Innovative 3D tours describing the accessibility and inclusion of pilot sites according to the IG-VAE methodology

Deliverable 4.2

Version 1.0

Project title:	**Fostering sustainable consumer behaviour with inclusive bicycle logistics infrastructure in urban outskirts**
Project acronym:	**SuCoLo**
Project duration:	01/2024 – 06/2026
Project number:	F-DUT-2022-0007
Work package/Task:	WP4 / T4.2
Project website:	https://sucolo.eu/
Authors:	Günther Ennemoser, Diego Visintin (IND)

This project has been funded by the Austrian Research Promotion Agency (FFG), Ministry of Enterprises and Made in Italy (MIMIT), the Federal Ministry of Research, Technology and Space in Germany (BMFTR) and the Swedish funding agency (Vinnova) under the Driving Urban Transitions Partnership, which has been co-funded by the European Union under grant agreement no. 905465.

Document versions

Version	Date	Changes	Authors
V0.1	25.07.2025	Establishment of the document and input	Günther Ennemoser, Diego Visintin (IND)
V0.2	30.07.2025	Review and formatting	Michael Thelen (SRFG)
V1.0	11.08.2025	Finalisation of the document	Michael Thelen, Olivia Zechner (SRFG)

List of abbreviations

3D	Three-dimensional
CMS	Content management system
DE	Germany
DNG	Digital negative
EN	English
IG-VAE	Guaranteed Information for Accessibility Evaluation Based on Individual Needs
IND	Cooperativa sociale independent L. Onlus soc. coop
IT	Italy
JPEG	Joint Photographic Experts Group
M	Meter
MIND	Meran.o Innovation District
PDF	Portable Document Format
POI	Point of interest
SEV	Rail replacement service
VR	Virtual reality

Table of contents

List of Tables

List of Figures

Administrative information

Basic information on the SuCoLo project and this deliverable:

Project title	SuCoLo: Fostering sustainable consumer behaviour with inclusive bicycle logistics infrastructure in urban outskirts
Project coordinator	Salzburg Research Forschungsgesellschaft mbH (SRFG), Salzburg, Austria; project coordinator: Michael Thelen
Project partners	Independent L. ONLUS (IND), Italy
	Sustainability InnoCenter (SIC), Sweden
	VIABIRDS Technologies GmbH (VIA), Austria
	Universität Leipzig (ULEI), Germany
	Südtiroler Transportstrukturen AG – Green Mobility Department (STA), Italy
Funding	DUT Call 2022 – European Commission under the Horizon Europe Partnership scheme
	Funding is being provided by the Austrian Research Promotion Agency (FFG), Ministry of Enterprises and Made in Italy (MIMIT), the Federal Ministry of Research, Technology and Space in Germany (BMFTR), and the Swedish funding agency (Vinnova)
Project nr.	F-DUT-2022-0007
Duration	01/2024 – 06/2026
Website	https://sucolo.eu/
Deliverable nr.	D4.2
Deliverable title	Innovative 3D tours describing the accessibility and inclusion of pilot sites according to the IG-VAE methodology
Authors	Günther Ennemoser, Diego Visintin (IND)
Version & status	Version 1.0
Date	11.08.2025

Purpose of the document

This document outlines the background, development and implementation of innovative 3D virtual tours designed to digitally assess the accessibility and inclusivity of SuCoLo's two peri-urban pilot sites and their surrounding points of interest (POIs) using the IG-VAE methodology (Guaranteed Information for Accessibility Evaluation Based on Individual Needs). It provides an overview of the applied technologies, methodological framework, and selected points of interest in SuCoLo pilot sites Merano and Leipzig. As part of T4.1 *Design and prepare accessible and inclusive pilots with local stakeholders* and T4.2 *Run and evaluate pilots in communities of local neighbourhoods*, this manuscript shines a light on the accessibility and inclusiveness attributes of SuCoLo's pilot sites in Leipzig (DE) and Merano (IT) where one can preview the area virtually. More broadly, this contributes to SuCoLo's objective of ensuring the inclusiveness of its designed pilot sites by fully taking into account barrier-free accessibility for all, with a focus employed on the requirements of families, persons with disabilities and the elderly who might partake in the pilot sites.

This document is complemented with D4.1 *Georeferenced mapping of POIs regarding accessibility and standardised adaptation plans (PEBA) in case of barriers*, which takes an on-site survey of the same POIs denoted in this document, assesses its degree of accessibility, and suggests actionable renovation suggestions if the sites were to be renovated to be fully accessible to all user groups. These take the form of standardised adaptation plans, specifically Plans for the Elimination of Architectural Barriers (known as *PEBA*).

Executive Summary

The IG-VAE methodology (Guaranteed Information for Accessibility Evaluation Based on Individual Needs) was harnessed within the SuCoLo project as a framework to digitally document and assess the level of accessibility and inclusiveness of its urban periphery pilot sites. It combines immersive 3D imaging, georeferenced mapping, and inclusive design principles to visualise relevant pedestrian routes and public infrastructure in real-world settings. Using high-resolution 360° cameras (Insta360 X5), professional editing tools and the CMS4VR platform, the methodology enabled the creation of interactive virtual tours that simulate barrier-free access for diverse user groups, such as persons with disabilities, elderly individuals, and families with strollers. Each path was selected and recorded with particular attention to universal design criteria, ensuring the representation of safe, legible, and inclusive environments. The IG-VAE approach supports participatory urban planning and inclusive mobility solutions, providing a replicable model for future accessibility evaluations across European cities.

Both SuCoLo research pilot sites in Merano and Leipzig are in urban peripheries.

- In Merano, the pilot site that hosts a pick-up station is in the Maia Bassa district. The neighbourhood's adjacent railway station, Stazione di Merano-Maia Bassa, serves as an important access point on the Bolzano–Merano railway for commuters living in outside localities. In the vicinity, there are also bus stops. Here, the placement of the SuCoLo pick-up station was intended to appeal to appeal to (inter-)modal commuters. The 3D tour of the Merano pilot site spans from the Maia Bassa train station to the SuCoLo pickup station at the MIND Centre in the Maia Bassa district and designates nine locations as points of interest.
- In Leipzig, the pilot site that hosts a mobile micro-hub is in the Lützschena-Stahmeln district where there exists a lack of fixed service facilities. The neighbourhood's adjacent tram stop, Freirodaer Weg, serves as an important access point on the Schkeuditz-Leipzig route for commuters. Also, the pilot site is in proximity to the freight consolidation center, for which the SuCoLo micro-hub will deliver a part of its parcels. The 3D tour of the Leipzig pilot site spans from the Freirodaer Weg tram stop to the SuCoLo micro-hub at the Lützschena Town Hall and designates twelve locations as points of interest.

The 3D tours described in this document can be accessed here:

3D tour Merano: https://cms4vr.independent.it/hotels/sucolo-meran

3D tour Leipzig: https://cms4vr.independent.it/hotels/sucolo-leipzig

Further points of interest surrounding the SuCoLo pilot sites, also the points of interest beyond the ones mentioned in the 3D tours, can be accessed here:

Merano research pilot: https://sucolo.independent.it/

Leipzig research pilot: https://sucolo.independent.it/map/

1. Background information on the SuCoLo pilot sites

This section describes the selection of the two urban periphery pilot sites in the SuCoLo project and its contextual considerations.

1.1. Merano

In Merano, the Meran.o Innovation District (MIND) is an initiative of the Municipality of Merano to strengthen the spirit of innovation, creativity and entrepreneurial culture in the Merano region. It promotes and supports start-ups and established companies, educators and interested citizens, with the aim of creating economic and social development in the area. As part of the SuCoLo project, MIND was chosen as the strategic location for the cargo bike-specific pickup station because it is:

- Located in the less connected outskirts of Merano
- In proximity to Maia Bassa railway station (350 m)
- Directly connected to the main bicycle network
- Connected to the public transport net (bus lines)
- Barrier-free accessible and encourages general accessibility for all
- A public building of the municipality of Merano (project partner)
- A Point of cooperation between public administration and the local economy
- Supported by the Merano Galoppo, the owner of the entire area around MIND, and backs the SuCoLo project

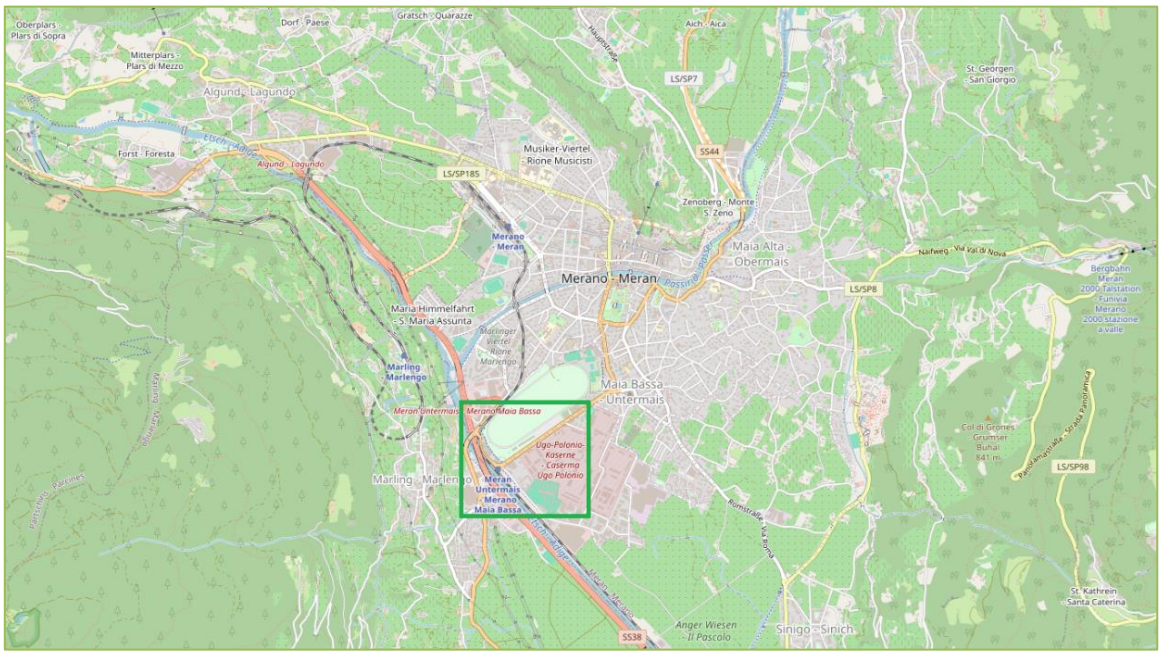


Figure 1 Map of Merano with districts (with Merano Maia Bassa & MIND framed in green) (Source: https://www.openstreetmap.org)

Figure 2 Map section of the Merano pilot district Maia Bassa with transport connections (Source: https://www.openstreetmap.org)

1.2. Leipzig

Lützschena-Stahmeln comprises the districts of Hänichen, Lützschena, Quasnitz and Stahmeln (with the old town centres and the industrial and commercial park). It is located on the White Elster river and New Luppe water channel and stretches along Hallesche Straße street and the White Elster river.

Lützschena-Stahmeln has road and rail connections. It is located on Federal Highway 6, the section of which runs from Halle to Leipzig. Tram line 11 connects the town with the city of Leipzig, and bus line 91 connects the freight transport centre. In addition, the district is crossed by the Leipzig-Wahren–Leipzig central station railway line, which provides half-hourly connections to Halle and Leipzig city centre via the Lützschena stop on the S3 line of the Central German S-Bahn (source: https://de.wikipedia.org/wiki/Lützschena-Stahmeln).

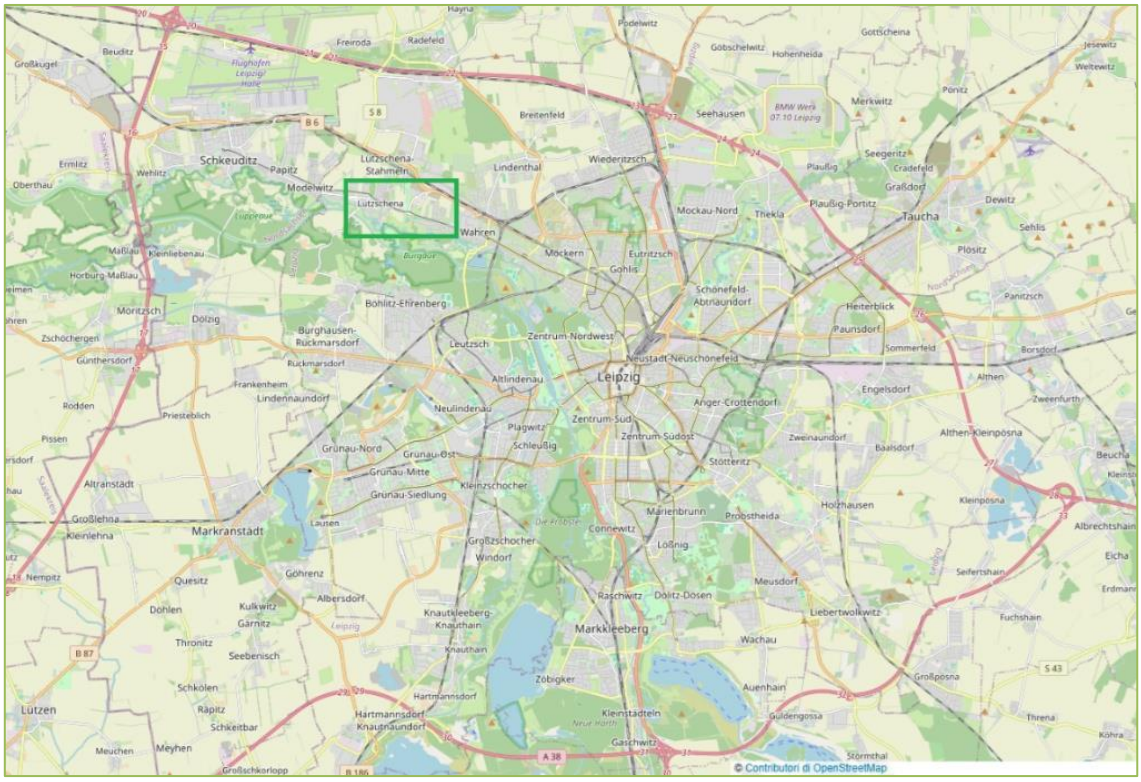


Figure 3 Map of Leipzig and its (with Lützschena framed in green) (Source: https://www.openstreetmap.org)

As part of the SuCoLo project, the car park at Lützschena Town Hall was selected as a strategic location for the mobile micro-hub. This location was chosen because the Lützschena district offers favorable conditions that make the operation and use of such a hub particularly sensible:

- Lützschena is located on the less well-connected outskirts of Leipzig and therefore offers great potential for innovative solutions in the field of sustainable logistics to make up for the area's lack of fixed service facilities. At the same time, the district is near Leipzig's freight transport centre, which includes Leipzig Airport, European Air Transport Leipzig and the World Cargo Centre Leipzig. This proximity enables efficient connections to supra-regional goods flows and promotes integration into existing logistics networks.
- Despite its peripheral location, Lützschena is well connected to public transport, both by tram and by buses as part of the rail replacement service (SEV) (see above). The selected location at the town hall is also characterised by its barrier-free accessibility and is easily accessible for all users.
- Another advantage is that the site is owned by the city of Leipzig, which ensures a stable institutional basis and close cooperation between public administration and the local economy. The mobile micro-hub also functions as a cooperation point where new models of sustainable urban logistics can be tested and jointly developed.
- Last but not least, the Lützschena district fits in with the concept of the "15-minute city": most everyday errands can be done within a 15-minute walk. This creates ideal conditions for neighbourhood-based and environmentally-friendly distribution of goods – a key goal of the SuCoLo project.

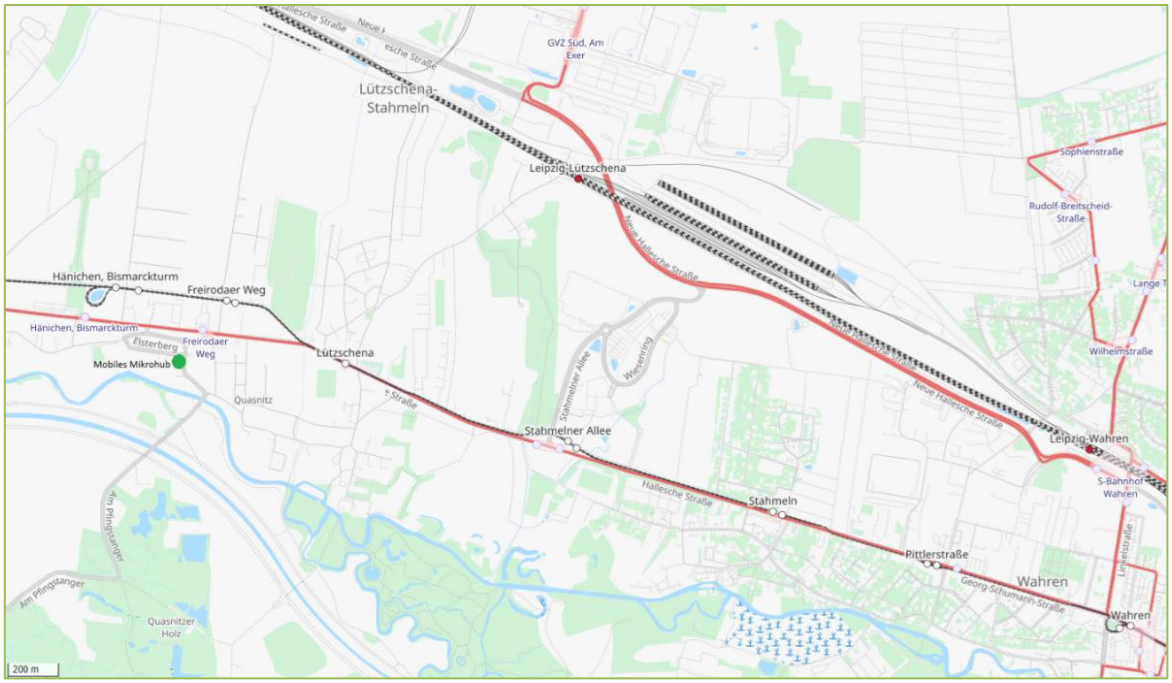
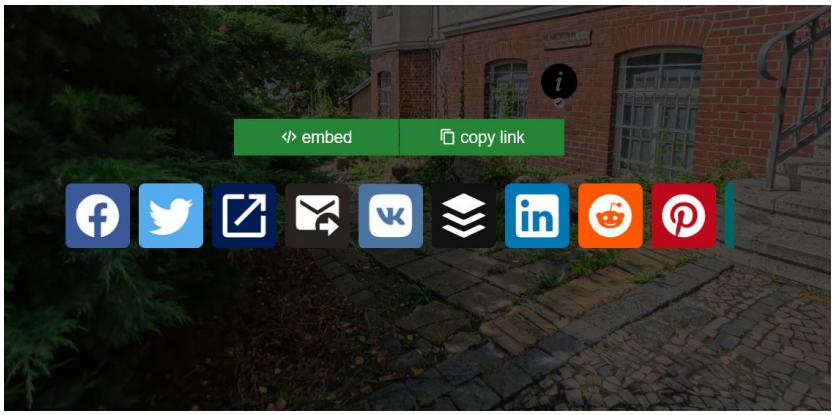
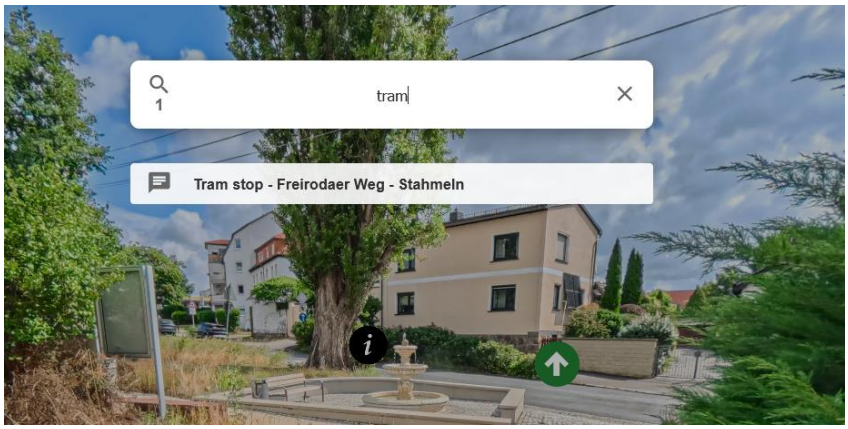


Figure 4 Map section of the pilot district of Lützschena with transport connections (Source: https://www.openstreetmap.org)

2. Features

The 3D tours possess the following attributes:

Table 1 Features of the 3D tours

Language toggles (English, German and Italian)	
Sharable link/plug-in insert of a chosen location	
VR mode	
Search bar	

Slow spin around chosen location	
Zoom-in, zoom-out	
Point of interest info box with supplementary information	 
Link to the SuCoLo website	
Easy-to-understand instructional guide	

Overview of all captured locations and points of interest	
Full screen mode	
Journey guide along the specified route	

3. Applied methodology

In order to carry out the 3D tours, the following methodology and specifications were utilised:

Table 2 Utilised methodology and specifications

Technical equipment:	Insta360 X5, which is a compact 360° camera with 8K resolution. It is waterproof and offers interchangeable lenses and a particularly good stabiliser function. It is ideal for high-quality outdoor shots.
Recording on site:	Before recording, the whole path was assessed in advance to identify eventual challenges in order to plan the most accessible route for everybody. To take the 3D images, the special camera was mounted on a tripod and the device was connected via Bluetooth to the device-specific user software on a tablet. Beginning from a starting point (in Merano the Maia Bassa train station, and in Leipzig the Lützschena tram station), a 3D image was taken approximately every 25 metres. The fully automatic image capture was triggered remotely via the tablet. To avoid SuCoLo staff being in the picture, they hid behind local elements.
Image editing:	The 360° photos were initially transferred from the camera to the computer and imported into Insta360 Studio. There, the individual images were stitched together to form a seamless 360° image. After exporting as JPEG or DNG (RAW), the images are further processed in Adobe Lightroom Classic (Removing faces and car number plates, colour correction, exposure adjustment and detail optimisation).
Creation of the 360° tour:	This was conducted on the CMS4VR-System. This CMS (*content management system*) offers quick and easy implementation of an interactive 360° tour. First, the edited 360° images are uploaded to the CMS4VR backend and linked there to form a virtual tour. POIs, information content, navigation elements and multimedia content (e.g. descriptions, PDFs, external links) can be added via a user-friendly interface. The finished tour can be published directly online and integrated into websites.

4. Points of interest denoted in the 3D tours

This section denotes the 3D tours' locations as points of interest for Merano and Leipzig, respectively.

4.1. Merano (Maia Bassa district)

Starting at the Maia Bassa train station until the SuCoLo pickup station at the MIND Centre, the following points of interest are listed in the 3D tour of the Merano pilot site:

Table 3 Bird's eye overview of the listed points of interest (Source: https://cms4vr.independent.it/hotels/sucolo-meran)

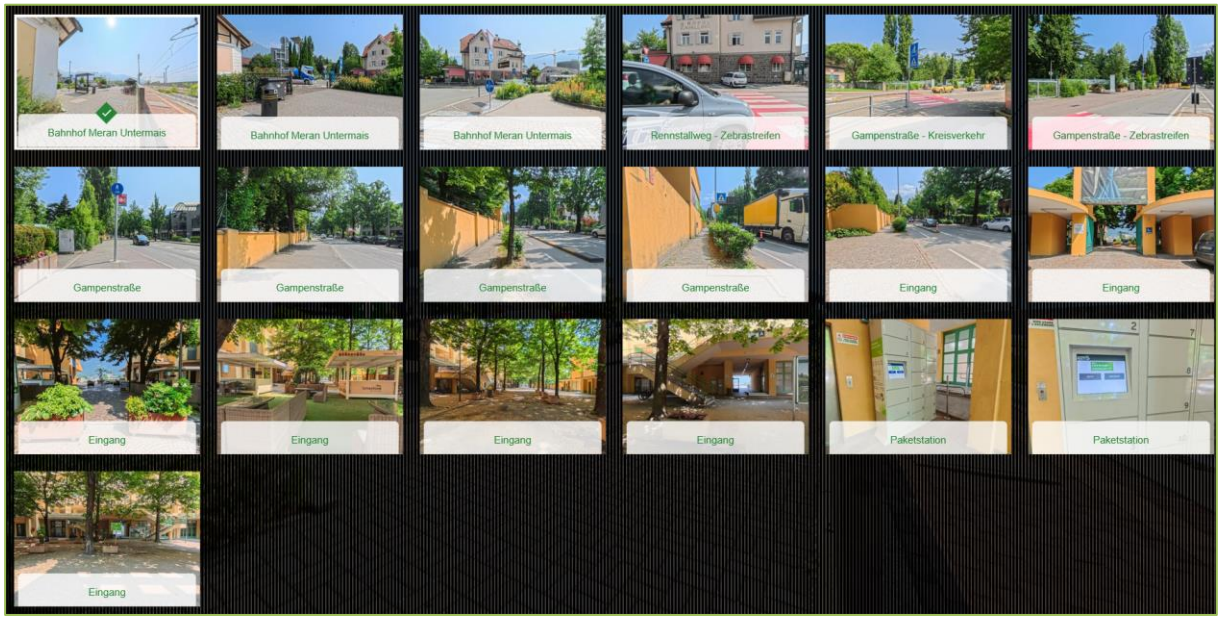
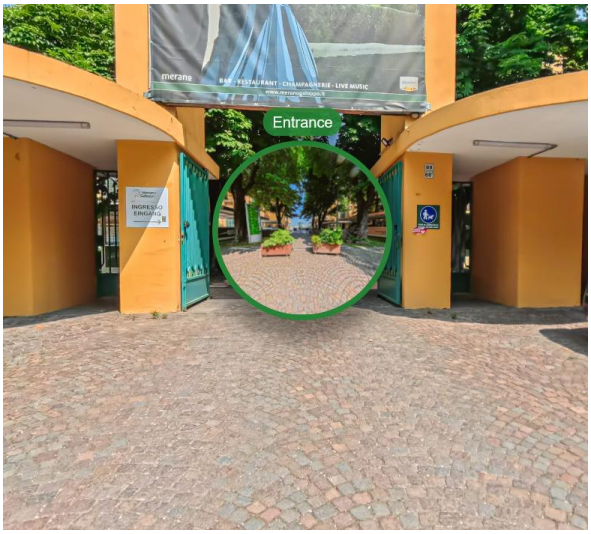
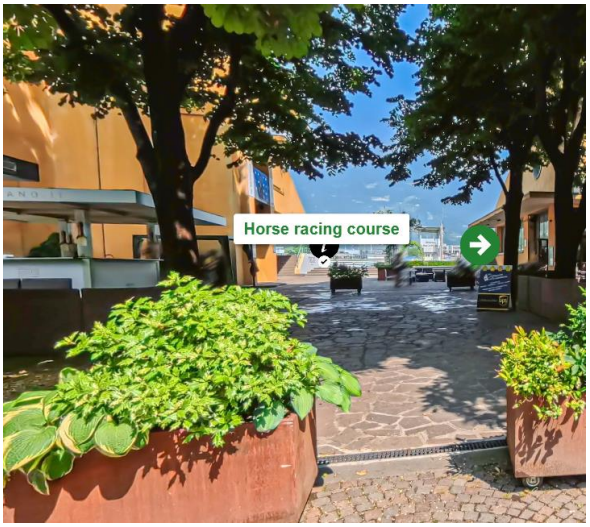


Table 4 Merano (Maia Bassa district) listed points of interest

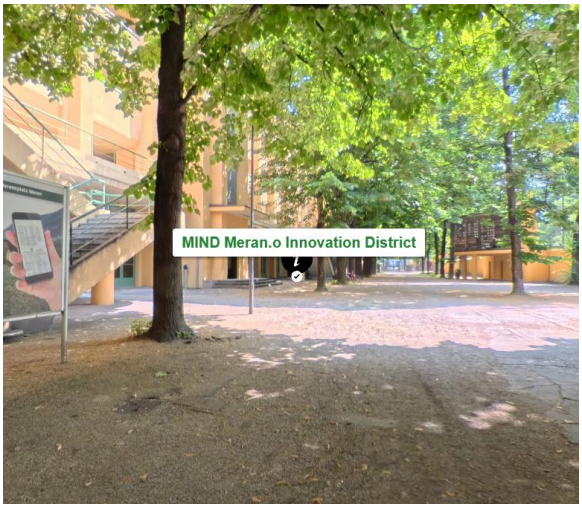
Maia Bassa train stop	
Maia Bassa bus stop	
Reserved car parks for people with a disability at Maia Bassa train stop	

Via delle Palade street bus stop towards the city center	
MIND Merano	
Horse racing track Merano	

Bar Ippodromo

SuCoLo pick-up station

MIND Meran.o Innovation District



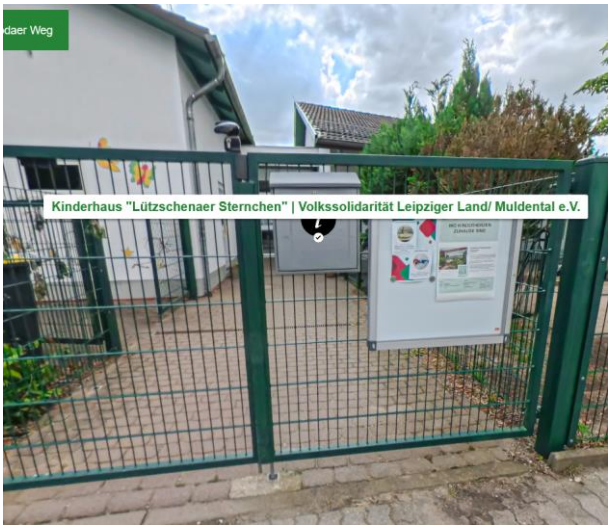
4.2. Leipzig (Lützschena)

Starting at the Freirodaer Weg tram stop until the SuCoLo micro-hub at the Lützschena Town Hall, the following points of interest are listed in the 3D tour of the Leipzig pilot site:

Table 5 Leipzig (Lützschena district) listed points of interest

Tram stop Stahmeln - Freirodaer Weg	
Freirodaer Weg	

Kinderhaus "Lützschenaer Sternchen" | Volkssolidarität Leipziger Land/ Muldental e.V.



Bus stop Freirodaer Weg

HundefrEulein - Hundesalon

Am Brunnen street

Elsterberg street

Playground Elterberg

Town Hall Lützschena-Stahmeln	
Heimatverein Lützschena-Stahmeln e.V.	
SuCoLo mobile micro-hub	

Fountain in front of the town hall Lützschena-Stahmeln	

5. Conclusion and outlook

The application of the IG-VAE methodology with respect to the SuCoLo project's research pilot sites has demonstrated to be an effective approach for systematically evaluating and communicating accessibility and inclusiveness in urban peripheral environments. By integrating high-resolution 360° imaging, interactive features and a user-friendly interface, the resulting 3D tours provide any interested stakeholder with a user-friendly digital representation of the critical pedestrian and intermodal transport infrastructure relevant to the SuCoLo pilot sites. This enables stakeholders to virtually explore the SuCoLo pilot sites and their surrounding areas which have considered accessible design principles, particularly from the perspective of people with disabilities, older adults, and families.

Looking ahead, this deliverable, together with D4.1 *Georeferenced mapping of POIs regarding accessibility and standardised adaptation plans (PEBA) in case of barriers*, forms a foundational input for the upcoming document D4.4 *Toolkit for bicycle hubs & sustainable logistics in urban outskirts*. The insights gained from the IG-VAE-based visualisation, georeferenced mapping of POIs and plans for the elimination of architectural barriers (PEBA) will directly inform the infrastructural requirements and necessary planning criteria for developing the sustainable logistic solutions embedded in the toolkit. This will ensure that future bicycle logistics hubs and peri-urban freight nodes are not only operationally effective but also meet high standards of accessibility and inclusiveness - supporting SuCoLo's overarching objective of fostering equitable and sustainable last-mile mobility solutions in peripheral urban contexts.