 1. PRISMA literature review flowchart.

title and abstract screening followed by full-text screening, was implemented. To minimise potential bias, three reviewers participated in the screening processes. One main reviewer conducted the primary screening of all literature and managed the overall review process, while two additional reviewers independently assessed publications that were flagged as uncertain or low-confidence cases. Conflicts or discrepancies among reviewers were resolved through discussion sessions to reach consensus.

To improve the reliability of the final dataset and ensure comprehensive coverage of the relevant literature, we adopted both forward and backward snowballing methods (Wohlin et al., 2022). Backward snowballing was conducted by reviewing the reference lists of the initially included studies, while forward snowballing was performed using Google Scholar to identify articles that cited those included studies. These snowballing processes yielded an additional 229 records (after removing 46 duplicates), which were then subjected to the same two-step screening procedure, using the original inclusion and exclusion criteria. As a result, 38 additional studies were identified and incorporated into the final dataset for analysis. The complete list of the included 83 studies, along with relevant metadata and coding, is provided in Appendix A.

4. Bibliometric overview

To provide an overview of the publications included in this review, the bibliometric analysis gives us results of temporal evolution of research, geographical distribution of case studies, and keyword patterns. At the end of this chapter, thematic clusters will be introduced and described. The analysis results are presented in this chapter and the next chapter.

The 83 studies identified included 62 journal articles, 9 conference papers, 4 book chapters, 5 reports, 2 theses, and 1 preprint. Fig. 2 presents the chronological distribution of annual publications, from which we can see output remained sparse until the mid-2010 s, followed by a clear increase after 2015 and a marked acceleration in the most recent years. Publication activity rises sharply from 2022 onwards and reaches a peak of 21 publications in 2024, reflecting the rapid rise of scholarly attention to the scope between city logistics and urban design. The early period (before 2015) appears fragmented, with relevant contributions dispersed across different publication types and outlets. The gradual growth between 2015 and 2022 shows a growing interest in how city logistics relates to urban design across multiple spatial scales. The sharp acceleration from 2022 onwards coincides with increasing attention to freight impacts on urban space and liveability. Counts for the most recent years should nevertheless be interpreted with caution, as publication cycles and database indexing delays may affect annual totals. One publication dated 2025 is not shown in Fig. 2 because the search was conducted primarily in December 2024, and one additional record was excluded from the trend plot as an outlier.

Table 3 summarises the geographical distribution of studied countries. Instead of referring to the geographical location of the author institutions, the countries here were identified directly from the study contexts reported in the papers, which resulted in multiple countries existing within a single paper in a few cases. In this classification,

Table 2
Inclusion and exclusion criteria used in the screening process.

Title and Abstract Screening	
Exclusion criteria	Studies that do not engage with city logistics. Studies that do not engage with urban design. Studies focused primarily on non-road transport modes (e.g., rail, air, maritime, or drones). Studies that address logistics only at the regional or intercity scale. Editorials or opinion pieces lacking original and scientific content
Inclusion criteria	The study engages with both city logistics and urban design, even if this is not explicitly stated. The focus is on on-road transport (e.g., trucks, vans) as the primary mode of logistics. The study is situated in urban or *peri*-urban contexts
Full-text Screening	
Additional exclusion criteria	The paper is not available in English. The full text is inaccessible.
Additional inclusion criteria (To assess relevance to the research scope, a question-based approach was applied during full-text screening. A study was included if it allowed for clear answers to the following questions)	What city logistics problems are addressed? What urban design dimensions or attributes are involved? Is there a meaningful and reciprocal interaction between urban design and city logistics in the study?

"Generic" refers to papers without a specific geographical study area, but a general or conceptual focus. It is shown that the United States is the most frequently studied country, which is consistent with the fact that several highly relevant papers also originate from the USA. Brazil and several European countries, including France, Spain, and the Netherlands.

We conducted a co-occurrence analysis on titles and abstracts using VOSviewer. Applying binary counting, setting the occurrence threshold to five, and using association strength as the normalisation method, we obtained the results shown in Fig. 3.

The figure highlights that "space" is a central concept in the discourse. The colour gradient reveals a temporal shift. Earlier studies (before 2020, shown in blue) tended to emphasise planning- and policy-level issues, often focusing on location choice and operational efficiency. More recent research (after 2020, shown in red), however, has shifted towards micro-scale problems, as illustrated by the growing presence of terms such as pedestrian and sidewalk. This demonstrates a move towards practical issues of urban design, where different flows must coexist, which can be proven by the emergence of the terms "integration" and "interaction". In a word, this figure suggests a recognition of the need to embed logistics functions more directly into the spatial environment, particularly at the micro scale, rather than treating them as isolated operational concerns.

5. Themes in the existing literature

A content analysis was performed by means of 1) an inductive clustering approach, identifying key research themes on the city logistics' side (Fereday and Muir-Cochrane, 2006) and 2) a matching with Carmona's 6-dimension framework.

The themes were developed through an iterative manual coding process, ensuring that patterns emerged from the data, and were cross-validated among reviewers. Four clear clusters emerged that show the scope and diversity of the full corpus. After synthesis and interpretation, we identified the following 4 key themes:

Table 3
Geographical distribution of study context.

Geographical context	Count
USA	27
Generic	11
France	8
Brazil	6
Spain	5
Netherlands	4
Italy	4
Australia	3
UK	3
Greece	3
Belgium	2
China	2
Sweden	2
Norway	2
Colombia	2
South Korea	2
Morocco	2
Singapore	1
Japan	1
Poland	1

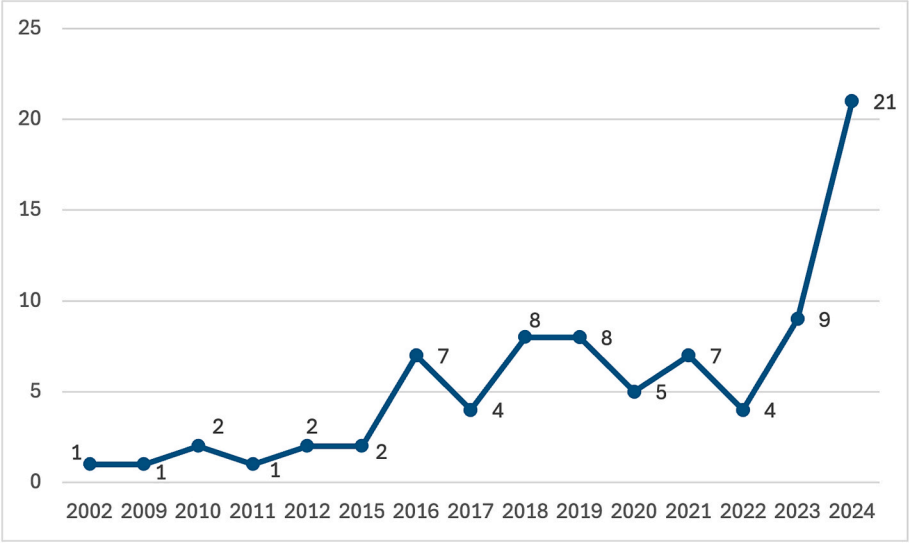

Fig. 2. Publication year trend.

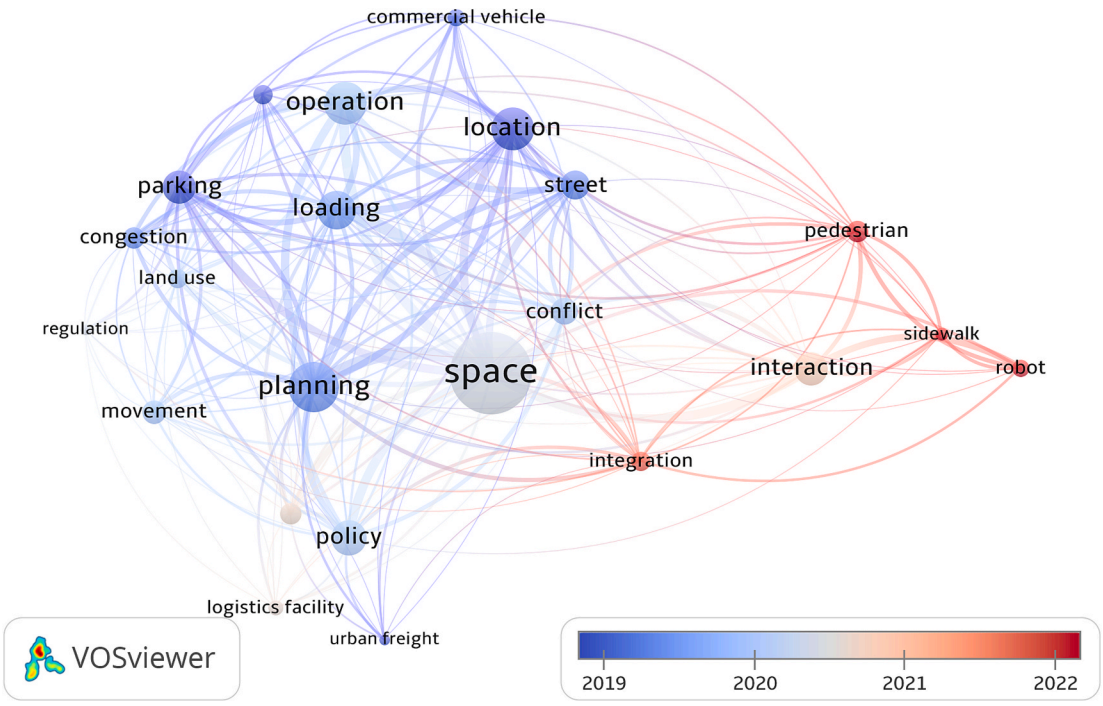

Fig. 3. Co-occurrence network of keywords and key terms.

- **Problematisation**: This cluster comprises studies that define, reflect on, or critique key challenges at the intersection of urban design and city logistics. Rather than providing empirical solutions, these studies contribute by articulating emerging problems. Interestingly, with one notable exception, none of the papers attempts to provide a comprehensive framing of the interactions between urban design and city logistics.
- **Analysis of traffic conflicts**: This group includes studies that focus on the interaction between freight traffic and other transport modes, with particular attention to conflicts and coexistence within shared urban spaces, understanding the issues around moving road users. The research is descriptive and strongly empirically oriented.
- **Curbside design and management**: This cluster focuses on the design, allocation, and governance of curbside space to better negotiate logistics functions, particularly when vehicles are parked and where handling and storage activities ensue which conflict with typical curbside uses, including pedestrian traffic and signage.
- **Freight facility integration**: This cluster covers research that addresses the location and spatial integration of logistics infrastructure into the urban fabric. The emphasis is on siting strategies and the impact of facilities on the surroundings. The research has strong connections with meso and macro-scale designs (transport and urban planning).

Next, the identified themes were mapped onto the 6 urban design dimensions. Their distribution is shown in Table 4. The numbers in Table 4 refer to individual papers, and can be cross-referenced using the column "**ID**" in Appendix A.

As is clear from the table, the distribution of studies across the 6 dimensions is highly uneven. The vast majority of studies focuses on the functional dimension, with no representation at all of the visual dimension, and varying degrees of attention in the remaining four (morphological, social, perceptual and temporal). We return to this pattern later in the paper to suggest avenues of future work. Below, we discuss the presence of these dimensions of urban design in the extant literature, with the purpose to identify main lines of thinking, as well as gaps.

5.1. Theme 1: problematisation (11 papers)

This cluster engages with the conceptual framing of freight-related challenges in the urban environment, providing interdisciplinary insights at the intersection of urban design and city logistics. These

Table 4
City logistics themes and urban design dimensions.

City Logistics Themes	Urban Design Dimensions Functional	Morphological	Social	Perceptual	Temporal	Visual
Problematisation	[4], [11], [12], [14], [15], [20], [22], [35], [36], [64], [78]	[12], [15], [20], [22]	[4], [12], [36]	[4], [14], [78]	[4]	
Analysis of traffic conflicts	[6], [8], [19], [28], [33], [38], [40], [56], [63], [68], [69], [70], [83]		[38], [40], [83]	[30], [40], [56], [59], [62], [63], [70], [74], [77], [83]	[62]	
Curbside design and management	[2], [3], [5], [7], [9], [10], [16], [17], [23], [25], [26], [27], [31], [32], [34], [37], [41], [42], [44], [48], [49], [50], [53], [54], [58], [60], [65], [66], [67], [71], [76], [79]		[31], [67], [76]	[44]	[41], [49], [65], [71]	
Freight facility integration	[1], [18], [21], [24], [29], [39], [45], [46], [47], [51], [52], [55], [57], [61], [72], [73], [75], [80], [82]	[13], [21], [43], [46], [51], [52], [61], [82]	[18], [39], [46], [47], [82]	[57]	[43], [55], [81]	

contributions are conceptual in nature, aiming to highlight gaps, challenge existing assumptions, and inspire future research directions. Notably, most publications in this cluster are authored from a transportation research perspective, with urban design frequently mentioned as either missing, under-theorised, or in need of deeper integration into the logistics discourse.

Several studies explicitly identify the absence of urban design considerations in current logistics research. For instance, Bell (2021, p. 20) highlights the significance of urban design by clearly defining its scope and emphasising the role of streetscapes, spatial layouts, and other built environment elements that both influence logistics performance and are shaped by it. Similarly, Haarstad et al. (2024) identify urban design as a critical issue in bridging freight logistics and urban studies, advocating for its inclusion as a core concern when integrating logistics into urban environments. Wygonik et al. (2015) also frame urban goods movement as central to compact city development, implicitly engaging with urban design and offering a comprehensive overview of how logistics could be embedded into spatial planning practices. Across these papers, functionality emerges as the most addressed urban design dimension. The urban built environment is frequently conceptualised as a spatial system for movement and accessibility, with emphasis on how cities allocate space for logistics activities.

However, several studies also engage with other design dimensions. For example, the morphological dimension is evident in three studies. Conway (2024) reflects on freight integration strategies from a land-use and planning perspective, suggesting significant implications for spatial configuration. Ducret & Gonzalez-Feliu (2016) and Buldeo Rai et al. (2023) examine how urban form and land use shape freight demand and infrastructure, both at the city level, with clear attention to built environment characteristics. From a neighbourhood-level perspective, Sgura Viana and Delgado (2019) explore freight accessibility and curb allocation in historic centres, linking urban form and logistics strategies. Their approach frames logistics as a land-use issue, aligning closely with the morphological dimension.

The social dimension is reflected in Cruz-Daraviña and Bocarejo Suescún's study, which discusses spatial conflicts between freight operations and other urban functions in city centres (Cruz-Daraviña and Bocarejo Suescún, 2021). Their work sheds light on the inclusiveness of freight planning and the relationship between people and space within compact urban environments.

Two studies engage with the perceptual dimension, incorporating citizens' perspectives into freight discussions. França et al. (2025) use a structural modelling approach to explore how different urban freight initiatives are perceived by residents, revealing contextual variability in public acceptance and perceived effectiveness. Amaya et al. (2021) similarly apply Structural Equation Modelling (SEM) to examine perceptions of freight impacts on urban sustainability, testing hypotheses around liveability and logistics impacts.

A particularly noteworthy contribution comes from Buldeo Rai (2024), who explicitly links multiple urban design dimensions to city logistics through a placemaking lens. This study integrates functional, social, perceptual, and temporal aspects of design, highlighting the role of logistics in shaping local public spaces. The visual dimension is not addressed explicitly. It demonstrates a growing research interest in embedding logistics considerations into spatial design thinking and stands out as well-aligned with the direction of our review.

Overall, this cluster reflects a broad and multi-dimensional engagement with urban design, primarily through a conceptual or agenda-setting lens, validating the topic that this review addresses is timely. While most studies focus on the city-level or remain scale-generic, they collectively stress the urgency of incorporating spatial design thinking into logistics policy and research. Urban street design and management emerge as recurring focal points, with freight often discussed as a challenge to be better integrated into evolving visions of urban form and function. Attempts at a comprehensive framing, with the exception mentioned, are lacking, however.

5.2. Theme 2: analysis of traffic conflicts (18 papers)

This cluster primarily examines conflicts between freight vehicles or emerging logistics technologies and other urban users, particularly in shared public spaces such as sidewalks and bike lanes. Studies in this category explore issues such as congestion, road safety, and the broader impact of freight traffic on urban mobility.

Almost all the studies in this cluster engage with the functional dimension of urban design, focusing on vehicular and pedestrian movements, curb allocation, and the environmental impacts of freight traffic. At the neighbourhood scale, Ros-McDonnell et al. (2018) investigate how freight distribution flows are influenced by spatial organisation and local regulatory restrictions, highlighting the adverse environmental effects of logistics operations in dense urban areas. Verlinde et al. (2016) explore how pedestrianised zones are disrupted by freight activities, pointing to increased traffic flows, reduced accessibility, and additional spatial demands for parking and modal transfer. A broader, city-level perspective is taken by Yuan and Wang (2021), who analyse the spatial distribution of freight-related crash rates across urban neighbourhoods. Their findings reveal socio-spatial inequalities in freight-related safety outcomes, where socially disadvantaged areas experience higher crash concentrations. This study therefore not only engages with the functional dimension but also touches upon the social dimension, framing logistics safety as an issue of spatial justice.

The social and perceptual impacts of urban freight are further examined by Iacobucci et al. (2022), who analyse social media data to understand the challenges faced by US parcel delivery drivers. The study highlights frequent conflicts with other road users and the perceived stress of navigating urban environments. It engages the perceptual dimension through lived experiences of drivers and the social dimension by acknowledging how their social identities shape their interactions with the built environment and other stakeholders.

Zooming into the street-level context, we find that another subset of studies concentrates on the interactional conflicts between freight vehicles and cyclists. Pokorny et al. (2018) investigate cyclist–truck conflicts in Norwegian cities, linking logistics activity with street safety, cycling infrastructure, and spatial design. In the US context, Conway et al. (2016) examine how freight movement interacts with cycling infrastructure in bicycle-friendly cities, while Pitera et al. (2017) analyse the planning challenges of accommodating freight and cyclists in shared street spaces. These studies foreground the functional dimension but also hint at the perceptual implications of sharing infrastructure. Laboratory-based experiments conducted in both studies (Jashami et al., 2020, 2024) extend the investigation of freight–cyclist interactions by examining cyclists' behaviour and psychological responses in controlled settings. These studies contribute to the understanding of the perceptual dimension of urban design, offering insights into stress, visual attention, and perceived safety in environments shared with freight vehicles.

More recently, the emergence of autonomous delivery robots has introduced new challenges in the urban realm, giving rise to a growing body of research on human–robot interactions in shared public spaces. Linking emerging city logistics solutions with the design and configuration of public environments, Arntz et al. (2023) assess the readiness of urban traffic settings for integrating autonomous delivery robots in the context of the Netherlands. Most studies on delivery robots remain exploratory, aiming to understand how humans react to and perceive robots in real-world urban contexts. This reflects a broader phase of experimentation, intended to inform future adoption and integration strategies. For instance, Gehrke et al. (2023) use observational data to analyse interactions between delivery robots, pedestrians, and cyclists on shared sidewalks, linking logistics innovation to street usability, spatial design, and public space management. Similarly, several recent studies (Weinberg et al., 2023; Heisel et al., 2024; Yu et al., 2024; Pelikan et al., 2024) explore pedestrian–robot interactions in sidewalk environments, offering insights into how city logistics intersects with urban design and pedestrian experience.

Other studies focus on the integration of autonomous delivery robots into urban systems, examining spatial requirements, behavioural responses, and acceptance thresholds. Puig-Pey et al. (2023) assess system acceptance and design challenges, while Wang et al. (2024) investigate how robot behaviours affect pedestrians' trust, reactions, and willingness to share space. Collectively, these studies engage primarily with the functional and perceptual dimensions of urban design, reflecting concerns with circulation, spatial configuration, and the user experience of public space. The social dimension is also addressed, particularly in relation to safety, inclusivity, and access. In contrast, the temporal dimension remains overlooked. Only one study (Xu et al., 2024) addresses it directly, examining how nighttime robot deliveries affect perceived safety in sidewalk environments.

To summarise, most studies in this cluster are conducted at the street-level scale, where interactions between freight flows and other urban users, particularly pedestrians and cyclists, are most pronounced. A notable and growing subtheme is the investigation of human–robot interactions, which has gained momentum in recent years. These studies are predominantly based in North America and tend to engage with the perceptual dimension of urban design. Methodologically, the research in this cluster relies heavily on real-world observational studies and experimental or simulation-based approaches, including video analysis, behavioural experiments, and scenario testing.

5.3. Theme 3: curbside design and management (32 papers)

This cluster addresses the issues arising at the curbside. Rather than focusing on dynamic conflicts, research in this cluster highlights the contested nature of the street when delivery vehicles are statically parked.

Some studies within this theme offer normative and methodological frameworks to optimise the design, allocation, and regulation of curb space for logistics operations. Jones et al. (2009) examine strategies for managing curb space to balance freight deliveries, passenger access, and other street uses. Similarly, other studies explore how curbside space can be designated and managed to accommodate freight activities (Allen and Piecyk, 2022; Cerema, 2010; Goodchild et al., 2018; Mitman and Davis, 2019; Oliveira et al., 2012), offering valuable design guidance. Addressing spatial allocation challenges at the street level, Castrellon et al. (2024a) propose a framework for understanding curbside conflicts by analysing competing demands among freight, active travel, and other users. Along the same lines, Pochowski et al. (2022) introduce a curb space allocation tool that balances freight and non-freight needs, explicitly linking city logistics with urban design. Several studies focus more specifically on the planning of urban freight loading and unloading zones. Muñuzuri et al. (2017) advocate for optimising zone placement based on freight demand patterns and land use context. Similarly, Moufad and Jawab (2019) propose a case-study-based planning methodology to allocate freight spaces within the street network. Castrellon and Sanchez-Diaz (2024) take a more data-driven approach, using analytical modelling to link freight needs with neighbourhood-scale planning. The studies reviewed above not only address operational demands but also integrate land use, street typologies, and urban design considerations into their frameworks.

Many studies centre on the competition for curb space usage. These studies emphasise the issues that arise from limited curb space under such conditions. Ringsberg et al. (2023) explore stakeholder priorities and conflicts over freight use of public space, offering insights into multi-stakeholder dynamics and the broader social implications of curb use. Similarly, Kawamura & Sriraj (2016) and Pivo et al. (2002) collect empirical data to examine how different actors engage with curbside space. While both address the widespread issue of illegal parking, they approach it from different angles: from the truck drivers' perspective, the focus lies on how the built environment shapes their delivery experience, revealed through qualitative interviews; from the governance level, attention shifts to the implications for urban liveability, leading to policy recommendations and design strategies proposed by decision-makers. The discussion on stakeholder conflicts continues in several other studies. Girón-Valderrama et al. (2019) analyse commercial vehicle parking behaviour and the competition for limited curb space in dense downtown areas, while Jaller et al. (2021) examine conflicts among freight, ride-hailing, and parking users, both studies highlighting the ongoing "battle" for curb access. Schmid et al. (2018) further investigate how parking duration and street design features influence freight behaviour. In addition to these dynamics, several studies focus specifically on the illegal occupation of loading bays by private vehicles, which exacerbates curbside pressures. Ezquerro et al. (2020), McDonald & Yuan (2021), and Mitman & Davis (2019) examine how such practices disrupt freight delivery operations and restrict public space access. These studies suggest that inadequate enforcement and spatial planning contribute to persistent conflicts between freight and other curb users.

Drawing on observations, simulations, or survey data to examine curb use, parking behaviour, and freight delivery patterns, there are studies that take a more empirical approach. Ranjbari et al. (2023) explore drivers' decision-making processes in simulated urban parking scenarios, offering insights into how freight drivers navigate curbside constraints and infrastructure limitations. Similarly, Zou et al. (2016), Bouhouras et al. (2024b), and Chen et al. (2017) examine on-street parking patterns of delivery vehicles in dense urban contexts, highlighting the challenges of street-space allocation and curbside management. McCormack et al. (2019) focus on how delivery drivers respond to street-level design elements, such as street furniture and pedestrian activity. Using a combination of field observation and simulated street dynamics, they offer recommendations for accommodating freight vehicles through improved street envelope design. A comparable approach is seen in the work of Chen et al. (2019), who conduct field observations and micro-simulation modelling to estimate corridor capacity and examine how commercial vehicles access residential buildings in dense urban areas. Taking a distinct yet highly relevant approach, Machado-León et al. (2020) investigate freight activity in urban alleys, one of the most overlooked yet problematic spaces in dense city environments. Through survey data and field evidence, their study captures how different types of freight vehicles occupy alley space, offering critical insights into the spatial challenges and design implications for both alleyways and streets.

The curbside is recognised within urban planning frameworks as an integral component of the urban transportation system. A few studies adopt a strategic, system-level perspective to address curbside design and management, situating it within broader planning and governance contexts. For instance, Castrellon and Sanchez-Diaz (2023, 2024) examine how freight-related curbside management decisions, ranging from infrastructure provision to regulatory frameworks, affect urban street-space allocation and contribute to sustainable city development. Similarly, Moufad and Jawab (2020) focus on enforcement challenges surrounding loading bays in Morocco, reflecting the institutional and regulatory dimensions of curbside governance. Beyond governance, another strand of research explores the integration of curbside logistics with land use planning and urban form. Gardrat and Serouge (2016) model delivery bays to reveal persistent misalignments between urban design practices and the operational realities of freight delivery. Research also focuses on loading and unloading zones (Bouhouras et al., 2024a; Dezi et al., 2010), analysing their spatial distribution and functional alignment with the built environment.

In summary, key topics include normative guidance for freight operations, stakeholder conflicts over logistics parking, real-world behavioural studies, and curbside strategies embedded within urban planning frameworks. Publications in the curbside cluster consistently engage with the functional dimension of urban design. Most studies are conducted at the street level. The social dimension emerges in discussions on stakeholder interactions and perceptions, while the temporal dimension is addressed through examinations of how curbside use varies

throughout the day, highlighting the need for adaptable spatial strategies that respond to dynamic curb use patterns.

5.4. Theme 4: freight facility integration (22 papers)

This cluster explores the spatial and functional integration of freight facilities within urban environments. The facility types discussed include parcel lockers and pickup points, urban consolidation centres (UCCs) and micro-hubs, warehouses and distribution centres, and loading/unloading (L/U) zones (bays).

Several studies focus on parcel locker systems, particularly with respect to accessibility. These studies typically adopt case study approaches, examining how the spatial placement of lockers relates to land-use patterns, urban density, and user access. For example, Russo et al. (2024) investigate the spatial distribution and walking accessibility of pickup points in a Greek city, evaluating how well they serve residents and support sustainable last-mile logistics. Similarly, Campisi et al. (2024) employ a GIS-based accessibility analysis that combines spatial network modelling with land-use considerations to assess the walkability and coverage of pickup points. In addition to evaluating the performance of the locker systems themselves, some studies also explore how parcel lockers affect surrounding urban environments, analysing how their placement interacts with built environment variables, such as land-use mix, street connectivity, and proximity to public amenities, as well as how these factors influence travel behaviour and spatial planning decisions (Lachapelle et al., 2018; Ma et al., 2024). These papers examine how spatial placement, land-use context, and urban design characteristics affect the performance and accessibility of parcel lockers, as well as their broader impacts on user behaviour and travel patterns.

As infrastructure supporting freight transhipment and last-mile delivery optimisation, a few studies explore the spatial role and urban integration of medium- and large-scale logistics facilities, such as UCCs, micro-hubs, and warehouses. Kin and Quak (2024) examine spatial conflicts between these facilities and surrounding land uses, and the governance mechanisms required to integrate them into the wider urban system. One case study illustrates how repurposing urban space for logistics, specifically as a micro-hub, reveals the intersection of logistics operations and urban design within a temporal planning framework (Panuccio et al., 2015). Focusing on historical city centres, Carvalho et al. (2019) investigate the location criteria for urban distribution centres at the neighbourhood scale. From a similar perspective on the neighbourhood level, other studies analyse the spatial characteristics, land-use context, and social externalities of urban warehouses, highlighting how these facilities can coexist with residential and commercial functions. These insights contribute to a better understanding of how logistics infrastructure can be more effectively embedded in dense urban environments (Buldeo Rai, 2023). Taking a broader planning perspective, Dablanc and Heitz (2024) discuss the spatial restructuring of warehouse distribution patterns, with particular attention to their proximity to consumption zones and the resulting implications for urban design morphology. These works discuss challenges such as site selection, spatial conflicts with surrounding land uses, and governance frameworks needed to embed logistics infrastructure into the broader urban fabric, especially in dense inner-city areas. These studies also reflect a growing concern about the re-emergence of logistics land uses, and their integration into inner-city and *peri*-urban areas.

Some other studies examine the planning and allocation of L/U bays, treating them as logistics facilities rather than merely components of curbside operations. One study estimates the location and characteristics of private freight infrastructure by analysing land use patterns, building typologies, and delivery vehicle behaviour (Leon and Luis, 2018). Beyond exploratory research, several scholars focus on the decision-making processes for the allocation of L/U zones. For example, Arantes and Prata (2024) propose a method to identify optimal locations for L/U bays in urban centres, integrating freight operational requirements with urban spatial attributes. Similarly, another study presents a planning framework for determining the location and size of L/U areas, linking freight operations to street-level spatial planning and infrastructure provision (Pinto et al., 2019). In the same vein, Prata et al. (2018) develop a mixed-integer programming model to optimise the placement of on-street L/U spaces, balancing logistics efficiency with constraints such as walking distance to establishments and curb space availability. Rather than framing L/U bays solely as a curbside management issue, these studies conceptualise them as essential infrastructure embedded within the broader urban system. The emphasis lies on how their spatial distribution supports urban freight functioning and aligns with wider planning strategies.

A final group of studies explores multiple types of logistics facilities in combination, typically situating them within broader urban planning and land-use frameworks. These studies focus on how to better integrate logistics infrastructure into urban environments by addressing various facility types from multiple analytical perspectives. Kin and Quak (2024) highlight regulatory, spatial, and procedural barriers and propose mechanisms for spatially integrating logistics into urban development and planning processes to enable decarbonisation. Other research addresses how cities, from the street to the neighbourhood level, can accommodate the operational needs of freight vehicles, examining urban planning guidelines, building placement, and stakeholder perceptions regarding the functionality and accessibility of logistics infrastructure (Aljohani, 2016; Conway, 2018; Diziain et al., 2012; Furquim et al., 2020). Positioned at the intersection of urbanism and logistics, Chaberek (2017) investigates how land use, density, and street configurations affect the siting and feasibility of logistics hubs, proposing a conceptual synthesis of spatial planning and freight systems. Building on this, Buldeo Rai et al. (2022) introduce the concept of "proximity logistics" as a counterpoint to logistics sprawl, examining the emergence of logistics facilities within dense, mixed-use urban environments and classifying them based on size and function. The temporal dimension also emerges in this literature, particularly in relation to the evolving logic of logistics facility siting over time. Studies highlight how changing land-use patterns and the emergence of new facility types reflect the dynamic interplay between logistics operations and urban development (Xiao et al., 2021). For example, Vanky (2011), in a thesis, explores how the increasing presence of logistics infrastructure, such as distribution centres, intermodal hubs, and delivery flows, is reshaping the contemporary urban landscape and contributing to a new urban paradigm. These studies typically adopt the perspective of urban planners and policymakers, aiming to mitigate the externalities of freight logistics in dense urban contexts. While these studies primarily focus on land-use planning and governance, many also offer valuable insights for urban design, especially where spatial and functional overlaps emerge.

In summary, studies in this cluster treat logistics facilities as components of urban infrastructure whose location and operation should be coordinated with land use and road networks, rather than solely logistics assets. Most papers approach these spaces from a functional perspective, emphasising accessibility and locational efficiency. A notable subset investigates logistics facilities through a morphological lens, exploring relationships with land use, density, and street structures at broader spatial scales. The social dimension emerges primarily in discussions of externalities and the coexistence of diverse urban values. Temporal and perceptual dimensions are acknowledged but require further development, while the visual dimension remains largely absent, indicating a promising direction for future research.

6. Research opportunities

This section identifies research gaps and topics for future research, building on the inductive clustering and detailed discussion of papers. Since we employ the urban design lens to evaluate city logistics, the range of research opportunities can be defined around the 6 dimensions.

The **functional** dimension appears most prominently, as it concerns fundamental issues of movement, connectivity, accessibility, and

environmental performance. A substantial body of literature has examined these aspects, ranging from evaluations of freight flows and transport efficiency to assessments of environmental externalities (Castrellon and Sanchez-Diaz, 2024; Pokorny et al., 2018). However, despite this extensive coverage, the functional dimension is far from complete. Much of the existing work focuses on logistics efficiency alone, often neglecting the broader implications of freight movement in urban contexts. From an urban design perspective, future research could enrich this dimension by exploring how design interventions at multiple scales, from street to district, shape and are shaped by logistics functionality (Bell, 2021a; França et al., 2025; Kin and Quak, 2024). For instance, performance frameworks that integrate logistics and urban design key performance indicators (KPIs) could provide a more holistic basis for evaluating interventions. A further question concerns how urban design methods can be applied to inform city logistics, particularly in relation to how redesigned street layouts, micro-mobility integration, or shared curb spaces might simultaneously enhance logistics efficiency and urban quality of life. Moreover, as the reviewed studies suggest, emerging technologies are reshaping both urban design and city logistics, introducing delivery robots and artificial intelligence into practice. Questions concern how technology-driven delivery modes can be accommodated within urban environments, for instance, through studies of delivery-robot operations and human–robot interaction (Gehrke et al., 2023; Xu et al., 2024). Established tools such as digital twins remain promising for this agenda. By developing coupled urban-logistics digital twins, researchers can model and inform the adaptation of new delivery technologies within the physical urban environment.

The **morphological** dimension is partially addressed in the existing literature and most often investigated at the city-wide scale. Among the reviewed studies, morphological aspects of urban design are typically discussed in relation to land use and urban form, with most contributions situated in the facility cluster (Dablanc and Heitz, 2024; Ma et al., 2024). Although urban morphology is more strongly associated with urban planning, it also plays a critical role in urban design, at smaller spatial scales such as block and street patterns. Within urban design-oriented research, the integration with city logistics can be further approached through, building structures, floor plot patterns, and street networks. Future research should therefore investigate how urban typologies can support logistics functions at meso- and micro-scales of the urban fabric. Specifically, this may involve developing design typologies for freight-capable streets and neighbourhoods, as well as creating urban infrastructure that facilitates last-mile deliveries. In recent years, as AI adds analytical and generative capacities to urban design (Burry, 2022; Haddad et al., 2025), integrating these methods with urban form theories makes it possible to generate logistics-friendly urban-design prototypes. Besides, the literature to date overlooks small and medium-sized cities, which is an area where scholars from both fields can contribute. Future studies could also advance this dimension by producing systematic design typologies, such as pedestrian zones with service windows or transit corridors with freight staging areas, that link urban form to logistics performance.

Research on the **social** dimension of city logistics has focused on conflicts among stakeholders, safety, and equity, often framed through logistics externalities and their environmental consequences. From an urban-design perspective, however, this social lens remains underdeveloped. We still know little about how logistics infrastructures and practices mediate people–space relations in everyday settings; how curb zones, micro-hubs, and delivery corridors operate as parts of the public realm; and how inclusive these places are for different social groups (Buldeo Rai, 2023, 2024). Questions of procedural and spatial justice, both in decision-making and in the siting and accessibility of facilities, remain underexamined. Future work could adopt design methods, including participatory and co-design approaches, to negotiate shared street use, assess who benefits from proximity-based services, who bears associated burdens such as noise, safety risks, and degraded air quality, and evaluate accessibility for the elderly, people with disabilities, and low-income or otherwise marginalised residents. In urban studies, emerging applications of large language models (LLMs) include processing extensive planning documents, summarising stakeholder feedback, and translating technical design data into accessible narratives, which can help bridge disciplinary gaps and make the design language more comprehensible and participatory (Eduardo et al., 2025; Vivekanandan et al., 2025). Embedding spatial-justice frameworks and human-centred urban design in city-logistics research can yield principles that reconcile operational efficiency with social wellbeing.

The **perceptual** dimension has gained prominence in recent years, particularly in street-level empirical studies examining conflicts between logistics vehicles and other traffic, the adoption of delivery robots, and the effects of curbside design interventions, much of which is grounded in “sense of place” (Pelikan et al., 2024b; Wang et al., 2024). However, in urban design the perceptual domain extends further to include wayfinding, legibility, place theming, and distinctiveness (Carmona, 2021). Integrating these facets with logistics is crucial, as it can illuminate how logistics operations shape users’ psychological experiences of space and their navigational behaviour. Building on this insight, we identify several paths for future research. First, to compare perceptions across user groups, times of day, and street contexts using visual and immersive methods. Second, to link perceptual outcomes to behavioural risk and safety indicators. Third, to investigate wayfinding and legibility to support logistics facility siting. Finally, augmented, virtual, and extended reality (AR, VR, XR) provide safe and controllable environments for experiments and co-design, enabling rigorous measurement of perceptual outcomes before implementation (Hajrasouliha, 2024).

The **temporal** dimension is acknowledged in the literature but remains under-examined. Most studies treat time as an incidental variable rather than a structuring principle. Temporality is crucial because (i) heritage constraints fix design decisions over long time horizons; (ii) plans become obsolete when they ignore redevelopment dynamics and the need for continuity; and (iii) daily, weekly, and seasonal rhythms enable time-sharing of space (Lang, 2017). Building on this, we suggest that future work should develop and evaluate time-flexible design and policy, and systematically assess night-time logistics for their noise, safety, lighting, and equity implications (Bouhouras et al., 2024a; Vanky, 2011). Designers are encouraged to explore counterfactual, time-flexible designs with users. Longitudinal analyses may be needed to trace facility usage and curb supply across redevelopment cycles, and to conduct spatial–temporal accessibility analyses paired with equity assessments of alternative time allocations by user group and neighbourhood. Methodologically, studies could combine passive sensing and video analytics with time-use diaries to capture temporal variation at sufficient granularity to inform design practice.

The **visual** dimension is largely absent from the reviewed literature, although it has been highlighted in problematisation studies as a crucial factor in relation to urban design. While city logistics as a discipline tends to prioritise efficiency and operations, the visual implications of logistics should not be overlooked (Bell, 2021b). Logistics activities inevitably create visual disturbances in the urban environment, and addressing these challenges falls more naturally within the domain of urban design than logistics itself. If such disturbances are not adequately managed, urban design plans risk failing to achieve their intended purpose. Integrating the visual dimension into city logistics and urban design requires attention to aesthetic appreciation, the visual qualities of space, and the design of visual elements such as landscapes and streetscapes. From this perspective, it becomes possible to develop visual integration guidelines for logistics infrastructure, including parcel lockers, micro-hubs, and curb zones. Future research could further examine how the visual presence of logistics infrastructure influences aesthetics, wayfinding, and place legibility. Attention might also be given to how the façades, materials, colours, and lighting of freight facilities can be harmonised with surrounding streetscapes.

Methodologically, recent studies use image segmentation and street view analysis to characterise streetscapes, yielding insights into how built form, aesthetic qualities, and functional patterns influence city-logistics operations (Ito et al., 2024; Perez and Fusco, 2025).

Across **all** dimensions, it is essential to recognise that these dimensions often overlap and occasionally conflict. Urban design encompasses wider objectives, seeking to shape spaces that enable social, cultural, and economic engagement while satisfying functional as well as aesthetic requirements (Lang, 2017). Examining the trade-offs among these dimensions in relation to city logistics is necessary to reduce unwanted side-effects and may open important new research directions. There is no universal solution: prioritising the visual dimension may compromise functionality or increase costs, and optimising morphological characteristics such as layout and density may fail to support desired movement patterns. Although perceptual and visual dimensions can be complementary, they may also conflict: what appears visually striking may disrupt legibility or evoke feelings of confusion, discomfort, or insecurity.

7. Conclusions

This paper strengthens the conceptual and empirical link between urban design and city logistics. Following a rigorous review of 83 publications on the topic across different years, countries, and document types, a bibliometric analysis revealed that this stream of work has grown significantly over the past three years, since the COVID-19 pandemic. Through inductive thematic analysis, four key clusters were identified: problematisation, analysis of traffic conflicts, curbside design and management, and freight facility integration. All reviewed studies were mapped in a matrix connecting six urban design dimensions with these thematic clusters. Across all clusters, the functional dimension of urban design is the most frequently discussed, while the social dimension appears primarily in studies concerning stakeholder conflicts and equity. The morphological dimension is most visible in research on freight facility integration, focusing on the spatial distribution and siting of logistics infrastructure. The perceptual dimension emerges in studies of traffic conflicts, often relating to movement, perception, and the emerging field of human–robot interaction. The temporal dimension is occasionally mentioned but rarely examined in depth. Notably, the visual dimension is absent from city logistics discussions, representing a significant gap for future research.

Several salient directions for research emerge when taking the urban design dimensions as a basis for evaluation. The functional dimension could be expanded by developing an integrated framework of performance indicators relevant to both disciplines. The morphological dimension would benefit from smaller-scale spatial analyses. The social dimension could be deepened through participatory and co-design methods. The perceptual dimension might integrate behavioural indicators and diverse user experiences. The temporal dimension could be advanced through studies of time-flexible urban forms and temporal variation in logistics activity. Finally, the visual dimension presents strong potential for exploration in developing design guidelines for logistics infrastructure and examining how its visual presence affects wayfinding, aesthetics, and place legibility. Emerging technologies such as AI, XR, and visual analysis tools offer new opportunities to bridge these fields further by enhancing visualisation, participatory design, and simulation. We can recommend further research into the choice of framework to represent the urban design discipline. While we believe that Carmona's framework as used here has fulfilled its purpose to explore the subject, other frameworks may develop niches in urban design in much more detail and may prove more effective at tackling specific concerns or dimensions.

In sum, this paper contributes to conceptualising and clarifying the multiple roles of urban design, especially within the context of urban freight transport. Conceptually, it reframes city logistics literature through an urban-design lens, shifting attention from network efficiency to the spatial, social, and experiential qualities of the environments in which freight operates. Methodologically, it applies Carmona's six-dimension framework to the city-logistics literature for the first time, producing a two-dimensional analytical matrix that reveals research gaps. Doing so can support the aims of the 2030 Agenda (United Nations, 2015), including sustainability, resilience, and social inclusion. While some cities and practitioner communities are already experimenting with interventions such as designated loading bays, micro-hubs, and broader curbside management frameworks, the knowledge base informing these efforts remains fragmented across disciplines. With logistics services expected to continue growing, and with cities increasingly required to adapt, this review reinforces the practical urgency of integrating city logistics into urban design. We hope that this study will inspire new transdisciplinary research to make future cities more efficient and liveable.

CRediT authorship contribution statement

Jiayu (Joslyn) Sun: Conceptualization, Formal analysis, Funding acquisition, Methodology, Visualization, Writing – original draft. **Lóránt Tavasszy:** Conceptualization, Methodology, Supervision, Validation, Writing – review & editing. **Ron van Duin:** Conceptualization, Supervision, Validation, Writing – review & editing.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.trip.2026.102028.

Data availability

Data will be made available on request.

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