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Low-Carbon Stations

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Low-Carbon Stations

A Workshop organized by PhD Candidate Halina Veloso e Zarate and Assistant Professor Dr. Manuela Triggianese, TU Delft

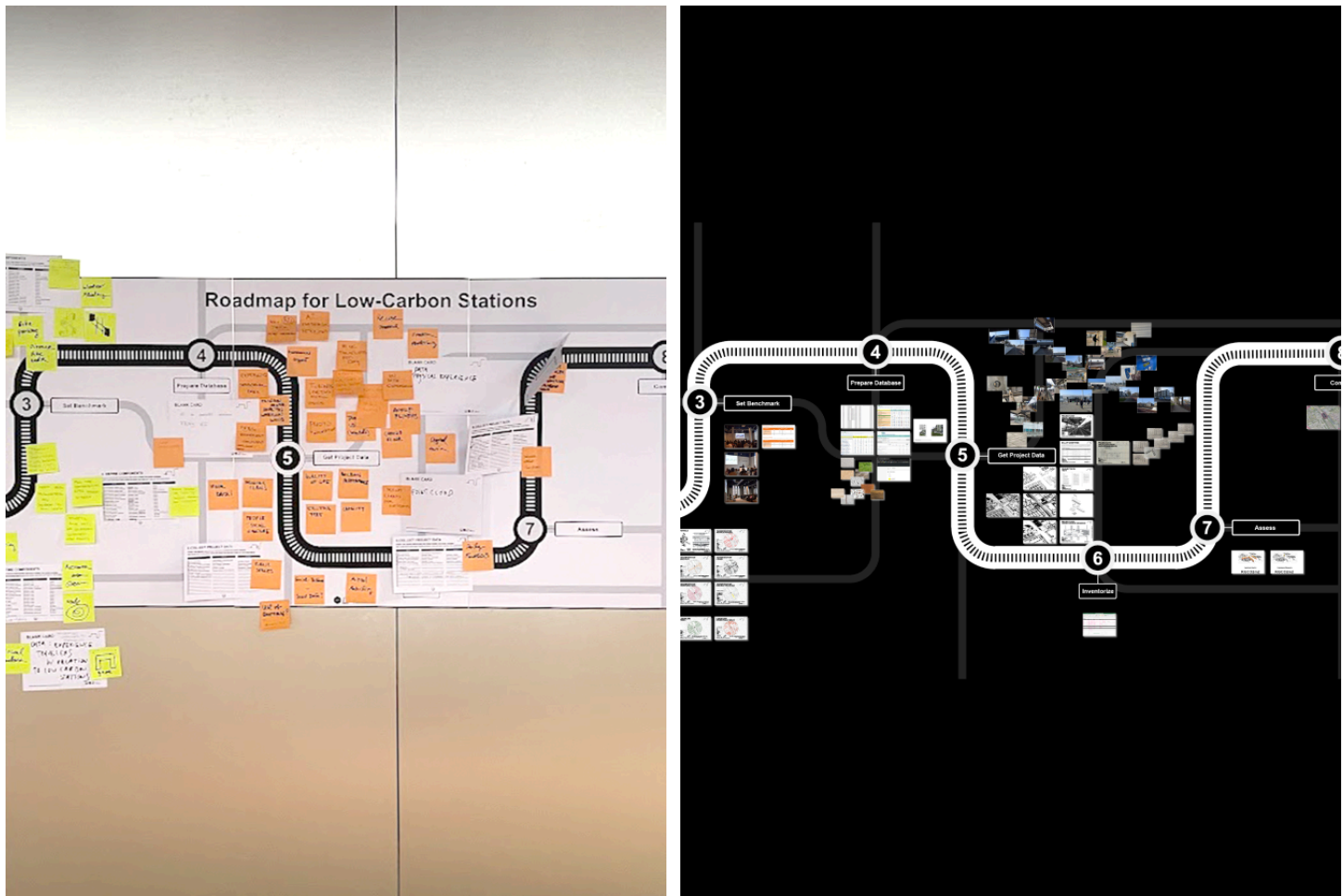
A part of the PhD research on Data-supported Design in Transport Nodes and Sustainable Urbanization
April 18, 2024

Welcome to the LCS DATA-HUB, an interactive report for the LCS (Low-Carbon Stations) Workshop. The workshop held in March 12th of 2024, in TU Delft, gathered experts from academia, industry and public authorities to exchange knowledge and experiences pertinent to the integration of data (embodied carbon) in design of the built environment.

The event “Low-Carbon Station Workshop: A roadmap for integrating carbon data in cross-scale station design” was organized by PhD Candidate Halina Veloso e Zarate and Assistant Professor Dr. Manuela Triggianese, as methodological support to one of three empirical investigations of Zarate's PhD research.

The workshop aimed to explore the integration of data about embodied carbon in construction materials through low-carbon design methodologies for architecture and urban design, with a specific focus on stations and station areas.

In this platform, you can find the documentation of the event and navigate through the data that supported the hands-on design case of Lombardijen Station.



THE LCS ROADMAP

The LCS workshop proposed a 9-step framework called the LCS Roadmap.

1. Establishing the system boundary
2. Defining the components of the system
3. Setting benchmark references for low-carbon station and station area projects
4. Preparing the material database
5. Acquiring project data
6. Inventorization
7. Assessment
8. Comparison
9. Reiterative reflection about the outcomes obtained)

In the LCS Workshop, participants were involved in the co-creation of a data inventory to support three of the 9 steps. This data-hub portrays the workshop data underlying that hands-on exercise.

Slide the center bar from left to ride to see the collection of data provided and the input from participants.



THE WORKSHOP PROGRAM

9:00 - Welcome and Introduction Kees Kaan, Head of Department of Architecture Dr. Manuela

Triggianese, Research Coordinator of Building Knowledge Halina Veloso e Zarate, PhD Researcher in Data-Supported Design for Transport Nodes and Sustainable Urbanization

9:15 - Keynote Speakers Liesbeth Boeter, Architect at Bureau spoorbouwmeester; Willem Van Genugten, CARBONLAB creator at Group A; Dr. Nils Le Bot, Head of Research at AREP, Post Doc at TU Delft

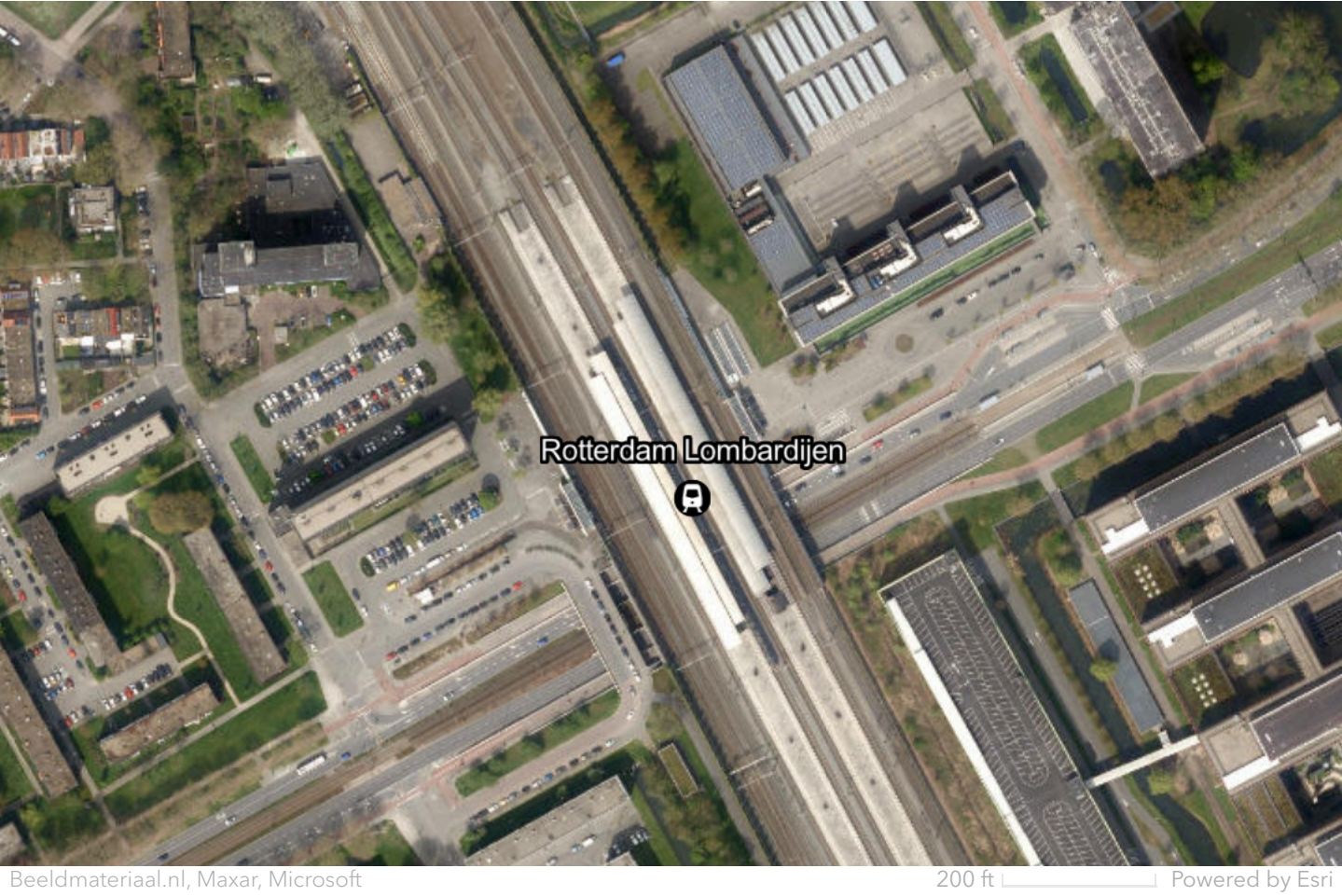
10:15 – 10:45 Panel Discussion Mediated by Assistant Professors M.Triggianese & Dr. S. Khademi

Joining the speakers for discussion, were the panellists Marianne Loof, with Bureau Spoorbouwmeester, Frank Schadewijk, with Pro Rail; Renske Backes, with NS Stations; Arend van Waart, with MVRDV Next Climate; and Valerie Heesakkers, with CITYFÖRSTER.

11:00 - 11:15 - Design case: Rotterdam Lombardijen Intro: “Carbon Tracks: A Roadmap towards a Low-carbon Lombardijen” 11:15 -

12:00 - Roadmap working session in Subgroups

12:00 - 12:30 - Wrap-up Discussion: Roadmap Co-creation Mediated by Post Doc Dr. Saba Golchehr and Halina Veloso e Zarate



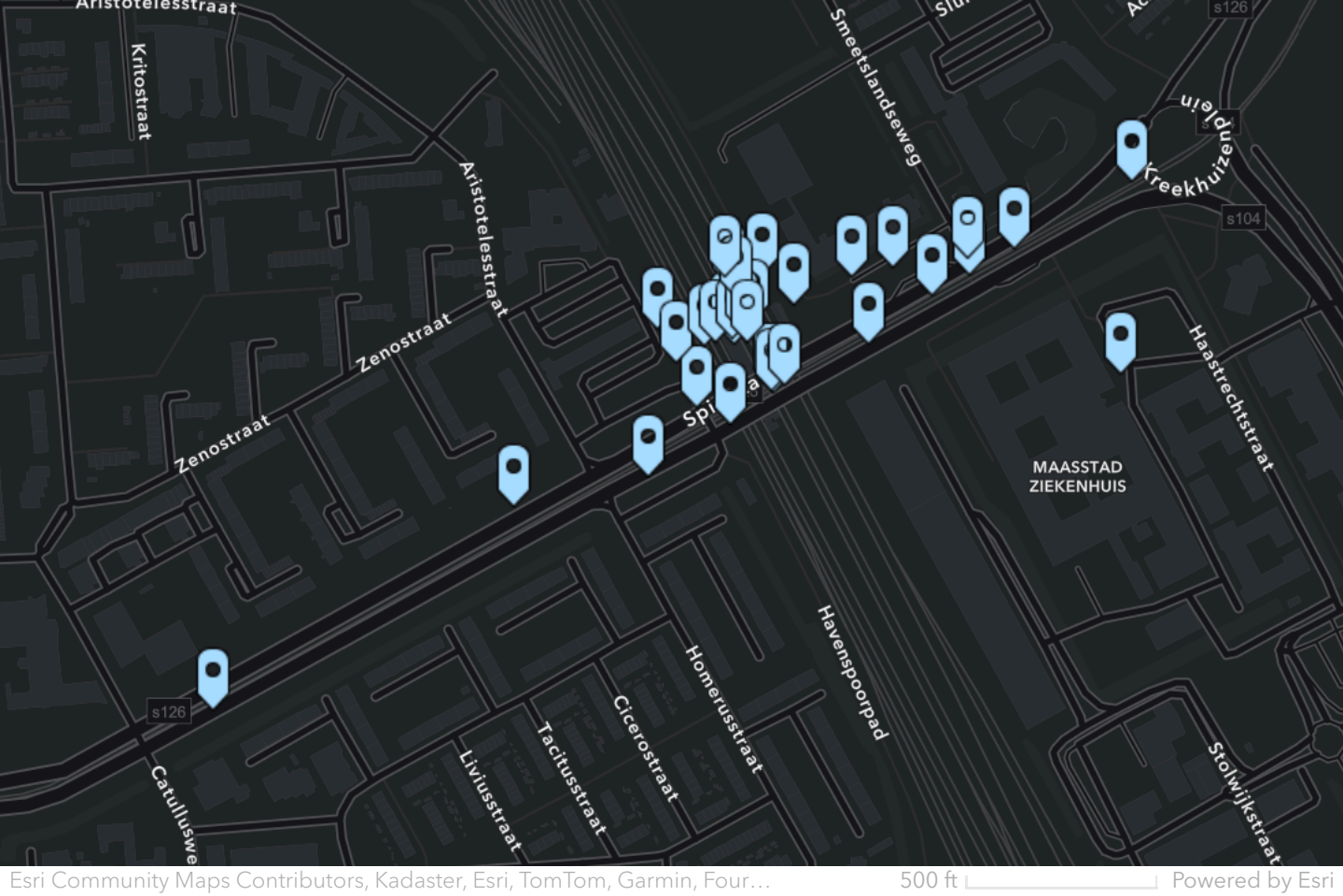
THE DESIGN CASE: LOMBARDIJEN

The urban challenges of rapid population growth, climate adaptation, and sustainable living have prompted Dutch cities to reevaluate their built environment and transportation systems.

The transportation sector is a significant contributor to CO₂ emissions, and the transition to low-carbon mobility means land-use integrated urbanization strategies, following a Transit-oriented Development (TOD) approach.

The City of Rotterdam has defined 13 public transportation nodes to bear the urban growth of the city: 50 thousand new homes by 2040.

This workshop focuses on one potential transportation node, the Lombardijen station area in Rotterdam.



Rotterdam Lombardijen
Positioned in Rotterdam South, the Lombardijen station is part of the Rotterdam-Dordrecht railway line.



"...the station was constructed as a 'temporary station'. Project architect Paul van der Ree designed it with a lifespan of up to five...



A precursor to 'circular construction'
"The 'temporary character' was a motive to respond to this with the design. As a precursor to 'circular construction', we see a...



Precursor to circular design
"...the steel structure of the roofs was not painted, but simply galvanized and the installations are surface-mounted. The roofs were...



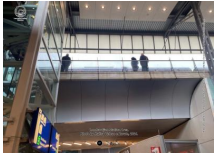
Lombardijen Station Platform
Design elements to provide shelter to the waiting passenger



Staircase of the Lombardijen Station



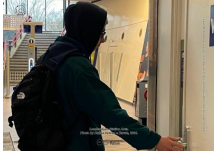
Elevators



Station Hall



Station Hall

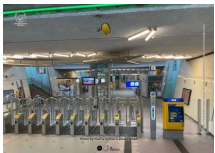


WC

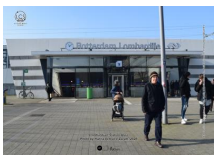


Retail

A Cafe to grab a warm beverage and a snack



Ticket control



Lombardijen Station - East



OV-Fiets



Maasstad Hospital

Likely the main destination for the passengers coming to the Lombardijen Station, the Maasstad Hospital is on the East side of the...



School Guido de Brès

"The floor plans can be freely arranged due to the concrete skeleton and elongated voids, allowing maximum response to (rapidly changing)..."



Kiss and Ride



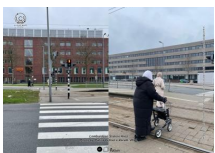
Multi-modal hub



Green tram tracks



Tram Stop



Crossing Spinozaweg



Crossing Spinozaweg



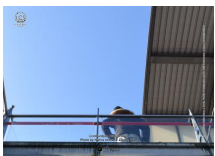
Crossing the tunnel



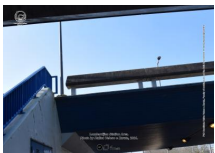
Tunnel



Station platformr seen from tunnel



Station platformr seen from tunnel



Former tram-train direct access



West side of the tracks



Residential area



Lombardijen Station - West



Lombardijen Station - West



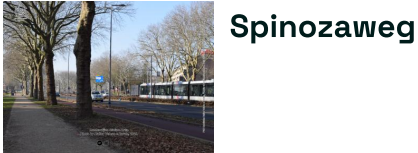
Taxi and parking



Residential buildings built on the 1960s



Residential buildings built on the 1960s



WORKSHOP DATA

The hands-on workshop began with a given assignment to four subgroups of about 10 experts with complementary backgrounds.

The task was to adopt a design case as a base for discussion, the Rotterdam Lombardijen station. This station is anticipating increased passenger flow and population growth in its surroundings, a prime location for redevelopment following principles of Transport Oriented Development.

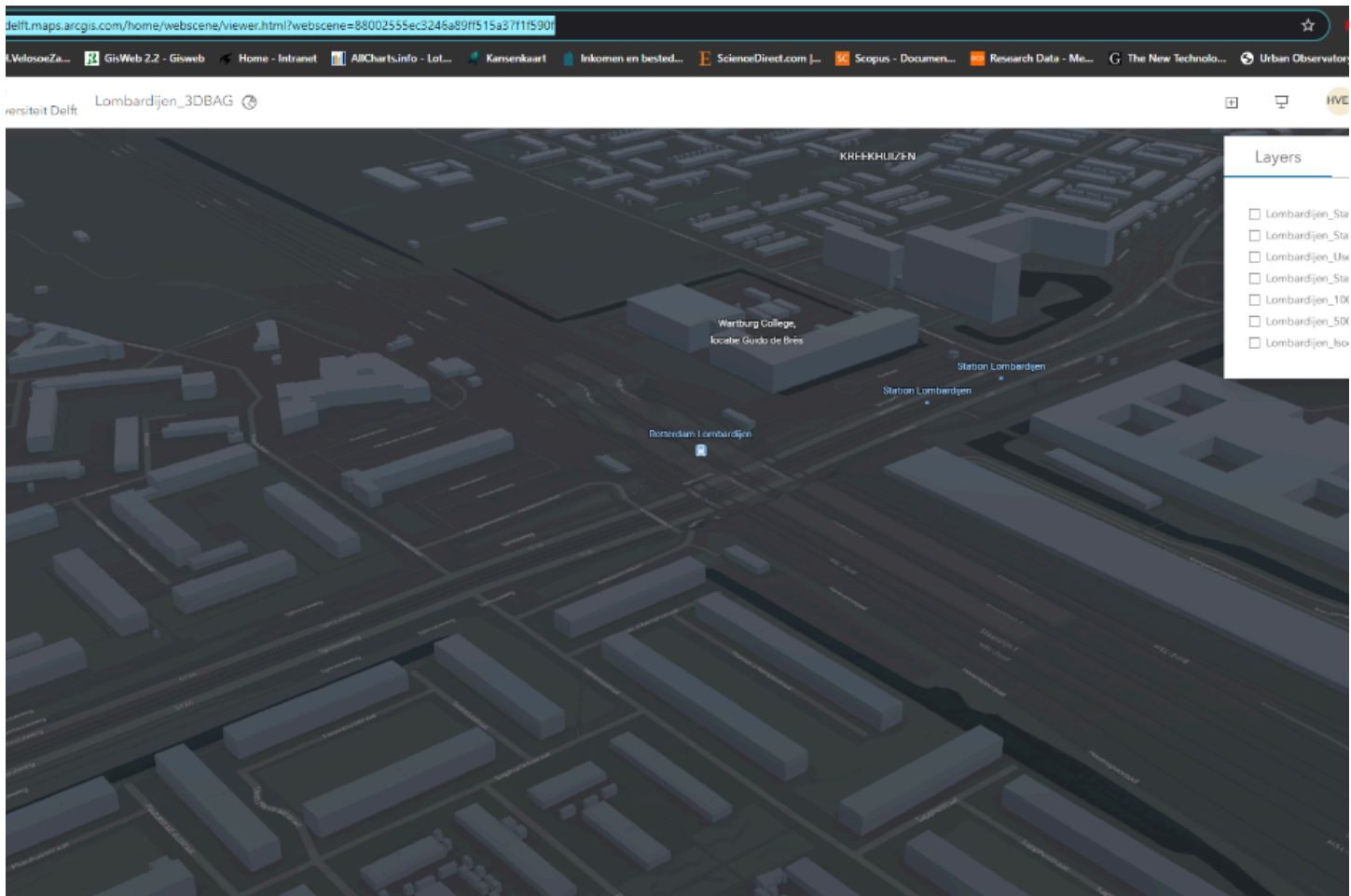
Participants were asked three key questions, based on steps 1,2 and 5 of the LCS Roadmap:

1. Establish the Boundaries

2. Define the components

5. Get Project Data

The objective was to evaluate which data supports decision-making at each of these steps, for an integrated design approach that considers embodied carbon data across architecture (station building) and urban design (transportation node and district).



1. ESTABLISHING THE BOUNDARY

The system's boundary is the area within which elements will be assessed for their carbon impact, and beyond which elements will be disconsidered.

In this exercise, participants delve into the considerations taken in defining the boundaries of the LCA system for the station. The groups discussed which factors and data-sets support that decision, looking into the spatial extent, system interdependencies, and data availability.

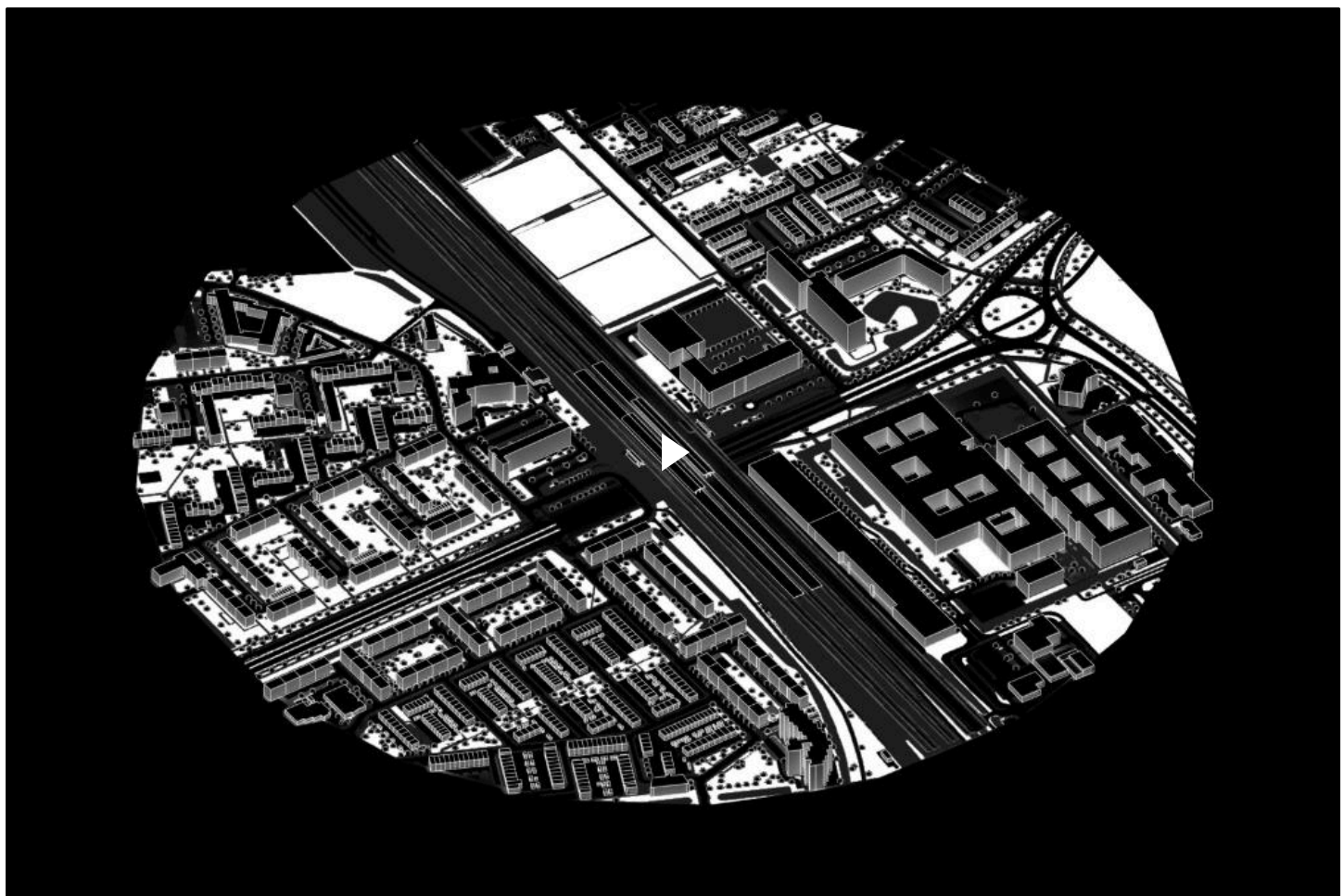
Navigate the interactive scene on the right to encounter some of the data-sets that were provided as a starting point to this discussion:

-100m Buffer from station

-500m Buffer from Station

-5,10,15min isochrone (walking)

-15 minute "Experience" isochrone (users on a mission)



2. DEFINE THE COMPONENTS

The components of the system are the parts made of construction materials that are attributed to certain Global Warming Potential (GWP) value. The sum of the GWP values of all materials in all components, informs the total carbon impact of the system.

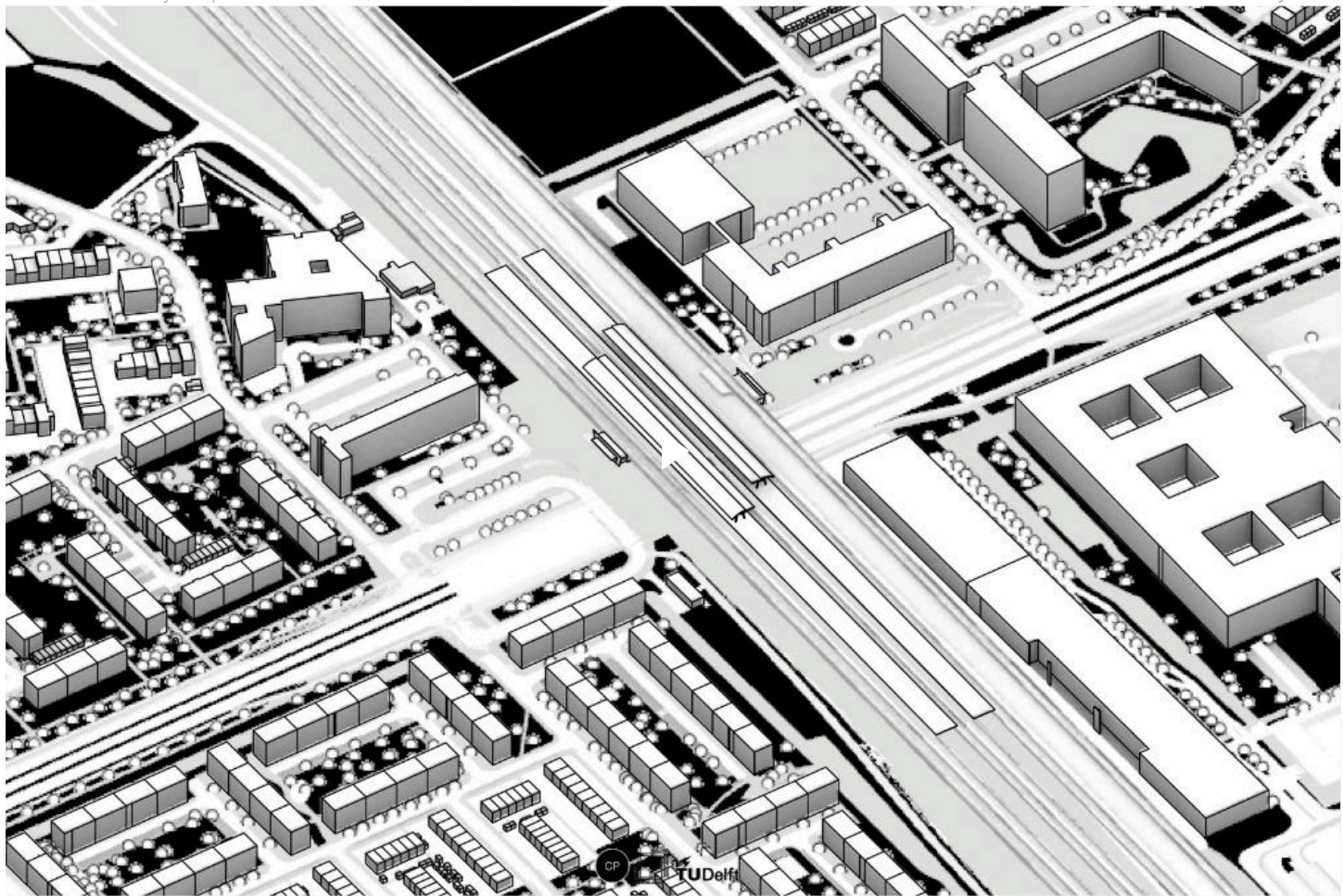
At the early design stage of a project, it is impossible to have a complete picture of all the components of the system. Nonetheless, designers can start by defining which are the components that can/should be roughly estimated. That provides a value to start designing with, a notion about the order of magnitude of the system's carbon impact.

The components provided for discussion are organized according to the categories:

Buildings: The edifications within the station area, excluding the station building. Building components given were floor, facade and roof.

Transportation: The infrastructure dedicated to mobility. Examples of transportation components include but are not limited to roads, bike paths, and parking; and the floor, facade and roof of the parking structure building, and the roof, boarding platform, hall, and tunnels of the station building.

Landscape: The infrastructure dedicated to public spaces including components such as parks, lawns, trees, water (canals) and plazas.



5. PROJECT DATA

Project data informs the quantity of each component and material per component.

Project data is given in different modalities and sources:

Visual data: building floorplans from historic drawings, building and site 3D digital model, maps depicting geospatial data, building and site pictures for material identification, among others

Audio data: recorded interviews, discussions, etc
(not provided in the LCS workshop)

Text data: project descriptions, site observation notes, planning documents, etc

Tabular data: attribute tables from geospatial components, bill of quantities from historic

documents or 3D models, LCA data-base, etc.

SPECIAL THANKS

LCS KEY NOTE SPEAKERS

Liesbeth Boeter, Bureau Spoorbouwmeester

Liesbeth Boeter is an architect and advisor at Bureau Spoorbouwmeester. She develops spatial policy for the rail sector, in collaboration with NS and Pro Rail. She has been working on infrastructure projects and stations for more than 30 years. In the role of architect at StudioSK, Zwarts and Jansma architects, among others, where she was project architect of the Beatrixlaan station and viaduct in The Hague. She is supervisor of the Amsterdam Central Station, all the stations in The Hague and Den Bosch. Her specialty is developing design policy regarding sustainable stations.

Willem van Genugten, Group A

Willem is an architect graduated from TU-Delft and the University of Illinois Chicago, acting as a Sustainable Business Developer at Group A. Willem is the initiator of GROUP A's think-tank CARBONLAB, connecting research and knowledge networks to running projects. CARBONLAB proposes a research-by-design approach with tangible steps towards urbanism and architecture that serve as carbon sinks. In collaboration with IABR and KeileCollectief, this initiative organizes interdisciplinary debates, events and workshops to accelerate climate-positive design and construction. Willem has 23 years of professional experience, nearly a decade addressing the ambition to design and realize CO2 Negative = Climate Positive projects.

Dr. Nils Le Bot, AREP and TU Delft

Nils Le Bot is architect and urban planner, Head of Research Coordination at the multidisciplinary architecture agency AREP (a subsidiary of SNCF). He is conducting post-doctoral research TU Delft and is an Associate Professor at ENSA Paris Val-de-Seine. His research interest is on creative and robust solutions for resilient urbanism, low-carbon architecture and ecological design. Focusing on cross-disciplinary and multi-scalar approaches to metropolitan mobility, urban foresight, low-tech cities and discerning urbanism.

PANNELISTS

The panel discussion was mediated by Dr. Manuela Triggianese and Dr. Seyran Khademi, facilitating insightful exchanges and dialogue among the panelists and workshop participants. Besides the Keynote Speakers, the panelists were:

Marianne Loof, Bureau Spoorbouwmeester

Marianne Loof, a founding partner of LEVS architects, brings expertise in urban densification and sustainability. Her extensive involvement in spatial quality committees underscores her commitment to advancing sustainable architectural practices.

Frank van Schedewijk, ProRail

Frank Schedewijk, Program Manager Circular Construction at ProRail, drives the transition to circular design and construction in train stations. His presentation highlighted ProRail's ambitious targets for sustainable material usage and CO2 reduction in station infrastructure.

Renske Backes, Stationsontwikkelaar NS Stations

Renske Backes, a stations developer at NS Stations, contributes to the development of sustainable railway infrastructure. Her expertise in bio-based construction aligns with NS Stations' goal of increasing the use of renewable materials in station development projects.

Valerie Heesakkers, CITYFÖRSTER

Valerie Heesakkers, a designer and researcher at CITYFÖRSTER, specializes in carbon-based design methodologies. Her contributions to research and architectural projects underscore her commitment to advancing sustainable design practices.

Arend van Waart, MVRDV Next Climate

Arend van Waart, a leading figure in innovation and sustainability at MVRDV Next Climate, focuses on optimizing building carbon footprints through software solutions. His expertise in design research and software development drives innovative solutions for sustainable architecture.

CONTRIBUTORS

Kees Kaan (Opening note) Head of the Architecture Department Faculty of Architecture and the Built Environment, TU Delft

Dr. Seyran Khademi (Panel mediation) Assistant Professor, AiDapt Lab Faculty of Architecture and the Built Environment, TU Delft

Dr. Saba Golcwehr (Co-creation facilitation) Post Doctoral Researcher in the Building Knowledge section Faculty of Architecture and the Built Environment, TU Delft

Paul van der Ree, Studio SK | Movares Senior Architect StudioSK, Movares Responsible for the original architecture project of the Lombardijen Station

Jasper van der Vaart, TU Delft Researcher and Software Developer at Urban Data Sciences Faculty of Architecture and the Built Environment

Mark Caruana, TU Delft Student Assistant Faculty of Architecture and the Built Environment, TU Delft

Max Cunin, Superworld Architect and Strategic designer, co-founder of Superworld

Christian Oettinger, Henning Larsen Design Engineer, contributor to the development of Urban Decarb digital tool by Henning Larsen and Ramboll

Inès Zaid, TU Delft PhD Researcher/Junior Lecturer Faculty of Architecture and the Built Environment, TU Delft

Nathalie Kooijmans, TU Delft Management assistant for: R&D support and coordination section Faculty of Architecture and the Built Environment, TU Delft

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ORGANIZERS

Halina Veloso e Zarate, PhD Researcher

Data Supported Design in Transport Nodes and Sustainable Urbanization

Faculty of Architecture and the Built Environment, TU Delft *H.VelosoZarate@tudelft.nl*

Halina is investigating the integration of building data with geospatial aspects, focusing on carbon data for the built environment. Using Transit Oriented Development as a case for investigating low-carbon design methods, this PhD tests the transferability of embodied carbon data across the design scales of Architecture and Urban Design.

Graduated in Architecture and Urbanism (2014), at the Pontifical Catholic University of Goias in Brazil, she obtained her Masters degree in Architecture in UCLA, where she worked as Graduate Student Researcher for the Now Institute, a partnership between UCLA and Morphosis Architects (Aug 2015- Jun 2016). She worked with Skidmore, Owings and Merrill LLP, in Los Angeles, (Jun 2016 - Nov 2017) and MVRDV (Feb 2018 - Jun 2021), as an Architect and Urban Designer, and as a Project Leader.

Dr. Manuela Triggianese Assistant Professor

Complex Projects Faculty of Architecture and the Built Environment, TU Delft *m.triggianese-1@tudelft.nl*

Manuela is the research coordinator of the Section Building Knowledge and master coordinator for the Group of Complex Projects. Her focus is on the integrated approach of design and its role in the development of complex projects (e.g. stations) where multiple stakeholders, disciplines and data are involved.

Graduated and trained as an architect, she holds the international doctoral degree Villard d’Honnecourt, a collaboration between TU Delft, IUAV, ETSAM and ENSA Paris-Belleville. She worked as Marie Curie research fellow at the Beijing Technical University and Postdoc at AMS Institute.

LCS WORKSHOP MARCH 12th, 2024

Moving towards a CO2-free built environment requires changes in how we plan and design our public transportation stations and station areas. In this context, carbon data becomes a fundamental layer in design decision-making.

The LCS (Low-Carbon Stations) Workshop focused on low-carbon design methods and their applications on the scale of architecture and urban design, within the context of stations and their immediate surroundings. The goal of this workshop was to exchange knowledge between experts in low-carbon design, station design and data-integrated design methods, followed by a co-creative session taking the station Lombardijen, in Rotterdam, as a case study.

This workshop breaks ground in defining a road-map for a cross-scale approach to low-carbon station design, outlining the data supporting each step of this integrated design method.

A ROAD-MAP FOR
INTEGRATING CARBON
DATA IN CROSS-SCALE
STATION DESIGN

HOW CAN LOW-CARBON
DESIGN METHODS FOR
STATIONS HELP ASSESS
THE INTEGRATION OF
DATA ACROSS
ARCHITECTURE AND
URBAN DESIGN SCALES?