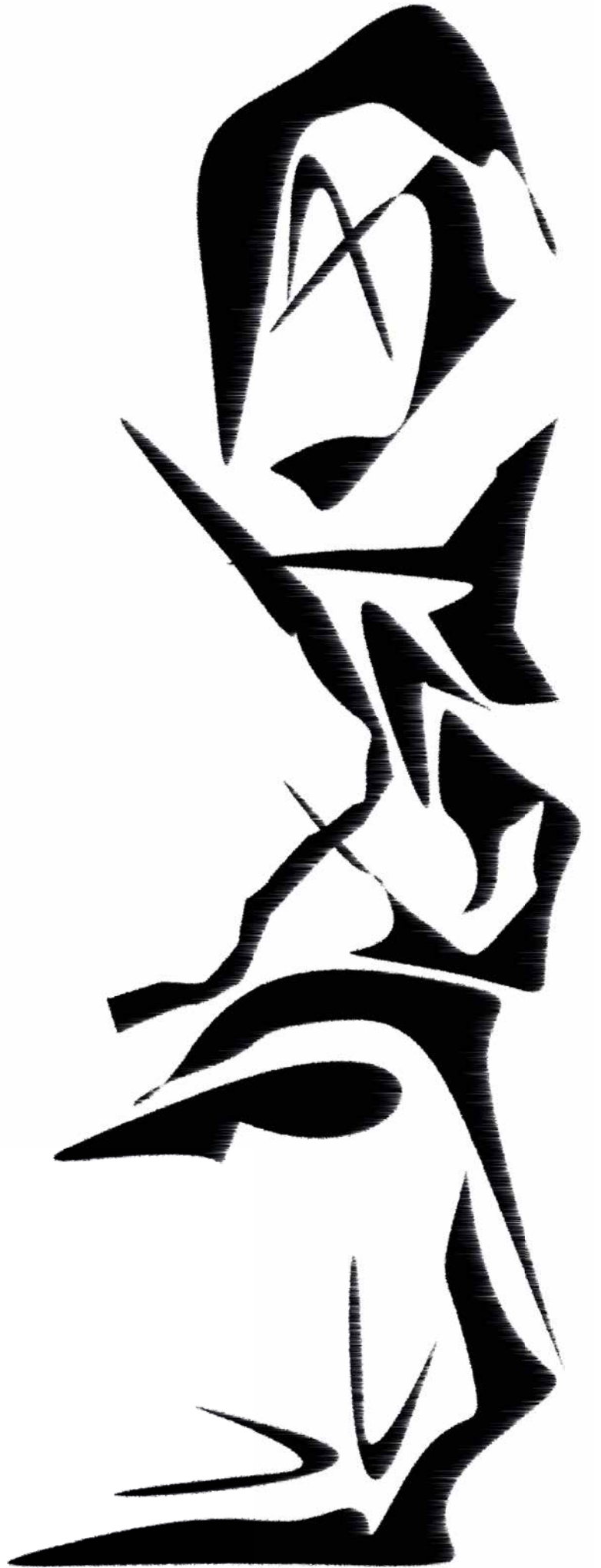


Gökçe Demiral
Research Booklet



content

research booklet

+ dynamics between space and time | aachen | msc thesis

+ resilience and urban structure | weizhou | research

+ mapping the structural changes | nrw | research

+ eltis sump report | izmir | report

+ resources

for more information about the projects, please contact me!

CV

gokcedemiral.com
architect | urban planner | designer



education

master of science | transforming city regions | rwth aachen university | aachen | 24'
bachelor of arts | architecture, minor in business | mef university | istanbul | 19'

skills

software | rhinoceros, grasshopper, vray, autocad, revit, adobe suite, qgis, m. office
language | turkish, english, german
soft | model making, group work, project management, mediating, research and writing

interests

sustainable design, neuro-architecture, urban complexity, stage and curatorial design, placemaking

studios | workshops | exhibitions | congresses

academic participant | aesop | aachen | 24'
member | isocarp | brussels | 22'
contributor | biennale der urbanen landschaft | g.kirchen | 22'
contributor | vereniging deltametropool | rotterdam | 21'
instructor | fada | istanbul | 19'
contributor | fondazione la biennale di venezia | venice | 18'
contributor | fada | istanbul | 16'-18'
volunteer | whatabout | istanbul | 16'
volunteer | architecture for all | mugla | 15'

work experience

mobility consultant | rupperecht consult | köln | 23' - 24'
architect, urban planner | söğütlü municipality | sakarya | 20'-21'
assistant curator | uniq gallery | istanbul | 19'
junior architect | yerce-zaas architecture | istanbul | 18'-19'
director | yet-gen academy | istanbul | 15'-16'
teaching assistant | mef university | istanbul | 15'-16'

internships

editorial | xxi architectural magazine | istanbul | 18'
construction | podima architecture | istanbul | 17'
office | sebastiano adragna architectti | catania | 16'
in-school | mef university | istanbul | 15'

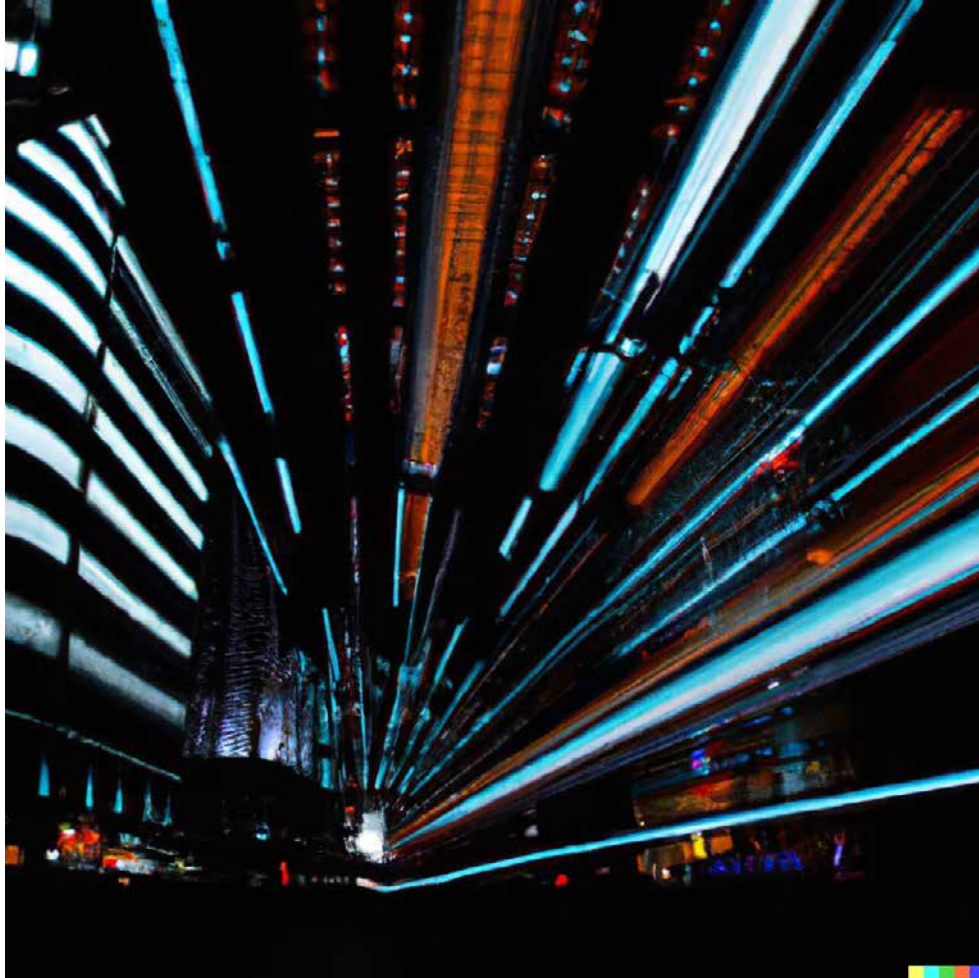
awards

1st prize | tasteful city | isocarp | 22'
3rd prize | symbioscape | lala.ruhr | 22'
finalist | dwelling | arched | 17'
special | a bridge to the dreams | arched | 15'
nominated | a bridge to the dreams | national arch. awards | 15'

dynamics between space and time | msc thesis - aachen

rwth aachen university | prof. axel sowa, prof. stefan böschel | 2023

#rhythmanalysis, campus planning, time perception, public space



“Dynamics Between Space and Time,” explores the relationship between rhythms and the perceived spatio-temporal quality of urban spaces, with a focus on campus environments. By studying RWTH Aachen University in Germany, the research investigates how the rhythms of daily life and temporal factors influence users’ experiences in public spaces. Using both qualitative and quantitative methods, the project employs rhythmanalysis to assess whether the perceived temporal quality aligns with the actual rhythms of the campus.

The goal is to uncover insights into how temporal arrangements affect the quality of place, aiming to make campus spaces more inclusive, diverse, and flexible. This research has broader implications for urban design, potentially informing strategies that can lead to more vibrant, dynamic, and socially sustainable communities in other contexts.

Interactions between temporality, design, and user experience in public spaces are essential for understanding how space and time influence daily life. The relationship between campus rhythms—such as class schedules, foot traffic, and the availability of amenities—and the perceived spatio-temporal quality experienced by users highlights the role of time in shaping the functionality and inclusivity of urban environments. By exploring the correlation between these rhythms and user perceptions, the study emphasizes the critical, yet often overlooked, influence of temporal factors in urban design.

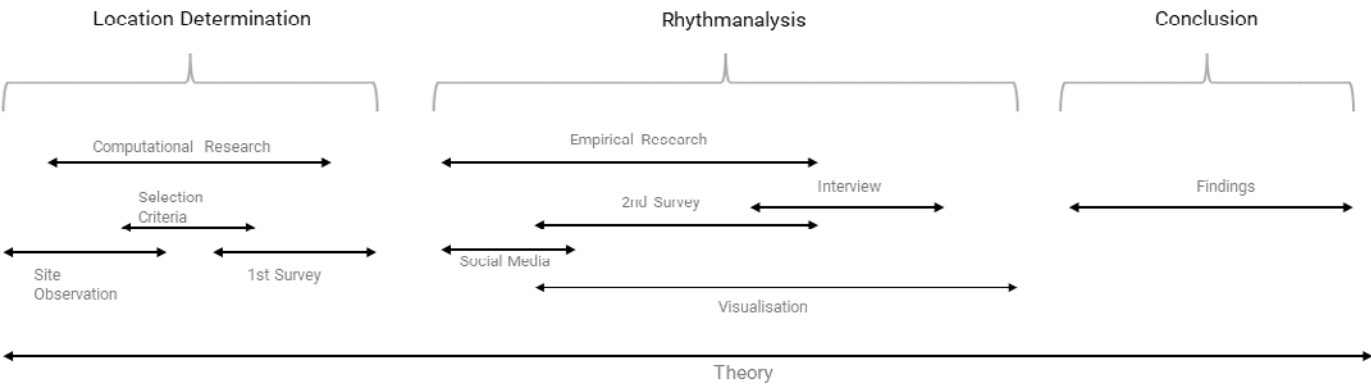
RWTH Aachen University serves as an ideal case study due to its dynamic campus, which features diverse temporal and spatial experiences. These range from the inner city’s fast-paced environments to the more tranquil, peripheral areas. The research methodology employs rhythmanalysis, along with surveys and observational studies, to investigate how campus design and usage patterns impact the quality of users’ experiences. Through an analysis of how space and time intersect, the project highlights the potential for creating more flexible and inclusive public spaces. It also offers insights into how temporal elements can be integrated into urban design discourse, proposing practical strategies for time-based urbanism that can lead to more socially sustainable communities.

The concept of time plays a central role in human life, as explored by philosophers, sociologists, and designers. Figures like Heidegger, Lefebvre, Lynch, and others have examined how time influences urban experiences. Lefebvre’s rhythmanalysis compares the city to a symphony, where rhythms shaped by social and cultural contexts affect urban interactions, revealing how space is often controlled by dominant social groups. Similarly, Lynch discusses the importance of design in shaping how people experience time in public spaces, arguing that a city’s temporal structure must enhance spatial quality. Rhythms—recurring sequences that influence human interactions and perceptions—include environmental, biological, and institutional patterns that blend to shape daily life. Bosselmann and

Bergson further highlight how design influences time perception, with Bergson emphasizing subjective experiences over measurable, linear time. Wunderlich and Gwiazdzinski also note how sensory and social experiences contribute to a city’s temporal and spatial character, while rapid urbanization demands a rethink of design to enhance livability.

To explore the relationship between time and space, this research focuses on campus areas through Lefebvre’s rhythmanalysis, examining how institutional hours, traffic, and social interactions create dynamic temporal environments. Data will be gathered through maps, surveys, and empirical observations, aiming to enhance social sustainability and time quality in these public spaces. The methodology combines qualitative and quantitative methods, including GIS, visualization software, and empirical observations of vehicle and pedestrian movements, pauses, and social interactions throughout the day and week. The analysis will focus on key areas of RWTH Aachen University, selecting diverse campus environments that vary in temporal characteristics and user profiles. By mapping these rhythms, the study seeks to improve spatial and temporal design, contributing to the development of more vibrant, inclusive, and socially sustainable environments.

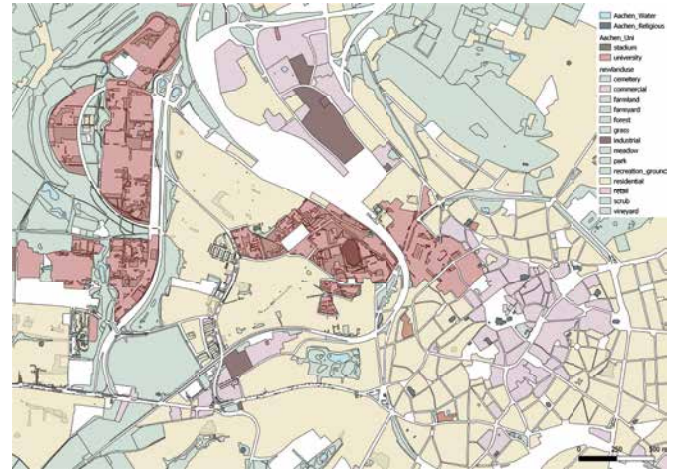
Data collection will employ tools such as GIS, photography, videography, and surveys. These methods will help to visualize temporal dynamics through mapping and time-series analysis. Surveys and interviews will focus on gathering user feedback on the quality of space and time, particularly regarding aspects such as inclusiveness, comfort, safety, and enjoyment. The study will specifically analyze RWTH Aachen’s campuses, including Melaten, Mitte, and the emerging West, selecting areas with varied temporal rhythms to develop insights into how the design and rhythms of these spaces influence users’ experiences. Through this comprehensive approach, the research aims to inform urban planning by emphasizing the role of time in creating more dynamic and flexible public spaces.



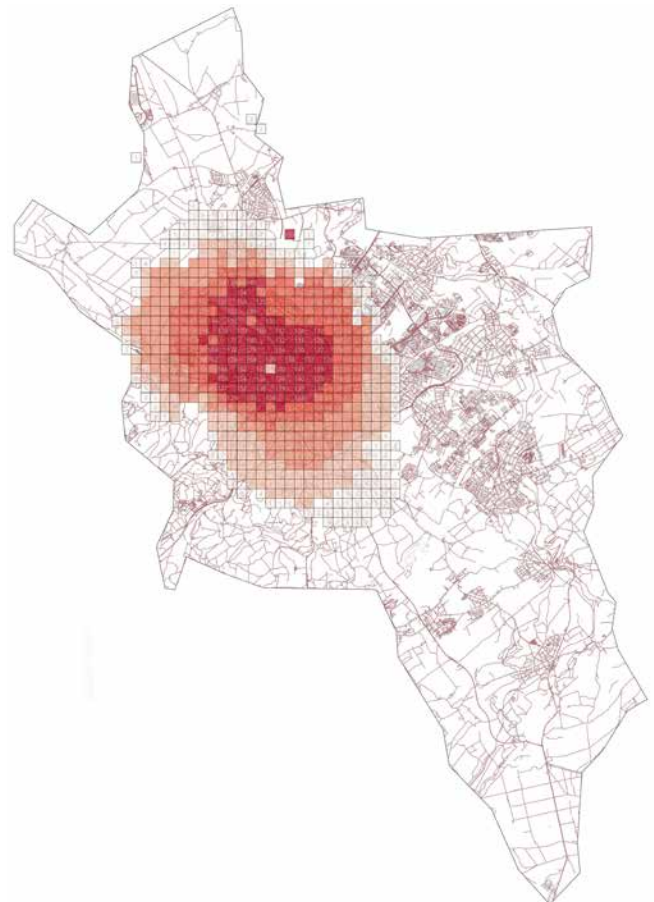
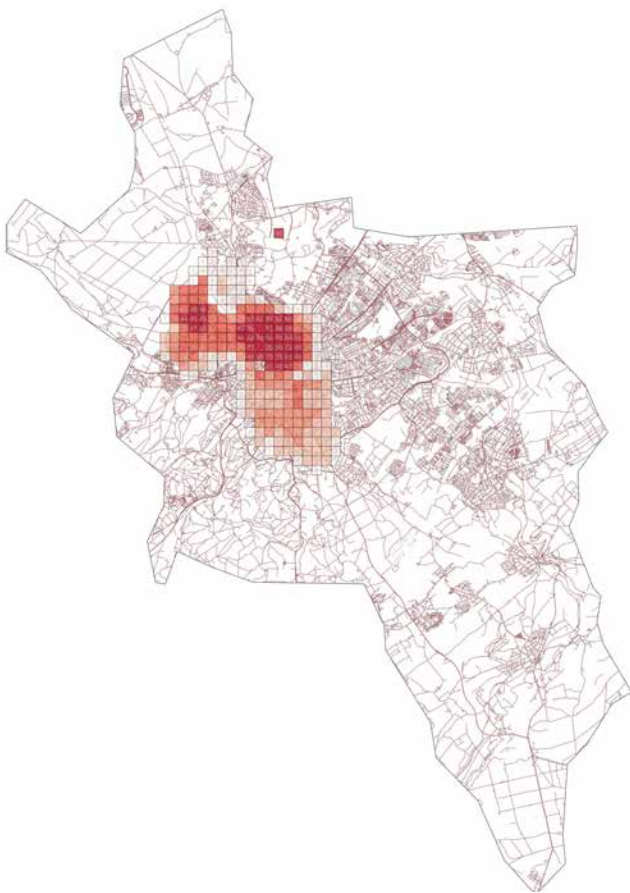
The Situation | RWTH Aachen University

RWTH Aachen University, located in Aachen, Germany, with a diverse international student population, serves as a prime case study for exploring campus rhythms and their impact on user experiences. The city's blend of historic areas, industrial zones, and green spaces promotes ease of movement, making it ideal for rhythm analysis. The campus, spread across 620 acres, integrates with the city but lacks cohesion due to the dispersed layout of its two main areas: Campus Mitte and Campus Melaten.

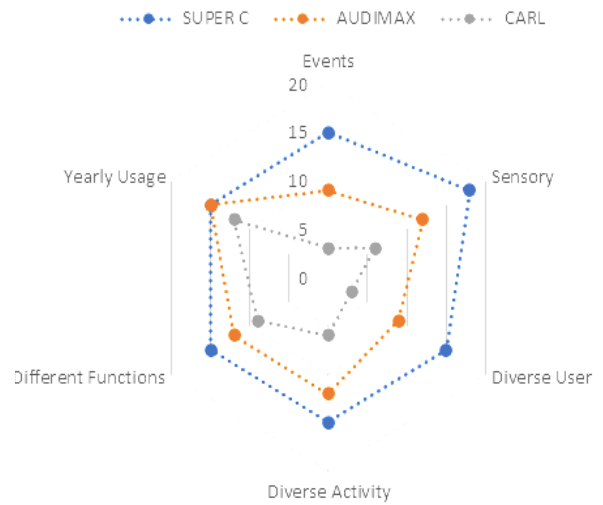
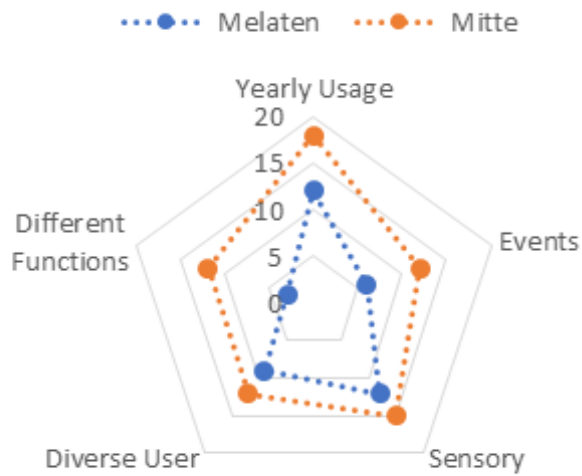
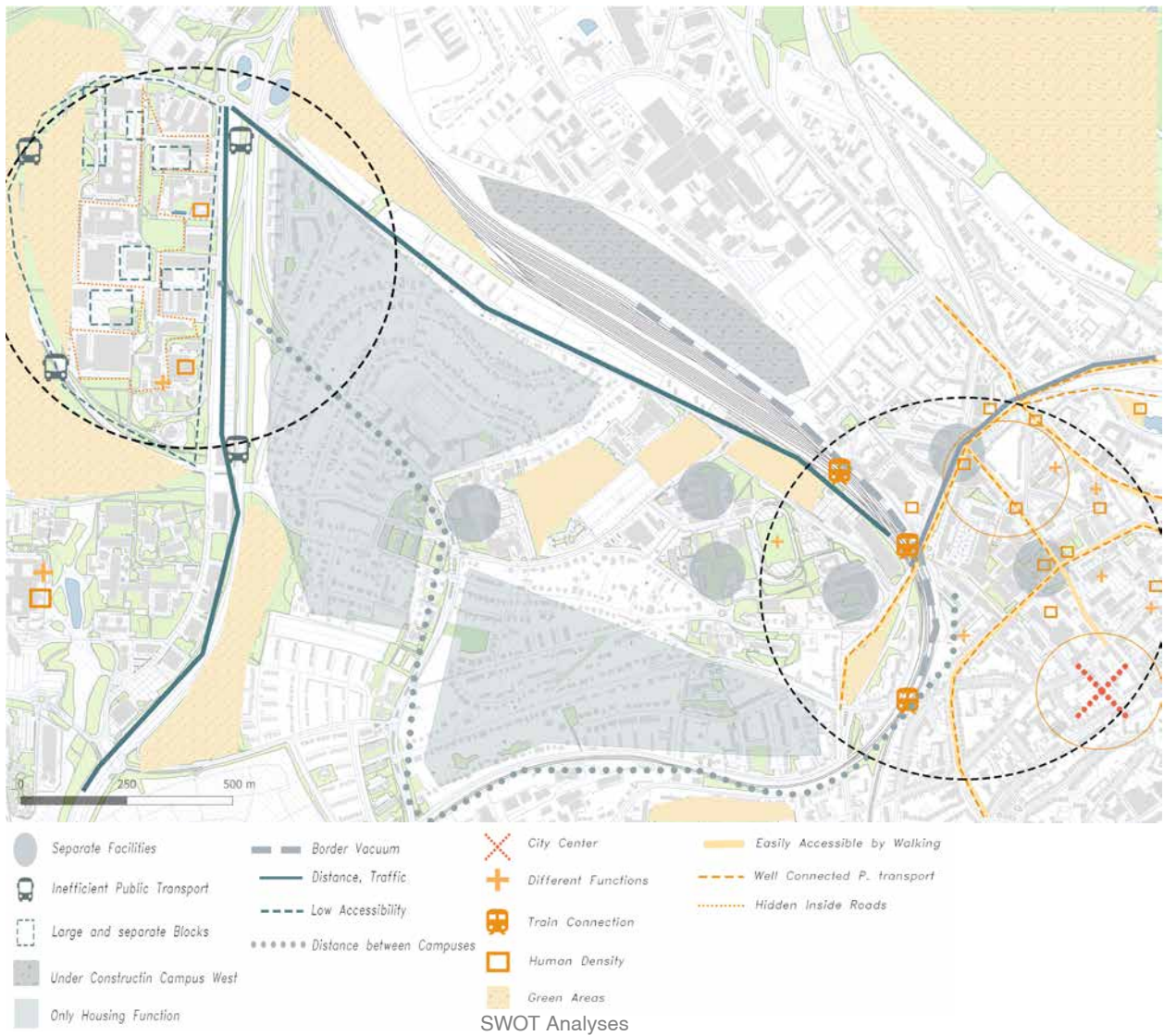
Campus Mitte, centrally located, is primarily a transit hub, while Campus Melaten, focused on research, suffers from isolation due to its distance from amenities and poor public transport. To enhance livability and inclusiveness, the study will focus on areas with diverse user profiles, functions, sensory stimuli, and potential for events, assessing their rhythms year-round. Improving transportation and integrating campuses could increase vibrancy and community cohesion.



Aachen Landuse Map



School Facilities within 1km and 5km Walking Distance



Survey Results

Rhythmanalysis of Super C

Super C, the student service center at RWTH Aachen University, plays a pivotal role in the campus's temporal and spatial dynamics. Centrally located, it offers services like the Student Secretariat and Career Center and hosts exhibition areas and conference rooms. The building's open design, featuring a glass facade symbolizing transparency, serves as a hub for both students and visitors.

Spatial Aspects

The area around Super C, designed by Susanne Fritzer and Eva-Maria Pape, connects the Main Building and Kármán-Auditorium, forming a public face for the university. Continuous pavement, tree circles, and long benches create a welcoming environment. The proximity to historical buildings and cafes makes the area a vibrant part of campus life, particularly during lunch hours in the summer.

However, while the surrounding open space is lively, the interior of Super C itself sees less activity, with nearby cafes like Katapult compensating for the lack of student engagement. Mehta's criteria indicate lower scores for comfort and meaningful activity, attributed to a scarcity of green spaces and permanent urban furniture.

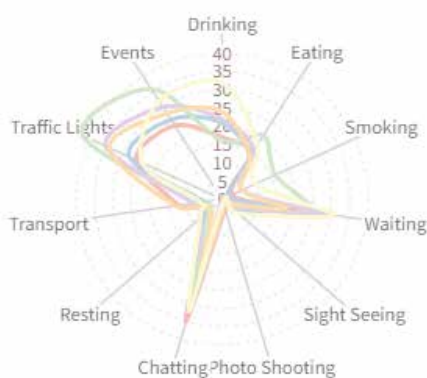
The rhythms of Super C are shaped by varied move-

ments, from hurried students on scooters to people pausing and socializing. Even though the area is busiest between 12 pm and 3 pm, particularly during lunch, it remains in use throughout the day. Seasonal fluctuations are noticeable, with the area less populated during colder months but still active due to its central location.

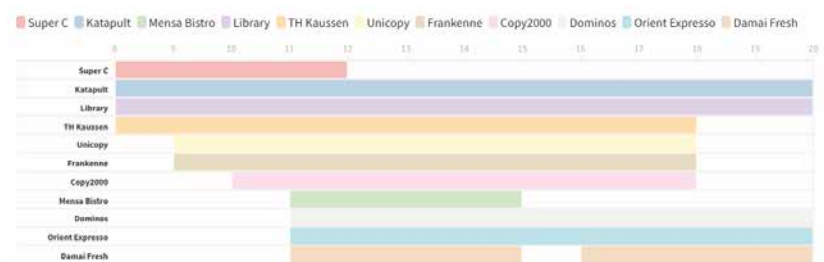
Pedestrian flow is the dominant rhythm, as Tempelgraben restricts vehicle access. Nearly half of users walk, with peak usage during class breaks. People engage in diverse activities like skateboarding on weekends, highlighting the area's flexibility.

Mapping these rhythms shows fragmented patterns of fast and slow movements, with some pausing spots tied to urban elements. While users perceive the space cohesively, there's room for improvement. Integrating the road space with Super C's surroundings and adding adaptable urban features like hidden passages, steps, and multifunctional furniture could better distribute density and enhance the temporal experience.

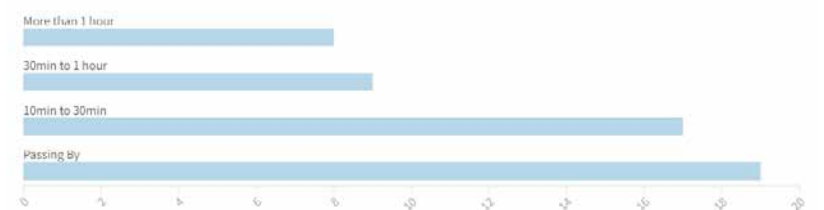
Super C's spatial and temporal dynamics reflect both its importance and potential. With thoughtful urban design interventions, it can become a more inclusive, vibrant, and functional part of RWTH Aachen University's campus life.



Durations in Different Activities



Functions from the Area



How long do users spend time in the area?



Movement Map



Sensory Map



MEHTA Results

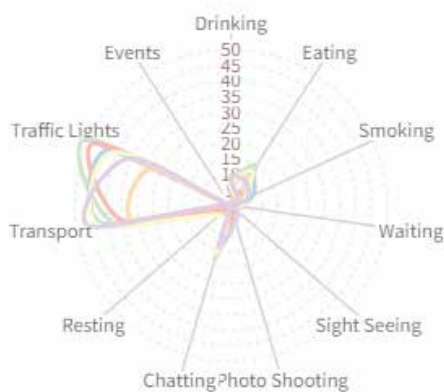
Rhythmanalysis of Audimax

Audimax, designed by Karl Schlueter in 1954, is positioned at the intersection of Wüllnerstrasse and Turmstrasse, featuring three large lecture halls. While it serves an important academic role, it requires renovation and has seen its significance overshadowed by the newer CARL building.

Spatial Aspects

The building's symmetrical design promotes movement, linking it to key university areas like Pontstrasse and Super C. However, the lack of urban furniture and traffic protection turns it into a transient space rather than a destination. Lunchtime crowds from the nearby Mensa Academica create congestion, and the underground passage draws skateboarders and artists. Pedestrian flow is interrupted by stairs on Wüllnerstrasse, limiting access to the Elektrische Maschinen building.

Sensorial analysis reveals discomfort due to traffic noise, which acts as a barrier. Users report low pleasurable ability, viewing the area mainly as a thoroughfare rather than a place to enjoy, highlighting the need for better urban design.



Timetable of Usage from Survey Results

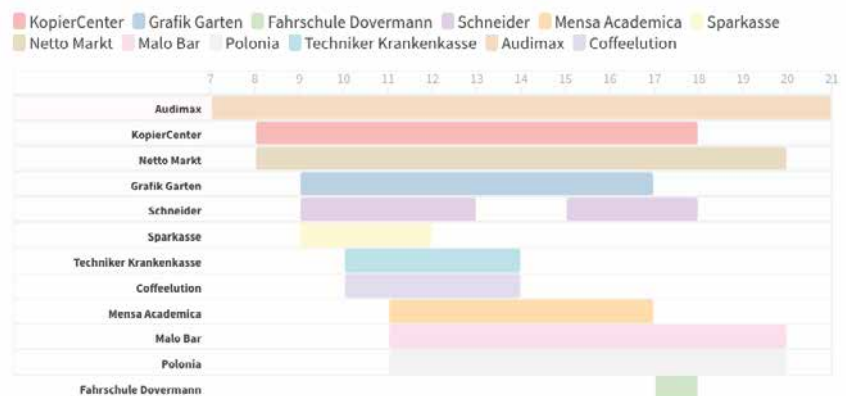
Temporal Aspects

The rhythms of Audimax are dictated by traffic patterns, particularly traffic lights and construction at Turm Bridge. Unlike the clear pedestrian flow at Super C, Audimax experiences overlapping movements due to its layered design, with bike parking disrupting the flow.

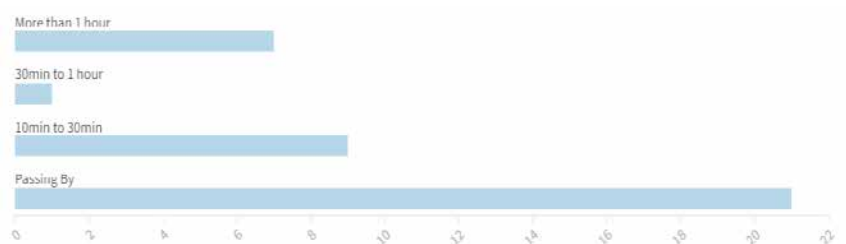
Despite limited activities, the area remains active throughout the year, driven by the busy ring road. Most users pass through or study briefly, indicating untapped potential. Enhancements like adaptable furniture, weather shielding, and events in the underground passage could increase engagement. While many users visit weekly, few linger, suggesting factors that discourage longer stays need addressing.

Usage peaks between 11 am and 1 pm, influenced by nearby functions and lunchtime at Mensa Academica. Car traffic predominates over pedestrians, with about half arriving on foot and many using public transport. Pausing activities primarily involve waiting at traffic lights or bus stops.

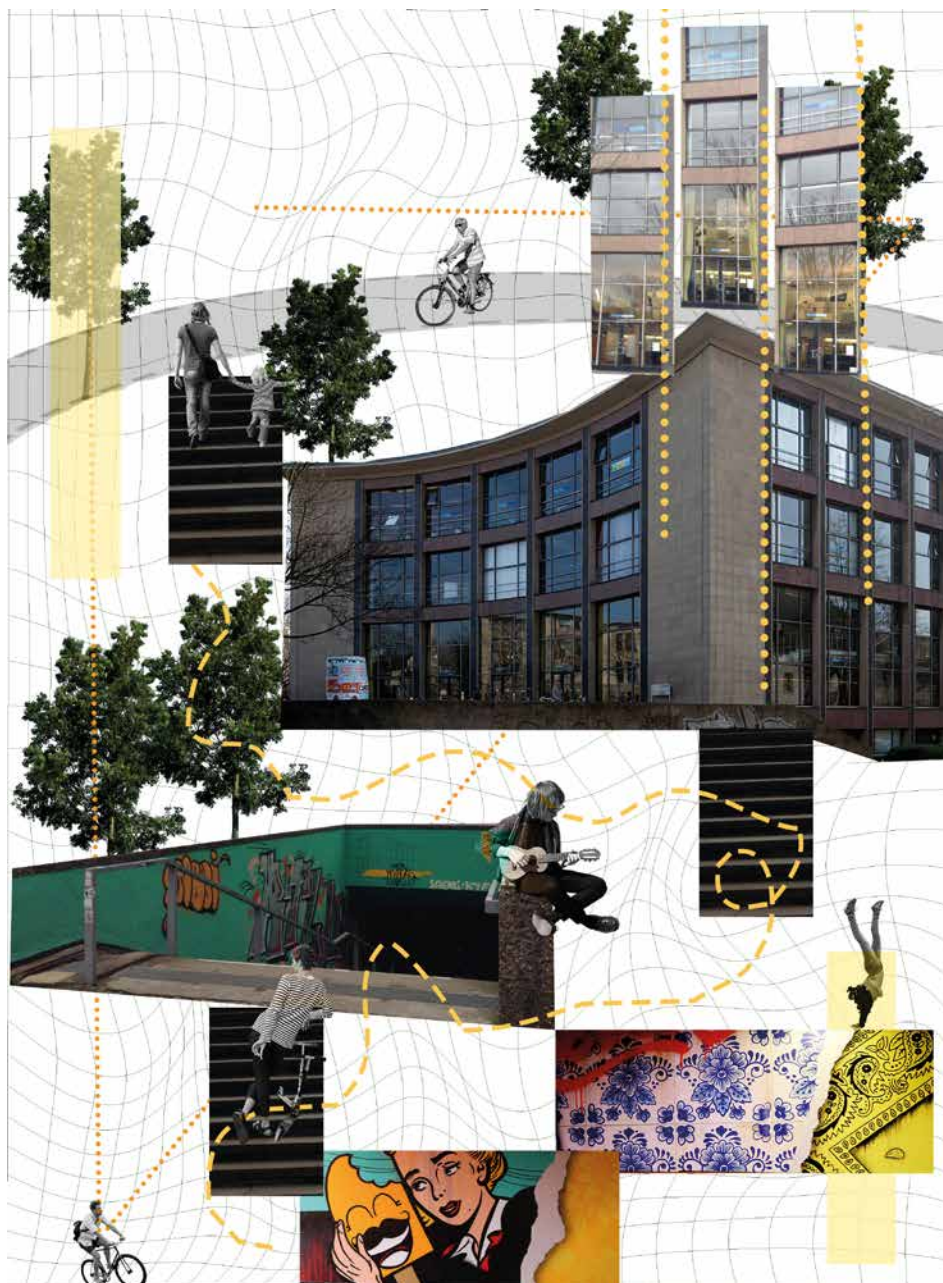
Overall, Audimax is perceived as a segmented space with potential for improvement along the left route, where foot traffic is denser. Enhancing the urban layout with adaptable furniture and varied events could significantly improve the area's spatial and temporal quality.



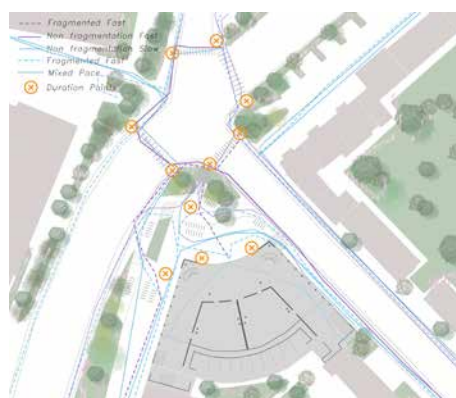
Functions from the Area



How long do users spend time in the area?



Sensory Map



Movement Map

MEHTA Results

Rhythmanalysis of CARL

CARL (Central Auditorium for Research and Learning) at RWTH Aachen University is a major lecture hall complex covering 14,000 square meters and accommodating around 4,000 students. Designed by Schmidt Hammer Lassen Architects, it features eleven lecture halls, with the largest seating 1,000 people.

Spatial Aspects

Strategically located near Westbahnhof and Turmstrasse, CARL benefits from easy public transport access. However, surrounding urban functions are underdeveloped, limiting activity outside class hours. The area experiences traffic and noise from ongoing construction, and while there is some urban furniture and bicycle parking, the space lacks green areas and adequate seating (only 15 seats for thousands of users). Despite its inviting architecture, the area’s potential for activities like skateboarding is not fully realized due to a lack of sensory richness. Survey responses indicate a desire for amenities like cafés and additional seating to enhance the overall experience and spatio-temporal quality.

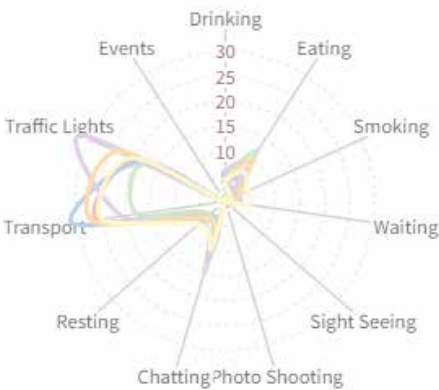
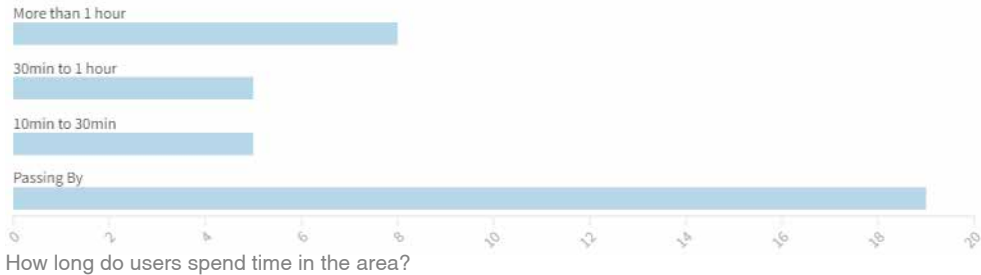
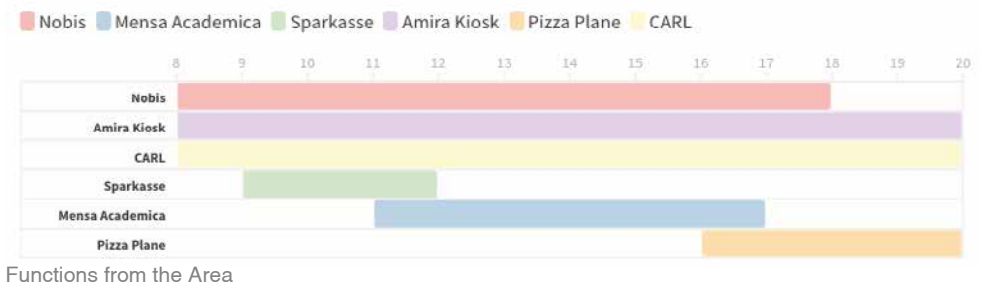
Temporal Aspects

CARL experiences significant pedestrian movement, serving as a main pathway for students heading to nearby dormitories and sports centers. However, urban furniture is scarce, limiting options for lingering. While the area is busy year-round due to its proximity to Westbahnhof, it remains underutilized outside of class hours.

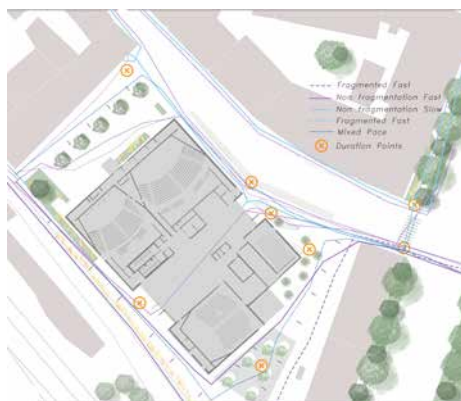
Surveys reveal that most users primarily pass through CARL, with limited engagement in other activities. Improved transport links, more green spaces, and enhanced urban design could boost its appeal. Notably, nearly 50% of users visit at least once a week, with peak activity occurring around lunchtime and class transitions.

Observations show a mix of pedestrian and car traffic, with users often stopping at traffic lights or bus stops. The design of CARL, with its rectangular shape, influences movement patterns, creating defined flows but limiting passage through the building. The open space adjacent to CARL has gathering potential but remains underutilized due to nearby parking.

In conclusion, while CARL shares characteristics with other campus buildings, its unique rhythms and layout highlight the need for better urban design, green spaces, and amenities to enhance its spatio-temporal quality.



Timetable of Usage from Survey Results



Movement Map



Sensory Map



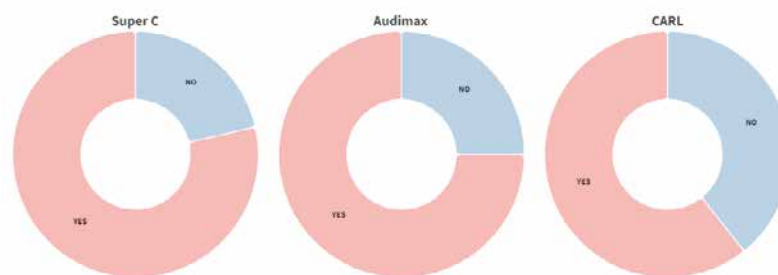
MEHTA Results

Events

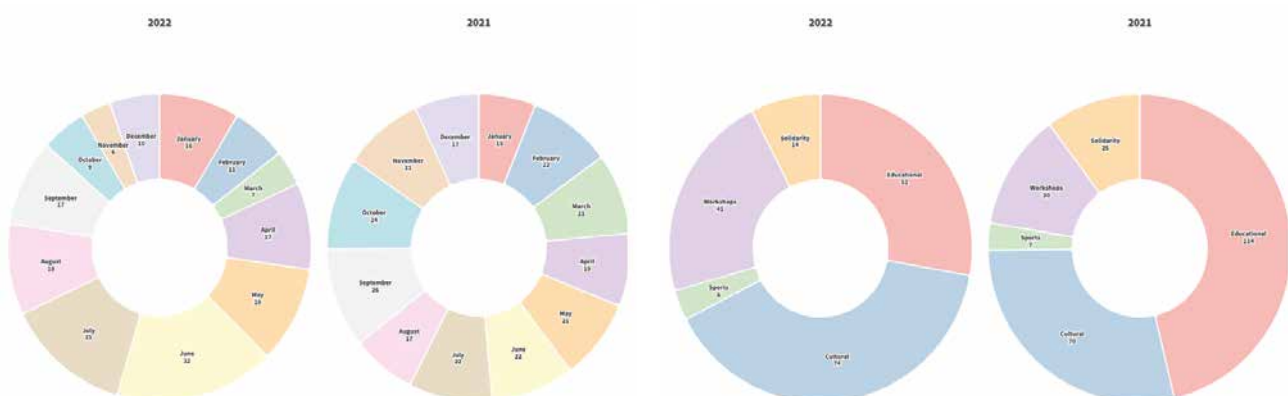
Events are essential for fostering social connections and community development, revitalizing urban spaces, and enhancing student life at RWTH Aachen University. Organized by the General Student Committee (AStA), these activities provide opportunities for interaction and learning. However, the COVID-19 pandemic disrupted in-person gatherings for about 1.5 years, leaving a gap that students are eager to fill.

Survey responses reveal mixed feelings about current events; while some students are satisfied, others call for improvements, particularly in winter when outdoor activities are limited. Recent data

show a shift from online to more frequent events by summer 2022, indicating a need for better year-round distribution to combat winter stagnation. The types of events have changed, with a rise in cultural workshops but a decline in solidarity and educational events. Most activities occur outside main campus areas like Super C, Audimax, and CARL, leading to underutilization of other spaces. User surveys highlight that many students at CARL feel excluded from campus events, largely due to a lack of activities in that area. Improving flexible spaces across campus could enhance event quality and create memorable experiences for students.



Have users ever participated in an activity in which area?



Number and Types of Events in 21 - 22

Findings

Although these buildings are close to each other and share similar rhythms, their experiences differ significantly. Super C stands out for its dynamic usage and frequent events, making it a vibrant and well-integrated space. Audimax and CARL, despite their proximity, lack engaging rhythms and suffer from lower user satisfaction.

The study, drawing on Luc Gwiazdzinski and Lefebvre's concepts of natural, social, and cultural rhythms, emphasizes the importance of these rhythms in shaping urban spaces. Recommendations include strategic spatial planning, public art, community engagement, maintenance, event programming, and technology to enhance the vibrancy and functionality of public spaces, transforming them into social hubs. A timeline for future design processes will also be outlined to guide urban development.



Slow Down



Campus areas should be allowed multiple paces of movement. Hidden corners for resting, places for practicing yoga, and communal gardens for mindfulness should be a part of everyday life rather than class-to-class understanding. Students and workers need places to take a break.

Collaboration



Campuses should have opportunities to collaborate more with different stakeholders like the public, digital nomads, and startups. At the same time environments for co-habitation, and co-development like car-sharing should get supported.

Hybridization



Multi-functions should become hybridized. Two or more functions can come together to attract more users but at the same time help them to spend more quality time while they are experiencing multiple actions. Concepts like art-business, daycare-green areas, and cafe-library should get encouraged.

Rotation



Spaces and their functions or the happening events can change over time according to needs, and weather. They should be modular convertible and allow temporality.

Optimization



Unused volumes and spaces should get an optimization process. These areas can diversify from classrooms to urban furniture. Optimization which is closely related to modularity should be inclusive of age, gender, orientation, and disabilities.

Adaptation



Campuses and their new temporal tools should be in tune with technological developments like virtual reality and smart solutions. All the systems that create collaboration and all the convertible spaces should be adaptable to development.

resilience and urban structure | weizhou

rwth aachen university | prof. agnes förster | 2021

#gis, urban planning, urban resilience, natural disasters

w: nahed nabhan, luna torres



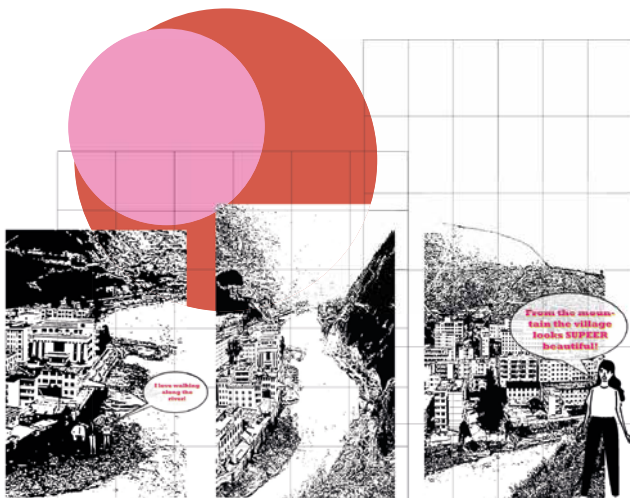
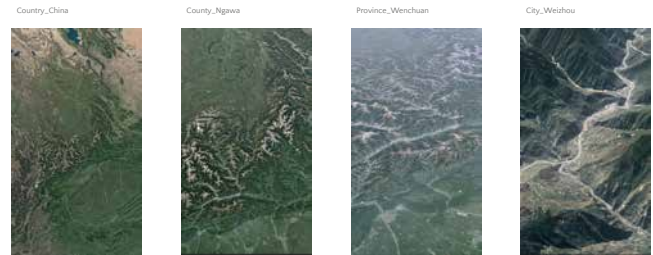
Resilience is increasingly crucial in urbanism, particularly in the context of climate change and migration. Urban planners and governments must adopt innovative strategies to enhance infrastructure, urban, and social resilience in cities. This project focuses on Wenchuan City, Weizhou, China, located in a mountainous region where agriculture is the primary source of income, supplemented by investments in education and tourism.

Following the devastating earthquake in 2008, Wenchuan was largely destroyed, leading to population migration. Although reconstruction efforts have been supported by neighboring states and the Chinese government, resilience has not received adequate attention during this process. The public housing constructed due to declining land prices fails to align with the area's topography and overall urban morphology.

Project Weizhou aims to establish a more resilient urban structure by addressing infrastructural, urban, and social aspects of resilience. This involves analyzing the region, developing a theoretical background, and studying concrete cases, such as Istanbul. Using the Multi-Scale, Inter-Relations Approach, we offer solutions that address both regional and local needs.

Location

Weizhou City is situated in the southeastern part of central China, within the Wenchuan region. Covering an area of 4,804 km² and located at an elevation of 1,330 meters, the region is characterized by pronounced relief, with steep mountains and rivers creating deep valleys. Weizhou City itself is nestled along both banks of the Min River, surrounded by steep mountains that limit urban expansion.



Theoretical Background

This research project explores various resilience concepts at multiple levels within urban systems, leading to key insights that shape the research question.

Resilience

Resilience is defined as “the ability of a system, community, or society exposed to hazards to resist, absorb, accommodate, and recover from the effects of a hazard promptly and efficiently” (UNDRR, 2009).

Infrastructural Resilience

Infrastructural resilience pertains to systems and services vital for emergency response and community recovery (Jha et al., 2013). Key elements include strong, well-maintained structures, adequate evacuation routes, and high-capacity shelters to facilitate relief efforts.

Social Resilience

Social resilience refers to a community’s capacity to adapt to disturbances and changes, influenced by demographics and social capital (Jha et al., 2013). Enhancing social resilience requires addressing basic needs, fostering community engagement, and ensuring collaboration between local governments and citizens.

Research Question

This project focuses on social and infrastructural resilience as essential components of urban resilience, defined as “the ability of an urban system—and its socio-ecological and socio-technical networks—to maintain or rapidly return to desired functions in the face of disturbances” (Meerow et al., 2016). The central question is: How can a complex system achieve resilience through multi-scale reciprocal relationships among various social and urban elements?



Framework

The project framework follows disaster cycle phases, with each phase paired with a strategy outlining necessary actions, involved actors, and goals.

The phases includes:

Operation: Involves regular tasks for system maintenance, emphasizing redundancy and adaptation.

Early Warning: Focuses on communication and coordination among governmental and non-governmental organizations to anticipate disasters.

Emergency Response: Prioritizes cooperation among various actors to manage disaster impacts effectively.
Recovery: Addresses immediate relief and restoration of critical infrastructure and ecology.

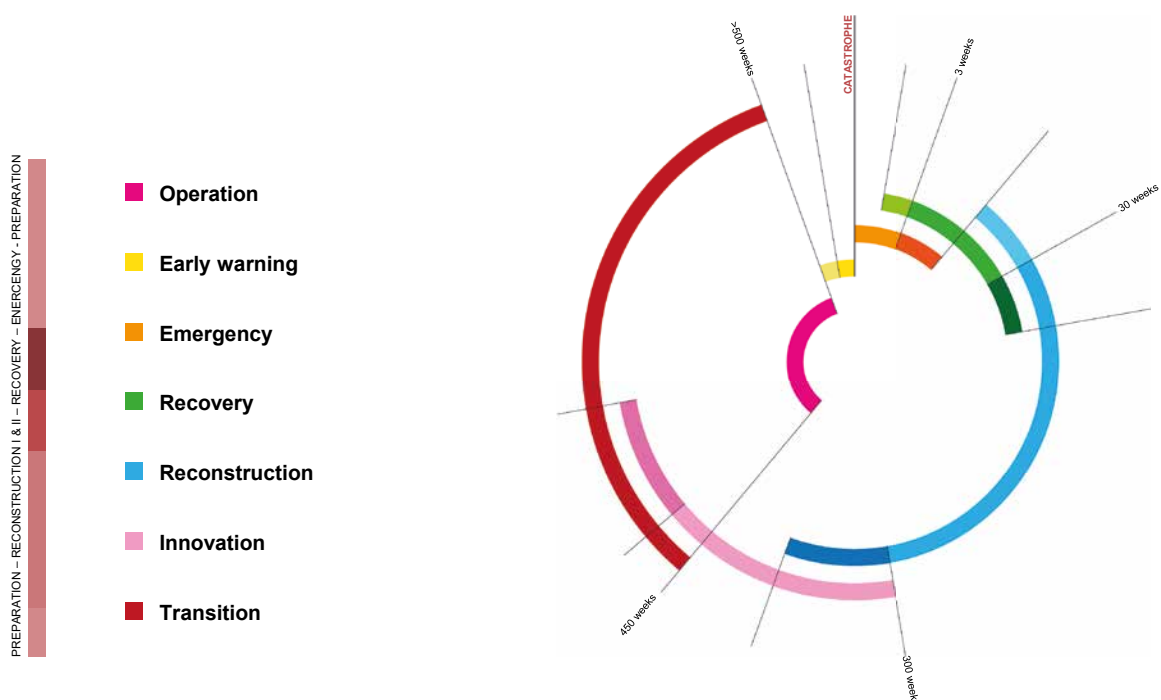
Reconstruction: Plans for flexible urban designs post-disaster, engaging multiple stakeholders to enhance quality of life.

Innovation: Explores opportunities for economic growth and development in the region after reconstruction.

Transition: A state of reconciling with the past through memorialization and progressing toward a resilient future.

Methodology: Macro-Micro Approach

A macro-micro approach focuses on multi-scalar interchanges, where macro-scale changes address regional needs and micro-scale changes target specific urban zones. This mutual support enables resilience to function independently during emergencies, combining top-down policies with bottom-up solutions.

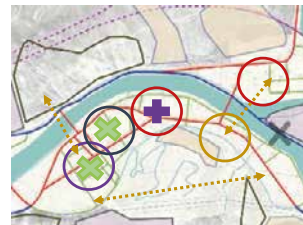
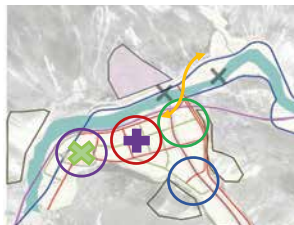


PHASES	OPERATION	EARLY WARNING	EMERGENCY RESPONSE	RECOVERY	RECONSTRUCTION	INNOVATION	TRANSITION
Strategies	Redundancy Adaptation	Communication Connection	Co-operation	Restoration	Flexibility & Diversity	Seizing Opportunities	Progression
Actions	Simulation Training	Prediction	Detection Damage Control Empowerment Of Field Personal Policy Switching	Provision & Relief Resource Optimization Boundary Expansion	Surveys Master Plans	Archiving And Postmortem Urban & Infrastructural Consensus	Memorials Improvement
Functions	Stockpiling Resources Secondary Roads Clinics, N.H + N.P	Administrative Facilities Main Hospitals Main Schools	Secondary Roads Air-roads Clinics N.H + N.P	Critical Infrastructure & Functions Roads, Hospitals, Schools Ecology	Land Use Zoning Mobility	Different Types Of Urban Hubs With Economical Benefits	Memorials Social Commemoration Reconciliation With The Past
Scale	Micro & Macro Neighborhood & City	Macro City & Region	Micro Neighborhood	Micro & Macro Neighborhood & City	Micro & Macro Neighborhood & City	Regional	Whole Region
Actors	Civil Society Municipal Government	Municipal & Provincial Government Ngo's	Operations At Municipal Level Coordination & Support At Provincial And Central Government	Municipal & Provincial Government Aid Management Groups	Central, Provincial & Municipal Governments Public & Private Partnership Community	Investors Stakeholders	Whole Society
Goals	Preparation	Reducing Damage	Efficiency	Solidarity	Planning	Development	Resilience



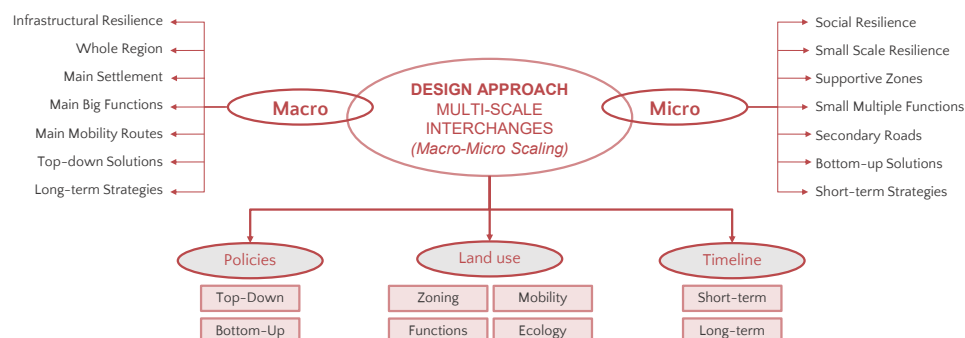
Macro-Scale:

- Includes all region
- Focuses on the mobility routes and support system
- Each settlement is another "Zone" that connects with roads and multiple cross bridges and helicopter spots
- In the Main Settlement there will be hospitals, big public buildings, big open areas
- Warehouses for water, food, medicine supply



Micro-Scale:

- Supportive zones covers the settlements needs
- Focuses on the small-scale resilience
- Instead of hospitals and big public buildings will have clinics and n.hood houses with multiple functions
- Based on secondary roads and strong connections
- Social resilience and education plays a huge part

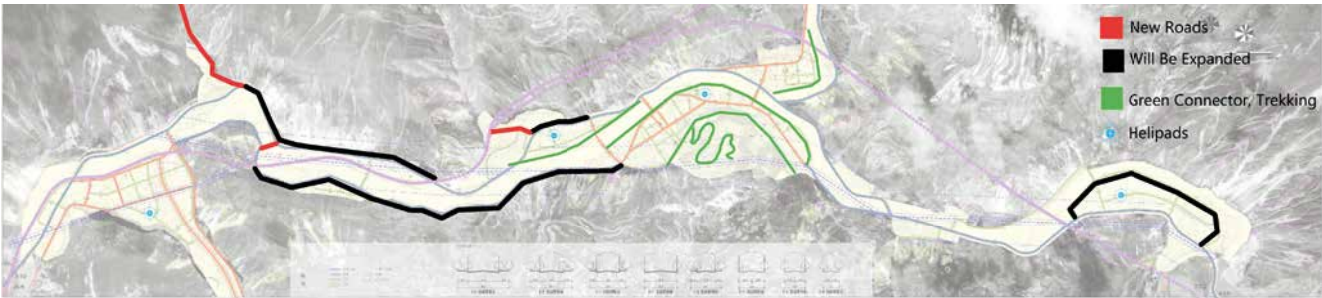


Mobility

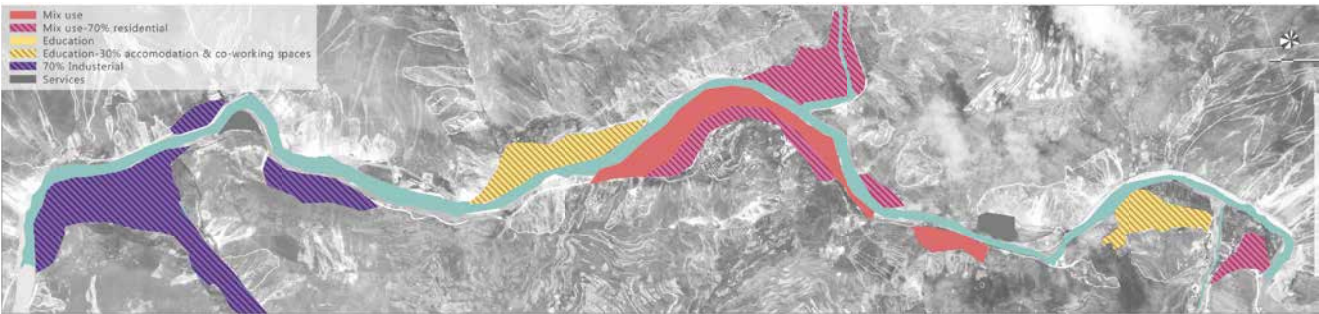
On a macro scale, given the mountainous terrain, the focus is on constructing linear and ring roads to improve connectivity with major cities. On a micro scale, existing main arteries will be expanded, and new connecting routes added to enhance local mobility. Additionally, emergency transport options will be introduced, including helipads and drone fields at public buildings, along with ecological trekking routes to connect the city center to surrounding villages and promote tourism.

Micro Functions	Before Disaster	During Disaster	After Disaster
Health Clinics			
N.hood Houses			
Secondary Roads			
N.hood Parks			

Suggested Functions



Suggested Mobility Axes



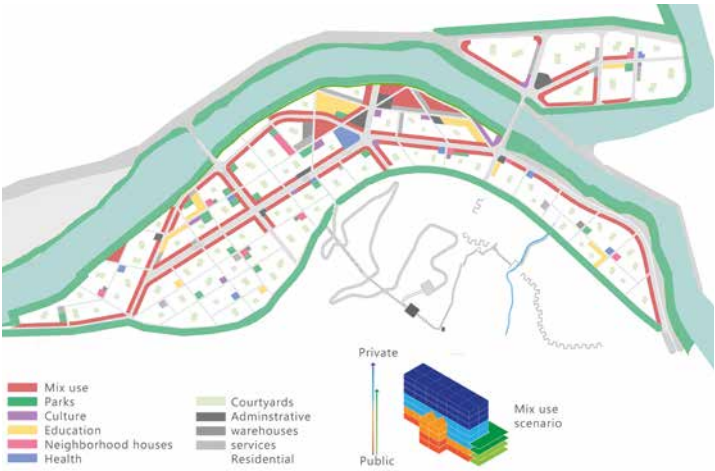
Functions

Functions are categorized based on their scale and use, with five new functions introduced: Green Ecological Belt, Neighborhood Houses, Health Clinics, Secondary Roads, and Airway Landing Fields. The Green Ecological Belt serves as a walking path along the river, enhancing connections while protecting against floods. Neighborhood Houses will act as educational centers pre-emergency and gathering points during crises, equipped with supplies. Health Clinics will alleviate hospital burdens, connected to Neighborhood Houses and parks. Airway runways for helicopters and drones will provide emergency services.

Zoning

Weizhou is divided into five settlement zones, each with micro-zones. The first zone features the Green Ecological Belt

and Main Road. The second zone allocates 60% to public buildings and 40% to accommodations to mitigate flood and landslide risks, while the third zone reverses this ratio. Secondary vertical roads and ecological solutions will support each zone, balancing macro and micro functions.



Suggested Landuse Plans

Land use planning prioritizes a green belt, public functions, and accommodations. Existing road structures are preserved, with new routes added for connectivity. Each micro-zone will have public parks and essential facilities, fostering community interaction. Mixed-use buildings will activate streets, with commercial spaces on the ground floor and offices or residences above.

Ecology

Landslides: To mitigate landslides, several approaches are proposed:

Shotcrete and Steel Mesh: Reinforcing slopes with shotcrete and mesh reduces collapse risk.

Vegetation: Planting vegetation stabilizes slopes through root systems, providing a natural solution.

Geotextiles: Biodegradable fabrics will help stabilize hillsides and control erosion.

Flooding: To address flooding from the Min River, improvements to existing infrastructure are suggested. Inspired by Alejandro Aravena's design in Constitución,

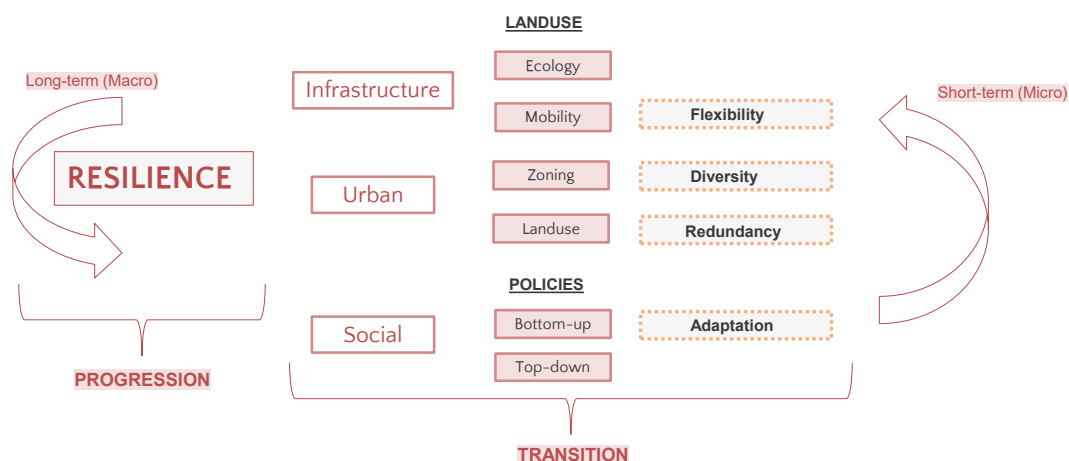
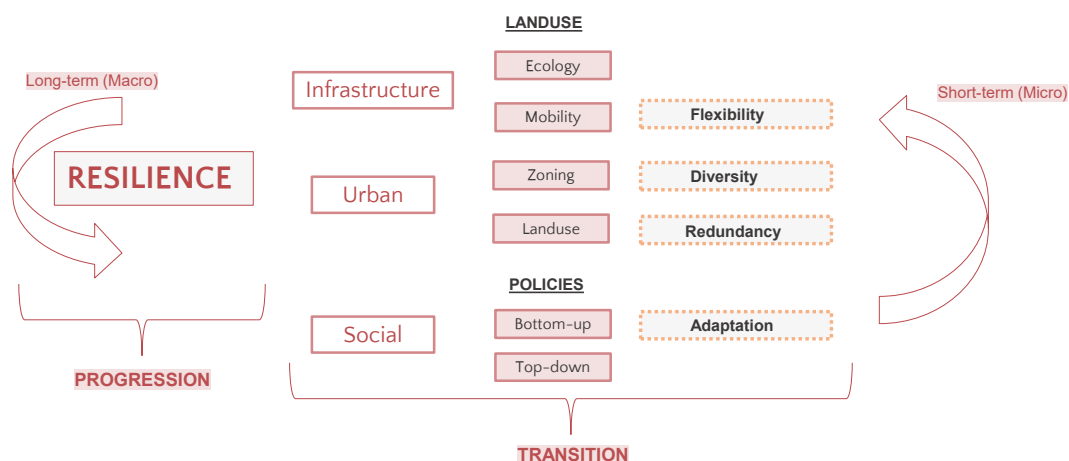
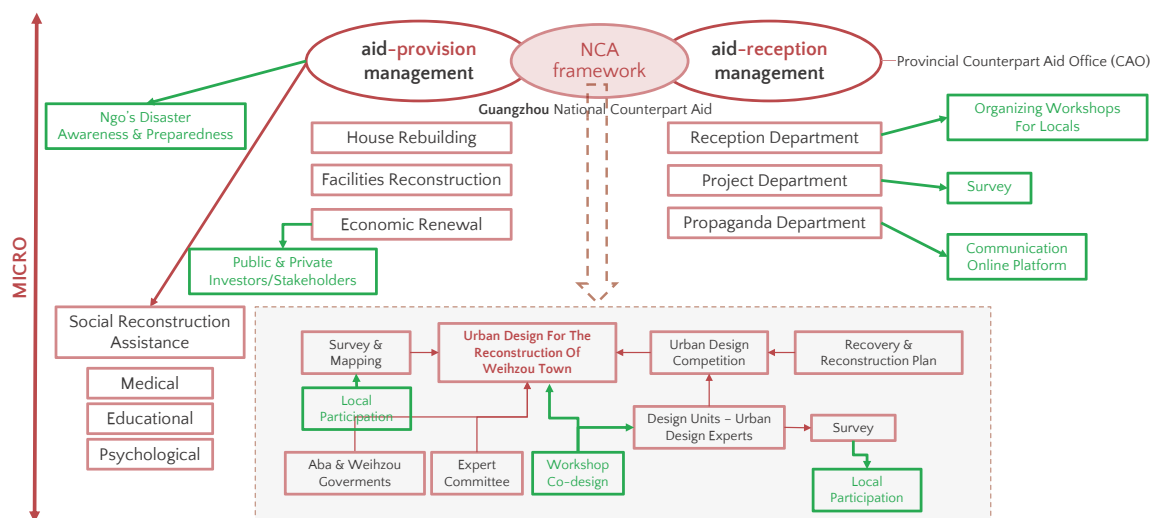
a green barrier of vegetation along the riverbank will serve as both a park and flood defense

Governance and Reconstruction Strategy

The governance structure for reconstruction is predominantly top-down, leading to effective but less participatory outcomes. To enhance resilience, micro-scale adjustments are recommended, such as incorporating NGOs for disaster preparedness and engaging local communities in decision-making through workshops and co-design sessions. This approach will strengthen community bonds and improve awareness of reconstruction plans.

Conclusion

Achieving resilience requires long-term strategies addressing urban, infrastructural, and societal elements. Planners must focus on ecological sustainability, mobility, land use, and community engagement. Short-term actions fostering adaptability and collaboration will ultimately lead to a more resilient Weizhou City.



mapping the structural change in nrw | nrw - duisburg

rwth aachen university | prof agnes förster, martin bangartz | 2022

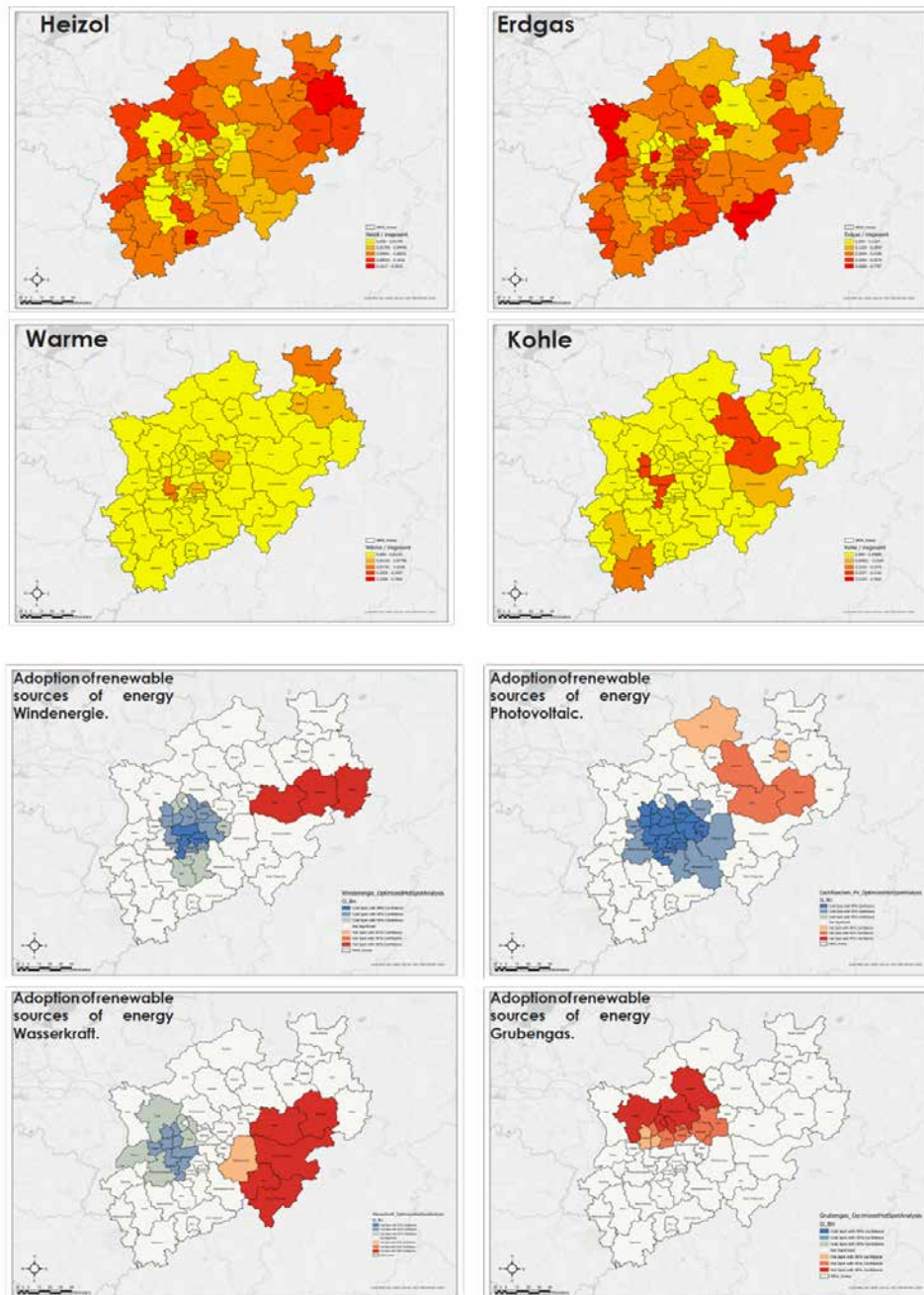
#gis, economical development, energy patterns, industrial elements

w: aditya patil



Changing trends in the mining sector significantly affect the overall urban structure of North Rhine-Westphalia and influence the connection between four main urban actors: energy, industry, economy, and society. North Rhine-Westphalia has historically been Germany's economic powerhouse, with the largest GDP among the states. The mining sector, particularly coal mining, has been a crucial component of the region's development, serving as an economic backbone during industrialization. However, Germany's shift towards green policies has reduced reliance on coal, culminating in the closure of the last coal mine in 2018.

This transition in energy production has triggered both short- and long-term changes across North Rhine-Westphalia. The project hypothesizes that evolving trends in energy production directly influence the industrial sector, impacting the economy and social life. Structural changes in energy production and consumption are closely linked to shifts in the region's industrial landscape, which in turn affect economic conditions and the socio-economic well-being of residents. Understanding this interconnectedness is vital for grasping the overall prosperity of the region as it navigates its post-coal future.

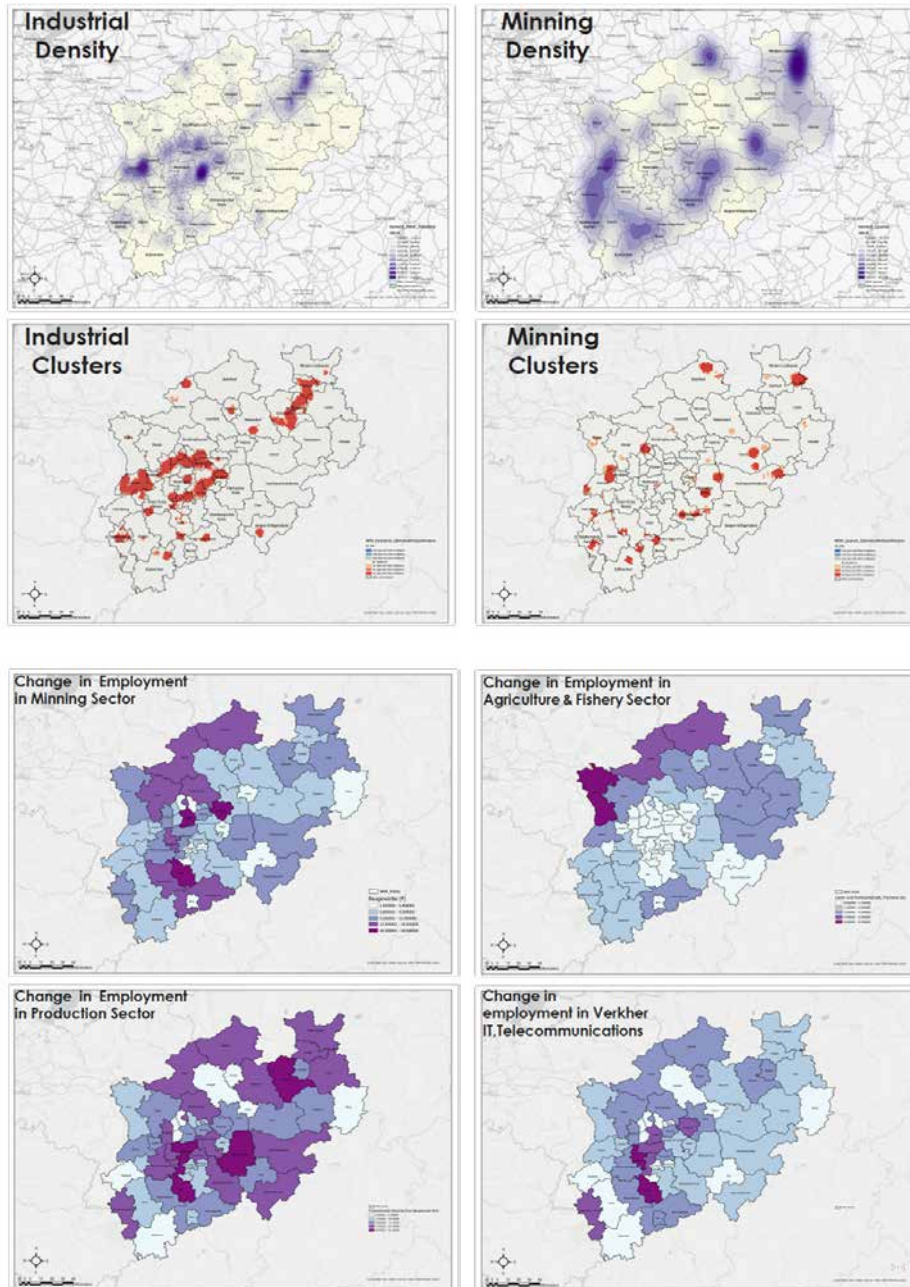


Dependence on Non-Renewable Energy

Maps illustrate the production of natural gas, coal, heating oil, and other non-renewable energy sources in North Rhine-Westphalia, revealing that many districts remain heavily reliant on these forms of energy. Districts with higher dependence on non-renewable energies are marked in orange, while those with less reliance are shown in yellow. The Multivariate Clustering tool employs the K Means algorithm to partition districts based on their non-renewable energy usage. This algorithm aims to minimize differences among features in each cluster, calculating a mean data center for each group and reassigning districts to the closest center until stabilization occurs. Both K Means and K Medoids yield similar clustering results, helping to group districts with comparable dependence on non-renewable energy sources.

Transition to Renewable Energy

The Hot Spot Analysis tool calculates the Getis-Ord G_i^* statistic for each district, assessing spatial clustering of high and low values. A feature must not only have a high value but also be surrounded by similar high-value features to qualify as a statistically significant hot spot. By comparing local sums of a district with its neighbors to the expected sums, significant z-scores indicate meaningful clustering. This method identifies districts resistant to transitioning to renewable energy sources, with red districts representing leaders in this transition and blue districts indicating continued reliance on non-renewable energy.



Structural Change in Industry

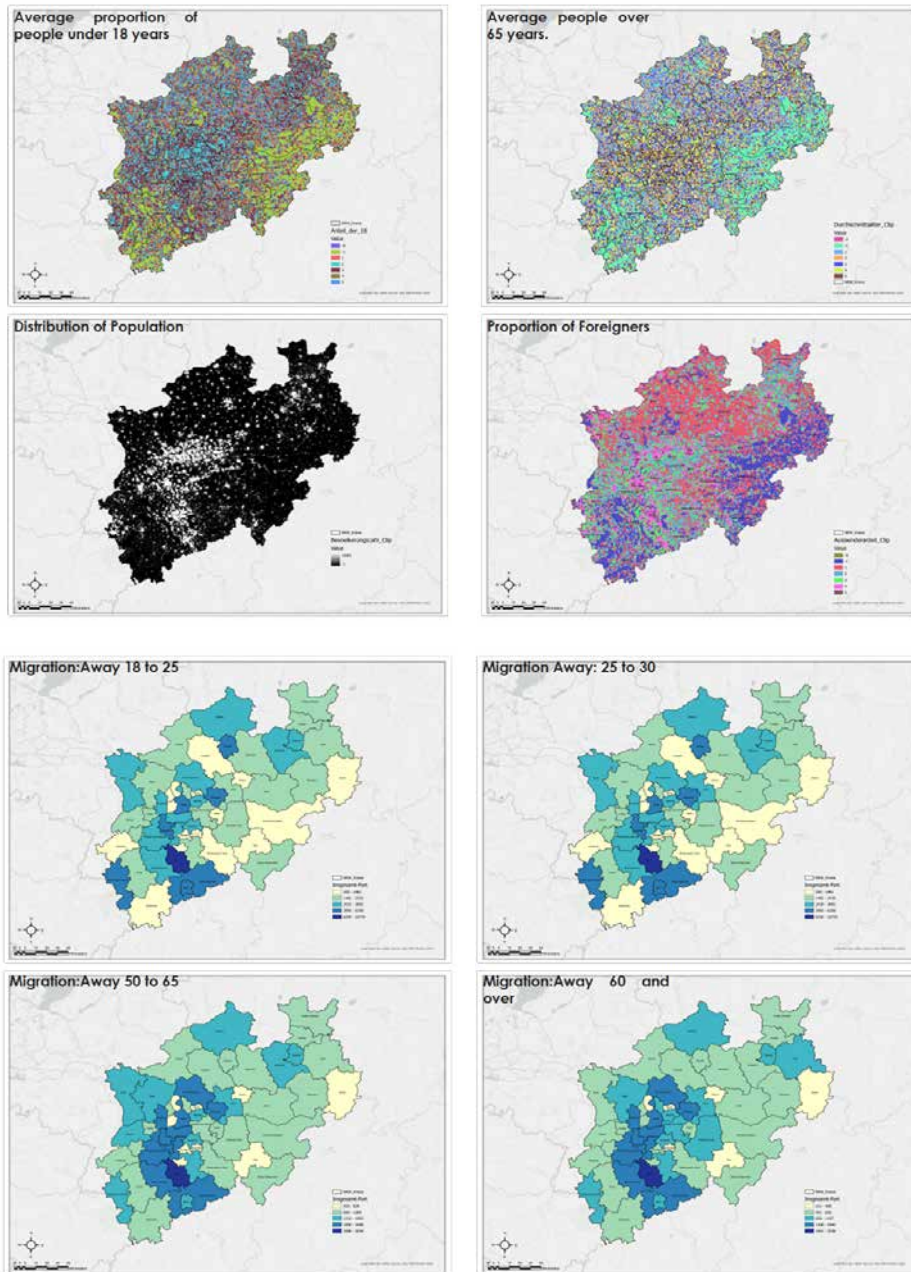
Kernel Density Analysis was conducted to assess the density of mining and industrial activities, revealing distinct clusters in Krefeld, Essen, Bochum, and Duisburg. Six areas with concentrated mining activities were identified. An optimized hotspots analysis evaluated regions with high industrial and mining activities, examining their spatial relationships across various combinations of candidate explanatory variables for statistical models, adhering to the minimum and maximum requirements for explanatory variables.

Structural Change in Economy

Exploratory regression analyzed the correlation between coal mining activity and its impact on GDP, along with contributions from other

economic sectors. It was found that coal mining accounts for 25% of the region's overall GDP; however, it exhibits a 97% negative correlation, indicating that increased coal mining activity leads to a negative impact of 25% on the region's GDP.

The analysis also highlighted various economic sectors and their employment levels, with darker purple shades representing higher employment numbers and lighter shades indicating lower rates. A comparative bivariate classification examined total energy production against the overall GDP of North Rhine-Westphalia, revealing that districts heavily dependent on non-renewable energy sources are the highest consumers and producers, yet they exhibit the lowest GDP, indicating economic lag compared to other districts.



Structural Change in Society

Coal mining has a 33% stake in population growth among men aged 35 to 40 in North Rhine-Westphalia (NRW), but this is 87% negatively correlated, meaning increased coal mining leads to a 33% decline in this demographic. A bivariate classification of total energy production and population growth shows that districts with high non-renewable energy consumption/production (in blue) have lower population growth. Maps on the right illustrate youth-to-elderly ratios and foreign population proportions across NRW, measured on a -10 to 10 index.

Exploratory regression reveals a 27% stake in the population growth of 30-35 year-olds, also negatively correlated at 97%, indicating that more coal mining results in a 27% population decline in this age group.

Economy vs. Migration

Regression analysis shows that coal mining accounts for 53% of population migration among those aged 25 to 30, with a 95% positive correlation. This means increased mining activity leads to 27% of the population leaving NRW. A bivariate classification of GDP and migration shows districts with higher migration (in blue) have lower GDP.

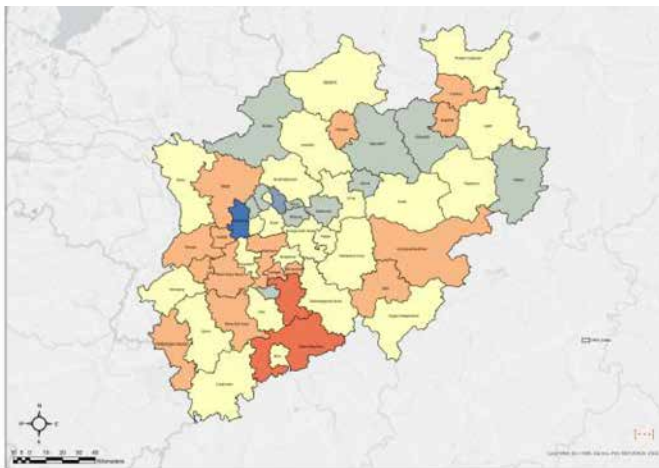
Maps display migration trends, showing elderly people aged 50 to 65 moving away from urban centers like Cologne to rural areas. A similar pattern is observed in the 18-30 age group.

Quindang River basin, Gyeonggi region, South Korea

Legend:

- Quindang_riverway_clipped
- Quindang_buildings_clipped
- Quindang_road_clipped
- Quindang_waterways_clipped
- Quindang_water_clipped
- Quindang_landscape_clipped
- commercial
- farmland
- farmland
- forest
- grass
- industrial
- meadow
- military
- nature_reserve
- park
- recreation_ground
- residential
- road
- scrub
- Quindang_gilcom_clipped

0 1 2 km

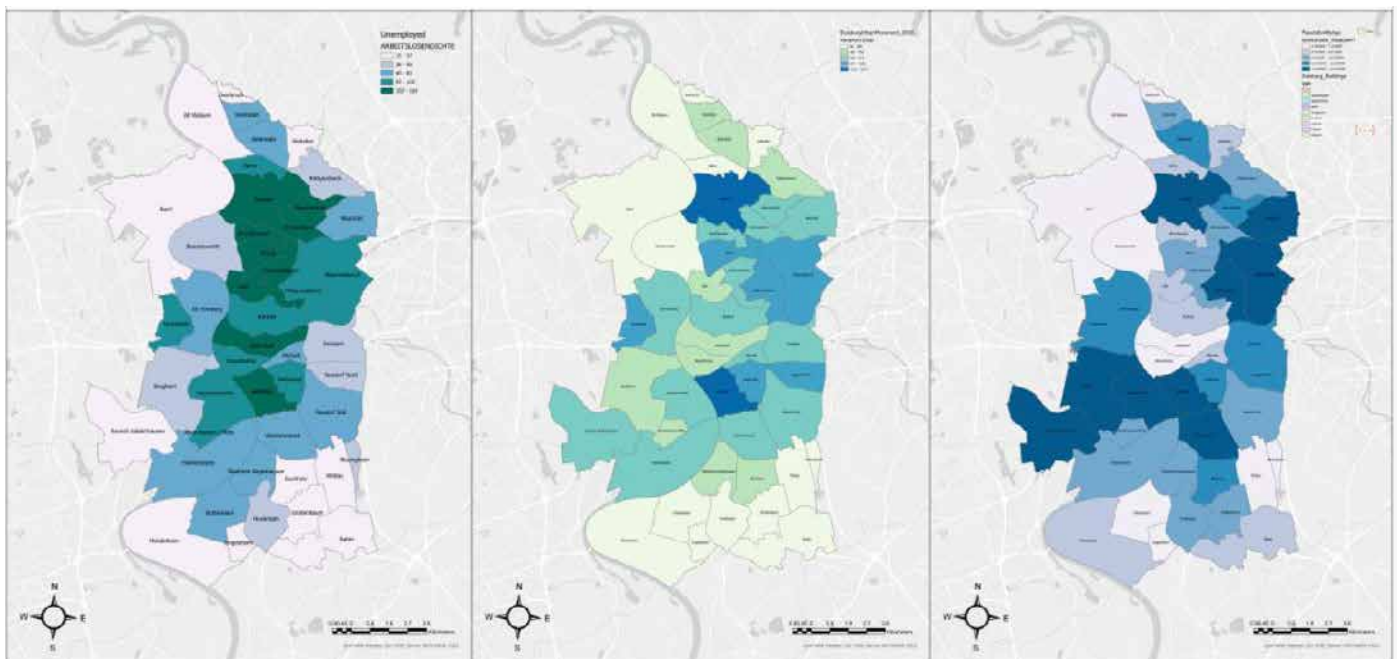


Industrial Infrastructure
Strong Railway Connection
Culture of Mining and Steel Industry
Duisburg Port

- High Emigration Ratio
- Lowest GDP of the Region
- Lack of Cultural Activities

University of Duisburg
Close to Other Bigger Cities Like
Düsseldorf, Essen, Dortmund

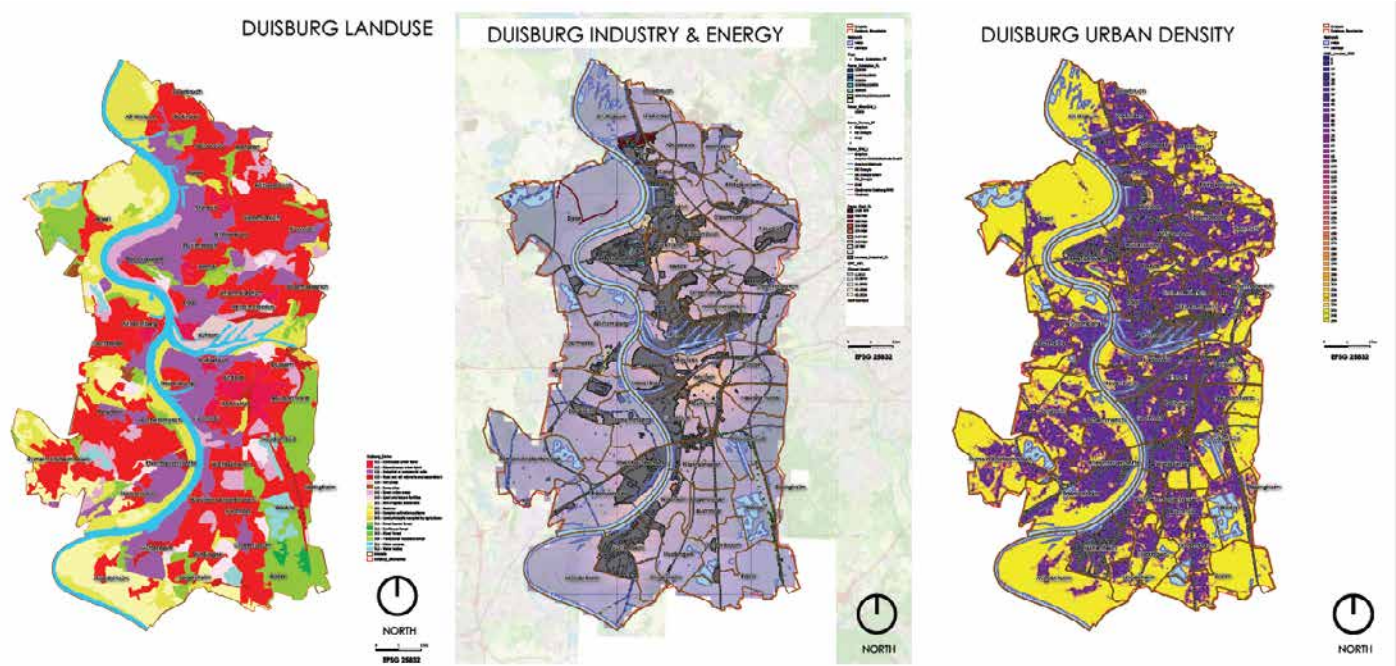
Risky Area to Invest
High Unemployment Ratio



The map on the right illustrates Duisburg's unemployment ratio, with darker green areas, representing industrial zones, showing higher unemployment rates and population density. This unemployment, coupled with a lack of social activities, drives migration out of the city, creating an economic decline. The middle map shows outward migration, with higher rates in areas of high unemployment. The age distribution map on the left shows that elderly populations reside in the outskirts, while younger populations live closer to industrial zones for job opportunities.

The land use map highlights the city's structure, with red areas indicating continuous urban zones and purple areas showing industrial zones, mainly near the Rhine River. Green spaces, including forests and pastures, are at the city borders. The port areas are crucial for the economy. The industry and energy map shows the alignment of mobility lines and power substations with industrial zones. Major stakeholders such as RWE, Statdwerk Duisburg, DB Energie, and Ampirion manage the energy grids and power plants.

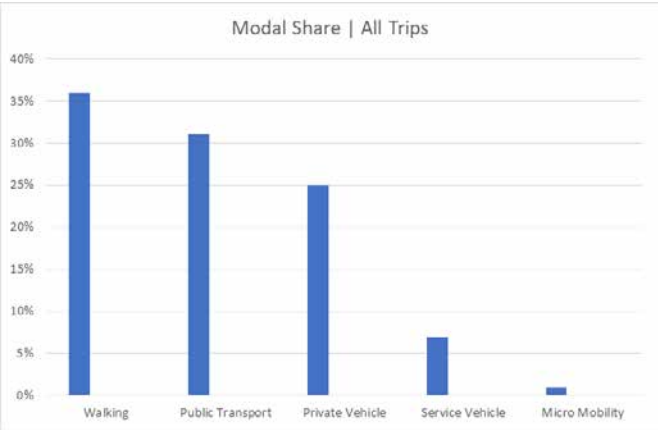
The conclusion reflects on the region's historical dependence on coal mining, which has shaped its industrial development. The research focused on how energy consumption changes affect manufacturing, the economy, and society, and proposed methods to reduce dependency on coal. The study found that energy consumption trends have profound, long-term effects on urban development, social structures, and economic prosperity. Understanding these trends is essential for addressing challenges like migration, unemployment, and demographic shifts, as exemplified by Duisburg's situation. This analysis offers insights for city planners to tackle the socio-economic dynamics of the region.



Izmir's Sustainable Mobility Transition:
A Commitment to Carbon Neutrality

Summary

This case study examines Izmir's Sustainable Urban Mobility Plan (SUMP) for 2035, focusing on strategies to promote eco-friendly transportation in line with European standards. The plan aims to redefine mobility in the city through ambitious long-term visions that enhance sustainability, reduce congestion, and align with the European Commission's decarbonisation mission for 100 cities.



Context

The primary goal of Izmir's SUMP is to improve livability and sustainability by providing safer, cleaner, more accessible, and affordable mobility options. This initiative involves the preparation and adoption of a comprehensive SUMP and delivering technical assistance to the Izmir Metropolitan Municipality (IMM).

As Turkey's third-largest city with a population of 4.5 million, Izmir is a key economic hub, contributing significantly to the country's GDP. It is also a center for regional trade, commerce, and cultural exchange. However, the city faces persistent transportation challenges, particularly in its central economic district.

Izmir's commitment to sustainable urban development is underscored by the SECAP report, which highlights the transport sector as a major contributor to carbon emissions, accounting for 23.1% of total emissions in 2018. The heavy reliance on private vehicles, particularly older models that depend on fossil fuels, has prompted the city to align its goals with the EU Mission for 100 climate-neutral cities by 2030, reaffirming its dedication to a broader European sustainability agenda.

In response, Izmir is implementing initiatives from the Izmir Transportation Master Plan (UPI 2030), aiming for a modal split of 25.5% private cars, 42% public transport, 31% pedestrian, and 1.5% bicycle use by 2030. This vision includes enhancing walking culture, developing dedicated cycling lanes, and promoting low-emission alternatives like electric vehicles. As Izmir moves toward these objectives, the need for an integrated governance framework becomes crucial for effective coordination and implementation of sustainable urban mobility initiatives.

Key Observations

Walking is a significant mode of transportation in Izmir, particularly for short-distance trips, driven by infrastructure and safety considerations.

Public transport trip durations exceed average travel times, indicating areas needing improvement.

There is a limited number of metro and IZBAN stations, highlighting the need for strategic expansion to enhance public transport accessibility.

IMM Railway Network Map with ongoing projects(Source: IMM)



In Action

The Sustainable Urban Mobility Plan (SUMP) for Izmir is spearheaded by a consortium led by MU Consult - Panteia B.V., which includes notable companies such as Rupprecht Consult Forschung & Beratung GmbH, POLIS, and ERTICO. This team collaborates with local partners like Parabol Smart Mobility Solutions and BNN Danismanlik ve Mühendislik. Dr. Ashraf Hamed leads the initiative, supported by Dr.-Ing. Susanne Böhler-Baedeker, bringing over 55 years of combined expertise in sustainable urban mobility.

The proposed strategy is structured around five key components:

Mobilisation and Inception: This initial phase lays the groundwork for the project. **Analysis and Scoping:** In this phase, the team assesses the existing mobility landscape and outlines a carbon-neutral scenario aligned with EU objectives, engaging citizens through workshops to develop a shared vision. **SUMP Strategy Development:** This component includes identifying practical measures, a comprehensive monitoring plan, financial modeling, and potential funding sources. **Measure Planning and SUMP Adoption:** Here, practical measures for implementation are outlined, ensuring the SUMP is actionable and sustainable. **Capacity Building, Training, and Visibility:** The final component focuses on enhancing the capabilities of the Izmir Metropolitan Municipality (IMM) through workshops, training programs, and study visits, aimed at increasing visibility and public engagement in the SUMP. The project commenced with an assessment of institutional resources and the local planning context, establishing an interdepartmental team at IMM to encourage collaboration and foster a sense of ownership

over the study. The analysis of Izmir's current situation encompassed demographic data, employment statistics, economic conditions, climate change impacts, governance structures, and sectoral relationships. Surveys on mobility habits and GIS analyses complemented this analysis, along with policy evaluations.

An extensive stakeholder participation and engagement strategy was implemented, involving informational and participatory sessions throughout the process. Simultaneously, capacity-building and training initiatives were undertaken.

Scenario Development

In addressing the functional urban area of Izmir, interdisciplinary experts developed four distinct scenarios:

Multimodal Scenario: This scenario targets congestion and traffic bottlenecks by establishing large-scale, comprehensive transfer hubs. It also aims to enhance sea transport infrastructure, leveraging currently unused docks to improve connectivity.

Inclusive Scenario: Focused on smaller-scale, neighborhood-level issues, this scenario promotes active mobility (walking and cycling) and strives to create equitable streets accessible to all residents. It emphasizes recognizing socio-economic differences in transportation access across neighborhoods.

Technological Scenario: This forward-looking scenario advocates for significant technological investments across multiple scales, encompassing holistic applications to modernize the city's transport infrastructure.

Carbon-Neutral Izmir Scenario: This scenario outlines strategies aimed at achieving the city's emission reduction targets for 2040 and 2050, promoting a cleaner and healthier urban environment.

These scenarios have played a critical role in gathering community input, establishing a solid foundation for developing the city's vision, identifying key indicators, and selecting actionable measures for the SUMP.

Leveraging European SUMP guidelines, the Izmir Metropolitan Municipality (IMM) is implementing measures to combat global warming in collaboration with the European Union. Initiatives include the GO-4Med Nature Project, Power Management, Cardi-Med, and Re-Value projects. A key action plan is the “Sünger Kent” (Sponge City) Project, featuring the Bornova Rain Park, Rain Stops, and the green renovation of Bornova Metro Station. Actions are underway to achieve the primary objectives outlined in SUMP 2035, including the Izmir Transportation Master Plan (UPI 2030), which focuses on creating an inclusive and environmentally friendly transport system.

Several rail projects are in development, including the Fahrettin Altay-Narlıdere metro line (2024), the Üçyol-Buca metro line (2026), and the Çigli tram line (2024). The Suburban Systems Development Project has enhanced the existing 80 km railway, improving stations and adding new infrastructure. In sea transportation, 15 passenger ships and three ferries have been added, emphasizing eco-friendly designs that accommodate bicycles. Efforts are also focused on increasing the electric bus fleet (currently 20 units).

The Izmir Transportation Center (IZUM) has been established to monitor and manage traffic, utilizing intelligent systems for comprehensive control. Izmir is

part of the Euro-Velo network, featuring eight bike connections to Dikili and Çesme. The BISIM bike-sharing system has served 2.5 million users since its 2014 launch and plans to expand to 60 stations by the end of 2023. Stakeholder workshops led by Rupprecht Consult have fostered public engagement with the SUMP, addressing urban challenges such as congestion and accessibility. The project aims to enhance livability, equity, and sustainability by 2030 and 2035.

The SUMP development process is improving teamwork among stakeholders and raising awareness about traffic and air pollution. Efforts are being made to establish reliable transportation alternatives, including robust public transport, an extensive cycling network, and pedestrian-friendly areas.

The transportation modeling process has been crucial for understanding urban mobility in Izmir and developing future scenarios. Active participation and alignment with European SUMP guidelines have shaped clear objectives and actionable measures. However, the decentralized nature of data collection has presented challenges, highlighting the need for a more organized framework for future planning.



Scenes from workshops



Bike Repair Station Source: IMM



Future of Izmir Poster - Writer's Creation

DYNAMICS BETWEEN SPACE AND TIME | MSC THESIS

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MAPPING THE STRUCTURAL CHANGE

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