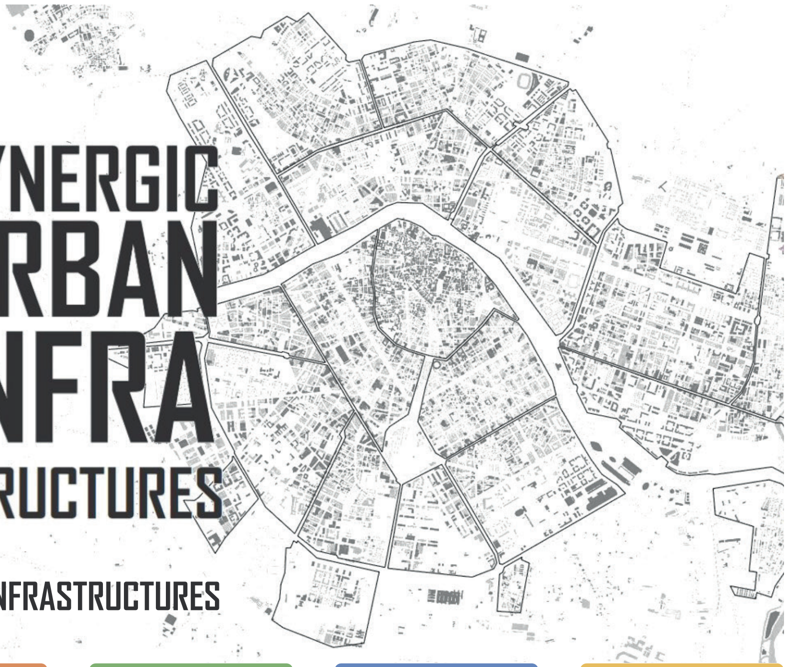
VLC SYNERGIC URBAN INFRA STRUCTURES



VALENCIA SUMMER SCHOOL ON SYNERGIC URBAN INFRASTRUCTURES

Editors: Juanjo Galan Vivas | Luis Bosch Roig

To cite this publication please use the following reference:
Galan Vivas, Juanjo and Bosch Roig, Luis (editors) (2024). *Valencia Summer School on Synergic Urban Infrastructures*. Valencia: edUPV. DOI: https://doi.org/10.4995/2024.677901

Editors
Juanjo Galan Vivas
Luis Bosch Roig

Authors
Juanjo Galan Vivas
Mrudhula Joshy
Stefano Salata
Fabio Bayro Kaiser
Christian Larisch
Alena Cohrs
Carolina Pacchi
Christoph Wessling
Maciej Lasocki
Kinga Zinowiec-Cieplik
Luis Bosch Roig
Julia Deltoro Soto
Christa Reichter
Adolfo Vigil de Insausti

Edited by: edUPV, 2024
Ref.: 6779_01_01_01

Graphic design and layout
Júlia Martínez Villaronga
Juanjo Galan Vivas

ISBN: 974-84-1396-254-2 (printed version) ISBN: 978-84-1396-255-9 (electronic version)
DOI: https://doi.org./10.4995/2024.677901

If the reader decects a mistake in the book or wishes to contact the authors, he can send an email to edicion@editorial.upv.es

TABLE OF CONTENTS

2.5_MOBILITY INFRASTRUCTURES: PRINCIPLES, DIAGNOSIS AND TOOLBOX IN VALENCIA

Christian Larisch | Research Associate, RTWTH Aachen University
Fabio Bayro Kaiser | Research Associate, RTWTH Aachen University

2.5.1. Introduction

Mobility infrastructure is an integral part of cities. In the past, transport connections were often catalysts for the emergence of cities, but, more recently, transport infrastructure - and the opportunities it offers – has contributed significantly to the further development of urban structures. On the one hand, as a physical element in the form of major roads and railways, the significantly increased amount of space required for parking, and, on the other hand, in a more subtle way, through technological advances, increasing micro-logistics or a greater emancipation from the location within the urban fabric. At the same time, the greater range of vehicles and shorter travel times have allowed cities to expand and become more connected to their surroundings. Urban development and mobility infrastructure are inextricably linked. On a smaller scale, the existing mobility infrastructure influences the living environment, our everyday journeys and, last but not least, the local quality of life. Thereby, the importance of active mobility (walking and cycling) and proximity is becoming increasingly important in the professional and public discourse.

2.5.2. Methodological approach

The different backgrounds and levels of knowledge of the students had to be considered during the online phase. In order to provide the mobility team with an overview of key concepts and, at the same time, to prepare them for the upcoming analysis of the Valencia case study, the students were asked to analyze several pre-selected case studies and then present them to the team. The objective of the first week was formulated as follows:

> "Develop a basic understanding of different planning/mobility concepts and principles and their impact on cities and neighborhoods, based on the exploration of different good practice case studies."

The selected case studies included good practice examples from different European countries. The idea was to convey different approaches (both in terms of scale and strategy) and different thematic focuses in order to provide a more comprehensive overall picture. However, all the case studies share the objective of reducing car use, improving quality of life, and putting people back at the center of urban development.

2.5.3. Case studies

1. Paris, France: The 15-Minute City
2. Copenhagen, Denmark: "Copenhagenize"
3. Pontevedra, Spain: Pioneer of car free city centers
4. Barcelona, Spain: Superblocks
5. Houten, Netherlands: Holistic car- and pedestrian oriented design
6. Vienna, Austria: Redesigning *Mariahilfer Straße*

In order to better structure the results, the students were given different objectives and themes to analyze the case studies. These included, among others:

- Spatial and strategical context
- Objective of your case study + key implemented actions including timetable
- Push & pull factors (e.g. parking management & comfortable cycle lanes)
- The strategic implementation
- Space requirements & dealing with limited public space
- The impact of the project (for instance, on modal split or life quality)
- The role of e-mobility
- The role of settlement structures (density, typologies, land use, etc.)
- Possible synergies with other infrastructures

There were three guiding questions that the students had to address in their case studies:

- How are the three basic objectives of mobility planning addressed? (avoiding traffic, shifting traffic (to more sustainable modes) and reducing emissions)
- What makes your case study special and what design principles and potentials do you derive for future projects?
- What might limit the realization or successful transfer of ideas in general?

An interim seminar was organized to present the results of the analysis of case studies. During the 15-minute presentations, the students were urged to identify strategies and principles that could be relevant to the pilot area in Valencia. After the presentations, the case studies were discussed and important aspects were emphasized by the tutors (also in the light of the upcoming task in Valencia). Through the case studies, the students were exposed to different measures and strategies for different scales, both for public space design and for the consideration of the overall city structure. In addition, this approach helped to sensitize the students to different topics and issues, which were then reflected in the definition of proposals (see section 5).

2.5.4. City of Valencia

The detailed analysis of case studies led to numerous questions regarding the status quo in the city of Valencia. The analysis this city was based on a large amount of data and documents that had already been gathered in the run-up to the Summer School. This was supplemented by the students' own research and the analysis of geodata (e.g. for the calculation of isochrones or travel times).

The compact, dense structure of the city center provides good conditions for sustainable and active mobility. Many points of interest are spatially clustered due to the existing building structure, resulting in shorter distances (<15 minutes walking) and fewer incentives to use the private car. This is also reflected in the high share of walking and cycling (53%) in the city's internal modal split. This is expected to increase to 62% by 2030.

Valencia has a well-developed network of cycle paths and a high level of accessibility for pedestrians in many areas. It is noteworthy that walking dominates for journeys of less than 5 km. Here, cycling accounts for only 4% of journeys made. Despite the ongoing development of cycling infrastructure, the modal split remained relatively constant between 2009 and 2017.

In addition to its compact urban structure, Valencia also has a good public transport network. Besides numerous bus lines, the city is served by 9 metro lines (see Figure 2.5.1). While railways connect the different areas of the city, the bus system provides a more refined service. The result is a dense public transport network. Over 90% of residents can walk to a bus stop in less than 10 minutes, and over 80% can walk to a metro station in less than 15 minutes.

Due to the importance of Valencia, there are numerous connections to the outskirts. The regional rail network is characterized by many radial connections linking the surroundings with the city center. While there is a good connection to the city center, the connections between the radial axes are poorly developed (see Figure 2.5.1.).

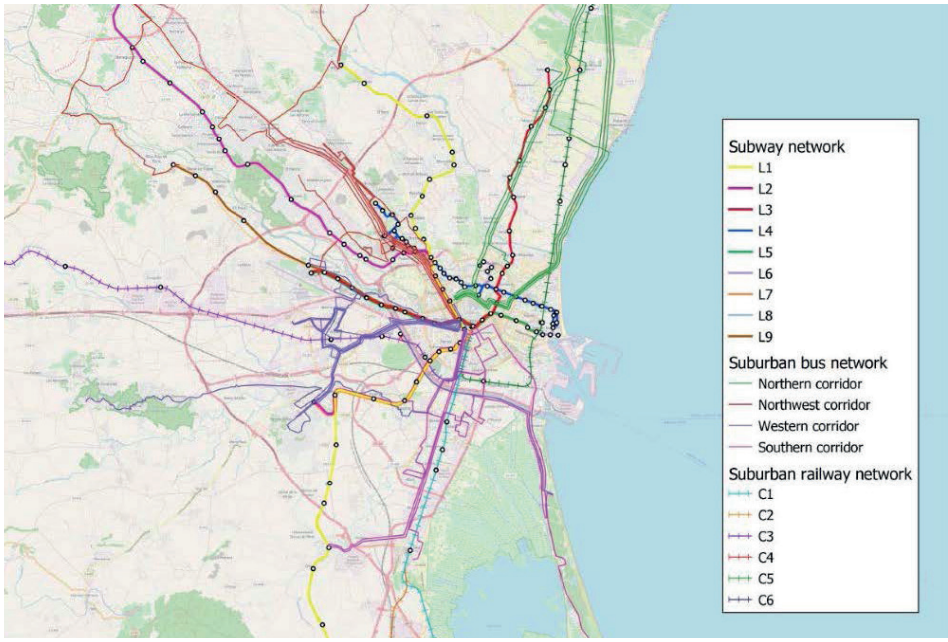


Figure 2.5.1: Public Transport Network of Valencia (Source: Gerwenat, Gadkar, Polyakova, Chen, Farkas, & Zhu, 2023)

Despite the numerous radial lines, Valencia's external modal split is still heavily dependent on private motorized transport. The decline in density and the increasingly dispersed settlement structure in the metropolitan area play a key role on this.

By 2030, public transport is expected to account for 55% of external trips, up from 22% in 2013.

The students have categorized different types of districts/urban elements in terms of their mobility and infrastructure requirements (see Table 2.5.1).

This overview not only served to reflect on the different mobility needs and the strong interaction between space and mobility, but also laid the foundation for deriving conceptual ideas for the transport infrastructure in the pilot site.

Type	Transport Hubs	Central Business District	Residential Areas	Recreational and Entertainment Zone	Industrial Zones	Educational Institutions	Medical Facilities
Example	Mercat Central, Aeropuerto	Benimaclet	Ruzafa	Jardines del Real, Marítimo	Poligono Vara de Quart	Blasco Ibáñez	Hospital Clinic Universitari
Requirements	Access to various modes of transport and good connections between the modes	Accessible and convenient public transport	Adequate roads, sidewalks and cycling lanes	Accessible and convenient public transport	Efficient transportation network	Safe pedestrian and cyclist routes and a well-organized PT network	Good accessibility for ambulances and visitors (PT access)
Primary travel purpose	Mixed	Commuting	Commuting and Leisure Traffic	Leisure traffic	Freight and logistics traffic	High traffic volume during specific times of the day	(Leisure) traffic

Table 2.5.1: Urban areas according to their mobility and infrastructure requirements (Source: Gerwenat, Gadkar, Polyakova, Chen, Farkas, & Zhu, 2023)

2.5.5. Pilot site

The pilot site to the south-east of the city center is currently spatially isolated. There are numerous spatial barriers (river, motorway, railway line) to the adjacent neighborhoods. Only three access points to the study area could be identified (Figure 2.5.2). This particularly affects pedestrians and cyclists. However, the proximity to Turia Park - as one of the most important axes for active mobility - is a strength of the area.

The study area itself is connected to the metro system and to the bus network at various points. The students investigated the travel times to different central points in Valencia (Table 2.5.2).

	Car	Public Transport	Bike
City Center	22 Min	40 Min	19 Min
Politécnico VLC	10 Min	34 Min	12 Min
Beach	6 Min	33 Min	9 Min

Table 2.5.2: Travel Times from the Pilot Site (Source: Google Maps)

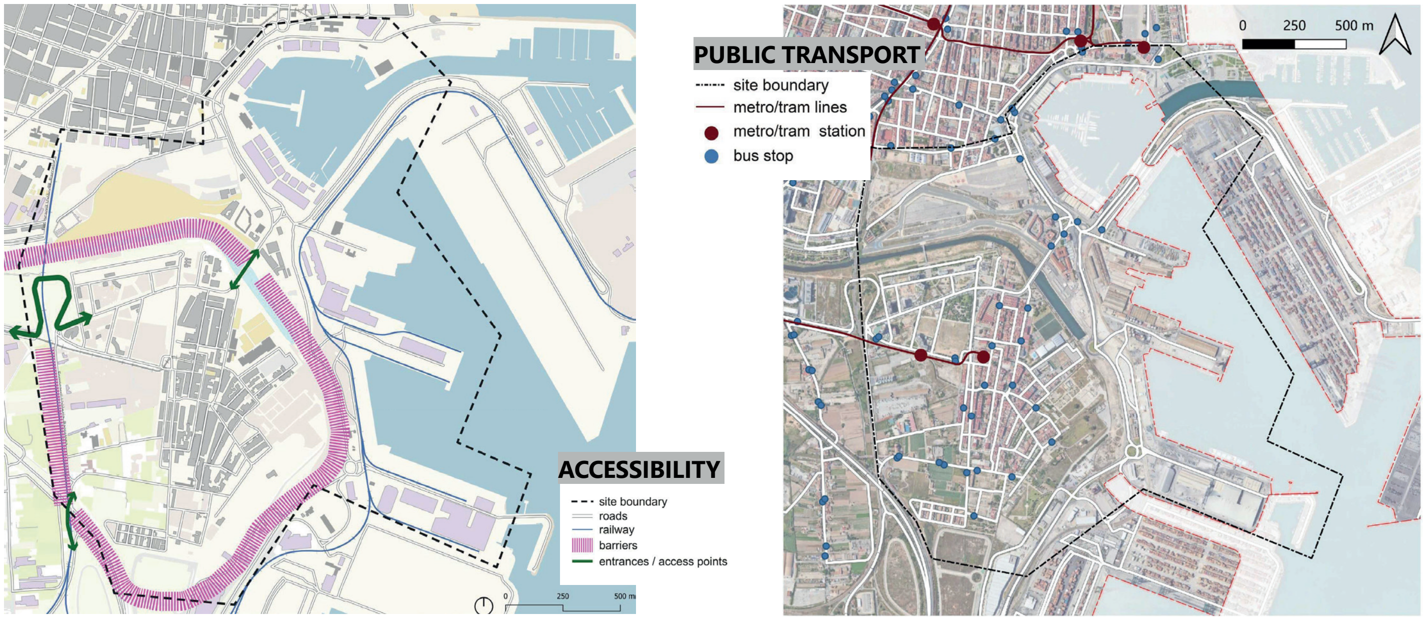


Figure 2.5.2: Accessibility and Public Transport Network of the Pilot Site (Source: Gerwenat, Gadkar, Polyakova, Chen, Farkas, & Zhu, 2023)

Bicycles are proving to be particularly competitive with cars here. Public transport connections to the university and the beach are currently in need of improvement. In terms of design, the students observed that the streets in the study area are heavily dominated by motorized traffic, with little space for pedestrians and cyclists.

Based on these findings and the analysis of good practice examples, the following key aspects for the design phase in Valencia were formulated:

- Accessibility
- Speed restrictions
- Materials
- Cycle routes
- Shared space
- Public transport
- Smart solutions
- Bike and car sharing

2.5.6. Toolbox development

Based on the findings, the students developed a mobility toolbox. This toolbox addressed general and specific objectives and formulated qualitative and quantitative approaches for a detailed analysis of the status quo. Intersections with other infrastructure layers were also outlined.

Goal 1: Sustainable modal split

The modal split should be balanced between cars, bicycles, pedestrians, and public transport. To achieve this, a dense public transport network needs to be developed and a variety of transport options should be available. Mobile stations and sharing services were identified as an important urban building block. Furthermore, the cost of sustainable modes of transport should be affordable for all and the design should be inclusive. Ensuring a sense of security for all target groups is emphasized (Table 2.5.3).

Goal	Aspects	Measurement of status quo	Tools	Relation to other infrastructures
Sustainable Modal Split	**Accessibility**	How many people have access to the public transport system within 150 m?	**Have at least one accessible public transport system within 150m.**	
		How many different networks of modalities are there?	**Providing more options, developing micro-mobility, car/bike-sharing, jeli station**	Social infrastructure
		Costs	**Have a balance between affordable public transportation costs & usage of sustainable energy**	Social Infrastructure
	Sustainability	Ratio of Pedestrian – cars – bikes – public transport	**25/25/25/25**	
	Time	How much time differences do we have in-between the different modals?	**Have a balanced network, emission free networks should be more attractive**	
	User Groups	Who is Using the different networks?	**Create a safe space for all categories, including women, elder generation, kids, disabled etc**	Social Infrastructure

Table 2.5.3: Overview goal 1 (Source: Gerwenat, Gadkar, Polyakova, Chen, Farkas, & Zhu, 2023)

Goal 2: Strong public transport network

Similar to the sustainable modal split, a dense public transport network is the backbone of a more sustainable urban mobility system. Furthermore, travel and transfer times need to be optimized in order to keep public transport as competitive as possible with private transport. In addition to travel costs and ticketing models, the students also highlighted soft factors such as safety, comfort (e.g. Wi-Fi and charging facilities) and accessibility. In addition to traditional forms of service, ride-sharing concepts were also mentioned as a way to complement the public transport system (Table 2.5.4).

Goal	Aspects	Measurement of status quo	Tools	Relation to other infrastructures
Strong Public Transport Network	Speediness	Average travel time, On-time performance	**Calculating departure and arrival times and defining acceptable thresholds**	Energy infrastructure
		Average frequency and waiting time	**Identifying discrepancies for the actual and estimated travel time**	Energy infrastructure
	Convenience	Number of shared vehicles	**Planning more integrated modes of travel**	Blue and Green infastructure
		Coverage percentage of transport network	**Making every (key) area well-connected**	Social and Housing infrastructure
	Security and Comfort	Incident rate, Number of vandalism and crime	**Implementing more security measures**	Social inrastructure
		User Experience	**Providing amenities like Wi-fi, charging station**	Energy and Social infrastructure
	Expense	Ticket fees	**Evaulating and adjusting the fare structure (Regular commuters, student, seniors)**	Social infrastructure
		Tourism	**Ensuring public transport is the most desirable option for (Transport Pass)**	

Table 2.5.4: Overview goal 2 (Source: Gerwenat, Gadkar, Polyakova, Chen, Farkas, & Zhu, 2023)

Goal 3: Attractive walkable network

An attractive pedestrian network is based on several measures. On the one hand, there is the provision of wide footpaths and the implementation of traffic-calmed zones, as well as the reduction of driving speeds - especially in the inner-city neighbourhoods. Here, too, the aim is to minimize through traffic. The redesign of the street space should strengthen human interaction on the street and increase the safety of all participants in traffic. It is important to ensure that there is sufficient shade in the summer. The students also stated that the benefits of walking should be communicated more clearly (Table 2.5.5).

Goal	Aspects	Measurement of status quo	Tools	Relation to other infrastructures
Attractive Walkable Network	**Diversity**	Density of Opportunities/Activities for human social interaction	**Pacification of internal roads**	Social Infastructure
		Ease of walking (Ratio of faciltation & obstructions)		
	Comfort	Percentage of shaded areas	**Expand areas devoted to pedestrians on streets**	Social Infastructure Green Infastructure
		Width of sidewalk		
	Safety	No. Of crosswalks/intersections around educational buildings	**Safe mobility for children**	Social Infastructure
		No. of streets with reduced vehicle speed	**Implement 30 zones**	Housing Infrastructure
	Convenience	Tracking pedestrian usage on internal streets	**Reduce external vehicles in residential areas by rerouting traffic**	Housing Infrastructure
		Percentage of people choosing to walk – before and after	**Publicise Benefits of Walking**	Social Infastructure

Table 2.5.5: Overview goal 3 (Source: Gerwenat, Gadkar, Polyakova, Chen, Farkas, & Zhu, 2023)

Goal 4: Attractive bicycle network

The requirements for an attractive cycle network are similar to those for an attractive pedestrian network. The different types of cycle lanes need to be emphasized for their variety of capacity and possible speeds, while still being safe for all users. In addition, more infrastructure is needed, such as nearby bicycle parking or services. The design of multimodal hubs should also encourage easy transitions from cycling to public transport and vice versa. As with paths, attractive routes, such as through parks or along blue infrastructure, can attract more cyclists and improve the cycling experience. Signposts can also help, especially in dense urban areas (Table 2.5.6).

Goal	Aspects	Measurement of status quo	Tools	Relation to other infrastructures
Attractive bycicle network	**Convenience**	Coverage percentage of parking space (Length of cycling paths/number of parking spots)	**Parking Space**	Housing infrastructure Social infrastructure
		Coverage percentage of cyclist service facilities (Length of cycling paths/number of service points)	**cyclists service**	Energy infrastructure Social infrastructure
		Riding accessibility to metro and bus stops	**Transition possibility**	
		Condition of a cyclist hitting a red light	**Riding-friendly traffic light**	
	Diversity	Coverage percentage of green interfaces in bike lanes	**Green interfaces**	Green infrastructure
		Coverage percentage of blue interfaces in bike lanes	**Blue interfaces**	Blue infrastructure
		Coverage percentage commercial interfaces in bike lanes	**Commercial interfaces**	Social infrastructure
	Safety	Occupation condition of road space by cycling and driving	**Different types of cycling lanes**	
		Percentage of number of two-, three-, and four-lane roads	**Number of cycling lanes**	

Table 2.5.6: Overview goal 4 (Source: Gerwenat, Gadkar, Polyakova, Chen, Farkas, & Zhu, 2023)

Goal 5: Reduce the number of cars

At the forefront are push & pull actions. On the one hand, there is the provision of different sharing schemes and a pedestrian and cyclist first approach regarding all actions taken. This is also reflected in the safe and convenient design of the necessary infrastructure. On the other hand, there are speed limits and filtered permeability for streets, neighborhood garages, car free zones and parking management. A key component for both sides is the street network layout, which enables and promotes different strategies (e.g. Super Blocks) (Table 2.5.7).

Goal	Aspects	Measurement of status quo	Tools	Relation to other infrastructures
Attractive Car Sharing Systems (Non-Traffic	**Convenience**	Number of shared vehicles	**In each neighborhood there's a carsharing point and charging piles**	Housing & Energy & Social infrastructure
		Number of parking space	**Use neighborhood's garage**	Housing & Social infrastructure
		Traffic light timing	**Improvement of the traffic signal timing on individual roads**	Social infrastructure
	Expense	Parking fees	**Parking fee discount for shared vehicles**	Social infrastructure
	Speediness & Traffic	Separating slower and faster modes of transport	**Use span to separate slower and faster modes**	
			Speed limitation in some roads (Filtered Permeability)	
	Safety	Integrated with pedestrians and cyclists	**Pedestrian and cyclist first rule**	Social infrastructure
			Car free zone	Housing & Social infrastructure
			Transition zone to other modals	Housing & Social infrastructure

Table 2.5.7: Overview goal 5 (Source: Gerwenat, Gadkar, Polyakova, Chen, Farkas, & Zhu, 2023)

Goal 6: Sustainable and eco-friendly cargo & delivery systems

In addition to a strategic framework that includes emissions monitoring, route optimization and certification schemes, the integration of multimodal freight terminals (on a larger scale), micro-hubs (on a smaller scale) and the strengthening of environmentally friendly last-mile delivery models are key to making freight transport more sustainable. Innovations such as drones or autonomous deliveries should also be considered (Table 2.5.8).

Goal	Aspects	Measurement of status quo	Tools	Relation to other infrastructures
Sustainable and eco-friendly Cargo & Delievery Systems	**Sustainability**	Number of certified companies & Number of emissions from delivering	**Green Certification System / Emission Monitoring**	Energy
		single-use plastic waste	**Eco-Friendly Packaging Materials**	
		usage of sustainable delivery methods	**Behavioral Mobile Apps**	Social
	Efficiency	travel time, fuel consumption	**Smart Route optimization**	
		travel time, fuel consumption	**Multi-Modal Freight Terminals**	
		delivery time, cost, and emissions	**Last-Mile Delivery Robotics and Drones**	

Table 2.5.8: Overview goal 6 (Source: Gerwenat, Gadkar, Polyakova, Chen, Farkas, & Zhu, 2023)

2.5.7. Synergies with other infrastructures

The emergence of e-mobility plays a key role in the search for synergies with energy infrastructure. The upcoming need for charging infrastructure (cars and bicycles) needs to be addressed and should be considered in any planning project. Existing electricity grids, especially at medium voltage level, offer a good opportunity to implement fast charging infrastructure in public spaces.

Waterways are part of the transport network, especially in coastal cities. Although their potential for public transport is somewhat limited, they can play a key role in logistics. In addition, blue infrastructure offers great opportunities for attractive cycling routes through the city or along the coast (for commuting or recreation).

Green and mobility infrastructure are essential parts public spaces and can easily create synergies, making walking and cycling more attractive, absorbing air pollutants from adjacent streets, cooling public spaces, or enhancing local biodiversity. Mobility infrastructure can always be enriched with green space, be it grassed tracks or green roofs on bus stops, for instance.

Accessibility is key to social infrastructure. Whether it's a safe journey to school or the ability to visit public facilities with a low threshold. Mobility ensures social participation and inclusion and should always be considered when planning social infrastructure. Here, low-cost alternatives contribute significantly. In addition, the appropriate design of public spaces can also strengthen social interactions in neighborhoods, for example through traffic-calmed areas.

Housing infrastructure and mobility patterns are directly linked. Housing ensures the sustainability of mobility infrastructure, especially public transport (more users, more revenue, and better service, among others). Density plays a central role and should not be underestimated in its impact on an attractive public transport network. In particular, mixed-use areas can provide short travel distances and help reduce car dependency. Bicycle parking and good pedestrian accessibility can improve the local quality of life.

2.5.8. Reflection

Activating the topic by conducting short case study analyses proved to be a sensible approach for the mobility infrastructure. Even with just a few meetings, it was possible to provide the students with a lot of information in a short timeframe. The formulation of key questions was essential for an efficient approach and to ensure comparability between different case studies. In addition, the students could already become aware of possible synergies between the various infrastructures through a targeted discussion after each presentation.