Summary

Transportsektoren udgør en af de væsentligste udfordringer i den grønne omstilling, og Danmark har forpligtet sig til ambitiøse mål for reduktion af CO_2-udledninger. For at realisere disse målsætninger er det nødvendigt at fremme aktive transportformer og samtidig reducere afhængigheden af privatbilisme. Aarhus Kommunes nye Grønne Mobilitetsplan (2024) betoner betydningen af transitnær byudvikling, og er et eksempel på initiativer for at realisere klimamålene. Det rejser samtidig spørgsmålet: Hvordan kan byplanlægning understøtte udviklingen af en sammenhængende og helhedsorienteret bystruktur, der faciliterer denne grønne omstilling af transportsektoren? Det er dette spørgsmål, der danner grundlaget for nærværende artikels forskningsfokus.

Artiklen tager afsæt i en kritisk behandling af det eksisterende koncept Transit-Oriented Development 2 (TOD2), som jeg tidligere har arbejdet med i en akademisk sammenhæng. TOD2 er skabt som en videreudvikling af det oprindelige Transit-Oriented Development (TOD) koncept og har til formål at kombinere transitnær byudvikling med menneskeskala, multimodal infrastruktur og bylivskvalitet. Konceptet introducerer en integreret planlægningsmodel, hvor mobilitetsknudepunkter ikke alene ses som tekniske transitplatforme, men også som levende og tilgængelige byrum, der understøtter modale skift.

Den oprindelige TOD tilgang, som blev formuleret i 1990'erne, fokuserer primært på tæt, blandet og transitnær byudvikling, særligt i storbykontekster. Det er blevet kritiseret for sin stærke forudsætning af byfortætning som løftestang for bæredygtig mobilitet. Dette ensidige fokus på forøget densitetsudvikling medfører, at modellen ofte mister sin relevans i mindre urbaniserede områder, hvor sådanne strategier ikke er politisk, socialt eller fysisk realiserbare. Derudover er TOD modellen i stigende grad blevet kritiseret for at overse sociale og oplevelsesmæssige dimensioner af mobilitet, såsom beskyttelse mod dårligt vejr og andre usikkerheder, samt brugernes oplevelse af byrummet.

TOD2 søger at imødekomme disse udfordringer ved at udvide planlægningsperspektivet til også at inkludere stedsspecifikke forhold, brugeroplevelser og sociale hensyn i form af et designperspektiv. Dog afdækkes det i denne undersøgelse, at også TOD2 modellen har væsentlige begrænsninger i relation til mindre urbaniserede områder, hvor høj byfortætning ikke er en ønsket eller mulig planlægningsstrategi. I denne henseende kritiseres TOD2 for at mangle tilstrækkelig sensitivitet overfor den lokale kontekst og for ikke i tilstrækkelig grad at kunne operationaliseres på kommunal skala grundet divers bysammensætning, hvortil planlæggere er forpligtet til at sikre mobilitetsretfærdighed og lige adgang for alle borgere, uanset geografisk placering.

Formålet med denne undersøgelse er derfor at udvikle en metodisk værktøjspakke, der gør TOD2 anvendeligt i et bredere spektrum af urbane kontekster, med særligt fokus på lavt befolkede og mindre urbaniserede områder. Ved at analysere transportbehov og mobilitetsmønstre i disse områder, søger undersøgelsen at identificere både barrierer og potentialer for at fremme en mere bæredygtig omstilling af transportsektoren.

Undersøgelsen baserer sig på en etnografisk, empirisk tilgang og kombinerer flere kvalitative metoder. Feltstudier, herunder deltagerobservation, gennemføres i udvalgte lokalområder i Aarhus Kommune med særligt fokus på de eksisterende mobilitetsknudepunkter og deres samspil med det omkringliggende byliv. Derudover suppleres feltarbejdet med kvalitative interviews, som foretages med eksperter fra den kommunale forvaltning og det regionale trafikselskab, samt uformenlle samtaler med lokale borgere, for at indfange både de strategiske planlægningsperspektiver og de situerede brugeroplevelser i de konkrete cases.

Valget om at inddrage etnografi i et byplanlægningsprojekt begrundes i et ønske om at bringe planlæggerens blik tættere på den levede hverdagsmobilitet, som til tider overses i top-down styrede planlægningsmodeller. Etnografien bidrager med dybdegående indsigt i, hvordan borgere oplever og navigerer i byens rum og mobilitetstilbud, og gør det muligt at identificere relationer mellem den fysiske infrastruktur og de sociale praksisser. Herved skabes et grundlag for at udvikle planlægningsstrategier, der ikke blot er funktionelle, men socialt og kulturelt forankrede i den lokale kontekst. Grounded Theory danner det metodiske fundament for både dataindsamling og analyse. Denne tilgang muliggør en induktiv og situeret udforskning af planlægningspraksis og bidrager til udviklingen af en kontekstsensitiv tilgang til TOD2-planlægning, der kan tilpasses de sociale og rumlige forhold i en kommunal kontekst som Aarhus Kommune.

Resultaterne peger på, at bæredygtig mobilitetsplanlægning forudsætter en lokal forankring og en socialt inkluderende tilgang, hvor planlæggere aktivt påtager sig ansvaret for at forstå og agere i den specifikke kontekst. Undersøgelsen munder ud i en konceptuel model for en kontekstsensitiv planlægningsproces, der opererer inden for rammerne af TOD2-konceptet og understøtter udviklingen af mobilitetsknudepunkter, som er tilpasset forskellige urbane situationer. Modellen tager afsæt i en analyse af situerede interaktioner mellem menneskelige og ikke-menneskelige aktanter, og fremhæver betydningen af stedsspecifikke sociale og fysiske dynamikker.

Herudover suppleres modellen af fire typologiske idealtyper for Mobility Hubs, som er inspireret af eksisterende forskning. Disse tilbyder et analytisk værktøj til at identificere og differentiere mobilitetsknudepunkter på tværs af kontekster, og styrker dermed modellens anvendelighed i praksis. Samlet set bidrager undersøgelsen med et planlægningsredskab, der kan understøtte mere retfærdige, effektive og stedssensitive mobilitetsstrategier i kommuner som Aarhus med divers sammensætning af urbane kontekster.

Context-Sensitive Transit-Oriented Development 2 as a Concept for Sustainable Mobility Transitions

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ABSTRACT

Urbanisation and the historical car-centric planning have contributed to global urban challenges such as CO_2 emissions, air and noise pollution and traffic congestion. In response, urban planning discourse has increasingly embraced sustainable mobility paradigms that prioritise sustainable modes of transport. This paper explores how to apply Transit-Oriented Development 2 (TOD2), as an expanded, human-scale version of the traditional TOD framework, in the means of a context-sensitive planning strategy to promote a modal shift away from private car use while ensuring equal accessibility across diverse urban environments. Using Aarhus Municipality as a situated case study, the research investigates how the TOD2 concept can be translated into adaptable interventions within both high- and low-density contexts. Grounded Theory and ethnographic fieldwork form the methodological basis for developing a grounded conceptual framework, which integrates relational analyses of human and non-human elements having impact on mobility behaviour. Furthermore, the article introduces a typological tool for interpreting Mobility Hub characteristics, challenges, and development potential, enhancing the operationalisation of TOD2 across varying spatial scales. The findings underscore that sustainable urban mobility requires a planning logic that is both adaptable and locally informed. Requiring a framework that recognises the complexity of place, supports modal shift, and enables equal access to sustainable mobility options. The proposed framework aims to guide planners in integrating urban identity, infrastructure, and socio-cultural dynamics to strengthen the transition toward carbon-neutral and inclusive cities.

KEYWORDS

Interdisciplinary, ethnography, Transit-oriented Development 2, Mobility Hub, sustainable mobility

1 INTRODUCTION

Urbanisation presents a critical challenge for urban infrastructure, as studies reveal that urban areas are expanding at a pace that exceeds population growth, particularly driven by increasing migration to metropolitan cities, in conjunction with the escalating impacts of climate change and a range of qualitative social issues [12]. These trends place significant pressure on urban infrastructure, conjunction with rising global temperatures, which intensify environmental stress, and increase levels of social segregation and urban conflict [12]. They therefor highlights the urgent need to facilitate urban structures that can accommodate social diversity, ensure access to affordable housing, provide sufficient critical infrastructure, and deliver a transport system capable of meeting the increasing demand for capacity [12].

A major factor contributing to these infrastructural capacity issues, is the historical "predict and provide" approach, which has shaped car-oriented urban planning for decades [47], reinforcing car dependency and contributing to congestion [13]. However, contemporary urban planning strategies are increasingly shifting towards reducing reliance on car-centric development while ensuring accessibility and efficiency in prioritising sustainable mobility [33, pp. 13-15].

Beyond environmental consequences, car-centric infrastructure also poses significant public health risks. The greenhouse gas emissions contribute to air pollution, a leading cause of respiratory and cardiovascular diseases [10]. Additionally, transport-related noise pollution and inactive lifestyles linked to car dependency have been associated with increased risks of obesity, diabetes, and mental health issues[11]. Encouraging active modes of transport, such as walking and cycling could thereby significantly improve public health while reducing urban emissions.

The transition towards a sustainable mobility system in the transport sector is essential for addressing the intertwined challenges related to urbanisation and widespread car dependency. While the expansion of the electric vehicle industry contributes to reducing pollution, it is not sufficient in itself. A broader transformation is still necessary to tackle the sector's significant contribution to congestion and public health issues, also to improve quality of life [3]. The transport sector is one of Europe's largest contributors of CO_2 emissions, accounting for approximately 25% of the total output [2], yet progress on emission reduction remains slower than in other sectors [2]. This highlights the urgent need for a fundamental shift to meet the European climate targets, which require a 90% reduction in greenhouse gas emissions by 2050 compared to 1990 levels [2]. Private vehicles remain the largest source of emissions within the sector, responsible for 71% of the total emissions [2], with private vehicles accounting for 71.6% of the passenger-kilometers traveled in the EU-27 in 2019 [4]. This reliance on fossil-fuel-powered cars also poses a major challenge to Denmark's sustainability objectives, as private vehicles cars accounts for 82,3% of passenger-kilometers traveled in 2019 in Denmark [4]. To address these challenges, the Danish government has committed to a range of policies and initiatives that align with broader EU and global climate agreements, entailing sustainable mobility.

As a signatory to the Paris Agreement (2015), Denmark has committed to significantly reducing its carbon footprint, with transport

playing a critical role in achieving national targets [2]. The EU's Fit for 55 package (2021) reinforces these commitments by setting ambitious targets, including the transport sector, as an joint initiative aimed at reducing greenhouse gas emissions by 55% in 2030 compared to the level in 1990 [5], [2]. Additionally, Denmark's Climate Act (2020) sets an even more ambitious goal, mandating a 70% reduction, necessitating transformative changes in mobility infrastructure [20]. Furthermore, the United Nations Sustainable Development Goal 11 emphasises the need for inclusive, safe, and sustainable urban mobility, setting the course for national strategies on urban development towards 2030, which commits all the united nations to work towards the same sustainable goals [9].

One example of how these commitments translate into local action is the case of Aarhus, Denmark's second-largest city and an important metropolitan in the Central Denmark Region. In its Green Mobility Plan (2024), Aarhus Municipality aims to operationalise sustainable transport through the integration of Transit-Oriented Development (TOD) principles in its most recent mobility plan, Grøn Mobilitet [6], [16]. Transit-Oriented Development was originally introduced in 1993 as an urban planning concept designed to promote compact, sustainable communities centred around high-quality public transport [16]. TOD aims to reduce reliance on private vehicles by prioritising accessible public transit and promoting sustainable modes of transport, such as walking, cycling, and public transport. It focuses on the development of mobility hubs, mix-use of urban space, and reduced travel distances as strategies for facilitating a modal shift away from car dependency [16]. This approach supports sustainable urban growth by encouraging public transit use, while also helping to reduce congestion, air pollution, and the spatial fragmentation associated with car-oriented development [42].

In response to shifting planning paradigms increasingly concerned with urban quality and human-scale principles, the TOD concept has recently been refined into a more comprehensive framework – Transit-Oriented Development 2 (TOD2), reflecting current priorities in urban mobility planning [33, pp. 13, 21]. TOD2 brings together the original TOD-standard [35] with Jan Gehl's 12 quality criteria for human-scale urban design [25, p. 241], and operates across multiple planning scales, balancing strategic goals, such as reducing car dependency and promoting sustainable mobility networks, but notably it enhance a great focus on livability of public spaces [33, p. 60]. While the framework aims to support carbon-neutral and improve equal accessibility, it faces notable limitations in low-density contexts due to its strong emphasis on urban densification and transit proximity.

Aarhus is experiencing significant urban growth, necessitating a planning approach that balances the needs of both metropolitan inhabitants and inhabitants in the peripheral [7]. With a population of approximately 372,962 residents, only 37% reside lives in the city centre, while the majority lives in surrounding suburban and village contexts [1]. This spatial distribution presents both infrastructural and social challenges, particularly in delivering equal mobility services across the municipality.

In response, Aarhus' Planning Strategy 2023 outlines a spatial vision that prioritises development of outskirts, rather than further densifying the city centre [8, pp. 14–15]. The strategy advocates for strengthening local communities outside the urban core by supporting place-specific identities, enhancing accessibility, and recognising context-specific potentials and constraints. This represents a clear departure from previous densification oriented approaches, instead promoting a polycentric model of urban development that aligns with broader ambitions for climate neutrality and spatial justice.

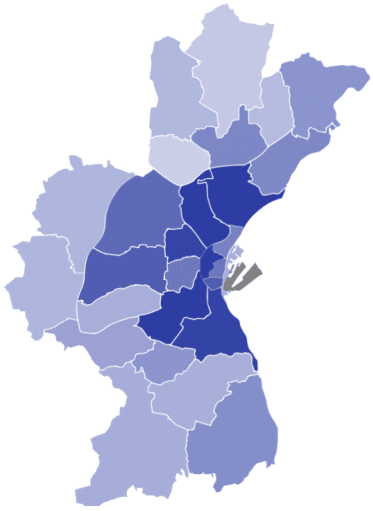


Figure 1: Population distributed across local communities and districts in Aarhus Municipality (01-11-2024). The darker the blue is, the higher the number of inhabitants is [1].

Furthermore, Aarhus Municipality's Green Mobility Plan 2024 serves as a guiding framework, with a set of ambitious goals of transforming Aarhus as a whole into a city with greater urban mobility, where the municipality are integrating the Transit-Oriented Development principle to support a more accessible and sustainable transport system [6]. In alignment with Denmark's climate commitments, Aarhus Municipality aims to reduce its CO_2-emissions by 270,000 tones by 2030, ultimately achieving carbon neutrality [6]. A central component of this strategy is the promotion of high-quality public transport and "station-oriented development", reducing reliance on private vehicles and fostering greener mobility choices. Investments in infrastructure for cycling, walking, and electrified public transport are seen as crucial steps in creating a well-functioning, low-carbon transport system for the region [6]. This transition is thereby both an environmental necessity but also a broader vision for urban quality, social sustainability, and equitable mobility. By integrating mobility planning with urban development, the municipality seeks to enhance livability while addressing long-term mobility challenges [6], [8, p. 15].

This article examines how a context-sensitive planning approach can support a transition towards sustainable mobility, with the contemporary urban development challenges, such as carbon neutrality, car dependency, pollution, and public health conditions, and within the framework of Aarhus Municipality's Green Mobility Plan. The aim is to develop a qualitative and strategic framework for applying the TOD2 concept in a grounded and adaptive way.

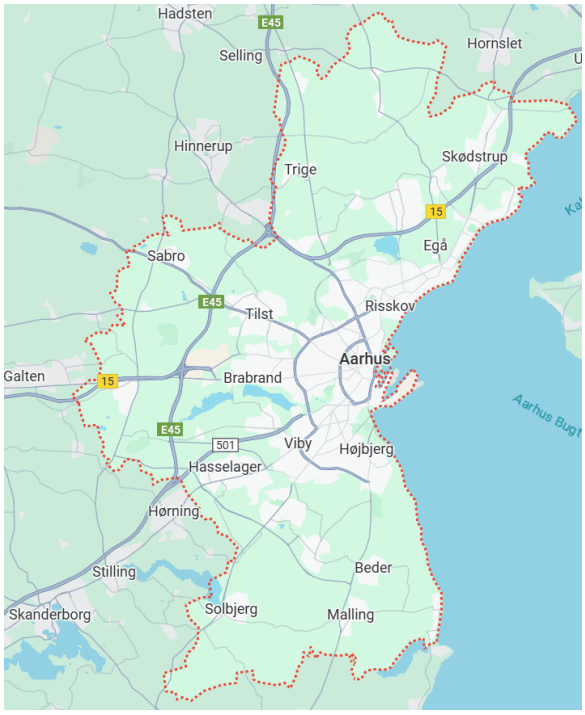


Figure 2: Aarhus Municipality borders, photo from Google Maps (26-02-2025).

Aarhus Municipality serves as a situated case for investigating how urban planners can translate local mobility dynamics into effective TOD2-based interventions. Through an ethnographic and iterative research approach, the research seeks to contribute to a more nuanced understanding of how TOD2 principles may be adapted to diverse urban settings, thereby enabling planning processes that better support modal shift and promote equal accessibility across varied spatial conditions, particularly with a focus on low-density village contexts.

1.1 Research Design

The increasing pressure on urban infrastructure, combined with the urgent need to meet ambitious climate goals, in the context of an evolving urban planning paradigm with emphasis on quality of life and livability, has led to the following research question:

How can TOD2 as a context-sensitive planning strategy, support the shift of commuters from car dependency to sustainable modes of transport, meanwhile ensuring equal accessibility in spatially diverse municipal contexts?

This article will take form as it is illustrated in figure 3 - a research design, structured in regards to a central research question and four supporting questions to structure the research processes [22].

The research design of this article follows a step-by-step progression, illustrated by the series of guiding arrows. Each step is structured around a supporting question. To the left of each supporting question there is a designated box outlining the specific objective that drives the corresponding section. To the right, a corresponding box presents the methodological approach employed to address the question.

The first supporting questions are intended to structure a literature review to frame the conceptual and theoretical lenses through which the research is conducted. These are further supported by methodological considerations aligned with the ambition to develop a context-sensitive approach through Grounded Theory, to investigate the planning concept that forms the foundation of this research; TOD2. Hereby, the literature review will provide a critical groundwork for understanding what planning opportunities arise when Transit-Oriented Development is adapted to greater sensitivity on diverse urban contexts.

To investigate the situated case of Aarhus Municipality, relevant planning documents will be examined through a structured document analysis. This will provide insight into how the municipality conceptualises and facilitates the implementation of Transit-Oriented Development as a leading strategy within the their regional mobility planning paradigm. Initial expert interviews will inform and nuance the analytical focus, particularly through professionals' perspectives on the diverse urban landscapes for which they hold a planning responsibility, with specific attention to the challenge of ensuring equal access to sustainable mobility solutions in light of broader goals for reducing carbon emissions in the transport sector.

Following the establishment of the theoretical and conceptual framework and the collection of empirical material, the data will be analysed with the objective of developing a context-sensitive application of TOD2-based planning in varied urban contexts, with a particular emphasis on low-density areas. Grounded Theory will serve as the overarching methodological framework, guiding both data collection (e.g. site visits) and the subsequent analytical processes.

The fourth supporting question frames the discussion of the analytical findings by critically reflecting on how these insights can inform planning practice. It further serves as a basis for evaluating the methodological and conceptual framework developed throughout the article.

Finally, the article concludes by addressing the research question, which reflects on the analytical findings and the purposed model for the establishment of the context-sensitive TOD2 planning strategy.

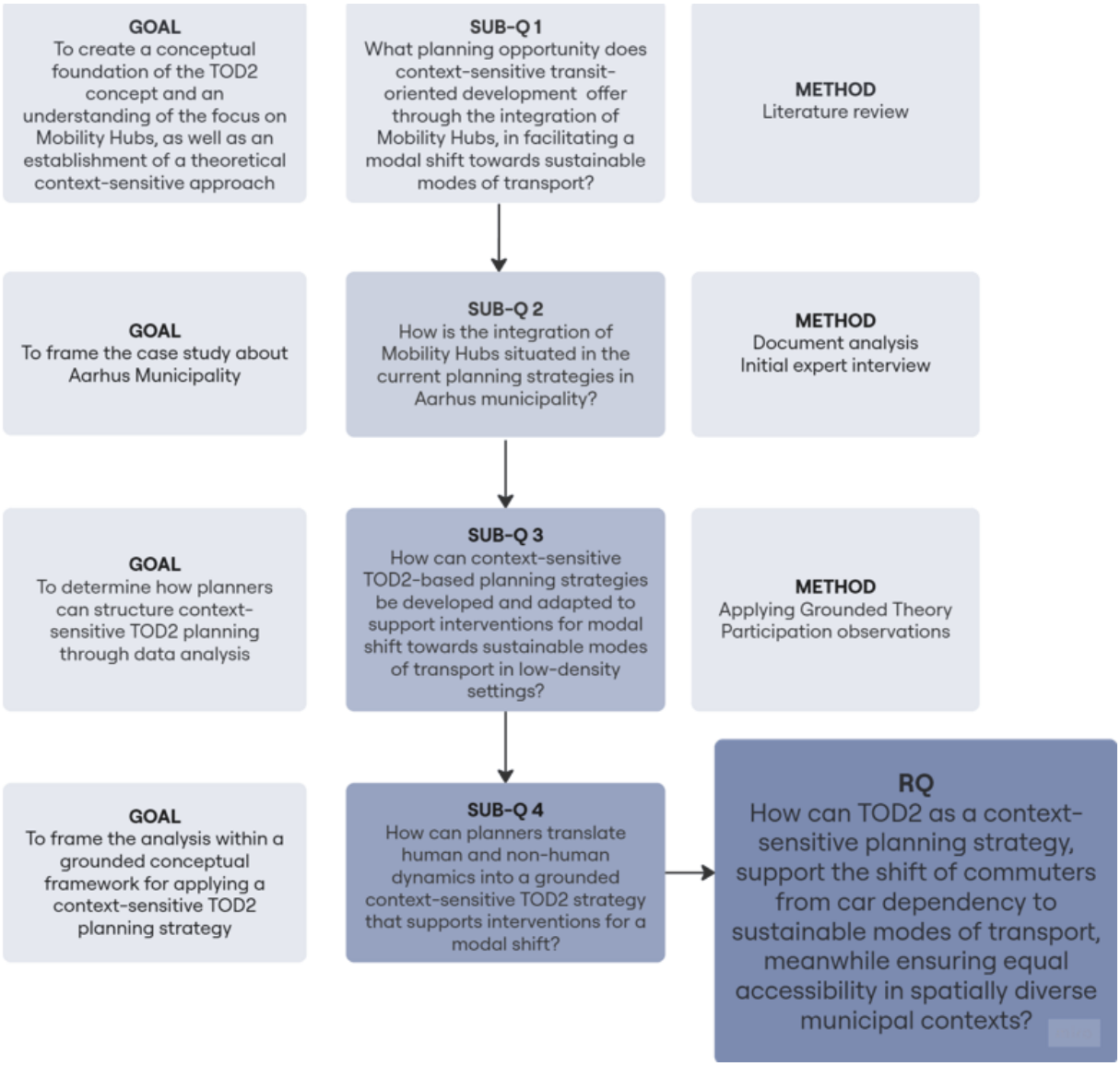


Figure 3: Research design of the articles content.

2 LITERATURE REVIEW

The question framing this chapter is:

What planning opportunity does context-sensitive transit-oriented development offer through the integration of Mobility Hubs, in facilitating a modal shift towards sustainable modes of transport?

Hereby, the article will examine literature on the traditional concept of Transit-Oriented Development (TOD), as well as research on typologies of Mobility Hubs, in order to establish a foundational understanding of how contextual conditions shape the requirements and characteristics of different types of Mobility Hubs. Within an ethnographic research design, the research will adopt Grounded Theory as its theoretical methodology. Grounded Theory will be explored as a scientific approach for generating empirical insights and will serve as a methodological lens through which theoretical concepts in urban and mobility planning are interpreted. Following the literature in the field of urban planning, the premises of mobility planning and the traditional Transit-Oriented Development (TOD) concept are increasingly being challenged by the trend towards human-scale planning and the integration of mobility planning with urban development plans. The changing paradigm foster a stronger emphasis on sensitivity and integration of human-scale design, when approaching TOD as a planning concept.

2.1 What are the Core Principles of TOD?

Transit-Oriented Development emerged in the early 1990s as a response to the growing environmental, spatial, and social consequences of car-oriented urban development. Formally introduced as a planning concept by architect and urban planner Peter Calthorpe in his work *The Next American Metropolis* (1993) [16], TOD is rooted in the New Urbanism movement, which marked a paradigm shift in urban planning away from functionalist, car-oriented growth and towards compact, mixed-use, and walkable neighbourhoods [34]. TOD is defined as a mixed-use community located within approximately 600 metres (2,000 feet) of a transit stop and commercial centre, and it is designed to encourage sustainable mobility; walking, cycling, and public transit use over private car dependency [16].

TOD is conceptualised through three foundational principles; *density*, *diversity*, and *design*, commonly referred to as the "3 Ds" [37, pp. 1–2]. This framework has since been expanded into the more comprehensive "5 Ds" and occasionally "7 Ds" [37, pp. 1–2], [34], as principal objectives to pursue the implementation of TOD planning, being:

- **Density**: population and employment intensity near transit.
- **Diversity**: a mix of residential, commercial, and civic land uses.
- **Design**: pedestrian- and cycle-friendly urban design.
- **Destination accessibility**: ease of access to key activities and services.
- **Distance to transit**: proximity to reliable and frequent transit stations.
- **Demand management (6D)**: policies to discourage car use.
- **Demographics (7D)**: consideration of socio-economic profiles affecting mobility choices.

[37, pp. 1–2]

The Institute for Transportation and Development Policy (ITDP) operationalised these principles in its framework *TOD-Standard*, which outlines measurable criteria across eight dimensions [35].

This framework both serves as a planning tool and an evaluation framework for sustainable urban development, in a point score system up to 100 points across the eight principles, where *transit* counts for zero points, because it is the central core for even considering a case as Transit-Oriented [35, pp. 8–10].

A central element in the implementation of TOD is the node-place model [52], which evaluates Mobility Hubs based on two factors of the 'node', indicating how well the area is connected through various modes of transport, and the 'place', referring to the surrounding land use characteristics [52, p. 282]. Balancing the interplay between these aspects is essential for creating effective and well-integrated transit areas. As such, Mobility Hubs are becoming focal points in TOD planning as places where multimodality and spatial coherence should facilitate modal shift.

Despite the benefits associated with TOD, such as contributing to sustainable urban development by limiting car dependency and urban sprawl, its application in practice is not without challenges: TOD models often fall short when applied without sensitivity to local conditions [33, p. 18]. The absence of contextual adaptation

ITDP's Principles of Urban Development for Transport in Urban Life:

1. [WALK] Develop neighborhoods that promote walking
2. [CYCLE] Prioritize non-motorized transport networks
3. [CONNECT] Create dense networks of streets and paths
4. [TRANSIT] Locate development near high-quality public transport
5. [MIX] Plan for mixed use
6. [DENSIFY] Optimize density and transit capacity
7. [COMPACT] Create regions with short commutes
8. [SHIFT] Increase mobility by regulating parking and road use

Figure 4: The framework of the TOD-standard [35, pp. 7].

risks producing uneven development outcomes, as place-specific social, economic, and physical characteristics must be integrated into planning processes to ensure equitable and inclusive outcomes [33, p. 17]. A critical concern is the potential for displacement of low socio-economic groups. As accessibility and urban amenities improve in TOD areas, housing prices tend to rise, thereby threatening the residential stability of populations who are most reliant on affordable public transit options [37, pp. 4–7]. This gentrification dynamic directly undermines the core objective of sustainable mobility planning: to promote equal accessibility for all social groups, regardless of income, background, or geographic location. Moreover, the spatial concentration of development around transit nodes often increases pressure on public infrastructure such as schools, healthcare facilities, and public spaces [53]. If this additional demand is not adequately addressed, it may reinforce existing socio-economic disparities in access to essential services, and further challenge the evolving urban planning principle of equal accessibility and quality of life across urban contexts [33, p. 17].

A key limitation in the traditional TOD framework lies in its strong emphasis on transit networks, with limited consideration of how users perceive and experience their journey environments, an aspect increasingly recognised as essential in influencing travel behaviour and supporting modal shift [50, pp. 134-135].

While TOD offers a strategic concept for aligning urban form with sustainable mobility, these limitations underscore the need to critically assess its application in practice and to emphasise inclusive planning around Mobility Hubs to ensure both functionality and social justice:

As mobility hubs become more widespread, cities should consider and design them as a network, where each node is adapted both to its function in the network and to local parameters. Mobility hubs are

also part of a wider urban and regional context, which needs to be considered for a comprehensive understanding of the impacts.

[27, pp. 3503]

2.2 Mobility Hub Typologies

The empirical understanding of sustainable mobility planning has undergone a historical shift, reflecting the broader transition from a 'predict and provide' approach that focuses on accommodating future traffic volumes, to a 'decide and provide' paradigm, in which planners proactively shape urban environments to promote sustainable and equal mobility [33, pp. 13-15]. As a result, Mobility Hubs has emerged as a concept that perceive a transit node as a experiential urban space, and no longer as purely functional [33, p. 24].

While various typologies of Mobility Hubs exist in the literature, this research focuses on three central contributions [28, 46, 54] that aim to develop analytical and conceptual frameworks rather than practical planning tools. These sources are selected due to their emphasis on creating transferable typologies that enable theoretical reflection, comparative analysis, and contextual understanding across diverse urban settings. Particularly for this research, the focus will be on low-density settlements in order to explore the limitations of TOD in relation to density, and to investigate alternative approaches to evaluating the role of Mobility Hubs within diverse urban contexts.

Hereby, an establish for how to understand the Mobility Hub phenomenon will be relevant in this situated research of Aarhus Municipality, to get a foundation of how Mobility Hub can differentiate in regards to their local context. Multiple studies on typology of Mobility Hubs will therefor be reviewed, and outlining different typologies as the research aims to approach the fieldwork with a structured understanding of site-specific conditions and identify the essential factors required for each location to function effectively as a Mobility Hub.

The most widely recognised typology is based on the size of the hub, as the size determines the service level within an urban context. Another typology is found in the book chapter "Mobility Hubs, an Innovative Concept for Sustainable Urban Mobility?" published in *Smart Cities* (2024)[28]. This source outlines a comprehensive presentation of Mobility Hub typologies, with multiple classification strategies, each reflecting different thematic perspectives. In *Smart Cities*, Mobility Hubs are categorised by their structure (e.g., regional, community, neighbourhood), their role in the transportation network (e.g., Anchor and Gateway hubs), and their urban context (e.g., city centre, suburban node, historic town) [28, pp. 251-256]. In addition, hubs can be distinguished based on user group (residents, professionals, tourists), as well as temporality (temporary or permanent), scale and size, and the multimodal range of mobility services offered [28, pp. 251-256]. This multifaceted typology underscores the idea that Mobility Hubs are not one-size-fits-all, but must instead be tailored to the socio-spatial characteristics and strategic objectives of their specific locations.

While the typology from *Smart Cities* [28] provides a rich palette of thematic perspectives, *Transport Geography's* "Towards a typology of mobility hubs" (2023) [54] synthesises these into a six-part typology structured around scale and service provision, in their article on the Dutch planning experience by a Grounded Theory approach. The six-part typology is framed as Community, Neighbourhood, Suburban, City Edge, City District, and City Centre hubs [54, pp. 5-6]. These types of Mobility Hubs are primarily defined by the quality and quantity of transport modes and services, thus linking spatial scale with multimodality and functionality in a more systematic way [54, p. 5]. Their work addresses a clear academic gap by offering a conceptual model for practical application, and they explicitly advocate for further research into user behaviour and transport justice, thus adding a normative dimension to the typological discourse.

Together, the two sources; *Smart Cities* [28] and *Transport Geography* [54], show how Mobility Hub typologies are shaped by different thematic perspectives, encompassing urban morphology and infrastructural role to equity, governance, and user needs. While the typology from *Smart Cities* [28] allows for flexible application across different types of urban environments, *Transport Geography* [54] contribute with a framework that is particularly useful for empirical studies and planning analysis.

In addition to these contributions, the paper in the journal *Sustainability* "An Analysis of the Emerging "Shared Mobility Hub" Concept in European Cities: Definition and a Proposed Typology" (2023)[46] presents a multi-dimensional typology specifically aimed at shared mobility systems. Responding to the absence of a unified definition, the paper proposes five key classification dimensions: urban context, spatial scale, hub size, transportation function, and the role within the transportation network [46, p. 8]. A central element in this typology is the matrix-based framework that combines hub types, such as neighbourhood, business, transit, district, city, regional, and private, with specific urban contexts to assess mobility needs and guide the design of a specific hub [46, pp. 6-8]. This framework is structured in a table [46, pp. 6-9], which shows how the different types of hubs are assessed against the urban context to determine local needs and spatial structures. Moreover, the typology is designed to work as a decision-making tool supported by multiple spatial criteria to identifying optimal hub locations and functions of Mobility Hubs as a conceptual understanding for mobility planning.

To compare the analytical scope and thematic focus of the reviewed typologies, the following Table 1 provides an overview of the three central contributions with a strong focus on less urbanised contexts:

Source	Typology Focus	Hub Types	Classification Dimensions	Analytical Use
[28]	Broad typological framing across urban contexts, including low-density areas through categories like Community and Neighbourhood hubs.	Community, Neighbourhood, Suburban; includes functional differentiation.	Urban context, user type (e.g., local residents), accessibility, multimodality, functional role in regional transport.	Useful for identifying flexible hub typologies adaptable to village conditions and socio-geographic variation.
[54]	Empirically grounded typology specifically distinguishing Community, Neighbourhood, and Suburban hubs as part of a six-level hierarchy based on service provision.	Community, Neighbourhood, Suburban – defined by transport service level and spatial scale.	Service quality, spatial scale, transport supply level, population size, surrounding area.	Supports evaluation of minimum requirements in size, accessibility, and service level for rural mobility hubs.
[46]	Five-dimensional framework combining hub type and urban context in a matrix, including lower-density areas through categories like Neighbourhood and Private hubs.	Neighbourhood, Private, and Business hubs – adjusted according to context-specific needs in rural or semi-urban settings.	Contextual suitability, proximity to key functions (e.g., housing, local services), and operational flexibility across rural and semi-urban settings.	A practical framework for evaluating and selecting hub types based on spatial data and real-world context; supports decision-making on location and hub size in low-dencity areas.

Table 1: A table on literature of Mobility Hubs typologies, established for an case analysis in a low-density contexts [28, 46, 54].

This comparison illustrates how each typology contributes differently in understanding the role and function of Mobility Hubs. While some emphasise adaptability to local urban contexts [28], others offer structured, scalable frameworks that support planning decisions and spatial analysis [46, 54]. Importantly, the selected typologies are particularly relevant for analysing Mobility Hubs within diverse urban contexts. In the table, the focus is placed on their applicability to village settings, as they offer valuable insights for low-density areas, peripheral settlements, and small-scale urban environments. The selected sources all include hub types such as Community, Neighbourhood, and Suburban hubs—typologies that are essential for capturing the diversity of needs and spatial conditions in urban villages settings. Together, these perspectives provide a robust theoretical foundation for classifying and assessing Mobility Hubs in the context of Aarhus Municipality.

In contrast, other typologies found in the literature [21, 38, 45] have primarily been developed to support operational planning and policy implementation. These frameworks often serve as context-specific guidelines, addressing practical concerns such as station design, land-use coordination, or modal integration in mid-sized or rural areas. Examples from the reviewed literature include frameworks focusing on transit optimisation at smaller nodes [38], policy-driven hub concepts in Dutch planning [45], and design-oriented guidelines for station areas [21]. While valuable for informing planning decisions, such practice- and policy-driven typologies are typically limited in their capacity to provide broader theoretical insights. As they are closely tied to specific policy agendas or infrastructure systems, they fall outside the scope of this research, which aims to investigate how typologies can be used as conceptual tools to understand and compare the role and function of Mobility Hubs across urban contexts.

Importantly, as highlighted in *Smart Cities*, the concept of Mobility Hubs remains flexible, with no single author having established a definitive understanding [28]. Therefore, a shared definition must be developed collaboratively among stakeholders for each project, ensuring contextual relevance [28, p. 269].

To investigate the relevance and service needs of Mobility Hubs in village contexts, this research applies an iterative and constructivist scientific approach inspired by Grounded Theory. This methodological choice supports the exploration of how local planners can strategically upgrade transit nodes to promote a shift towards more sustainable modes of transport. Therefore, the research seeks to contribute to developing context-sensitive strategies for enhancing Mobility Hubs in differed situations of TOD planning.

2.3 Grounded Theory and Situational Analysis

Grounded Theory, originally developed by Glaser and Strauss (1967) [26], was introduced as a research method for sociologists, emphasising an inductive, qualitative approach to conducting and analysing empirical data with the aim of generating theory. Rather than testing hypotheses through a deductive framework, Grounded Theory involves building theory from the ground up, ensuring that findings emerge directly from the data [26, p. 34]. This approach is particularly suited to studies exploring complex social phenomena where existing theoretical frameworks may be inadequate. Furthermore, it will clarify how this Grounded Theory approach offers a valuable methodological foundation for examining context-sensitive approaches to mobility planning.

Grounded Theory has been expanded by theorists who have shaped the approach in response to historical and scientific developments. Kathy Charmaz is a well known author in the field of Grounded Theory, who in 2006 introduced a constructivist perspective on Grounded Theory in her book textitConstructing grounded

theory: a practical guide through qualitative analysis [15]. In her constructivist perspective, Grounded Theory is reframed as an approach to understanding the social world through co-construction of meaning, challenging the notion of theory and data as objective realities existing independently of the researcher [15, pp. 188, 191]. Charmaz argues that grounded theories are interpretative constructions, shaped through interaction between the researcher and participants, and deeply influenced by the researcher's engagement, positionality, and the situational context of the research [15, p. 188]. She advocates for an approach that enables the researcher to explore a field from the ground up, with minimal biased assumptions. This forms a valuable methodological foundation for how this article is designed and conducted, supporting the planning sensitivity in regards to the design of Mobility Hubs in various settings. In her article "The Power of Constructivist Grounded Theory for Critical Inquiry" (2017) [17], Charmaz highlights reflexivity as a key element in ensuring the validity of research. She emphasises the need for researchers to remain critically aware of how their interpretations and social position shape knowledge production and influence both data collection and analysis [17, pp. 36–37]. In this way, Charmaz provides methodological tools and reflections that emphasise the researcher's need to remain critically aware of their own positionality in relation to the interpretation of empirical data and the production of knowledge. Reflexivity is also embraced by Adele Clarke in her alignment with Donna Haraway's concept of situated knowledge, which propose that all knowledge is embedded within a specific context and location [18, p. 368]. Recognising the situated nature of knowledge, is thereby strengthening the integrity of the research's findings by the researcher being transparent towards the conditions under which it is produced. Reflexivity will in this article be articulated through the use of field notes and analytical memos, capturing ongoing reflections on observational insights and methodological choices in the field.

Clarke's approach to Grounded Theory involves a recognition of multiple realities and emphasises that knowledge is situated and constructed, rather than assuming the existence of a single objective truth [18, pp. 367-368]. Building on Charmaz's constructivist Grounded Theory, Clarke further develops the methodology, which she presents as Situational Analysis [18]. This model will constitute the main foundation of the analysis, particularly when capturing insights into how a context-sensitive planning framework can be structured. Situational Analysis expands the analytical scope of Grounded Theory by shifting focus beyond individual human actors, to also include non-human elements as institutional discourses, infrastructures, technologies, and broader spatial elements that shape the research situation [18, pp. 363-370]. This provides an opportunity to integrate a social science perspective into urban planning, particularly given the centrality concern of non-human elements within this field. Furthermore, Situational Analysis makes use of situational maps to visualise complex relational dynamics, thereby enabling the researcher to systematically examine the multiple, intersecting forces that influence a particular phenomenon [18, pp. 370-377]. The construction of situational maps is inspired by Clarke's situational matrix, visualised on the following figure:

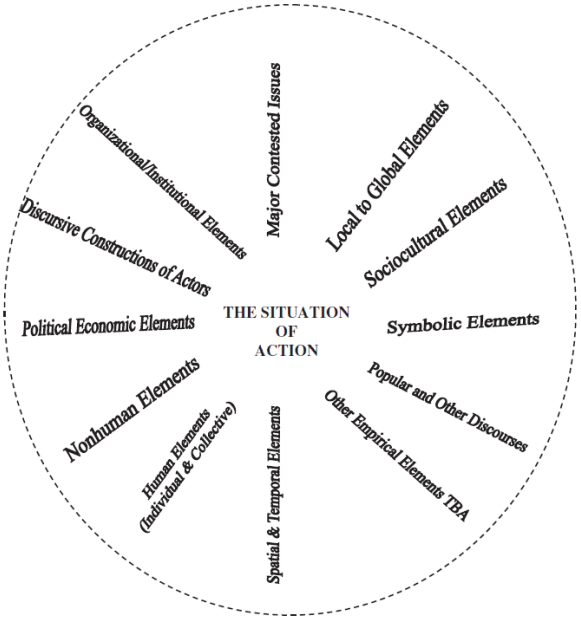


Figure 5: The matrix of the situational map by Clarke [19, p. 365].

This mapping technique is not constructed as a checklist to be followed, but rather as an inspirational setup of elements for the analytical orientation and engagement with empirical material. In this sense, the situational matrix will shape the interpretative mindset of the research during the analysis following the initial grounded coding process. The situational analysis thus serves to foreground the complex phenomenon of the research, enabling the researcher to identify and articulate the interplay between various actors, and contextual conditions. Within Clarke's situational matrix, elements like the non-human elements, institutional elements, and spatial elements will particularly influence the mapping of actors and actions, as these are essential for understanding how infrastructur, organisational structures, and spatial characteristics are impacting mobility behaviours within the focus on Mobility Hub's influence in the context-sensitive planning.

Within this transit-oriented framework, and viewed through a constructivist lens, the traditional TOD concept is being challenged in terms of its effectiveness and relevance for sensitive urban planning in the 21st century. As planning discourses continue to evolve, the extended concept of TOD, referred to as TOD2, will be examined as a more holistic and integrated urban planning approach, aiming to facilitate a shift in the transport mode hierarchy towards sustainable modalities in a human-scale development [33].

2.4 What is TOD2 and How does it Focus on Mobility Hubs?

Transit-Oriented Development 2 (TOD2) represents a conceptual framework, expanding from the original TOD concept [35] and Gehl's 12 quality criteria for human-scale planning [25]. The concept is developed in response to critiques of TOD's limitations, e.g.

regarding lack of contextual sensitivity and pressure on infrastructure [33, p. 17], but especially its relevance in current planning discourses with a growing demand for human-scale planning and better integration of mobility planning and urban planning. As planning paradigmes have evolved, TOD2 has become the modern version of Transit-Oriented Development, offering strategic planning and development of Mobility Hubs, as a pivotal instrument in achieving carbon neutrality. By integrating multimodal transport services with human-scale urban design, TOD2 positions Mobility Hubs as critical nodes that not only enhance accessibility but actively support behavioural change towards sustainable mobility choices [50]. The expansion of the concept thus lies in a broader interpretation that integrates mobility planning and urban planning to promote a modal shift.

The concept of TOD2 is fundamentally linked to the first/last mile principle, which addresses one of the key challenges in multimodal transport: connecting the gap between a journey's origin (first mile) and its final destination (last mile) via a central transit node [39]. Research highlights that these first/last mile connections are critical to the success of multimodal travel, significantly shaping public perceptions of its efficiency and convenience [45, p. 2]. In the context of transit-oriented development, strengthening first/last mile connections is essential for making sustainable modes of transport more attractive alternatives to private car dependency. This requires a cohesive mobility network centred around Mobility Hubs. The first/last mile challenge is particularly relevant in low-density areas, where public transport is often limited and the infrastructure tends to favour private cars, making active modes of transport less appealing. Moreover, the role of Mobility Hubs differs significantly from their function in high-density urban areas [45, p. 10].

Hereby, the TOD2 concept adapts an extended formate of the node-place model, which balances a third dimensions, known as the design-index [52]. This third index reflects on urban design conditions which influence accessibility of the station areas for pedestrians to shape urban development [52, p. 282]. This third design dimension is a central and influential element in TOD2 planning, as it facilitates the integration of urban and mobility planning. The focus lies in shaping the surroundings of the Mobility Hub to create an inviting and vibrant urban environment that encourages sustainable mobility choices. Thereby, it wants to emphasises, that the build environment of the surrounding space of a Mobility hub should "*guide users to the 'right' choice*" [33, p. 23].

As a planning concept, TOD2 represents a synthesis of the TOD Standard and Gehl's 12 quality criteria for designing liveable urban spaces. Its conceptual framework is structured around five overall themes, each consisting of three criteria to navigate the success for network planning of Mobility Hubs [33, pp. 35-51].

Figure 6: The conceptual framework of the TOD2 concept, divided into five themes where each have a set of criteria to achieve the conditions of the themes [33, p. 44].

The TOD2 framework address both the spatial infrastructure and users' perceptual experience by examening Mobility Hubs across the five thematic categories: Navigation, Protection, Livability, Experience, and Transit [33, pp. 44-51]. The associated 15 supplementary criteria are operationalised through distinct work packages, each comprising a set of guiding principles to support effective planning within each thematic area [33, pp. 46-50]. These are intended to assist planners in either evaluating existing Mobility Hubs or structuring new development projects. However, the themes are not designed to be applied in a fixed sequence, they should rather be engaged with selectively, depending on the specific needs and contextual conditions of each individual case [33, p. 45].

At its core, TOD2 seeks to integrate Mobility Hubs in a manner that aligns with everyday mobility patterns and responds to the lived needs of users. Rather than limiting its focus to multimodality at the station area (node-index), and land use characteristics (place-index), the framework extends its scope to include experiential dimensions, ensuring that design supports human-scale and quality of space [33]. It guides planners in promoting active modes of transport, ensuring equal access, and enhancing user experience, supporting a strategic modal shift towards sustainable urban mobility [33, p. 51].

A particular challenge of the TOD2 concept lies in its strong emphasis on dense urban areas, combined with its strategic focus on the local scale [33, p. 60]. The absence of regional-scale planning has been identified as a critical limitation, as it may result in spatial gaps between Mobility Hubs that are not addressed in local mobility planning [33, pp. 52–58]. These gaps become even more profound when considering planning at the scale of an entire municipality or region, where ensuring equal accessibility is challenged by significant variations in urban context, particularly in terms of the criteria Density to succeed the important theme of Transit.

With this approach, TOD2 facilitates planning of Mobility Hubs as the central elements in an integrated transit network, thus the definition of a Mobility Hub within the TOD2 framework is not universal. A definition must be established for the individual projects among the stakeholders regarding the development [28]. For this

research, such an establishment will take place across the planning concept and planning policies related to the case study.

2.5 Summary of the Literature Review

This literature review identifies the opportunity to evolve from the traditional Transit-Oriented Development (TOD) concept, that is rooted in the principles of density, diversity, and design, which has proven effective in fostering compact, mixed-use, and walkable urban areas near transit. However, the TOD concept is being criticised for neglecting the social and experiential dimensions of mobility, such as protection from weather conditions, perceived safety, and the overall quality of urban space. In response, the TOD2 framework places central emphasis on the design of Mobility Hubs, not merely as transit nodes, but as livable urban spaces, and is structured within a conceptual framework of five planning themes: Navigation, Protection, Livability, Experience, and Transit. Furthermore, the literature reveals critical limitations in both concept's application across varied urban contexts, particularly in low-density areas.

Moreover, it offers a new planning opportunities for context-sensitive Transit-Oriented Development, through the TOD2 framework, by positioning Mobility Hubs as both functional transit nodes and lived urban places. The reviewed typologies emphasise the need for flexible, context-specific hub design across varying urban densities to support modal shift. Importantly, by applying Grounded Theory and Situational Analysis, the research frames context not merely as a background variable, but as an active element for understanding the situated mobility behaviours. This methodological approach enables planners to interpret situated mobility patterns, spatial needs, and social dynamics. Thereby supporting the development of Mobility Hubs that are both multimodal and socially embedded, and capable of guiding users toward sustainable modes of transport.

3 DOCUMENT ANALYSIS

The question framing this chapter is:

How is the integration of Mobility Hubs situated in the current planning strategies in Aarhus municipality?

As outlined in the introduction, Aarhus Municipality serves as a case study in this research, as it is required to fulfill international, national, and local commitments concerning CO_2 reduction goals. This chapter examines different planning documents and strategic planning frameworks for Aarhus, with a particular focus on how the municipality is addressing the development towards a greater sustainable transport infrastructure that shift people's modal choice.

3.1 What Policies and Planning Frameworks Guide Sustainable Mobility in Aarhus?

Aarhus Municipality presents a particularly relevant context for exploring the applicability of the TOD2 framework. It is the second-largest city in Denmark, situated in Eastern Jutland, with a population of about 372.962 residents in 2025 and it continues to grow by approximately 4.000 new inhabitants each year [1],[7, p. 16]. This growth is expected to expand the population to 450.000 by 2050, which will intensify the pressure on the municipality's mobility systems, infrastructure, and spatial environment [6].

The urban challenges that put pressure on Aarhus, such as carbon emissions, car dependency, air pollution, and transport-related public health risks, align with the city's ambitious climate commitments. Locally, Aarhus has committed to achieve carbon neutrality by 2030, in alignment with both national legislation and international climate goals [8, p. 24]. To meet the reduction goals for the transport sector, which accounts for more than half of the municipality's total CO_2 emissions, a key objective of Aarhus Municipality's mobility strategy is to enable a significant modal shift towards more space-efficient and zero-emission modes of transport, including public transit, cycling, and walking [6, p. 24]

3.1.1 Municipal plan 2017.

For several generations, Aarhus municipal planning strategies has been inspired by the Copenhagen finger plan principle, where urban development follows selected growth axes extending from the city centre and out [7, p. 16]. This pattern has given rise to a series of smaller, detached local communities outside the central area, each with its own identity and largely separated by green corridors. These green landscapes have been, and will continue to be, preserved in order to maintain clear boundaries between urban and less urban areas, ensuring residents' access to nature and recreational spaces, and to serve additional purposes such as climate adaptation [7]. The outcome is a municipality characterised by great spatial contrasts. In the city centre, one finds a dense and vibrant urban centre, while many of the surrounding settlements are more dispersed and defined by lower building density. The green areas in between, not only enhance the city's recreational qualities but also highlight the diverse composition of the municipality, ranging from metropolitan to small village environments within a relatively short distance.

The Municipal Plan 2017 has laid the foundation for a more integrated and purposeful use of urban space, setting a strategic direction that priorities efficient infrastructure use, compact development, and sustainable everyday mobility. A guiding principle in this plan is the notion that "*urban spaces should be designed around the life they are meant to support, city life before urban space, and urban space before buildings*" [7, p. 7]. The plan emphasises local livability and social balance, calling for a compact urban form where everyday destinations such as shops, institutions, cultural services, and green areas are accessible by foot or bicycle [7]. This urban density is seen as a way of reducing transport demand and promoting sustainable mobility patterns. Additionally, the plan calls for more efficient use of existing infrastructure and a careful alignment between land use and mobility, where every square metre is to be used meaningfully, whether for housing, recreation, or transport [7].

While the Municipal Plan 2017 set the foundation for compact and sustainable urban development, the evolving demographic and environmental challenges necessitated a more refined and adaptive approach. This shift is articulated in the Plan Strategy 2023, which reaffirms many of the earlier goals but also introduces a stronger emphasis on decentralised development and social sustainability.

3.1.2 The Plan Strategy 2023.

Building on the ideas from the Municipal plan 2017, the Planning

Strategy 2023 represents a practical focus for new development. Here, the political ambition is to create "*a good city for all – also for the future*" [8, p. 5]. The strategy embraces Aarhus' polycentric character and spatial diversity, highlighting the importance of strengthening local communities in the municipality's edge zones rather than focusing on growth from within the city centre and out. It calls for planning that begins with the identity and qualities of each area and promotes strong and sustainable local communities as the basis for future development [8, p. 14–15]. It reflects a broader emphasises on sustainable mobility to be not only a means to reduce emissions but also a pathway to enhancing urban quality, and the overall livability of all inhabitants in Aarhus [8]. Such a decentralised approach makes the strategic positioning of Mobility Hubs particularly crucial, as they must serve not just as transit nodes but as anchors for sustainable local communities.

Underlining the need of a cohesive sustainable mobility system, it is considered important to strengthen connections both within and across the East Jutland region, with Aarhus as a central mobility node [8, p. 17, 24]. Key goals include reducing car dependency, integrating public transport with spatial development, and enabling short, sustainable everyday journeys through a well-connected, multimodal transport system [8, p. 24]. Emphasis is placed on transport as not just a functional necessity, but also as a driver of social cohesion "*where people of all backgrounds meet on the cycle path, at the bus stop or on the light rail*" [8]. In this planning strategy much of the values is linked til social justice and sensitivity towards local identity.

Recognising Aarhus' expanding role within the East Jutland urban and business corridor, the strategy place a clear regional responsibility on the municipality of Aarhus. With a projected population of over one million by 2050 across the 12 collaborating municipalities in Business Region Aarhus, there is increasing pressure to coordinate urban and economic development [7, p. 16]. In the Planning Strategy 2023, Aarhus is described as a regional "powerhouse", as it is expected that it contributes actively by improving the integration of public transport systems across municipalities and strategic investments in regional rail infrastructure [8, p. 6, 16].

Building upon these strategic visions, the Green Mobility Plan 2024 translates ambitions into concrete projects, with Transit-Oriented Development playing a pivotal role.

3.1.3 The Green Mobility Plan 2024.

The principles and ambitions culminate in the Green Mobility Plan 2024, a long-term political agreement that outlines a concrete and operational path for transforming Aarhus' mobility system. As outlined earlier, Aarhus Municipality aims to become carbon neutral by 2030, with the transport sector being a key contributor to CO_2 emissions, primarily from private fossil-fuel cars. This objective frames the development of all mobility strategies. Central to this plan, is the prioritisation of the establishment and refinement of Mobility Hubs in conjunction with high-class public transport systems such as the light rail, Bus Rapid Transit (BRT), and A-bus networks [6]. Particularly, the strategy of "*Stationsnær og transportorienteret byudvikling*" [6, p. 25] aligns explicitly with classic TOD principles and serves as a key action in realising the modal shift. Moreover, it presents mobility not just as movement, but as a tool for achieving broader societal goals: climate action, spatial equity, and urban quality. It explicitly calls for integrated planning of mobility and urban development, structured around the concept of the "door-to-door journey" [6, p. 7]. In doing so, the plan lays the groundwork for a comprehensive, multimodal system that supports everyday accessibility across the municipality and enables a more sustainable urban lifestyle [6].

A a central partner in fulfilling these plans and as the metropolitan in Eastern Jutland, the regional public transport company, Midttrafik comes in play. Midttrafik takes on a service and mediating role regarding public transport services across municipalities in the Central Denmark Region, and its ability to plan, coordinate, and deliver high-quality transit services is directly shaped by Aarhus' urban and mobility strategies [36]. In this sense, Aarhus' policy decisions, such as the focus on transit-oriented development, the expansion of Park and Ride facilities, and investments in last-mile infrastructure, have direct implications for Midttrafik's operations and regional public transport planning [6].

In an interview with the mobility planner, Line Ellesøe Jarlholm from Midttrafik, Jarlholm underlined how Aarhus' strategic plans influence the expectations and responsibilities of their role as provider of public transport services [36]. Jarlholm emphasised the need for contextual sensitivity when designing Mobility Hubs, as an important link for keeping and win passengers over. Further, she also highlights that safety and equal access must be understood in light of local demographics and geography [36]. Jarlholm mentions a user experience survey from 2024, that reveals a significant variation in needs and experiences of urban users, especially between those living in more low-density areas [40]. For example, while some areas in the outskirts continue to depend on private vehicles due to longer distances and less frequent public transport service, the passengers focuses most on needs that entails last-mile sensitivity and beneficial prices [40]. Whereas, other users prioritise convenience, comfort, and real-time information. Aarhus' planning documents recognise this diversity and seek to accommodate it, by providing differentiated solutions, for example, Park and Ride facilities along major access routes, investments in regional cycle infrastructure, and coordination of public services with transit development in growth areas [6]. These ideas aim to offer sustainable alternatives for shorter journeys and to facilitate equal access to sustainable mobility, tailored to the specific needs for different urban contexts that make sense [6, p. 28].

3.2 How does Aarhus' Green Mobility Plan Integrate the TOD Principles?

The urban complexity of Aarhus with its spatial duality, is acknowledged in both the Planning Strategy 2023 and the Green Mobility Plan 2024, where a decentralised planning approach is increasingly prioritised. Rather than pursuing further densification from the city centre, the municipality aims to strengthen the identity and sustainability of local communities, particularly in the less urbanised areas [8]. However, applying transit-oriented planning concepts at a regional scale presents notable challenges, particularly in spatially diverse contexts such as in Aarhus. Traditional transit-oriented planning approaches tend to focus on local planning within dense urban environments, making them less suited to municipalities characterised by a polycentric structure and varied urban forms.

Nevertheless, Aarhus represents a compelling case for exploring the TOD2 framework as a planning strategy, as the municipality clearly prioritises station-oriented development and aims to strengthen and densify existing local communities [6]. This is pursued through integrated urban and mobility planning that places quality of life and the residents needs at the core of new development initiatives, which aligns with the human oriented planning focus in TOD2. Furthermore, the case of Aarhus Municipality becomes especially relevant when considering the diverse roles of Mobility Hubs, as both transport nodes and local urban places. As outlined in the Green Mobility Plan 2024, these hubs are intended not only to facilitate modal shift but also to function as attractive and multifunctional transfer points [6, p. 30]. They are envisioned to integrate various transport modes with supportive facilities such as Park and Ride infrastructure, secure bicycle parking, and carpooling options. Combined with local services like retail, these hubs are intended to enhance green mobility, enable seamless modal transitions, and contribute to vibrant urban life [6]. This aligns directly with TOD2's emphasis on the balance between node, place, and design qualities, and supports the goal of facilitating equal and sustainable everyday mobility. In addition, the Table of Mobility Hub Typologies 1 from section 2.2 will serve as a supporting tool to contextualise the analyses within the TOD2 framework, thereby enabling a context-sensitive approach for multiple urban contexts when planning for Mobility Hubs.

Furthermore, the plan is complemented by other planning models that support TOD2's multidimensional framework. One such concept is the 15-minute city, which emphasises proximity to essential services such as work, education, retail, and recreation within a 15-minute radius by foot or bicycle [41]. This approach supports the TOD2 planning by strengthening smaller villages to be mature for a transit-oriented development that emphasises human-scale design, liveable environments that contributes to reducing the need for long-distance trips and thereby lowers the resilience on cars [6, pp. 36-37].

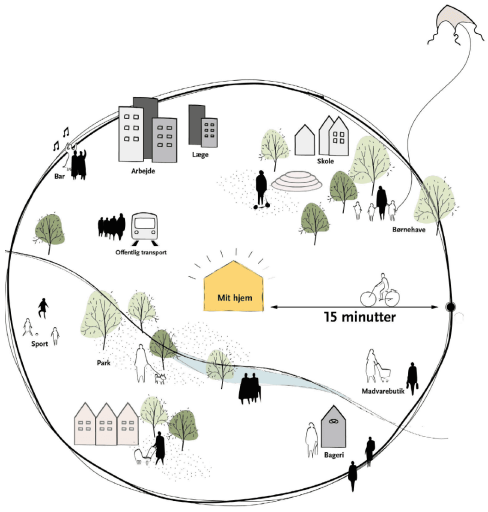


Figure 7: Illustration of the 15-minute city principle for shaping neighbourhoods and local urban areas [8, p. 37].

This model (figure 7) is framed within the Green Mobility Plan as a external supporting strategy to the TOD planning, so that the overall network is not relied upon to the same extent in order to ensure equal access to critical functions and a sustainable life for all inhabitants.

Another key element is the expansion of Park and Ride systems, to support infrastructural transition nodes along primary mobility corridors (see figure 8). These hubs are designed to encourage modal shift by enabling car users to switch to other sustainable transport services [6, pp. 13-14]. When integrated with collective transport corridors and local services, these Mobility Hubs reflect how the TOD2 concept must operate across scales and typologies of Mobility Hubs.

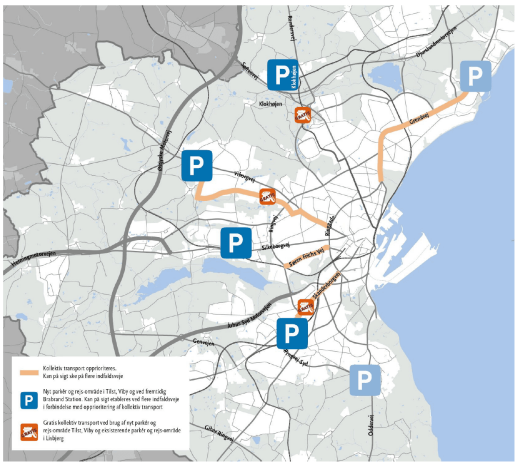


Figure 8: Illustration of the designated Park and Ride projects planned along major access routes [6, p. 14].

To summarise, the Green Mobility Plan 2024 integrates the foundational logic of TOD, while acknowledging the need for differentiated and locally adapted solutions. Its multi-scalar structure, focus on quality transit infrastructure, and emphasis on integrated mobility systems form a strong policy basis for exploring TOD2 in practice. Yet, its limitations in addressing mobility needs in less urbanised areas underscore the necessity of this research, that will investigate how TOD2 can support modal shift, livability, and mobility equity in divers urban contexts to accommodation planning on different scales to enhance inclusive mobility solutions within and beyond Aarhus.

3.3 How does Aarhus Municipality Perceive Mobility Hubs?

As it was argued in the literature review, the Mobility Hub definition varies for each specific project. Thereby, this research adopts the definition established in *Transit-Oriented Development 2; A conceptual framework of holistic planning* [33], while incorporating elements from Aarhus Municipality's Green Mobility Plan [6] to situate the research within Aarhus' strategic mobility framework. In Aarhus' Green Mobility Plan, it distinguished between hubs that facilitate public transport and park-and-ride hubs that facilitate

(a) Station town hub **(b) Village hub** **(c) Rural hub**

Figure 9: Typologies of Mobility Hubs across different contexts, by Midttrafik [36].

private cars, active modes of transportation, and carpooling regarding the extensive population that lives in low-density areas. This distinction has therefore influenced the definition of Mobility Hubs of this research [6]:

> *A livable urban space designed to integrate multiple modes of transport. Beyond serving as a transit node, Mobility Hubs aim to enhance urban livability by incorporating features that attract people to use sustainable transport options over private vehicle or supporting a park-and-ride system. To be effective, a Mobility Hub should be planned with attention to its role as node and place, and design in mind to guide users towards the 'right' choice. A cohesive system of Mobility Hubs serves as the foundation for Transit-Oriented Development 2 in all urban contexts.* [33], [6]

This definition underscores the trinity of Mobility Hubs as functional transit nodes and urban spaces, as well as the third dimension [52] - design quality that contribute to livability, accessibility, and multimodal connectivity. Within the TOD2 framework, the design and programming of Mobility Hubs are critical to enabling a modal shift away from private car dependency [33].

To complement the frame of the Mobility Hub definition for this research, the public transport operator Midttrafik has also produced three visual representations which reflect their interpretation of how they distinct the needs present within each of these spatial contexts.

3.4 Summary of the Document Analysis

The integration of Mobility Hubs in Aarhus' planning policies is shaped by a growing need to balance urban growth, sustainability, and regional responsibility. While the Municipal Plan 2017 established a foundation for compact development, the Planning Strategy 2023 introduces a more decentralised and socially sensitive approach, which also positioning Aarhus as a regional actor responsible for enhancing public transport integration and mobility equality.

This shift is operationalised in the Green Mobility Plan 2024, where Mobility Hubs are central to achieving station-oriented development and enabling a modal shift. The plan integrates concepts such as the 15-minute city and Park and Ride with classic TOD principles. Here, Mobility Hubs are framed as multifunctional spaces that support sustainable transport and urban livability across diverse contexts.

To reflect this, this article adopts a definition of Mobility Hubs grounded in both the TOD2 framework and Aarhus Municipality's planning documents. This is further substantiated by Midttrafik's visual typologies, which illustrate the differentiated functional requirements of hubs across varying urban densities.

This analysis underscores the fundamental responsibility of urban planners to secure equal accessibility as a core principle of TOD2 - "*accessibility for all*" [33, p. 42–43]. To implement this in practice, a clearly defined typology of Mobility Hubs is essential, as it enables a context-sensitive application of TOD2 across multiple urban and regional scales. In Aarhus, such an approach is particularly critical to ensure that station-oriented development supports inclusive access to sustainable mobility, regardless of settlement density or geographic location.

4 METHODOLOGY

This article is an urban planning research that takes a point of departure in a ethnographic approach and other qualitative methods. The article explores the interdisciplinary potential between planning as a strategic and normative discipline, and ethnography as a qualitative and interpretive approach to knowledge production. This interplay is especially relevant when planning seeks to intervene in contexts where established norms and everyday behaviours are about to transform.

The aim is to develop a qualitative and strategic framework of a context-sensitive planning approach to the TOD2 concept, that can inform how planning projects more effectively can support a modal shift from car dependency to sustainable modes of transport, and thereby contribute to a broader transition towards a sustainable and climate-neutral urban development.

Aarhus Municipality has been selected as the case study due to its political agenda to improve infrastructure in a sustainable direction, with the explicit aim of encouraging a modal shift and addressing future challenges related to urbanisation and climate change. In order to critically examine the transit-oriented planning's limited focus on density, two low-density villages; Hjortshøj and Harlev, located in the outskirts of the municipality, was chosen for a comparative case study with an in-depth analysis [23]. Both

cases are situated within a low-density village context and are comparable in terms of size and distance from Aarhus' urban centre. This enables them to be treated within a single, comparative analytical framework. At the same time, the analysis remains sensitive to the context-specific conditions that distinguish them, allowing for a nuanced exploration of how contextual differences shape the applicability of TOD2 principles.

As a point of departure, this research seeks to gain insider knowledge on how mobility planning is currently being articulated in Aarhus. This is initiated through expert interviews with professionals working within the field and followed by the closer examination of strategic planning documents that shape the municipality's current mobility paradigm and influence the urban development. To explore the context-specific conditions, the researcher engaged in participant observations during site visits, through which various forms of qualitative data was collected.

4.1 Initial Expert Interview

Interviews are conducted as a starting point for the research, to gain a better understanding of the situation of mobility planning in Aarhus Municipality. They lead to an evaluation of the research question to capture the essential problem and not as directly empirical material for the analysis.

An interview was done with the experienced traffic planner from Aarhus Municipality, Jesper Frandsen [24]. He provided valuable insights into the process and rationale behind the Green Mobility Plan, as well as the planners and politicians considerations regarding transit-oriented development.

The interview primarily offered perspectives on a mata level about the strategic direction of mobility planning within the municipality, rather than on specific ongoing projects. Conducted as a loose semi-structured interview [51], the format allowed him to explain aspects of planning for what he found most relevant, which in turn enabled me to critically challenge and reflect on the focal points and assumptions of the political planning agenda. As such, the interview contributed to a critical interpretation of the practices behind Aarhus' progressive mobility policies. It inspired the research's emphasis on grounded, qualitative examination into the often overlooked dynamics that shape equitable and sustainable mobility planning.

Furthermore, an interview has been conducted with Line Jarlholm, a mobility planner at Midttrafik — the regional public transport authority serving the Central Denmark Region [36]. Jarlholm provided valuable insights into how Midttrafik works with the design and development of Mobility Hubs, as she also provided me with their design of low-density Mobility Hub typologies in figure 9. She explained that Midttrafik has a particular focus on attracting more users to shift from private cars to public transport. She also highlighted how Aarhus, as the most influential metropolitan centre within the region, plays a significant role in shaping Midttrafik's planning practices [36]. The municipality's policies are therefore not only locally influential, but also impacting regional transport development. From this perspective, the article contributes to a broader agenda of meaningful and socially relevant planning practice.

4.2 Methods of the Document Analysis

A document analysis of planning and policy reports was conducted, including the Municipal Plan 2017 [7], the Planning Strategy 2023 [8], and the Green Mobility Plan [6]. These documents reflect the evolving values and strategic directions guiding Aarhus Municipality's development as an growing metropolitan area. This systematic evaluation of the documents provide an in-depth understanding of the municipality's current policies aimed at promoting socially sustainable urban development while enabling a future green mobility system [14]. It is important to note that all quotations used in the document analysis have been translated into English by the researcher, as the original documents were written in Danish.

The document analysis supports the article's conceptual engagement with Transit-Oriented Development orientation, by offering insight into how planning discourse in Aarhus is shifting to accommodate integrated, sustainable mobility solutions, and mentioning the transit oriented city as a goal [6, p. 25]. Furthermore, the document analysis offers a contextual foundation for understanding the municipality's recent urban development and future challenges, which this research builds upon.

4.3 Participation Observations at Site Visits

Participant observations serves as the primary method through which all grounded empirical material are generated, forming the foundation of the analysis [49]. However, the format and collection of this empirical data took place through multiple formats.

Undertaking site visits in this research involves experiencing a location with all senses. To experience, in this regard, entails engaging with one's journey; noting techniques, observing social behaviour, spatial characteristics, and material artefacts encountered along the way. This process is conceptualised as a user journey.

Consequently, the majority of the empirical data were collected through the researcher being present in the respective villages. At these sites visits, participant observations involved not only observing but also actively reflecting on how I, as a researcher, interpret what was seen and sensed. Crucially, this was guided by an explicitly defined theoretical lens established in advance. In this way, participant observations were approached with an open mind — but not an empty head — drawing on the consolidated theoretical framework that shapes the interpretative viewpoint [15].

Furthermore, in preparation for the site visits, a small set of questions were developed to support interactions with the local residents. These serve as a flexible guide for informal conversations and help facilitate data collection. Question were:

- Why do you use this particular stop, and how do you use it?
- Your journey – what is it part of, and do you combine it with other activities? (e.g. do you make other stops along the way?)
- Are there any services or options you would like to have available on this journey?
- What do you think about this place, and do you believe it influences your transport choices – either positively or negatively?

Additionally, on the site visits printed copies of the TOD2 theoretical framework and the table for Mobility Hub typologies was brought

(see 6 and 1). These informed the empirical material, which took form as field notes on the observed space as well as methodological reflections.

In this way, the fieldwork was prepared ahead of the site visits done in week 14, followed by a return visit to Harlev in week 18. The first excursion went to Hasle and served as a pilot study [30]. Hasle represents a somewhat different context compared to Hjortshøj and Harlev, as Hasle are in close proximity to Aarhus centre and thereby more integrated with the urban core.

The pilot visit provided an opportunity to reflect on choices and actions in the field in order to acquire the necessary empirical material. In particular, it helped to consider strategies for initiating conversations with local residents in public space, leading to the following methodological reflection recorded at Hjortshøj Station:

> "*It works remarkably well to sit down at a bus stop and let others settle beside you. Here, I can spend about a minute doing something else... before initiating a conversation, either by addressing the research purpose directly or by starting with some small talk*" [31].

However, this approach proved less effective during the subsequent visit to Harlev;

> "*It is clearly more difficult to engage with people at this particular stop, as very few individuals are waiting for the bus, and notably, there is no bench on the one side*" [29].

Do the two different contextual situations, the same method was not equally effective, and caused a second site visit to Harlev. At the second visit: *I sit in the bus stop shelter until a bus has passed and observe what happens. Once the bus has moved on, I walk over to the other side to be ready to meet some waiting passengers going out of Harlev.*"[29]. This change in strategy helped a little, but it was still difficult to get in touch with residents.

Additionally, a substantial amount of photographic material was generated as part of the field notes [43]. This material was compiled into a photo gallery, which serves to visualise connections within the text-based empirical data and, in particular, to guide the analysis by tracing observed actions, as projected through the photo sequences. This visual dimension thus became a significant component of the empirical foundation that will subsequently undergo a grounded coding process in section 4.5.

Furthermore, the journeys with public transport were also employed as empirical material. Initially, these were intended as a means to recruit users of multimodal journeys, with the aim of supplementing the dataset through visual documentation of their actions and interactions with both human and non-human actors encountered during their trips [18, pp. 363-370]. To support this, an illustrative example of a user journey was developed to serve as inspiration for participants. However, the approach was unsuccessful, as only one out of four users, who expressed interest, actually submitted some material. This was despite the task being designed to be simple and require minimal effort, only asking the participants to send the documentation after completing a journey. Given this outcome, the researchers own experience was instead used to situate the application of multimodal public transport journeys, serving as an analytical entry point for a situated understanding of the system as a whole.

4.4 Application of Grounded Theory and Situational Analysis in this Research

The data analysis will follow the iterative coding process outlined by Charmaz [15] in relation to the situational matrix [19]. The analysis will begin by uncovering findings that emerged through the iterative coding process, in which text-based and visual data are examined to identify key themes and concepts constructed through the conceptual lenses embedded in the TOD2 concept [15, p. 189]. Subsequently, focused coding is applied, where the most analytically significant codes are selected, refined, and sorted into broader conceptual categories [48]. As part of the analytical process, field notes and extensive memos will be employed to encapsulate the exploration of relationships between codes, and refine categories in the data material [15, pp. 189–190]. By documenting the researcher's own interpretations throughout the process, memo-writing becomes an integrated element of the analysis, supporting a transparent link between the data and the knowledge constructed from it [15, pp. 189-190].

By integrating Situational Analysis, this research moves beyond the iterative coding process to map out the broader socio-technical landscape of mobility planning [19]. For this part of the analysis, the lenses to interpret the empirical data are highly influenced by the prior grounded coding process, to focus the categories that are interrelated in a broader discourse, and spatial dimension of the situation. Thus, the situational matrix facilitate an iterative analytical process, ensuring that theoretical insights emerge dynamically from the empirical research (figure 5), and will culminate in a map of key elements shaped by actions and their interrelations. Methodologically, this is done by close examination of a code-board of focused coding [48], reading through the field notes and writing memos of my thoughts behind the series of pictures. Then, I revisit my personal experiences as a newcomer to the public transport system in Aarhus, which contribute as a reflexive approach of how I, as the ethnographic researcher interpret the mobility system. By following the actions examined in the data material, the finding leads to an understanding of the local situation and how elements that influence mobility behavior are intertwined. Ultimately, applying Grounded Theory and Situational Analysis aim to ensures that findings are deeply rooted in the empirical data while remaining sensitive to the exploration on complex social phenomenon when investigating Mobility Hubs and transit network planning in Aarhus.

The following section presents a first-person narrative description of the grounded coding process, outlining its structure and the rationale behind its progression.

4.5 The Grounded Coding Process

Drawing upon my background in ethnography and planning, I adopt an ethnographic approach to communicate how urban planners can operate in a more grounded manner when integrating mobility planning and urban planning. In this methodological context, the structure of the grounded data processing will be presented and later on, throughout the analysis, you will read through the

analytical reflections on what has been observed during my data collection, alongside the conceptual lenses that has been applied while producing knowledge.

The process of working through all the data begins with an initial coding, of the text-based and visual field notes.

4.5.1 Initial coding.

As I review my field notes, conversations from site visits, and personal memos, I begin to separate the material and organise it into overarching categories by physically cutting it apart and sorting it on a wall, which becomes my coding-board. These categories are shaped by the analytical lens of the TOD2 framework and therefore reflect central themes such as Experience, Livability, and Navigation. In addition, themes such as Potential for Urban Development and Culture also emerge from the data, as illustrated in the image below.

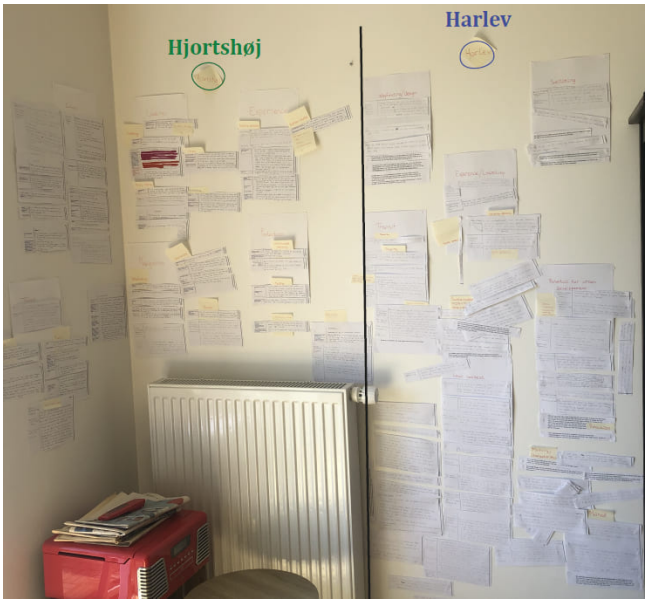


Figure 10: Image of my coding process; Initial coding.

Subsequently, I print all photographs taken during the participant observations and systematically examine each image to interpret its narrative. The visual material is then being categorised under overarching codes, aligned with the conceptual framework, based on the elements of the urban environment or user behaviour that each photograph uncovers (see figure 11).

(a) Hjortshøj **(b) Harlev**

Figure 11: Images from my initial coding process of the visual data.

4.5.2 Thematic coding.

I revisit the code-board that contains the preliminary text-based codes and begin to explore connections between text-based and visual data. In some cases, I integrate photographs with corresponding field notes where a clear thematic overlap emerges. This is especially encountered in infrastructural specifics and Transit, in alignment with the TOD2 criteria. In others, the materials remain distinct due to their differing contextual significance, such as the eco-community in Hjortshøj, which aids the understanding of the local context and culture, but will remain separate to give it external focus. This iterative process leads to an expansion of the coding-board, as illustrated in the image below (figure 12).

Figure 12: Image of my coding process; Thematic coding.

Looking at the code-board, respectively of the codes for Hjortshøj and Harlev, it becomes evident that the codes across both cases reveal a shared thematic direction, encompassing similar types of

data. An example of this is the similarity of *culture* and *spatial characteristics*, both including pictures and notes about what the space looks like and what artifacts in the urban environment that frame the life in each of the villages. In the diagram below all of the thematic codes are listed. This analytical convergence enables

Hjortshøj	**Harlev**
Culture	Local context
Transit	Mobility characteristics
Navigation	Transit
Livability	Wayfinding/Design
Experience	Experience/Livability
Protection	Switching
Wayfinding/Design	Potential for urban development
Infrastructure	Infrastructure generally
The Mobility Hub	The Mobility Hub
The eco-community	Mini-hubs
Sustainable mobility	Cycle infrastructure
Opportunities at the square	Car-oriented infrastructure/culture
Local context	Spatial characteristics
TOD2	TOD2
Facilities/Functions	Facilities/Functions
–	Sustainable mobility choices

Table 2: Thematic codes identified in the two cases.

a degree of generalisation in the next phase of the coding process, allowing for the construction of a unified framework that operates across two distinct urban contexts. This leads to a more detailed examination of the codes so fare, facilitates a deeper understanding of the empirical material and enables the identification of meaningful connections across the data material when refining the data into more specific categories.

4.5.3 Focused coding.

During a third review of the code-board, I decide to restructure and eventually remove certain categories, such as *Opportunities for the Square in Hjortshøj* and *Opportunities for Urban Development in Harlev*. Upon a closer examination, I find that the notes and photographs associated with these themes could be meaningfully integrated into other, more robust categories. Their analytical value lies not in forming stand-alone themes, but in supporting broader generalisable patterns already emerging elsewhere. This decision also aligns with the purpose of the article, which aims to inform urban planning decisions by creating a generalisable framework rather than direct suggestions for interventions in the two cases, as these specific categories tend to imply.

In contrast, the category *infrastructural techniques* appear consistently across the themes and is supported by rich empirical material in both cases, where the removed themes lack analytical weight to stand independently.

In the process of distributing the codes across the coding-board, new ways of identifying relationships within the material begin to emerge. As illustrated in the image below (figure 13), this leads to the development of several core themes under each of the two main categories; descriptive and interpretive, accompanied by six main categories.

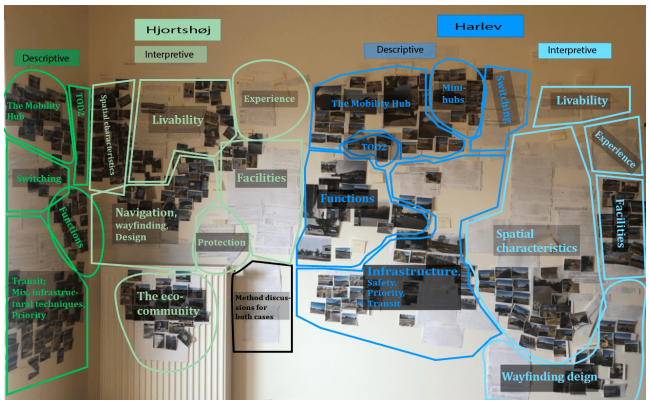


Figure 13: Image of my coding process; Focused coding.

This methodological processes will be further explained with analytical lenses in the following chapter 5.2, outlining the progression of the grounded coding process.

5 ANALYSIS

The question framing this chapter is:

> *How can context-sensitive TOD2-based planning strategies be developed and adapted to support interventions for modal shift towards sustainable modes of transport in low-density settings?*

This analysis will be outlined by the researcher as the direct mediator in the processing of knowledge, constructed from the ground up through a constructivist research approach in an inductive data analysis process. Moreover, all field notes and quotations from the qualitative empirical material, originally produced in Danish as it is the researcher's native language, have thereby been translated into English.

As outlined in chapter 2 and 3, this article examines the application of transit-oriented development in Aarhus Municipality, by a context-sensitive approach to TOD2 planning in low-density communities. It is within this context that a sensitivity to local contexts and the typologies of Mobility Hubs will address the TOD2 shortcomings, particularly with respect to spatial diversity.

Accordingly, this analysis will be grounded in my ethnographic field investigations, focusing on two villages; Hortshøj and Harlev, in Aarhus Municipality. Enabling a grounded examination of the context-specific characteristics, with the goal of contributing with an inspiring analysis for other urban planners to draw on as first hand project task for development projects regarding transit-oriented interventions. Based on the analytical approach and the situated analysis, an examination of both case's Mobility Hub typologies will guide the evaluation and interpretation of a more context-sensitive TOD2 planning framework.

To offer the reader a grounded insight into the two locations and their contextual conditions, I will present insights from my ethnographic fieldwork, informed by the site interpretations developed through my role as the researcher.

5.1 Characterisation of the Comparative Cases

As Aarhus presents a case of diverse spatial morphologies, these locations were chosen to support this research's focus on a sensitive planning approach to TOD2, and the aim of facilitate equal accessibility across varying urban contexts. The villages are highlighted on the map.

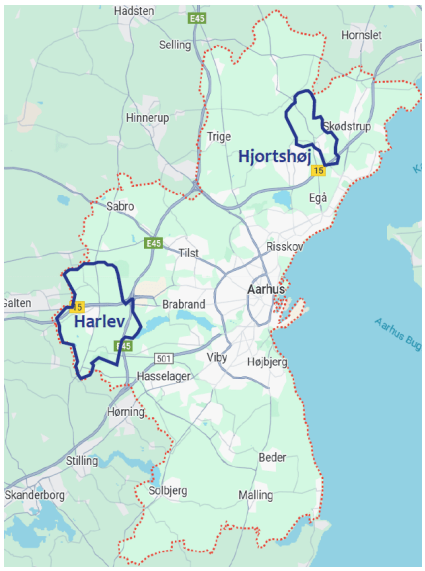


Figure 14: Highlighting the two locations for site visits - Hjortshøj and Harlev, from Google Maps (12-05-2025).

The following case descriptions build on the field notes from site visits in Hjortshøj [31] and Harlev [29], and will be characterised by a first-person narrative style.

5.1.1 Ethnographic description of Hjortshøj St.

Hjortshøj is defined by a total population of 3.889 spread across many low-density communities [1], approximately 15km north from the city centre of Aarhus.

My initial experience upon arriving at Hjortshøj St. was somewhat confusing in terms of recognisable objects and materials, which reminded me of a typical DSB station (the Danish national railway company), but are functioning as a light rail station now. Moreover, there were no signs indicating that this was a light rail station, apart from the digital information board located on one of the platforms. The station area is visualised in the images on figure 15.

The bus I arrived with stoppe in front of a shelter, at the same level as the station platform and is integrated into the same space, with buses traveling in opposite directions stopping just across from one another in dedicated bus stops. The bus shelters are both new, although they differ in design, while the shelters on the light rail platforms consist of homemade black-painted wooden structures, which give the station a certain personal character.

Moreover, the area is characterised by a single small square dedicated to transit. Here, one has a clear overview of the defined area. However, the platform for passengers heading towards Aarhus

Figure 15: Pictures from the Mobility Hub area at Hjortshøj

centre is somewhat hidden behind bushes and is separated from the main public space of the Mobility Hub. The hub itself is delimited by a three-way junction, residential buildings, dense shrubbery, and a corner featuring three commercial properties, although one of them is currently closed. Here is a lot of greenery and ample space between the tracks and the road, that is currently mostly used for covered bicycle parking, which is relatively empty. The surrounding buildings are designed in human scale, accommodating both residential and commercial functions.

Although it is a small station, it supports multiple modal functions and features two restaurants, primarily takeaway-oriented, which are only open from 16:00 to 21:00. The Mobility Hub is situated centrally along Hjortshøj's main road, with a primary school, various sports facilities, a café, a doctor, and a daycare located behind the station.

During the day, I wandered around the village to observe its character. People greeted me warmly, either with a verbal "hello" or at least a slight nod. The atmosphere is very calm, people do not seem rushed, and nature is close at hand. The village features several childcare institutions, a church, a community center, a mechanic, a farm property, a care home and senior residences, but most dominating is the single-family housing. A distinctive feature of Hjortshøj is its "eco-community", as described by one local resident — a cooperative housing community known as "Andelssamfundet i Hjortshøj", which is founded on the beliefs in a social-ecological local community. In the eco-community, they test environmental initiatives and social forms of community together with the rest of society, as an alternative to the welfare state with its materialism, consumption, empty communities, and money that runs the power [31]. It seems that the spirit of this local community affects the rest of Hjortshøj, or perhaps it is the other way around. Nevertheless, it is clear that this eco-community represents a distinct internal entity within the larger village.

5.1.2 Ethnographic description of Harlev.

In a slightly different direction, yet in many ways similar to Hjortshøj, lies the village of Harlev, approximately 15km vest from Aarhus centre. Demographically, the combined population of Harlev-Fremlev is about 4.888 inhabitants, corresponding closely with the population density of Hjortshøj [1]. The population is predominantly constituted by families with children living in single-family housing, accompanied by a substantial population of retirees housed in senior living facilities [1].

Based on my experiences of arriving at Næshøjskolen, a central bus stop in Harlev, the place is characterised by its open and wide spatial overview and clear delineations between modes of transport

that guide navigation. I noted the traffic hinders that act as traffic-calming measures, which prioritise cyclists and pedestrians, thereby creating a safe and secure atmosphere. There is also some space for greenery. However, when looking towards the bus traveling ahead, two large, gray, and rather uninviting parking lots appear on each side of the road, visual at the pictures:

Figure 16: Pictures from the Mobility Hub area at Næshøjskolen, Harlev.

The Mobility Hub in Harlev is centred around two bus stops located near a four-way junction, directly in front of the local primary school, Næshøjskolen. These stops are slightly offset from one another and differ significantly in character: The incoming stop, servicing the route toward the end destination in Harlev, is positioned on the school side. This stop features a modest shelter marked by a small blue cupola. In contrast, the outgoing stop consists only of a bus sign, a trash bin, and a designated pull-in bay for buses. Despite being highly visible and situated within the main urban area, there is no dedicated infrastructure supporting modal transfer, and the stops are primarily recognised by their characteristic yellow signs.

Next to the school lies a parking lot used by parents for morning drop-offs, but it also encounters a self-service bakery, a hairdresser, and an empty commercial unit. On the opposite side of the road, a series of commercial properties are located, some of which are under renovation. This commercial cluster includes a dental clinic, a small pub, and a pharmacy, and it is complemented by a small public square furnished with benches and tables for communal use. Slightly further ahead, a high-end grocery store (Meny) and another hairdresser are found, sharing an additional parking area that also serves a nearby petrol station. In close proximity to the Mobility Hub is the town's medical clinic, which has a dedicated bus stop located less than 500 metres from the school.

In many ways, this area combined by a four-way junction, functions as the urban centre of Harlev, as the available facilities and services attract both residents and visitors. Geographically, it is centrally positioned on the main street, which loops around the town and distributes single-family housing within and beyond this main street. The four-way junction is used in all directions throughout most of the day, and mostly by cars. There are very quiet periods, and it generally remains relatively calm, except around lunchtime when older schoolchildren flock to the supermarket to by food and beverages. The boys use the small public square to eat their lunch. The space is also used by other residents throughout the day as a meeting point, a resting place, or for eating a snack or lunch.

Walking around Harlev for a day, I experienced a distinct sense of being a visitor, an outsider, which of course, I am. However, in contrast to Hjortshøj, where I felt welcomed and part of the place, the sense of belonging was noticeably absent. In Harlev, few people were walking or cycling, and those I encountered did not greet one another, or me, with the exception of the supermarket cashier, an dog owner in the early morning, and a friendly nod from some construction workers engaged in a renovation project. What I recognised as an defining feature of Harlev is its abundant green meadows and the large centrally located park, which offers a range of recreational activities. Furthermore, very few individuals were seen waiting for the bus during the day, and most of the passengers appeared to arrive shortly before the bus and departed. The first- and last-mile travel was completed primarily on foot, except for the morning rush hour, during which two boys were dropped off by their mothers in private cars, and one women arrived by bicycle, which she parked at the school.

Additionally, Næshøjskolen´s facilities plays a major role in Harlev's cultural life, integrating the primary school with other public facilities such as the library, sports centre, health centre, and a cafeteria, all of which are situated in connection with the central four-way junction, thereby constituting the urban centre of Harlev. The sports centre and cafeteria function as a community meeting places in Harlev, offering both public and private activities designed to bring people together.

In sum, it appears that the two cases differ in how their local contexts are described, making them particularly interesting to compare in the analysis, in order to examine how context-specific conditions influence planning.

5.2 Grounded Examination of the Data Material

For this part of the analysis, the writing is based on the structure behind processing the qualitative data material, collected on site visits to Hjortshøj and Harlev. As outlined in the methodological chapter from *The Grounded Coding Process* 4.5, I will now present a more analytical description of the findings exhibited during the grounded process:

(1) Initial coding of field notes and conversations, conducted simultaneously across both cases, while maintaining distinct analytical frameworks for each.
(2) Thematic coding based on overarching topics, integrating text and visual data, and enabling a comparative reflection on emerging patterns between the two cases
(3) Focused coding of the full dataset into refined categories, intended to inform the analytical direction and structure first-hand investigations before developing interventions for urban development

After the initial coding and the process of thematic coding, thematic similarities emerge, despite minor differences in phrasing as outlined in Table 2. These variations may reflect my situated interpretation of each location. Hjortshøj Station, functioning as a multimodal mobility hub with direct access to the light rail, provides a spatial and infrastructural context that is easily associated with the principles of transit-oriented development, facilitating a high-quality transport system. In contrast, Harlev is structured around a more fragmented network of minimalistic Mobility Hubs, often characterised by monomodal service provision, which does

not evoke the same degree of transit-oriented urban character. Despite these phrasing variations, it is much the same type of data that the codes of each case provides, and therefor similar subjects that evolve from the data.

Moreover, the focused coding further investigate the data in the construct themes and categories. The empirical material reveals a broad distinction between two types of data: On the one hand, descriptive and atmospheric observations, on the other, technically oriented focused on infrastructural aspects. This distinction informs the development of two overarching coding categories: *descriptive* and *interpretive*. Accordingly, I organise the material from both case studies by separating the more objective, spatially explicit themes, such as *transit, infrastructure, the Mobility Hub, and TOD2* into the *descriptive* domain. In contrast, themes such as *culture and local context, liveability, experience, potential for urban development*, and other contextually embedded qualities are categorised as *interpretive* domains. It also reflects the interconnected criteria from TOD2; Transit versus Experience and Livability, representing node-index versus place- and design-index (section 2.4).

Some themes, most notably *navigation* and *facilities/functions*, presents a more complex character and appear to be placed in between the *descriptive* and *interpretive* domains, both representing a mixed set of date interpretation of both human and non-human elements, such as photos of standardised signage on the hubs and then the home-made hitchhiking sign at Hjortshøj Station.

Figure 17: Picture of standard bus sign and a home-made hitchhiking sign at Hjortshøj Station.

Though, other overlaps undoubtedly exist, I resolve these conceptual overlaps by assessing the primary analytical function of each theme. As a result, *facilities* and *functions* are separated into respectively categories based on their dominant attributes, like documentation on local mix of *functions*, and aesthetic qualities and positive sensory impressions as *facilities* (section 2.4), as well as the sub-theme *switch*, derived from the Navigation theme. These themes are placed within the *descriptive* domain due to its operational and infrastructural focus, as example quotes from field observations in Harlev present a lack of possibilities to park ones bike at the bus stops [29]. Other dimensions in the theme of Navigation is related to the design of identity and recognizable features in the urban space, leading back to the hitchhiking sign that provides contextually embedded qualities, therefor representing the *interpretive* domain.

Then there is the theme *infrastructural techniques*, which is strongly represented in both cases, as there is a substantial amount of both visual and text-based data concerning infrastructural morphology. This content is crucial for understanding the local context, including the prioritisation of different modes of transport and the opportunities for development within the constraints of existing infrastructure.

This examination of the data, driven by the lenses of the TOD2 framework, has lead to a code-board that is divided as visualized on figure 18, showcasing a schematically structure of how the actual code-board is constructed.

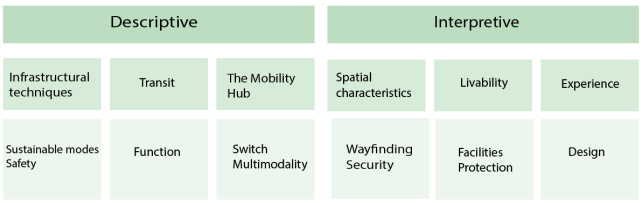


Figure 18: Image of a schematically structure of the result from the focused coding process.

I have organised the material according to a primary division between *descriptive* and *interpretive* orientations in the data collection. Under these two overarching categories, the following thematic areas emerge: *infrastructural techniques, Transit, and The Mobility Hub* are situated within the *descriptive* domain, while *spatial characteristics, livability, and experience* are positioned within the *interpretive* domain. These six thematic categories are informed by associations with the TOD2 framework, which have shaped my analytical lens during the development of the code-board. However, not all five thematic pillars from the TOD2 framework are represented as overall themes in my coding process. Nevertheless, the criteria of Navigation and Protection have been embedded across several of the overall themes presented as subcategories in the third row in figure 18. These subcategories have also guided the focus of the data collection process.

In the case of Harlev, the *descriptive* codes dominate the data material, highlighting a strong emphasis on infrastructural and technical aspects. By contrast, the Hjortshøj case is marked by a greater presence of *interpretive* codes, which indicate a deeper engagement with experiential and cultural dimensions.

This contrast not only reveals the distinct local dynamics at play in each case, but also illustrates how different types of Mobility Hubs may evoke fundamentally different types of data and interpretive depth, even when they share structural similarities. This acknowledgement must be reviewed as a fundamental difference

on how to perceive each place's needs for urban development in regards to promote the sustainable transportation choice.

The reason *local context* is not designated as a standalone thematic category, which is absent in figure 18, is that it is already embedded across multiple other themes: *Local Context* appears as the complex phenomenon at the core of this code-board, as described in Clarke's situational analysis [18]. The code-board thus functions as a matrix of themes that identify the *Local Context*, aligning with the research's context-sensitive approach.

As argued in relation to *infrastructural techniques*, this theme offers important insights into the spatial context, helping to understand the current state of infrastructure and to identify its shortcomings. For example, while traffic-calming measures such as chicanes are implemented to reduce the speed of car traffic, people continue to use their cars for short trips [29]. A lot of the data material is emphasising the infrastructural programming, but also how it affects human behaviour, which is most relevant when trying to plan for a modal shift in the mobility hierarchy.

Other themes, such as *livability* also contribute to an understanding of the *Local Context*. For example, it highlight the availability of facilities and opportunities for social interaction, which are central in how residents experience and engage with their surroundings.

In light of this, and based on my methodological reflections, I emphasise that the purpose of the site visits has been to interpret the *Local Context*. As examined in chapter 2, integrated mobility planning and urban development regarding the TOD2 framework must remain sensitive to the individual local contexts. Accordingly, the identification of *Local Context* in its many forms, constitutes the very core of this coding framework.

By organising the data in this manner, it becomes possible to trace how specific observations; visual, spatial, or narratives, contribute to broader patterns of knowledge production. These thematic codes are, as previously stated, influenced by the conceptual frame of TOD2 and typologies of Mobility Hubs. The code-board thus serves as an analytical and conceptual tool, supporting the identification of place-based dynamics that inform context-sensitive mobility planning and urban development strategies.

As a general methodological model, the grounded coding process offers an approach through which other urban planners may structure their site investigations prior to formulating specific intervention strategies. It thereby establishes a foundation for the next stage of the analysis, which turns attention more directly toward the *Local Context* as the central phenomenon for understanding the situated conditions that shape the success of future urban development, aiming to change peoples behaviour of their modal choice.

5.3 Follow the Actions

Clarke's expansion of the analytical scope of Grounded Theory emphasis's an a approach with directs attention to both human and non-human actors. Within this framework, non-human actors encompass institutional discourse, infrastructure, technologies, and broader spatial elements (see section 2.3). *Human elements* are hereby related to encompass *historical, socio-cultural*, and *institutional elements*. Accordingly, the data analysis in this part of the research is primarily guided by the Clarke's matrix of the situational map (see figure 5). By following the actions in the empirical material, the analysis seeks to identify both human and non-human agencies that shape the situated conditions. This contributes to a more grounded understanding of the central analytical phenomenon - the *Local Context*, as part of structuring first-hand investigations prior to making planning interventions in line with the TOD2 framework. Additionally, my own journeys will combine experiences and perceptions of these actions into knowledge about needs and impacts when planning for a modal shift from car dependency to sustainable modes of transport.

5.3.1 Relational connections of the situated elements.

Following the grounded examination and coding process, consolidation of the emperical complexity is presented in situational relationships. This is done through a situated map of relations that is being identified in the following situational analysis (see figure 19). The map illustrates the central elements of actions and their interrelations, as identified through the following analysis of the empirical material lead by the matrix of the situational map [19].

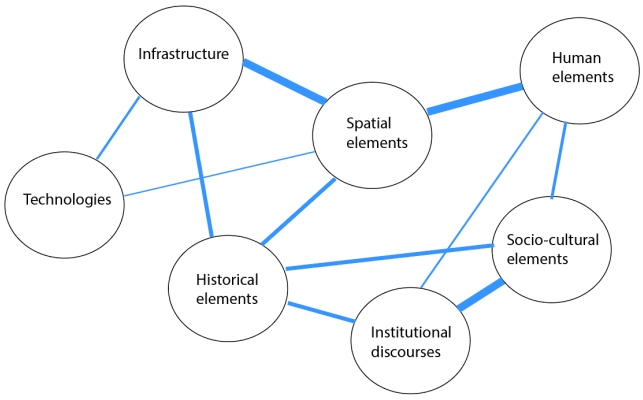


Figure 19: The circles represent types of elements, while the blue lines indicate connections where these influence or interact with each other. The density of the lines indicates how strong the relations are.

This map presents a synthesised overview of the core elements shaping the *Local Context* for mobility planning in Hjortshøj and Harlev. The seven elements have been developed in relation to the codes generated through the grounded coding process, but subsequently refined in accordance with the relational patterns identified as analytical findings in this section.

The situated map (figure 19) visualises how human behaviour and infrastructural design are influenced by technological features, spatial characteristics, institutional discourses, socio-cultural values, and historically rooted mobility practices. In particular, *spatial elements* serve as a strong link between the two dominant dimensions, *infrastructure* and *human elements*, connecting both non-human and human aspects. Furthermore, there is a significant interaction between *socio-cultural elements* and *institutional discourses*, both of which are shaped by human actions. Through this analysis it is highlighted how sustainable modes of transport are firstly planned and perceived as material design, such as traffic-calming

infrastructure and bus shelter quality, and then social dimensions that influence normative perceptions on mobility modes.

Through this mapping of actions, it becomes evident that these seven elements support the analytical argument that mobility behaviour and planning outcomes emerge from the interplay between these situated conditions. Following the actions as Clarke suggests, offers a critical lens through which mobility can be understood, not as an isolated behaviour, but as a product of interconnected conditions that shape the *Local Context*, that are fundamental to implementing TOD2 in a context-sensitive way.

5.3.2 *Human Elements.*

In examining mobility through a situational lens, it becomes clear that the *human elements*, as e.g. individual perceptions, play a critical role in how transit systems are understood. My own transition from a regular cyclist and user of regional trains to an experienced passenger of Aarhus' light rail and bus services provided an opportunity to reflect on the affective and social dimensions of public transport from a novice user perspective.

Initially, entering this new modality of movement was marked by uncertainty and social discomfort. Minor navigational choices, such as where to sit, when to stand, or how to interact with payment systems, were all constituted in unspoken norms and social codes. As I reflected in my field notes:

> "*I didn't fully sit down on the seat, as I felt I was getting very close to the person next to me without any good reason. The passenger were getting off a bit later on the route, so I moved over to the window seat – I had both seats to myself for the rest of the journey, even though others were standing – which surprised me. Perhaps it was slightly outside the social norms that I sat next to the other passenger when there was still plenty of room to stand?*" [32].

Such moments reveal how new users engage in a form of social decoupling, seeking to understand the unspoken codes of conduct embedded in everyday interactions on public transport. This interpretive process fostered a sense of confidence over time.

Other passengers expressed other embodied negotiations of the transit experience. One young man, during a light rail journey, described the service as physically and mentally draining, which had led to strategies for coping with his daily journey:

> "*The seats are actually not particularly comfortable to sit on for longer periods – he fells sore from the journey, and it's also quite noisy on the light rail. He says that he almost always wears headphones, often without even turning them on – just to block out the noise generated by the light rail*" [32].

This reflection highlights how design features such as seating comfort, acoustic conditions, and spatial density impact how passengers interpret the transport system. Hereby, it also showcase an example of how people perceive the travel-time in public transport as efficient and productive use of their time, and not as time for e.g. social interaction or a mental break from all the digital platforms. In that sense, the services should offer better conditions to meet the needs and expectations of these users, to at least keep them in the sustainable transport system, which also affects the design-index for the overall transit network system.

Taken together, these non-human elements that affect human actors illustrate the importance of recognising how public transport is lived, not just used, as emotional comfort, spatial perception, and social norms all influence modal engagement. In the context of the TOD2 framework, understanding these experiential dimensions is essential to designing transit environments that are not only accessible and efficient, but also inviting for everyday life. These *human elements* provides the map of actions with an indication on how public transport is lived and experienced.

5.3.3 *Infrastructure.*

Another highly recognisable element is rooted in mobility planning in relation to the TOD2 concept - *infrastructure*, which appears without a direct connection to the *human elements*.

The infrastructure in both locations is situated within a duality of efforts made to slow down car traffic within the village centres. The broader conditions surrounding the settlements, such as regional road access and spatial dispersal, that make car usage an almost unavoidable aspect of everyday mobility, as through-traffic by private cars is regarded as a necessary condition shaped by the wider territorial context, which continues to encourage car dependency among residents. This is concluded on the basis of different observations, one example states:

> "*Throughout the main road network, there were several speed bumps to reduce car traffic speed. The road clearly shows signs that efforts have been made within the existing infrastructure, to accommodate soft road users more effectively. However, sidewalks have been deprioritised; there are not many of good quality. Yet, due to the reduced speed of car traffic and the measures taken to support this, combined with the fact that the village is so small that traffic volume remains low, there is less need to separate transport modalities. – It appears harmonious here*" [31].

Similarly, in Harlev, physical interventions such as road chicanes contribute to a greater awareness of soft road users:

> "*Many measures have also been taken to reduce car speeds, and there is good separation between soft and hard road users*" [29]; "*Cars are clearly dominant in the urban landscape, but due to reduced speed through traffic calming measures, there is close attention to soft road users*" [29].

Despite these traffic-calming efforts, the areas surrounding both villages reveal an infrastructural landscape still largely dominated by car-centric planning. In Harlev, this is made explicit through spatial design and land use boundaries:

> "*The village is designed in a way in which there are very clear boundaries for who lives in Harlev*" [29]; "*Here it is clearly car-dominated, with parking on three out of four corners [at the Mobility Hub]*" [29].

This infrastructural framing is illustrated in figure 20, which displays Harlev's access points, from highway junctions to open rural roads, forming an edge condition shaped by car-centric infrastructure.

(a) Main road, vest side (b) Highway, east/south side (c) Highway, east/north side

Figure 20: Pictures that ilustrates: (a) the western side of the village, where there is only open contry roads and fields, (b) the eastern side of the main road where there is a highway access point, and (c) the north side of the main road where there is a highway entrance point.

Similarly, in Hjortshøj, Mejlbyvej (figure 21) exemplifies how the village transitions into the rural surroundings with minimal modal separation.

Figure 21: Picture of Mejlbyvej, which defines the boundary of Hjortshøj.

These observations demonstrate a variety of interventions aimed at regulating car traffic and supporting alternative modes, but the surroundings are still much oriented towards car traffic.

Nonetheless, the empirical data represented by human actors, suggest that residents do engage in sustainable mobility practices despite infrastructural limitations. A local pensioner in Hjortshøj told me, that: "*Normally, she cycles to most places. If she needs to go to Aarhus, it's usually via Mejlbyvej and Grenåvej – it's fast, and yes, there are a few parts of Mejlbyvej that aren't great, especially in the dark. But it's manageable*" [31]. Statements like hers are important to notice, as these kind of stories are the ones that will be inspirational when improving and maintaining new development projects as it points to a potential to attract more people into such behavius. In Harlev, cycling infrastructure is more formally established, with a direct link to Aarhus city centre; "*There is a straight cycle path in both directions all the way to Vestebro Torv, and it almost loops around the whole of Harlev, except for [the small stretch] on Framlev Korsvej. It is approximately a 15 km bike ride that intersects with the major decentralised node 'Åby Ringvejen/Silkeborgvej'*" [29]. Despite the apparent car-dominance, these examples show that individuals still choose active modes of transport in their daily routines, shaped by individual needs, values, and external factors such as weather and purpose of trips: "*...she needs to go into the city to get to work. Normally she cycles, but sometimes she takes the bus if the weather is unpleasant...*" - stated by a mother in Harlev that just dropped off her children at the school [29].

The infrastructural duality observed in Harlev and Hjortshøj, where village centres are calm and in human-scale yet surrounded by car-oriented infrastructure, highlights a central challenge in transitioning towards sustainable mobility. The duality refers to the coexistence of two conflicting spatial logics: while the core areas support walkability and local livability through traffic calming and compact form, they remain embedded within wider systems designed for car use. As a result, some users choose cycling and public transport despite these spatial and systemic limitations, but the wider infrastructural context undermines broader modal shift ambitions. In relation to the TOD2 framework, the users' transportation modes emphasises the need for integrated infrastructural strategies that support transit and active modes within the station area, and beyond. Even though there is examples of users of sustainable modalities, the TOD2 planning must address physical infrastructure as well as spatial continuity to support equal accessibility across user groups, as the most dominating modality is still the private car.

5.3.4 Spatial Elements.

Closely interrelated with the infrastructural conditions are the *spatial elements* of the Mobility Hubs themselves, namely the design and atmosphere of sitting and staying possibilities. These physical spaces serve as both functional and symbolic interfaces between people and the transport system, very much influenced of the existing infrastructural programming. In Hjortshøj, the station area offers a modest but pleasant waiting environment, where weather conditions such as sunlight, enhance the perceived quality of the space and support moments of informal presence and comfort. In winter it appears less pleasant, as a young girl told me at the bus stop at Hjortshøj St.: "*During the winter months, it has not been that great waiting here, because you are just standing out in the cold. But*

(a) Shelter at the light rail platform **(b) Shelter at the bus stop at the Mobility Hub** **(c) Shelter at the bus stop in front of the local supermarket**

Figure 22: Pictures of different designed shelters in Hjortshøj.

in general, it is fine here – just more seating options would be nice, because right here in the sun, it is lovely" [31].

The pictures in figure 22 illustrate the presence of several sheltered waiting areas, and some without shelters, which offer different levels of comfort. These conditions invite dwell time, presence, and interaction in regards to the TOD2 concept's criterion of Experience and Protection [33].

In contrast, the bus infrastructure in Harlev is lacking both in identity and user-friendliness as outlined in section 5.1. The bus stops are perceived as offering minimal support for basic needs or multimodal integration, as I observed at a site visit in Harlev:

> "*The bus stops do not make much of a statement; they can be considered as relatively anonymous in the urban landscape. If they were made more attractive and user-friendly, the system might attract more people, as there are actually already a handful who take the bus. It is just not a pleasant place to wait in terms of seating, enjoying the weather, or being protected from it. And bicycles are not welcome at all*" [29].

Based on the my own experience waiting at the Næshøjskolen bus stop, in Harlev (see figure 23), it becomes clear that spatial discomfort and anonymity discourage lingering and social interaction. The difference in spatial quality is also reflected in behavioural patterns, as people in Hjortshøj tend to gather and wait, while in Harlev, users arrive shortly before departure and avoid unnecessary exposure to the space.

In this way, there is minimal quality of space declines the TOD2 criteria of Livability. As noted in the field notes:

> "*My experience of standing and waiting at the bus stop [in Harlev]: no one looks at each other, people arrive and stare down at their phones. It can be extremely difficult to approach people, as it feels completely imposing to interrupt without first having made eye contact or simply acknowledged each other's presence*" [29].

In the absence of spaces that invite presence and enjoyment, it risks becoming a non-place, which undermines the behavioural change that transit-oriented planning seeks to promote.

Figure 23: Picture of the spatial characteristics of Næshøjskolen bus stop. On the left, direction towards Harlev. On the right, direction towards Aarhus C.

Taken together, the *infrastructural and spatial elements* identified in the two cases, reveal how place-based materialities, such as traffic design, waiting environments, and modal boundaries, not only reflect urban planning logics but also shape patterns of behaviour, perception, and social interaction. These situated non-human elements are foundational to understand how Mobility Hubs operate in practice, and to forme the TOD2 framework in a locally grounded and sensitive manner.

5.3.5 Historical Elements.

Furthermore, *historical elements* also emerge from the empirical material that influence mobility behaviour, informed by human actions. These elements are not only reflected through infrastructure, but also socio-economic legacies for embodied routines - what people are used to is what they trust, and what becomes a norm.

In Harlev, mobility practices appear to be deeply influenced by long-standing habits formed during the post-industrial expansion of car ownership and material convenience. This is especially evident among older population groups, who are likely to have spent the majority of their adult lives in a system built around private car dependency. Although the village features some infrastructural

support for active mobility, car use continues to dominate both the spatial landscape and the social rhythm of daily life, as noted in several observations:

> "*There is quite a bit of activity in Meny's [local supermarket] car park, but it is not full. It also spills over to the baker's parking area on the opposite site of the road – it seems like the children have now been picked up (4:30 pm)*" [29].

> "*The tradespeople have mostly gone home by now, and so have the schoolchildren. Traffic has eased a bit, and it is mostly Meny that are drawing people in by car, or people out exercising or heading to sports*" [29].

> "*Dogs are being walked and people are shopping in Meny - on foot, by bike, and mostly by car... Cars are clearly dominant in the urban landscape, but due to reduced speed through traffic calming measures, there is close attention to soft road users*" [29].

These field notes suggest a strong normative culture in which driving is the default mode even for short, local trips. This is reinforced not only by infrastructure, but by a historically embedded mobility mindset that persists despite features to reinforce a shift in the modal hierarchy.

Another dialogue with a resident illustrates how past experiences in urban settings continue to influence present behaviour, even when the actual risk has changed:

> "*She mentions her concern about having her bike stolen, as it is somewhat more valuable than other bikes and therefore probably attractive. On the other hand, she has not experienced bike theft in Harlev – it is perhaps more something that happens in the city, but it could still happen. It is as if her mindset or worry is deeply ingrained from previous experiences in the centre of Aarhus*" [29].

This comment demonstrates how history stays, exemplified in a risk perception that is not tied to local conditions, but shaped by historically situated memory. Despite no stories of stolen bicycles in Harlev, the fear stays, as well as her loyalty to sustainable transport modes. It highlights the effect of the absence of bike racks at the bus stops, and the monomodal character of the transit system in Harlev.

In contrast, Hjortshøj presents a different kind of historical influence. As a former railway village, Hjortshøj retains a symbolic attachment to this character of connectivity and vibrant place, even as the light rail has been established along what used to be the former train route. This historical identity is evident in everyday language, particularly among local residents, as I observed it:

> "*It is funny that people 'out here' call the light rail 'the train'. In fact, I found that people did not understand me at all when I referred to it as the light rail. I also heard the nursery staff calling it 'the train' when speaking to the little children. It makes sense that they are a bit too young to be told there is a difference, but then it just carries on in people's language*" [31].

This quote illustrates how linguistic patterns of human actors preserve historical meaning, embedding mobility infrastructure within the collective identity of the community. The persistence of the term "train" serves as a cultural anchor, reinforcing a place-based sense of familiarity and trust in transit, and it is elements that can be strategically nudged in efforts to promote a sustainable modal shift.

Taken together, these *historical elements*, ranging from inherited behavioural patterns to localised terminology, highlight the influence of the past in shaping present-day mobility systems. It also support the need, to invest in retaining younger generations whose modal norms already are much relaying on sustainable mobility to get around on there own, to change the history of the car-oriented planning paradigm [36]. As this research shows, early adoption of active and public transport modes has the potential to form long-lasting habits. Integrating historical consciousness into planning supports a more nuanced and place-sensitive approach to TOD2 planning, so that interventions not only respond to current needs but also address the social aspects of mobility culture. A focus on *historical elements* also ties into ingrained, institutionalised temporalities that affect the use of mobility patterns.

5.3.6 Institutional Discourses.

Institutional discourses, as defined within Clarke's situational framework, encompasses the socially embedded systems that organise everyday life, perceived trough human actions. In the context of mobility, such discourse is particularly visible in how formal institutions, such as schools and workplaces, but also leisure, structure the temporal and spatial patterns of daily movement. At the same time, more informal ideological communities, such as the eco-community in Hjortshøj, influence the local culture and spatial behaviour through its alternative values and systems.

A clear example of formal institutional structuring is seen in how schools and work schedules impact travel behaviour in Harlev and Hjortshøj. In Harlev, field observations point to a differentiated pattern in children's mobility: *while some walk or cycle to school independently, others are dropped off by car at a parking place, despite the presence of designated "kiss-and-drive" zone* [29]. These observed practices reveal how adults decisions are shaped not only by convenience and perceived safety, but also by broader infrastructural and service limitations, including the lack of sustainable connections to surrounding villages, as many Flex-taxis (a collective taxi service, facilitated by Midttrafik) also arrive with kids to the school in the morning. I noted it in my field notes, as:

> "*7:30: Families with children start passing by on foot, by car, and by bike. It is mostly children who walk on their own. Many children also arrive alone by bike. The car park by the bakery is used by parents to drop off their younger children at school [even though there is a kiss-and-drive option at the school]*" [29].

An alternative narrative, is presented in the case of a young woman working in Hjortshøj. She show how reliable transit services can support sustainable and equitable mobility to work across urban-rural boundaries, as I noted her statement: "*Young woman from Aarhus, working as a substitute in the kindergarten seven minutes' walk from the station. She thinks the bus runs well – you can*

really count on it..." [31]. My interaction with her led me to reflect on a broader implications:

> "*I wonder how she managed to get a job 'all the way out here'? It is fantastic that she can easily work as a substitute in Hjortshøj and rely entirely on sustainable transport. The conversation gave me hope that the transition is underway and can be accelerated [...] She is an example of one of the many young people we should try to retain*" [31].

Such examples illustrate how institutional structures; schools, work, and transport services, create a normative frame that shapes mobility decisions and future potential for a modal shift.

In addition, the *institutional discourses* of organised leisure also plays a significant role in structuring mobility patterns. In the Danish welfare society, sport and leisure activities form an institutional impact on everyday life. This is clearly reflected in the afternoon rhythms of both case areas. The station in Hjortshøj becomes a meeting point for local residents engaging in organised activities such as meeting before football or a cycling tours. The Mobility Hub transforms into a lively place, facilitating multimodal travel to sports activities: "*A lot of people are heading to football - they have been here since around 4:00 pm (4:30). And many men are out on exercise bikes*" [31].

In Harlev, such actions of social gathering are not observed. Instead, afternoon mobility patterns appear to be shaped primarily by car usage, as evidenced by the following observations:

> "*People are either at home or at sports – you can tell from the car parks. At the supermarkets, the number of parked cars has thinned out considerably, but in contrast, the sports centre's car park is full*" [29].

These institutional patterns indicate how transit are embedded within broader institutional temporal systems, influencing when and how people travel.

Moreover, the empirical material points to the sub-institutional discourse present in Hjortshøj's eco-community. It has impact on rest of the village's society and urban life, with its alternative values that promotes collective responsibility, environmental consciousness, and local participation. This is noted in my field notes, reflecting the experience of my presence as an outsider arriving in Hjortshøj:

> "*Hjortshøj reflects village life / a local community that takes ownership of the town*" [31];
>
> *"Furthermore, Hjortshøj has a strong aura of being a community to its core – people feel ownership and responsibility for the town and for one another. I see this, for example, of how;*
> - *Everyone greets each other, and me*
> - *It is clean and tidy*
> - *Flyers advertise local events*
> - *There are many public meeting places, all in good condition"*
>
> [31]

These expressions of community life reflect an institution embedded in social ethic, that appear to have a great impact, in shaping community behaviour and mobility preferences.

Together, the two cases demonstrate how *institutional discourses*, both formal and informal, frames the lived realities of mobility. Within a TOD2 perspective, recognising the influence of such *institutional discourses* is crucial for aligning mobility planning with the social institutionalised behaviour that structure everyday life. Planning for modal shift thus requires not only physical infrastructure, but an understanding of the institutional contexts in which mobility decisions are taken. It is also well connected to the *historical elements* as they impact one another, and must be taken into account in the context-sensitive planning approach.

While *institutional discourses* are led by human actions and shape planning and mobility through governance, they are also reproduced through everyday practices and social norms. The empirical data shows an interrelation of socio-cultural landscapes with informal institutional discourses, revealing not only how residents adapt to or resist formal structures, but also how place-based identities and behaviours influence the wider discourse of mobility.

5.3.7 Socio-Cultural Elements.

Socio-cultural elements manifest in the everyday life, in the ways residents relate to their environment, express community identity, and engage in informal practices of place-making. A visual comparison of the two case areas reveals distinct cultural landscapes, captured through images taken during site visits and interpreted as expressions of how local life is embedded within the built environment.

In Hjortshøj, the *socio-cultural* atmosphere is characterised by visible signs of personal investment and collective identity. Photographs show, for example, a book-sharing box installed in an otherwise unused bicycle shelter at the station, artwork and decorative lighting enhancing the face of an open barn situated by a constructed pond, and art on the side of the local supermarket. These interventions, whether created by residents or local institutions, imposes a strong sense of ownership and shared responsibility. Posters announcing local events and community activities, visual at the image below 24, it further highlight a culture that supports social responsibility and effort.

Figure 24: Image showcasing *socio-cultural* features that reflect the strong sense of local empowerment in Hjortshøj.

As with the previously discussed eco-community, its underlying values have influenced the broader social contributing to a sense of local empowerment in Hjortshøj, posing elements that strongly align with guidelines in the TOD2 framework's emphasis on Protection and Experience, as the urban space brings a great feeling of safety and belonging, created by the many features that facilitate identity to the village.

In contrast, the *socio-cultural elements* observed in Harlev point to a society in transition. While parts of the village is characterised by abandoned bus shelters and underused spaces, I experienced on a subsequent visit, new perspectives that came into focus. The new perspective emerges through engagement with volunteers at Café Harlev, a recently established community-run location, that has become a focal point for local social life. This café, along with a cluster of newly developed businesses, reflects a fresh and light aesthetic morphology, still grounded in human-scale design. Moreover, an appearance of wood-benches scattered across green areas, suggests early efforts to foster local identity in somthing that become iconic and recognisable for the city of Harlev. The pictures at figure 25 showcases a small part of this development going on in the village.

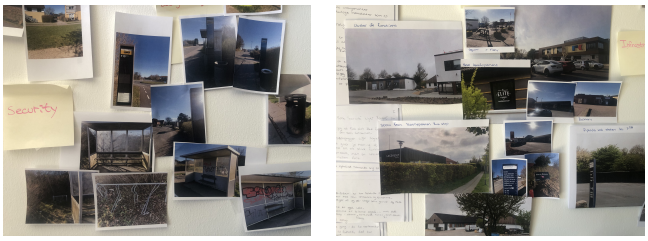


Figure 25: Image showcasing *socio-cultural* features that is observed in Harlev. On the right 30 March, focus on the abandoned. On the left 30 April, focus on the development.

In both cases, these *socio-cultural elements* contribute to the experiential qualities of the place and highlights qualities that supports more than just functional transit development. Within the TOD2 concept, such expressions of place-based identity should be essential as it influences perceptions of security, comfort and human-scale design, and thereby a playing a part in structuring planning for Experience and Protection. It foster the extended node-place model with som intuitive design elements all of which are critical to encourage the modal shift [33].

5.3.8 Technologies.

While technological artefacts do not dominate the empirical material, they nevertheless appear as meaningful components of the mobility experience, particularly through their role in wayfinding and payment systems. As highlighted in the TOD2 framework under the theme Navigation, access to reliable and user-friendly digital systems is essential to ensuring smooth multimodal travel [33, p. 46].

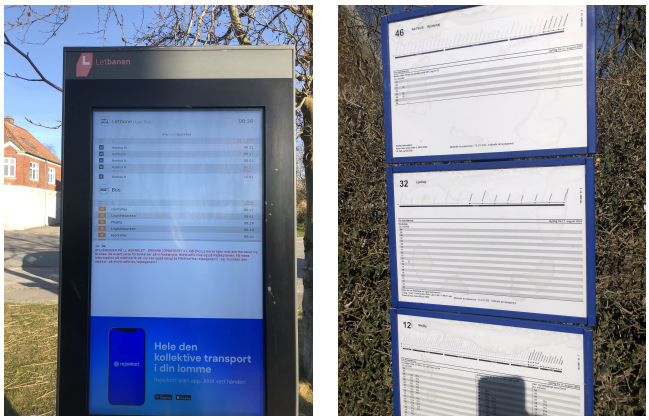
Payment technologies, such as the Danish *Rejsekort* system, illustrate this role in navigating the public transport system. As I noted on my own journey, despite the option of using a mobile app, I instead continued to relay on the physical card:

> "*I still check in using my manual Rejsekort. I have seen adverts and heard that I can now get it as an app, but since my phone is old and runs out of battery quickly, I feel safest using my manual card as I always have*" [32].

Likewise, digital journey planners, such as Google Maps, Midttrafik Live, and Rejseplanen are highly used across user groups. These platforms play a central role in planning one's journey, enabling spatial orientation and security of when and where to travel.

> "*I started by checking how to get to my meeting location using Google Maps, as it is a platform I often use for finding other places and routes. I understand how the platform is set up, and therefore where to find the information I need*" [32].

Still, while digital tools are present on personal devices, their physical integration into the Mobility Hubs remains minimal. Hjortshøj Station features only a single digital departure board on the platform towards Aarhus C, while most other hubs rely solely on analogue signage, as visualised in the following image (see figure 26).



(a) Digital information screen at Hjortshøj St.

(b) Analogue information board at the bus stop in Hjortshøj

Figure 26: Pictures showcasing different signage designs.

Whether this is a critical absence in these specific low-density contexts remains debatable, as the data material does not reveal much information about users' perceptions of these services. Yet, the lack of real-time digital infrastructure does highlight a missed opportunity to enhance the transit experience and strengthen Navigation and Livability, as two essential components within TOD2 planning.

The seven identified elements are interrelated, as visualised in figure 19, providing informations on the *Local Context* and insight into how planners can adopt a more strategic and deductive planning approach, and still respond to core principles of TOD2. The situational analysis, therefor highlights the importance of strategic, context-sensitive interventions. It draws attention to the various factors that influence mobility planning, as well as the specific conditions that must be met for an successful intervention aimed at changing travel behaviour.

To effectively implement TOD2 across diverse urban and regional contexts, it is essential to categorise station areas based on their functional characteristics and their potential for transformation. The use of Mobility Hub typologies offers a structured analytical framework for identifying context-specific hubs, grounded in an assessment of local needs and development potential. This typological analysis serves as a supplementary layer to the situational analysis.

5.4 Identification of Mobility Hub Typologies

This section begins by examining which typology from Table 1 that most accurately characterises the Mobility Hub at Hjortshøj Station and the bus stop at Næshøjskolen in Harlev, the comparable cases within Aarhus Municipality. The typologies are founded in an assessment of the extended Node-Place values of the land-use, accessibility and quality of space, and the urban design for a given location (section 2.4). In this framework, Mobility Hubs are not defined solely by transport infrastructure, but also by its multifaced characteristics of the local context.

5.4.1 Hjortshøj St.

In relation to the typologies presented in Table 1, this Mobility Hub should not primarily be assessed based on scale or transport supply within its urban context. To ensure context-sensitive planning that respects both urban form and local identity, this hub must instead be evaluated in terms of its users and its functional role. In this regard, I draw attention to literature from the *Smart Cities* discourse [28], which provides a flexible analytical framework, offering multiple interpretations of what may characterise this Mobility Hub. As previously discussed, there is a strong sense of community attachment in this village, and throughout the day the hub is indeed used by a diverse range of user groups [31]. The site receives frequent visits from local residents. However, this does not necessarily imply that it serves as a key node for sustainable transit. Rather, its frequent use is more closely tied to its location in proximity to other daily life functions and amenities, which attract people to pass through or linger nearby [29]. At the same time, the presence of the light rail means that it does function as a regional transport hub. However, an assessment based solely on factual data may challenge the classification of Hjortshøj St. On the one hand, the station provides high-quality mobility options, and on the other hand, it is situated in one of the least populated areas of Aarhus Municipality [1]. Hjortshøj is characterised with a spread of many low-density communities that experience significantly limited levels of public transport service, it becomes crucial not to overlook the urban identity of such places.

When examining the table of Mobility Hub typologies from section 2.2, it becomes evident that the hub can be defined according to several parameters. Based on my observations and the spatial characteristics of the area, Hjortshøj Station is primarily characterised by its urban context and geographical location, as well as by the transport services it provides both the local population and its surrounding areas. In this regard, I propose to assess the hub through the classification dimensions of urban context, user typologies, and its functional role within the regional transport network [28], highlighted in the image below (figure 27).

Source	Typology Focus	Hub Types	Classification Dimensions	Analytical Use
[31]	Broad typological framing across urban contexts, including rural and low-density areas through categories like Community and Neighbourhood hubs.	Community, Neighbourhood, Suburban; includes functional differentiation.	Urban context, user type (e.g., local residents), accessibility, multimodality, functional role in regional transport.	Useful for identifying flexible hub typologies adaptable to village conditions and socio-geographic variation.
[55]	Empirically grounded typology specifically distinguishing Community, Neighbourhood, and Suburban hubs as part of a six-level hierarchy based on service provision.	Community, Neighbourhood, Suburban – defined by transport service level and spatial scale.	Service quality, spatial scale, transport supply level, population size, surrounding area.	Supports evaluation of minimum requirements in size, accessibility, and service level for rural mobility hubs.
[48]	Five-dimensional framework combining hub type and urban context in a matrix, including lower-density areas through categories like Neighbourhood and Private hubs.	Neighbourhood, Private, and Business hubs – adjusted according to context-specific needs in rural or semi-urban settings.	Contextual suitability, proximity to key functions (e.g., housing, local services), and operational flexibility across rural and semi-urban settings.	A practical framework for evaluating and selecting hub types based on spatial data and real-world context; supports decision-making on location and hub size in low-dencity areas.

Table 1: A table on literature of Mobility Hubs typologies, established for an case analysis in a rural/villages contexts [31, 48, 55].

Figure 27: Image of Table 1 highlighting the focus on the paper "*Mobility Strategy - A fundamental transport transformation: Commission presents its plan for green, smart and affordable mobility*"[28].

Hjortshøj Station occupies a position between the structural typologies of a Neighbourhood Hub and a Suburban Mobility Hub. This is due to its location along a high-capacity public transport corridor (the light rail), which travels beyond municipal boundaries. This positioning allows the hub to function as a strategic anchor for surrounding low-density communities, enabling a link for first- and last-mile connections and thereby supporting its role as a transit corridor.

Nonetheless, the hub is currently defined by a relatively low service level. However, there is a distinct potential for further development, particularly with its ample public square and commercial property, which could support its transformation into a social and functional meeting point for both Hjortshøj residents and commuters from nearby areas. By treating the site as a Suburban Mobility Hub, a stronger emphasis on long-term growth and infrastructural improvement may serve to strengthen its position and sustain its development as a hub that attracts a broader user base. In relation to Midttrafik's typological framework, Hjortshøj aligns with the category of a "Station Town Hub", because it services a high-quality regional transit hub, that provides a central Mobility Hub for the surrounding villages. However, it is crucial to acknowledge that no typology will offer a one-size-fits-all classification. Rather, the role and development of such a hub must be adapted to the specific needs and aspirations of the local community, within the broader framework of what a light-scale Neighbourhood Mobility Hub [28] in a station town [40] context can and should provide .

5.4.2 Harlev, Næshøjskolen bus stop.

Looking closer at what type of Mobility Hub that is in play at Næshøjskolen in Harlev, and as the hub it self is not really multimodalt, but exist in an urban context with multiple functions, it will be relevant to evaluate its needs and potentials in regards to its service provision and urban context, to measure its potential. Therefor, I will look closer at the classification dimension from the third paper by Sustainability [46], in Table 1. This article proposes a matrix of how TOD and Park and Ride hubs can be interconnected by public transport and road infrastructure, in different urban contexts. In the *Sustainability* paper it is conclude that designing Mobility Hubs, ideally should be based on policies and adapted according to

context [46, p. 1]. On image 28, the focus on the *Sustainability* paper [46], for identifying this Mobility Hub typology is highlighted.

Source	Typology Focus	Hub Types	Classification Dimensions	Analytical Use
[31]	Broad typological framing across urban contexts, including rural and low-density areas through categories like Community and Neighbourhood hubs.	Community, Neighbourhood, Suburban; includes functional differentiation.	Urban context, user type (e.g., local residents), accessibility, multimodality, functional role in regional transport.	Useful for identifying flexible hub typologies adaptable to village conditions and socio-geographic variation.
[55]	Empirically grounded typology specifically distinguishing Community, Neighbourhood, and Suburban hubs as part of a six-level hierarchy based on service provision.	Community, Neighbourhood, Suburban – defined by transport service level and spatial scale.	Service quality, spatial scale, transport supply level, population size, surrounding area.	Supports evaluation of minimum requirements in size, accessibility, and service level for rural mobility hubs.
[48]	Five-dimensional framework combining hub type and urban context in a matrix, including lower-density areas through categories like Neighbourhood and Private hubs.	Neighbourhood, Private, and Business hubs – adjusted according to context-specific needs in rural or semi-urban settings.	Contextual suitability, proximity to key functions (e.g., housing, local services), and operational flexibility across rural and semi-urban settings.	A practical framework for evaluating and selecting hub types based on spatial data and real-world context; supports decision-making on location and hub size in low-dencity areas.

Table 1: A table on literature of Mobility Hubs typologies, established for an case analysis in a rural/villages contexts [31, 48, 55].

Figure 28: Image of Table 1, highlighting the focus on the paper "*An Analysis of the Emerging "Shared Mobility Hub" Concept in European Cities: Definition and a Proposed Typology*" [46].

Examining the typology of Mobility Hubs within the Dutch context, significant parallels can be identified with the planning strategies adopted in Aarhus Municipality, particularly in relation to the delineation between TOD nodes and Park and Ride facilities, and their envisioned roles within a broader transit infrastructure aimed at facilitating modal shift towards sustainable transport solutions [46, pp. 4-6].

The Dutch framework contributes with a valuable conceptual overlap between these two node types and underlines the need for context-specific adaptation when implementing Mobility Hubs. Within this context, the Dutch definition of Mobility Hubs intersects meaningfully with the TOD2 conceptualisation, while simultaneously echoing the emphasis on Park-and-Ride facilities seen in Aarhus' Green Mobility Plan [6, pp. 13–14].

From this point of view, the conceptual definition of Mobility Hubs adopted in this research reflects a typological alignment between TOD2's definition on Mobility Hub, which frames Mobility Hubs as integrated, liveable, and multimodal urban spaces, and the Green Mobility Plan's focus on Park-and-Ride functionality within a regional transit network [33, p. 24], [6]. Rather than viewing these perspectives as contradictory, this research positions them as complementary: "a Mobility Hub should be understood as more than a transit node; it should serve as a livable urban space that guides users towards sustainable transport modes through spatial design, accessibility, and intermodal coherence" 3.3. In this sense, Mobility Hubs must be planned with careful attention to their dual role as both node and place, and with the potential to support modal shift either through high-quality transit integration or, in certain contexts, through strategic Park-and-Ride solutions, still taking into account the third design dimension [52].

Moreover, the Dutch model distinguishes between Neighbourhood Hubs and Rural Hubs, a typology particularly useful for evaluating hubs in low-density areas like the one located at Næshøjskolen in Harlev [46]. Based on observational data and the site-specific descriptions, this hub can be classified in as a Neighbourhood Hub. Its proximity to educational, recreational and health institutions, combined with moderate residential density, highlights its potential to integrate shared mobility services, such as carpooling or bike-sharing within walking distance of the bus stops.

Although its scale remains limited, this hub can be redeveloped beyond its current function as a mere car parking stopover point. By reducing the emphasis on car parking and implementing human-scale urban design, such as seating areas and greenery, then the site could support a more livable public space. This aligns with the broader Dutch finding that bundling transport services with place making efforts enhances both functionality and attractiveness, especially in smaller hubs [46].

Furthermore, Midttrafik's typology plays an important role in shaping how Mobility Hubs are categorised and planned in the Central Denmark Region. In this context, Harlev can be understood as fitting within the category of a "Village Hub". This approach is in line with the Dutch emphasis on aligning local mobility planning with regional strategies and ensuring coordination across policies and planning practices. However, the Dutch framework also highlights the limitations of applying standardised models uniformly. A fixed, one-size-fits-all typology risks ignoring the specific needs, behaviours, and spatial conditions of individual communities. As such, the role and development of the nods in Harlev should be guided by local preferences and patterns of use while still contributing to overarching regional mobility objectives. Drawing on the *Smart Cities* literature, particularly the view that localised infrastructure must respond to both social and environmental imperatives, it remains important to recognise the transit-oriented approach in Harlev as centred around a system of mini-hubs [28]. However, this should not reduce their role to purely transport-related functions. Specifically, the Mobility Hub at Næshøjskolen should contribute to urban livability, social resilience, and community cohesion. As such, the planning and future development of TOD2 in Harlev must be tailored to the specific needs and aspirations of the local population, while acknowledging its role within a wider, neighbourhood-based network of interconnected mini-hubs.

5.4.3 Comparison of the two Mobility Hub typologies.

Although both Hjortshøj and Harlev are located in low-density village settings on the outskirts of Aarhus Municipality, the analysis of their Mobility Hub typologies reveals two distinct cases. Each is embedded in a unique urban context, shaped by differing levels of service provision, spatial morphology, and local social dynamics. In Table 3, the characteristic defining the two case's Mobility Hub typologies are compared, while also presenting differentiated planning challenges and development potentials.

Category	Hjortshøj	Harlev
Urban context (Classification Dimension)	Low-density **village** with strong **community identity**, ecological values spreading from the sub-community, and location along the **light rail line**.	**Service-rich** village with **centralised public and commercial facilities**; car-oriented culture and a central car-oriented **city centre**.
Mobility Hub typology (Hub Types)	Hybrid between **Suburban Mobility Hub** and **Neighbourhood Hub**, and constituted as a station town hub in Midttrafik's classifications.	**Mini Neighbourhood Hub**, and in regards to Midttrafik's classifications: a village hub.
Key challenges (Typology Focus)	Insufficiently activated infrastructure; lack of wayfinding, with no clear recognition as a light rail station.	Lack of multimodal integration; weak public transport culture that limits the sense of place at the hub.
Development possibilities (Analytical Use)	Enhance role as regional transit anchor; activate the insufficient public space to **reinforce local identity and community character**.	Introduce human-scale design; **reduce parking dominance** and **integrate active mobility functions with social and civic life**.

Table 3: Comparison of Mobility Hub typologies and development potentials in Hjortshøj and Harlev. Highlights acknowledge the analytical findings in relation to Table 1 of Mobility Hub typologies, and the inspired categories are noted in parenthesis for each Category in Table 3.

The categories in Table 3 has emerged through the comparative analysis of Hjortshøj and Harlev. As the empirical material was examined, it became evident that four key categories were describing the differences between the two cases. *Urban context* is formulated to capture the broader socio-cultural setting in which each hub is embedded, such as density, spatial structure, and local identity, which proved essential to understanding the role of the hub within its community. The category *Mobility Hub typology* is defined based on how each hub functionally aligns with or differentiate from existing typological frameworks, including Midttrafik's visual classifications. *Key challenges* reflects site-specific barriers to sustainable mobility, including infrastructural, cultural, or perceptual limitations observed during fieldwork. Finally, *Development potential* emerges from identified opportunities for enhancing the role of each hub, grounded in local characteristics and alignment with TOD2 criteria such as Navigation, Livability, and Experience.

As presented in Table 3, Hjortshøj Station functions as a hybrid between a Neighbourhood Hub and a Suburban Mobility Hub. While it is modest in scale and service level, it is situated along the high-capacity light rail corridor and thereby holds strategic potential as a regional anchor point for surrounding even lower density communities. The hub's role is not limited to transport connectivity, it reflects a strong local identity, influenced by the eco-community that fosters ecological values (see section 5.2). This community character shapes patterns of use and identity, and as such, mobility planning in Hjortshøj must be deeply responsive to place-specific values and rhythms, to encounter the local cultural behavior. The station's relatively underutilised facilities and no-space presents opportunities for strengthening the Mobility Hub's role as both a transport node and a social meeting point, emphasising integrated design, aligned with TOD2 criteria such as Livability, Experience, and Navigation.

Whereas, the hub at Næshøjskolen in Harlev aligns more clearly with the typology of a Neighbourhood Hub or a Village Hub, situated in a central junction that forms the functional heart of the town. It is surrounded by multiple public and private services, as educational, commercial, recreational, and health facilities. Thus, the hub itself lacks at multimodal integration and is characterised by a internal mini-hub network. While Harlev is spatially coherent and service-rich, it exhibits weaker signs of everyday transit culture and social cohesion around the Mobility Hub. Yet, its centrality and institutional clustering give it significant potential to expand the sustainable mobility choices. Through an integrated urban design and strategic down-scaling of parking priorities, it could evolve from a mono-functional bus stop into an integrated civic space that supports active mobility and contributes to a modal shift.

A notable aspect of this part of the analysis is the absence of the article from *Transport Geography* [54] in the comparative table summarising three key sources that frame the conceptual understanding of Mobility Hub typologies (see Table 1). This exclusion is primarily due to the considerable overlap in the proposed hub types; Community, Neighbourhood, and Suburban hubs, which are also introduced in the *Smart Cities* framework [28]. The *Smart Cities* typology not only encompasses similar classifications but also presents a broader and more flexible approach, making it more applicable for varying urban contexts. In the case of Harlev, the decision to prioritise the Shared Mobility Hub framework [46] was informed by the identified presence of a decentralised network of smaller-scale hubs, so-called mini-hubs [46]. Thereby, the analytical framework presented in the Shared Mobility Hub article was better suitable for capturing the minimalist, yet functionally interconnected, character of Mobility Hubs located on this urban periphery. As the analysis progressed, it became evident that the characteristics observed in the two case studies aligned most clearly with the

typological classifications proposed in the other two sources ([28] and [46]), as detailed in the analytical sections 5.1.

Furthermore, the typologies outlined in Table 1 serve as interpretive frameworks that facilitate the identification of site-specific conditions, challenges, and transformation potentials for each hub. They provide a interpretive framework for guiding on-site observations with sensitivity to how context-dependent features, such as spatial morphology, demographic composition, or existing modal infrastructure shape both the functional role and the spatial design of each Mobility Hub. The synthesis presented in Table 3 further demonstrates how the use of key analytical categories; *Urban context, Mobility Hub characteristics, Key challenges, and Development potential* can serve as adaptable references for informing context-sensitive TOD2 planning. It involves not only the existing functional objectives embedded within each case, but also situates the Mobility Hub's future development within a nuanced understanding of the level of service it has the capacity and responsibility to provide. In this way, the comparative typology categories (Table 3) becomes a generalisable supplementary framework to the context-sensitive TOD2 planning.

5.5 Summary of the Analysis

The comparative analysis of Hjortshøj and Harlev confirms that achieving a modal shift in low-density settings requires a context-sensitive application of TOD2. Through a situational analysis grounded in ethnographic fieldwork, seven interrelated elements were identified as key to understanding the *Local Context*, being interrelated in the situated map of *infrastructure, technologies, spatial elements, historical elements, institutional discourses, socio-cultural elements, and human elements*.

These elements shape how sustainable mobility is both planned and perceived, highlighting the importance of integrating both spatial and social dimensions into TOD2 strategies. Furthermore, the Mobility Hub typology analysis shows that functional variation across hubs must inform differentiated planning approaches.

Altogether, the findings demonstrate that TOD2 must be operationalised as a flexible framework, tailored to place-specific conditions, to effectively support interventions aimed at reducing car dependency and promoting sustainable transport in different urban contexts, with a specific emphasis on the low-density areas.

6 DISCUSSION

The question framing this chapter is:

How can planners translate human and non-human dynamics into a grounded context-sensitive TOD2 strategy that supports interventions for a modal shift?

Building on the analysis' numerous findings, this discussion seeks to critically reflect on how the varied interpretations of the empirical material can inform a context-sensitive and strategic approach to Transit-Oriented Development 2 (TOD2). Rather than imposing a fixed method, the aim is to explore how planning practices may be grounded in local structures while aligning with broader sustainability goals. In doing so, this discussion positions TOD2 not only as a planning model, but also as an adaptive planning strategy responsive to situated complexities and mobility behaviours.

Through the analytical process, findings of the human and non-human elements have led to the acknowledgment of their equal significance to the construction of knowledge in this context. This perspective challenges conventional planning approaches that often privilege the spatial dimension in isolation [50]. Accordingly, the analysis reflects a framework that acknowledges the inevitable co-existence of human and non-human actors in the context of urban mobility planning. Recognising this co-existence is crucial in TOD2 planning, as it enables a more nuanced understanding of how mobility behaviour emerges through the interplay between material conditions and socio-cultural dynamics.

6.1 The Identification of Human and Non-Human Elements

As demonstrated through the grounded coding process, *Local Context* emerges as the central, complex phenomenon underpinning the context-sensitive approach to TOD2, being embedded across all identified codes. It stands out as the primary guiding principle in shaping the TOD2 framework to inform a methodological approach for urban planning projects aiming to implement transit-oriented development interventions.

As urban planners often emphasise, no planning project can simply be replicated, as all projects are inherently context-dependent [44, pp. 164–165]. Recognising this dependency is not merely a methodological concern, but a fundamental planning principle. It requires frameworks that are adaptive and grounded in the particularities of place.

Moreover, the coding process also initiated the division of the empirical material into *descriptive* and *interpretive* data. As illustrated in figure 13, an imbalance was observed in the quantity of material between the main categories, as well as between the two case studies. This disparity suggests that both cases are equally relevant, while offering complementary types of insight into the *Local Context* phenomenon. Here, it is perceived as a meaningful reflection of the situated nature of the site conditions. The differing emphases across the two cases do not indicate inconsistency, but rather illustrate how distinct local contexts shape both the conditions of observation and the type of insights that emerge within context-sensitive planning.

This variation may also reflect the researchers' interpretive lenses during the site visits and the existing spatial and socio-cultural characteristics of each case. For instance, in the Hjortshøj case, a significantly larger share of the material was categorised as *interpretive*, marked by a dominance of human elements such as the themes *spatial characteristics* and *livability*. These themes relate closely to the strong sense of community and socially embedded practices perceived during the fieldwork. In contrast, the Harlev case presented a majority of *descriptive* material, which may be linked to the prominence of non-human elements, such as *infrastructural techniques* of its repetition design of the infrastructural programming, which made a stronger impression in the relative absence of human activity and social interactions that was observed.

The six main themes conducted from the Grounded Theory coding process; *infrastructural techniques, transit, the Mobility Hub*

space, spatial characteristics, livability, and experience, can be understood as expressions of how the data were perceived through the researchers' analytical lens informed by the TOD2 criteria. Rather than existing in isolation, these themes operate in relation to each other, each theme highlighting different aspects of the interaction between people, place, and mobility. These themes are to be evaluated against the identified elements, based on actions guided by the code-board categories. This resulted in the formulation of the action-oriented analytical categories: *infrastructure, technologies, spatial elements, historical elements, institutional discourses, socio-cultural elements, and human elements*. These elements emerged through a process of situational analysis grounded in iterative coding. The process synthesised empirical observations with the conceptual dimensions of the TOD2 framework, thereby translating situated actions and contextual conditions into analytically meaningful categories that can guide future planning practice.

6.2 The Grounded Conceptual Framework

Taking a point of departure in the situational map (figure 19) and the complex phenomenon of *Local Context*, the analysis led to the development of a framework that centres this phenomenon and is inherently embedded within the surrounding observational elements. Rather than treating context as a passive setting, the framework embed it within the observational logic of the research, supporting planning practices that emerge from the ground up. This enables urban planners to engage more directly with the specific interrelations between socio-cultural behaviour and infrastructural conditions, and to recognise how these shape mobility behaviour in practice.

The grounded conceptual framework (figure 29) presented here is developed not only as an outcome of inductive coding, but also as a response to the limitations of the existing TOD2 approach when applied in spatially diverse and low-density contexts. While other transit-oriented development frameworks tend to focus on density, they risk overlooking the situated nature of everyday mobility practices and the social and spatial variations that characterise less urbanised environments. In this regard, the framework proposed here, seeks to bridge that gap by foregrounding the complexity of place-specific conditions.

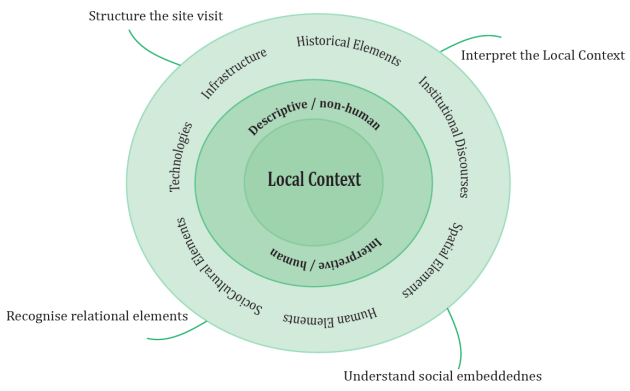


Figure 29: Model of the grounded conceptual framework, enhancing the approach to context-sensitive TOD2 planning.

This framework can guide planners in structuring project phases, from early site analysis to stakeholder engagement and design decisions, by explicitly mapping the relational dynamics between infrastructure, institutions, and local mobility cultures.

It has emerges directly from the empirical material and is shaped through iterative coding, relational mapping, and conceptual reflection. By tracing the situational dynamics across two comparative cases, the analysis has translated localised observations into more generalisable analytical categories. These categories are structured around key elements identified through Clarke's situational matrix (see figure 19), providing a situated and multi-dimensional perspective that informs the framework's application in TOD2 planning.

Drawing on this grounded conceptual framework, the structuring of a TOD2 planning process should involve the following four key considerations that can function as practical planning lenses: (1) Structuring the site visits through a context-sensitive lens, meaning that planners must prepare fieldwork by understanding the site's characteristics, such as scale, demographics, and the presence of local institutions in order to be adequately prepared to engage with local inhabitants and facilitate open dialogue, but still with an open, curious minded. This was, for instance, experienced as a challenge during the site visit in Harlev, as outlined in 5.3 (p. 24). (2) Visiting the site to interpret how the *Local Context* manifests in practice; how mobility is lived and experienced in the present settings, and to recognise and accept the established socio-cultural behaviours. (3) Remaining aware of both human and non-human elements that appear to influence field interpretations. Rather than separating these, the planner must seek to identify and understand their mutual influence and relational dynamics. (4) Contextualising mobility behaviour as socially embedded and normatively structured patterns of everyday life. These behaviours should not be considered 'wrong' but rather shaped by a combination of influencing factors ranging from infrastructural spatial morphologies to socio-cultural practices and institutional structures. This is the setting in which planners gain critical insight into which factors are open to intervention in order to encourage more sustainable transport choices. By grounding interventions in observed dynamics, such as the lack of bicycle racks at bus stops in Harlev or the community-driven spatial qualities in Hjortshøj, planners can design interventions that resonate with local mobility practices rather than impose abstract transit-oriented development norms.

This framework is not a fixed protocol to be followed, nor does it offer a universal solution to planning challenges. It should rather be understood as a reflective and transferable structure, one that enables context-sensitive interventions within the TOD2 concept. It is designed as a generalisable tool to support planning processes that emerge from the ground up, grounded in empirical observations and shaped by local complexity.

Instead of prescribing a definitive answer to a given intervention, the framework offers a substantive guide for initiating a grounded planning process. The central aim is to support planners in making sustainable transportation an equal option for all inhabitants, based on their specific contextual circumstances. In doing so, it operationalises the broader goals of TOD2, as equal accessibility, and modal shift through a planning logic that is adaptive and locally informed.

The framework is structured around four key planning considerations: (1) contextual structuring of site visits, (2) site interpretation, (3) situated mobility behaviour, and (4) relational perception. These are presented as interconnected orientations that together provide a practical entry point into applying the grounded conceptual framework. Each element reflects a conceptual commitment to understand mobility behaviour, not in isolation, but as the outcome of dynamic interactions between human and non-human elements, shaped by spatial, infrastructural, and cultural conditions. As such, the framework functions both as a conceptual lens and a methodological tool for planners seeking to integrate urban identity considerations into Mobility Hub planning.

6.3 Extending the Grounded Conceptual Framework through Mobility Hub Typologies

Furthermore, this grounded conceptual framework does not stand alone. Towards the end of the analysis, four categories were established, to interpreted Mobility Hub typologies; *Urban Context, Mobility Hub Typology, Key Challenges*, and *Development Potential*, which serve as a generalisable supplementary framework to the context-sensitive TOD2 planning. They serve as an interpretive framework that facilitate the identification of site-specific conditions, contextual challenges, and transformation potentials for each Mobility Hub, thereby enhancing the framework's applicability across varied spatial and socio-political settings. Thereby, they exist as supporting tools for decision-making, that translate abstract mobility goals into targeted design and policy interventions.

This constitutes an equally important component of the knowledge foundation that forms the basis for context-sensitive TOD2 planning interventions. It also provides a bridge for situating the insights generated through the site visits, lending empirical substance to the framework and laying the groundwork for identifying which elements influence the *Local Context* and for determining the focal points of potential interventions. The four typology categories hereby contribute to contextualising the knowledge, generated through the grounded conceptual framework, as outlined in the first two sections of the analysis (section 5.2 and 5.3).

It is important to emphasise that the situational analysis and the identification of Mobility Hub typologies are also foundational components of the broader conceptual analysis, serving to frame the methodological process through which the final grounded conceptual framework and the four typology categories have been developed. It also contributes to the production of knowledge on how planners can approach TOD2 in a context-sensitive manner that enable more effective integration between urban space and Mobility Hubs, and ultimately supporting a modal shift from car dependency towards sustainable modes of transport.

6.4 Methodological Discussion

The Grounded Theory approach has played a central methodological role in shaping this research, significantly influencing both its analytical orientation and process of conducting empirical data. As a result, the empirical material has taken on the character of a meta-reference, offering methodological insight into how other planners might engage with a similar research process, rather than functioning primarily as a source of site-specific knowledge about the two comparative cases. This analytical focus underscores the reflexive and conceptual ambitions of the research, where the cases serve less as objects of analysis and more as entry points into broader questions of mobility planning and contextual complexity.

A potential limitation of this approach is the lack of close engagement with the empirical material in the core analysis. Notably, it means that the analysis does not engage in depth with the empirical material to draw case-specific conclusions based on thematic categorisations. It is important to clarify that this was an intentional decision, as the aim was not to investigate the specifics of the individual cases in isolation, but rather to generalise across both case studies, using the identified elements as a foundation for articulating a conceptual framework for context-sensitive TOD2 planning.

6.5 Key Implications for Context-Sensitive TOD2 Planning

The analytical orientation also enabled the TOD2 categories and guidelines to influence the interpretive lens of the research, allowing the framework to be shaped not only by local observations, but by a broader planning perspective oriented towards sustainable mobility and spatial complexity.

An important implication of this framework is its ability to account for the scale sensitivity and contextual capacity of different nodes. Rather than assuming uniform conditions across urban, suburban, or rural settings, the framework supports an adaptive planning strategy. By linking Mobility Hub typologies with site-specific characteristics, such as institutional presence, socio-cultural composition, and infrastructural complexity, TOD2 planning can be adjusted to local capacity without compromising TOD2 goals, such as equal accessibility, modal shift, and the integration of Mobility Hubs [33]. This flexibility is particularly important in low-density areas, where conventional TOD strategies based on standardised spatial criteria such as density and distance to transit, which fail to achieve their intended outcomes [33, pp. 54-55].

Closely related to this is the need to acknowledge the relational agency of both human and non-human elements in shaping mobility environments. The framework developed here challenges fixed understandings of equal accessibility as solely a matter of spatial availability, and instead approaches it as a relational outcome shaped by the interplay of *infrastructural, institutional, and socio-cultural* dynamics. By foregrounding these relations, TOD2 becomes not only a spatial intervention, but a dynamic, context-sensitive strategy aimed at structural inclusion and sustained modal shift.

Although the framework is grounded in a qualitative, interpretive approach, its structure support urban planning practice as a strategic tool for decision-making and civic engagement. Rather than serving as a strict model, it offers a flexible orientation that enables planners to facilitate dialogue between technical experts, policymakers, and local communities. By establishing visible relations between infrastructure, institutions, and everyday mobility practices, the framework can inform participatory processes in early-stage planning, as well as the political priorities. This results

in a flexible framework that enables the application of TOD2 at broader regional scales, due to its adaptable approach to context and its conceptualisation of Mobility Hubs.

Moreover, the situational mapping method developed through this article can serve as an analytical support tool for planners and other stakeholders as well. It helps reveal where context-specific barriers or opportunities for shifting mobility behaviour may be situated, ensuring that interventions are not only technically robust but also socially embedded.

7 CONCLUSION

This conclusion aims to synthesise the findings from the four supporting questions and provide an answer to the research question:

How can TOD2 as a context-sensitive planning strategy, support the shift of commuters from car dependency to sustainable modes of transport, meanwhile ensuring equal accessibility in spatially diverse municipal contexts?

This article has explored how Transit-Oriented Development 2 can be applied as a context-sensitive planning strategy to promote a modal shift from private car dependency to sustainable modes of transport, while ensuring equal accessibility across diverse spatial contexts, aiming to plan for future carbon-neutrality and quality of life. Through an ethnographic and grounded informed methodology, supported by place-specific fieldwork in the villages Hjortshøj and Harlev, located in the outskirts of Aarhus Municipality. The article has contributed to the ongoing refinement of TOD2 as a sensitive planning tool adaptable to varied urban settings.

Building upon the empirical analysis comparing the two villages, this article demonstrated the need for differentiated and locally adapted planning solutions. In both contexts, a modal shift cannot be accomplished through infrastructure development alone. Instead, planning must account for the interplay between everyday practices, cultural perceptions, and spatial characteristics, as the research has identified seven situational elements: *infrastructural techniques, transit, the Mobility Hub space, spatial characteristics, livability*, and *experience*, that collectively inform the the central phenomenon - *Local Context*, which impact mobility behaviour.

Central to these findings is the understanding that planning for equal accessibility does not emerge through standardised processes, but rather through reflexive planning that is sensitive to local diversity. The grounded conceptual framework introduces a planning structure of four orientations: (1) contextual structuring of site visits, (2) site interpretation, (3) situated mobility behaviour, and (4) relational perception, in relation to examine the situational elements. These four phases are intended to establish a solid foundation for understanding the *Local Context*, which is essential for conducting relational analyses of urban forms and civic norms locally. This contextual awareness is critical for facilitating planning interventions that are more likely to align with embedded institutional norms, and thereby fostering long-term anchoring of sustainable mobility within these social structures. In this context, planners are required to adopt an open-minded towards the observed interrelations among the focal elements, consciously setting aside preconceived assumptions. It provides planners with a method for designing interventions that emerge from, and respond to, local complexity. When combined with typological analysis, this framework enables a reflexive and adaptive planning process that support planning interventions for modal shift without imposing uniform solutions.

An important contribution of this article is the development of the typology of Mobility Hubs, allowing planners to classify hubs according to their *Urban Context, Typology, Key Challenges, and Development Potential*. It provides a decision-making supporting tool for localising TOD2 strategies, particularly in low-density areas where densification is neither feasible nor desirable. The typology also reinforces the need for equal access to both active modes of transport and public mobility services across the municipality, particularly in areas beyond the reach of high-frequency transit.

The research further responds to the emerging policy context of Aarhus Municipality, where Mobility Hubs are positioned not only as transit nodes but as multifunctional spaces. Along with the emphasis on TOD the planning strategies also link to the 15-minute city concept and supported by Park and Ride infrastructure. This multi-faced conceptualisation is in this research supported by the extended node-place model, integrating a third design dimension, to evaluate how urban form and spatial quality influence behaviour. Drawing on Jan Gehl's 12 quality criteria for human-scale design, the research emphasises how the built environment can guide users toward sustainable choices by design safe, inviting and intuitive urban spaces.

In response to the research question, three key takeaways from the article is formulated:

A) **Cultural diversity must be acknowledged as a shaping force**. Urban mobility is socially embedded, and interventions aimed at changing behaviour must be informed by the local narratives of everyday life. The grounded conceptual framework provides a processual structure for interpreting context in ways that support equal accessibility across diverse urban environments.

B) **Planning interventions must be grounded in social science**. The research found that the success of integrated mobility and urban planning strategies depends on how they resonate with the cultural and social dynamics of specific communities. Ethnographic insights are not simply descriptive but provide a strategic foundation for creating interventions that align with how people understand and use mobility in their everyday lives.

C) **TOD2 remains a valid planning framework** but its success depends on its contextual adaptation. Not all Mobility Hubs serve the same function or operate under the same conditions, and the typology introduced in this article provides guidance for identifying which themes and criteria of the TOD2 framework that are most relevant in a given context. This enables planners to move from abstract principles to place-specific strategies that foster behavioural change and encourage modal shifts.

In conclusion, TOD2 supports a strategic reorientation of planning practice where sustainable mobility is not only an infrastructural issue, but depending on social and spatial identities. By embracing multimodality, equity, and local complexity, context-sensitive TOD2 planning offers coherent frameworks for developing Mobility Hubs that enhance quality of life, reduce CO_2 emission, and foster more justice in sustainable urban futures.

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