COOL NOONS | Interreg Euro-MED | Co-funded by the European Union

Preliminary study and mapping for testing project: Cool Noon paths printed and digital maps.

–

https://coolnoons.interreg-euro-med.eu/

Cool Noons

Cool Noons is an innovative project for the way it addresses an urgent and underestimated issue such as the **evolution of urban tourism towards a more sustainable model**. Five pilot cities will be innovative solutions **to improve the visitor experience of tourists and residents during the hottest hours of the day**. The tools and methods used combine scientific accuracy, pragmatism and creativity, thanks to the diversity of the partners involved.

***

Mission: Enhancing sustainable tourism

Programme priority: Greener MED

Specific Objective: RSO2.4: Promoting climate change adaptation and disaster risk prevention, resilience, taking into account eco-system based approaches

***

Deliverable number and title (as identified in Jems): D.1.2.1

Work package number, name of Work Package: Work Package 1 Co-Designing innovative solutions for Mediterranean cities.

Activity number, name of activity: Activity 1.2

Partner in charge (author): Lisbon Municipality with the support of Imola Faenza Tourism Company

Partners involved: AVITEM, MOB, DURA, MCBO, VDM, ACG-RC, IF, CML.

Status (draft, final, N version, etc.): version 1

Distribution (confidential, public, etc.): confidential

Date(s) of production: July 30, 2024

Introduction

This report presents the first draft of Deliverable 1.2, resulting from Activity 1.2 of the Cool Noons Project. In this activity, each pilot territory is required to map both the open air and indoor coolest places such as green areas, water points, museums, libraries, and more. This mapping will be highly useful for implementing solutions and developing, promoting, and testing "Cool Noons Paths" for tourists and residents.

The main phases of this activity are:

1. Definition of the database of green and cool areas.
2. Matching and creating connections with key tourist points.
3. Planning of the eco-cultural itinerary Cool Noons Paths.
4. Development of maps.
5. Design of an interactive app for tourists, potentially integrating with existing apps.

While a general methodology was defined for the development of the maps, the pilot cities had the autonomy to make their own methodological decisions. Each pilot city identified, within their institutions, the green and cool areas and developed methods for matching and creating connections with key tourist points and planning the eco-cultural itinerary Cool Noons Paths, which resulted in the creation of Cool Noons Paths maps.

This report proposes a comprehensive initial approach to mapping the coolest paths that connect different points of interest, as well as the options taken by each pilot city. Each city has approached the mapping and planning process according to its unique context and needs, allowing for a diverse set of solutions and methodologies to emerge. This flexibility ensures that the solutions are tailored to the specific climatic and urban characteristics of each city while adhering to the overall goals of the Cool Noons Project.

General methodology

The general methodology for mapping “Cool Noons Paths” was developed to identify and promote routes that offer thermal comfort in urban areas during the hottest periods. This approach is particularly relevant for pilot cities in the Mediterranean region but was designed to be replicable elsewhere. The aim was to create a methodology that could be applied in other areas, providing a common framework and methods to map cooling infrastructures and places where visitors and residents can find shelter from the heat. To enhance this initiative, the proposed methods include the use of the Least Cost Path and Optimal Regional Connectivity to connect and promote these areas as attractive routes through the identification of potential Cool Noons Paths.

The Least Cost Path method calculates the cheapest route from a destination to multiple sources, considering, in this approach, heat-related metrics. This method ensures the most cost-efficient route, as defined by the original heat-related cost raster.

The Optimal Regional Connectivity method calculates the optimal connectivity network between two or more input locations, also ensuring the most cost-efficient route, as defined by the original cost raster representing heat-related metrics.

To implement these methodologies, various types of information were required. First, it was essential to have a cost raster representing heat-related metrics, which could include maps of urban heat islands and heat waves, retrieved from different sources such as municipality proprietary data, Copernicus Climate Services (Urban heat island intensity for European cities from 2008 to 2017 derived from reanalysis) or, with less accuracy, derived from land use maps that contain a disaggregation of urban density. It is also important to identify refreshing buildings such as churches, monuments, libraries, shopping malls, museums, among others. Tourist origins, such as hotels and Airbnb, must be mapped, as well as the tourist destinations we wanted to promote, such as gardens, parks, and points of interest.

With this information, the implementation of the methodology for mapping Cool Noons Paths followed a series of detailed steps:

1. **Creation of the Cost Raster**: First, a cost raster was created to represent heat-related metrics (e.g., maximum daily temperature, urban heat island effect), ensuring all values were positive and greater than zero. This raster is fundamental for subsequent analysis.
2. **Preparation of Street Data**: OpenStreetMap data or other sources can be used to create a 5-meter buffer around streets and paths, generating a binary map representing accessible areas. Non-pedestrian areas must be eliminated by creating a 5-meter buffer around lines representing streets and paths, converting the result into a raster with a 5-meter cell size. This ensured that only the appropriate areas were considered for analysis. This binary map is then combined with the cost raster using mask extraction techniques to associate temperatures with pedestrian areas.
3. **Value Assignment**: High values were assigned to areas outside streets and paths using a raster calculator. This gives a value to areas that should not be prioritized in the routes.
4. **Identification of Refreshing Points**: Refreshing points, such as churches, monuments, libraries, or shopping centres, should be integrated into the analysis. To do so, a 50-meter buffer can be created around these points and converted into a binary map with a value of -0.99 (-0.99°C) to represent an area with lower temperatures that can influence the route.
5. **Data Combination**: The refreshing points were summed with the cost matrix using the raster condition function (Con). This integrated the refreshing points into the cost raster, improving the identification of routes that offer thermal relief.
6. **Least Cost Path Method**: Start points (e.g., hotels and Airbnb) and end points (e.g., a destination such as a park or a route we want to promote) were identified, and a script was created to calculate the least cost routes. The resulting raster were summed, ignoring null data, and converted into polygons. Polygons with values greater than zero were selected,

and a 50-meter buffer was created around these polygons, resulting in the least cost routes for the Cool Noons Paths.

7. **Optimal Regional Connectivity**: This step involves calculating the optimal connectivity network between two or more input locations, such as hotels, Airbnb, parks, churches, monuments, libraries, shopping malls, museums, or other points of interest, using the same cost raster (created between 1. And 5.). This method ensures the identification of the most efficient routes that connect different points of interest while maintaining thermal comfort. By considering various types of destinations and origins, this approach provides a comprehensive network of routes that optimize thermal comfort throughout the city.

These steps allowed for the identification of optimized routes that connect points of interest and refreshing areas, ensuring thermal comfort for users, and promoting a better experience during periods of extreme heat. The methodology significantly contributed to urban resilience in the face of climate change. This process not only improved the experience for visitors and residents during extreme heat periods but also enhanced urban resilience against climate change.

1. Metropolitan City of Bologna (Imola)

The Municipality of Imola is the second largest in terms of population within the Metropolitan City of Bologna, with about 70,000 inhabitants. It is part of the Imola District, which includes 10 municipalities with a total population of 140,000. Over the years, Imola has developed an extensive network of cycling paths totalling 110 km connecting all neighbourhoods to each other and to the historic centre.

In addition, the care of public spaces and particularly green areas has greatly enhanced the quality of life and well-being in residential neighbourhoods. Since 2022, the Municipality has implemented a climate mitigation and adaptation strategy focused on urban green infrastructure and sustainable mobility, with an integrated approach encompassing environment, urban planning, and mobility at multiple scales, from local interventions to broader territorial levels.

Imola's urban green infrastructure is the result of mapping the entire system of public green spaces which includes historic parks, riverbank park, recently created public parks and gardens and marginal areas integrated with tree-lined streets or cycle-pedestrian paths. These green spaces form a continuous and contiguous system of significant ecological and landscape value, strategically reducing vulnerability to heat islands.

Between 2021 and 2024, Nature Based Solution interventions have been implemented to increase tree coverage. This includes urban forestry with the planting of 4,011 new trees in public green areas, tree-lined avenues accompanying cycle-pedestrian paths, and freeing the soil interventions to enhance permeability and reduce surface temperatures.

This green infrastructure is linked to the sustainable mobility network to demonstrate how green areas can be easily enjoyed on foot or by bike and how trees provide shade making travel more pleasant.

Simultaneously, actions have been taken to promote sustainable tourism by enhancing cycle-pedestrian paths that provide access to the city’s main historical and artistic monuments and museums, the Osservanza Complex— a former mental hospital now undergoing significant urban

regeneration to become a university campus with a Metropolitan Cycle Tourism hub—and the Enzo and Dino Ferrari Racetrack. The Racetrack hosts internationally renowned events, attracting visitors from around the world, especially during the F1 Grand Prix, and is located a short distance from the historic center and about 1.5km from the train station.
The train station also plays a key role in attracting tourists from Bologna or Ravenna to visit the city. From this context arises the selection of two routes to transform into cool paths, as part of the Cool Noons project, both starting from the train station and ending at the Enzo and Dino Ferrari Racetrack.

Path 1: approximately 1.5km long, follows a linear path using existing cycle-pedestrian connections. It starts at the train station, crosses the historic centre, two central squares Piazza Matteotti and Piazza Gramsci and the Town Hall. It continues along Viale Dante, which is lined with early 20th-century historic villas, crosses the Santerno River Park, and reaches the Enzo and Dino Ferrari Racetrack.

Path 2: also starts at the train station, enters the historic centre and at the touristic point Torre dell'Orologio goes along Via Emilia to reach the Municipal Library with its Historical Archive and Museums, Sforza Fortress surrounded by a green area, Porta Montanara (a historic gate from the ancient city walls), Osservanza Park, Parco Aviatori D'Italia, the River Park, and finally the Enzo and Dino Ferrari Racetrack.

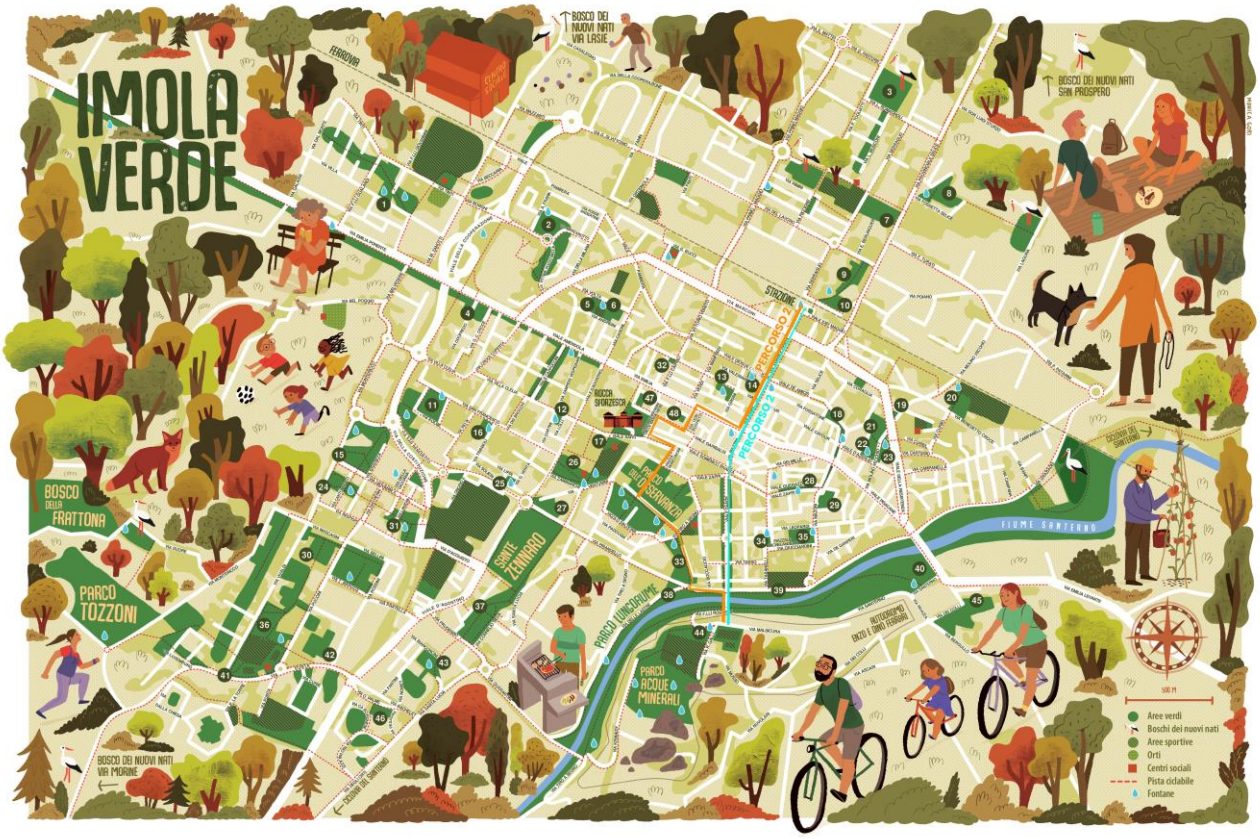

Figure 1. Imola Cool Noons Paths to be tested.

2. Budva

Budva, a coastal city located in Montenegro, is renowned for its stunning beaches and rich history. Situated on the Adriatic Sea, Budva is one of the country's most popular tourist destinations. The city is famous for its Old Town (Stari Grad), which dates back over 2,500 years and is surrounded by medieval walls. Budva also boasts a vibrant nightlife with numerous bars, clubs, and restaurants, and hosts the Budva Theatre City Festival, a major cultural event in the region. In addition to its natural beauty, Budva is an important historical and cultural center, attracting visitors from around the world.

As part of the Cool Noons Project, the City of Budva undertook the task of mapping both open-air and indoor coolest places, including green areas, water points, museums, libraries, and more. This comprehensive mapping was instrumental in implementing solutions and developing, promoting, and testing Cool Noons Paths for tourists and residents.

To implement nature-based cooling solutions during heat waves, the selection of paths involved careful consideration of several factors, particularly the least cost path. Cost-effective, high-impact strategies were prioritized to maximize benefits while ensuring sustainability and community engagement.

Key considerations for choosing paths in Budva included:

1. **Understanding Local Climate and Environment**: This involved analysing local climate characteristics such as temperature ranges, humidity levels, wind patterns, and precipitation. Additionally, the existing biodiversity and ecosystem were considered, with a focus on enhancing local flora and fauna.
2. **Existing Types of Nature-Based Solutions**: The use of urban forestry and green spaces was evaluated, as trees and parks significantly reduce urban heat through shade and transpiration. Water bodies such as ponds and fountains were also considered for their cooling effects through evaporation.

3. **Space Availability**: The available space for implementing green roofs, urban forests, or water bodies was assessed. Vertical spaces for green walls were also considered in densely built environments.

These considerations were aligned with the general methodology of the project:

1. **Least Cost Path**: This method identified paths from a destination to multiple sources, ensuring the cheapest route relative to the cost units defined by the original cost raster representing heat-related metrics.
2. **Optimal Regional Connectivity**: This method calculated the optimal connectivity network between two or more input locations, ensuring the most cost-efficient routes as defined by the original cost raster representing heat-related metrics.

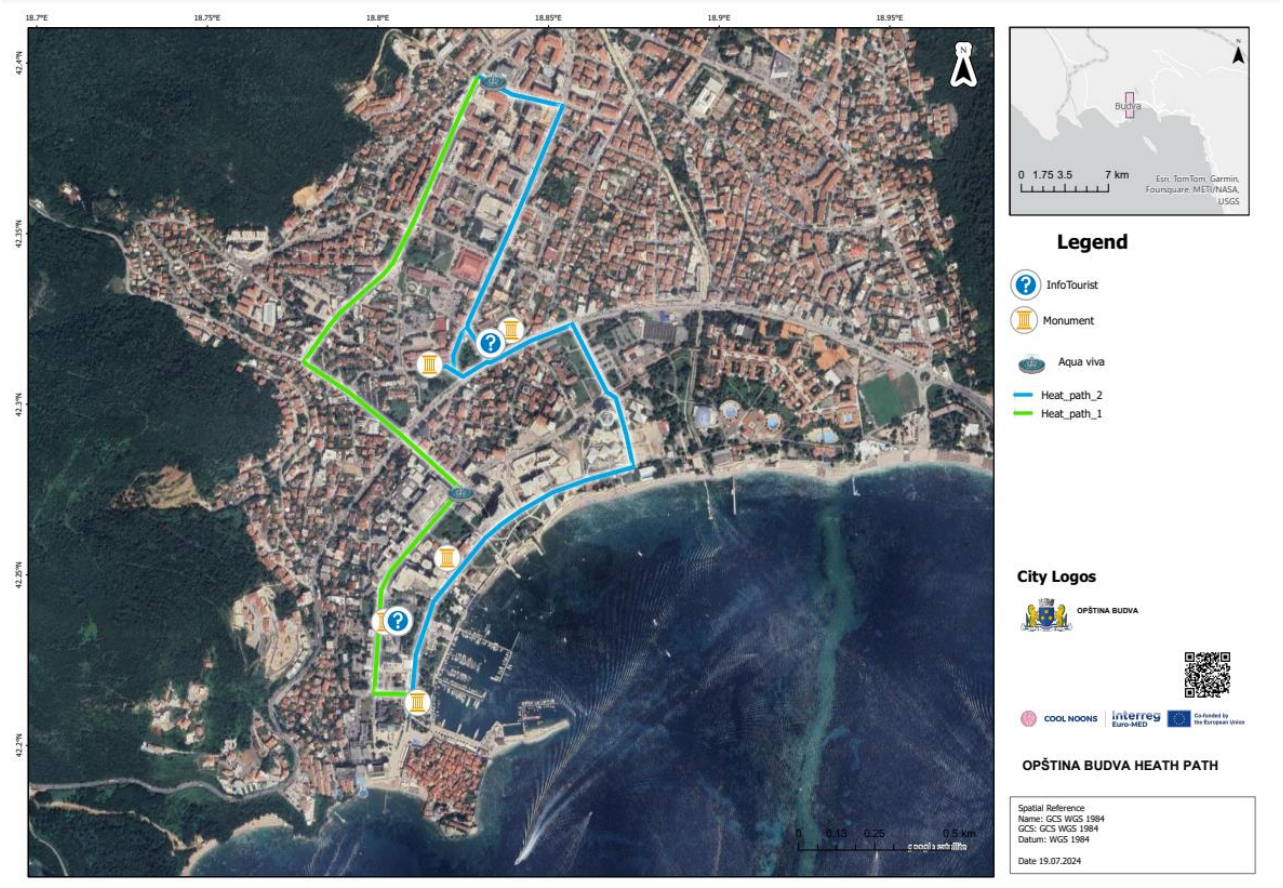

Figure 2. Budva Cool Noons Paths to be tested. Also available at: https://gisportal.budva.me

Given the limitations of the GIS data in providing comprehensive heat-related metrics, two paths were selected in Budva that included points of interest, water bodies, tourism information offices, fresh buildings, and tourist origins (Figure 2).

The paths and areas presented in this map are the result of mapping and testing of Cool Noons (Test round 1: Summer 2024 – Test round 2: Summer 2025). Regarding tourist origins not indicated on the main map, locations of official hotels, apartments, and other relevant accommodations were mapped in Figure 3.

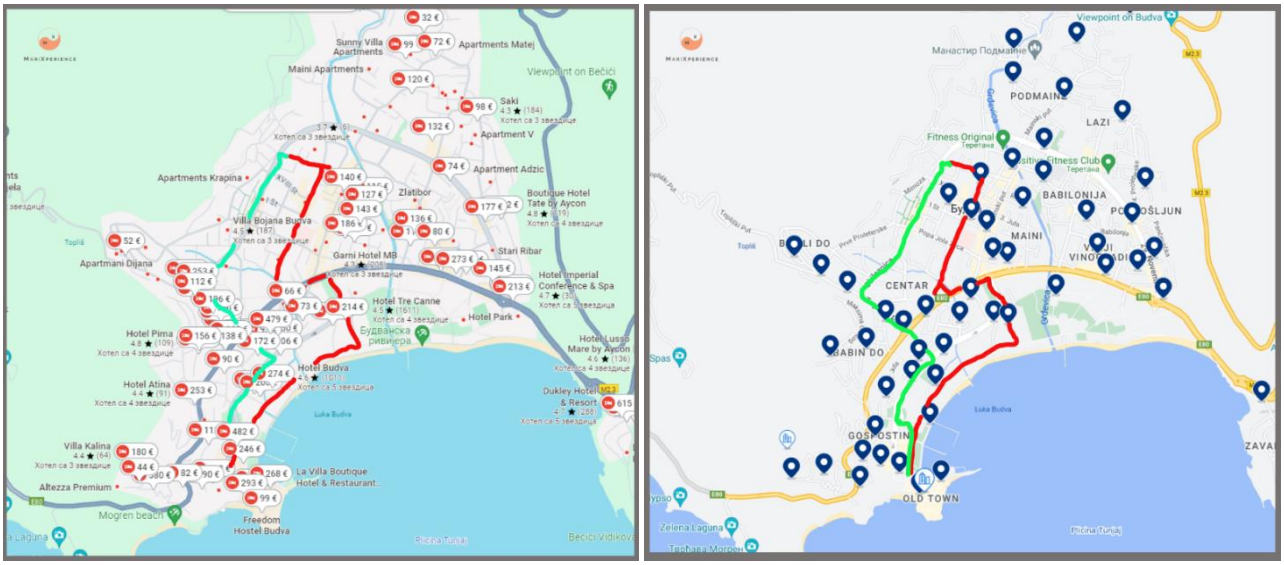

Figure 3. hotels and other accommodation

The next phase involves placing thermometers along both paths to measure temperatures and humidity over a 24-hour period starting this summer. By gathering and analysing this micro-location data, it will be easier to engage citizens, focus groups, and our Local Committee to select suitable solutions for the paths that will be tested in the summer of 2025.

3. Dubrovnik

Dubrovnik, nestled along the Adriatic Sea, is renowned for its historic Old Town surrounded by ancient stone walls. The city enjoys a Mediterranean climate, characterized by hot, dry summers with temperatures ranging from 25 to 35 degrees Celsius (77 to 95 degrees Fahrenheit). Winters are mild, averaging from 6 to 12 degrees Celsius (43 to 54 degrees Fahrenheit), with occasional rainfall contributing to its lush landscapes. The climate, featuring long sunny days and gentle sea breezes, shapes both local life and the appeal of Dubrovnik as a year-round destination. Managing heat, particularly in the compact Old Town area, is crucial for preserving its architectural heritage and ensuring visitor comfort.

The Cool Noons Paths initiative in Dubrovnik aims to enhance the visitor experience and promote sustainability by mapping out routes that optimize comfort during the city's hottest hours. These paths were selected based on insights gathered from a focus group involving key stakeholders, including representatives from the Administrative Departments of the City of Dubrovnik (Culture department, urban planning department, tourism department, and the Dubrovnik Tourist Board). Strategically guiding tourists and residents through shaded areas, green spaces, and other cool spots, the initiative offers respite from the Mediterranean sun. By integrating natural features and cultural landmarks, such as museums and historical sites, the initiative not only improves the quality of outdoor experiences but also supports local businesses and preserves the city's cultural heritage. Managing heat effectively in popular areas like the Old Town enhances visitor comfort and contributes to a more resilient and enjoyable urban environment for all (Figure 4).

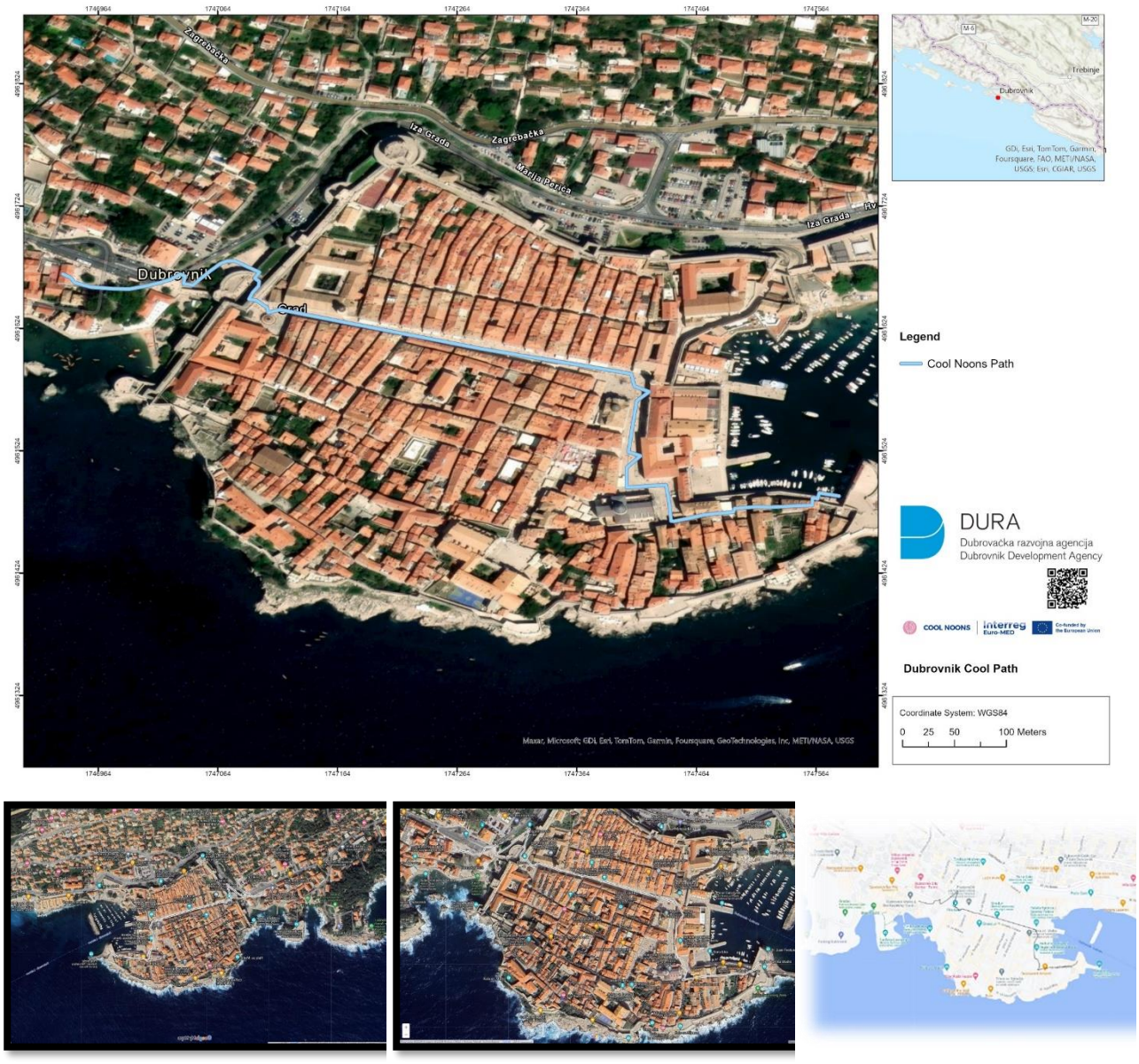

Figure 4. Dubrovnik Cool Noons Path to be tested. Also available at: https://www.google.com/maps

The Cool Noons Paths initiative in Dubrovnik connects the city's rich historical and cultural sites with modern efforts to enhance visitor comfort and sustainability. By guiding visitors through shaded areas, green spaces, and cool spots, the initiative optimizes comfort during the hottest hours, preserving the city's architectural heritage and ensuring a more enjoyable experience for all. Starting at the Tourist Information Centre, the path strategically weaves through historical

landmarks and natural features, ultimately promoting a resilient and pleasant urban environment year-round:

1. **TIC (Tourist Information Centre):** The starting point of the Dubrovnik Cool Noons Path, the Tourist Information Centre provides visitors with maps, guides, and essential information about Dubrovnik. It's a perfect place to begin the journey, offering shaded areas and air-conditioned interiors to help visitors acclimate before embarking on their exploration of the city. Visitor feedback highlights the comfort provided by the cool environment upon arrival. Proximity to public transport and easy accessibility ensure minimal exposure to direct sunlight for tourists starting their journey. Coordinates: 42.6419018, 18.1056507

Figure 5. TIC (Tourist Information Center)

2. **Židovska fontana (Jewish Fountain):** Situated in a historical part of Dubrovnik, the Jewish Fountain is a lesser-known gem that offers a cool, shaded area for rest. The fountain not only provides a refreshing spot but also a glimpse into the rich cultural tapestry of the city. Historical weather data shows lower temperatures in this area compared to surrounding streets due to shade and water presence. Cultural significance draws fewer crowds, allowing for a peaceful, cool respite. Coordinates: 42.6418752, 18.1057513

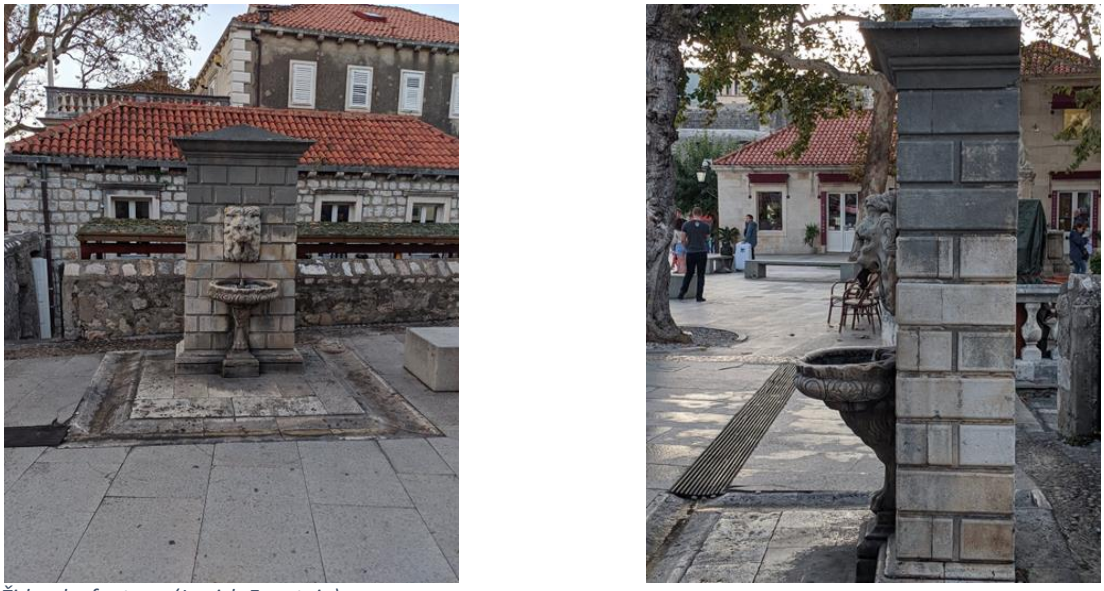

Figure 6. Židovska fontana (Jewish Fountain)

3. **Amerlingova fontane na Pilama (Amerling Fountain at Pile Gate):** Located near the bustling Pile Gate, this fountain is a popular spot for tourists. It offers a cool and refreshing stop along the path, surrounded by greenery, providing a perfect spot to relax before entering the old town. Observations from thermal imaging indicate significantly lower temperatures around the fountain area. Frequent usage by locals as a resting spot suggests its effectiveness as a cooling area. Coordinates: 42.6418515, 18.1058157

Figure 7. Amerlingova fontane na Pilama (Amerling Fountain at Pile Gate)

4. **Park u Pilama - Mihanovićeva fontana (Park at Pile Gate - Mihanović Fountain):** This park features the Mihanovićeva Fountain and is an oasis of greenery and shade. It's an ideal spot for visitors to take a break, enjoy the cool ambiance, and perhaps have a picnic under the shade of the trees. Reports from the Parks and Recreation Department identify this park as one of the coolest public spaces in the area during peak heat. Visitor surveys consistently rate it as a preferred spot for rest and relaxation. Coordinates: 42.6418327, 18.1059565


Figure 8. Park u Pilama - Mihanovićeva fontana (Park at Pile Gate - Mihanović Fountain)

5. **Ulaz u Grad - Velika Onofrijeva fontana (Entrance to the Old Town - the Great Onofrio Fountain):** The Great Onofrio Fountain marks the entrance to the Old Town and is a significant historical landmark. Built in the 15th century, it continues to provide fresh drinking water. The shaded areas around the fountain offer a cool respite from the sun. Thermal data shows temperature drops around the fountain due to evaporative cooling. High visitor footfall and frequent use of the fountain for refreshment underscore its importance. Coordinates: 42.64181, 18.1060222

Figure 9. Ulaz u Grad - Velika Onofrijeva fontana (Entrance to the Old Town - the Great Onofrio Fountain)

6. **Preko straduna - južnom stranom (Across Stradun - south side):** Stradun, the main street of Dubrovnik, is lined with shops and historical buildings. The southern side of Stradun offers shaded areas in the afternoons, making it a cooler path to take while exploring the heart of the city. Meteorological data indicates lower afternoon temperatures on this side of Stradun. Observations of pedestrian patterns show higher comfort levels on this side during hot days. Coordinates: 42.6418002, 18.1060772

Figure 10. Preko straduna - južnom stranom (Across Stradun - south side)

7. **Mala Onofrijeva fontana (Small Onofrio's Fountain):** At the opposite end of Stradun, the Small Onofrio Fountain provides another opportunity for refreshment. The cool, shaded area around it is perfect for a brief rest while taking in the historical surroundings. Historical significance and a cooler microclimate make it a popular resting spot. Recorded lower ambient temperatures compared to nearby open areas further highlight its appeal. Coordinates: 42.6418091, 18.1061335

Figure 11. Mala Onofrijeva fontana (Small Onofrio's Fountain)

8. **Pročelje Kneževog Dvora kao odmorište (Portico of Rector's Palace as a rest area):** The portico of Rector's Palace provides a shaded area where visitors can rest and admire the historical significance of the building. Thermal imaging highlights significant temperature differences between the shaded palace portico and sun-exposed areas. The historical building materials, particularly stone, naturally maintain lower temperatures. Coordinates: 42.6418091, 18.1062207

Figure 12. Pročelje Kneževog Dvora kao odmorište (Portico of Rector's Palace as a rest area)

9. **Ulicom od Pustijerne do Pomorskog muzeja (Street from Pustijerna to the Maritime Museum):** This street offers a picturesque and shaded route leading to the Maritime Museum. The cool and narrow alleyways provide relief from the sun, and the destination, the Maritime Museum, offers an air-conditioned environment where visitors can learn about Dubrovnik's rich maritime history. Urban design studies show that narrow streets can lower temperatures by up to 10 degrees Celsius. Visitor logs note this route as a preferred path due to its cooler conditions. Coordinates: 42.6418209, 18.1062716

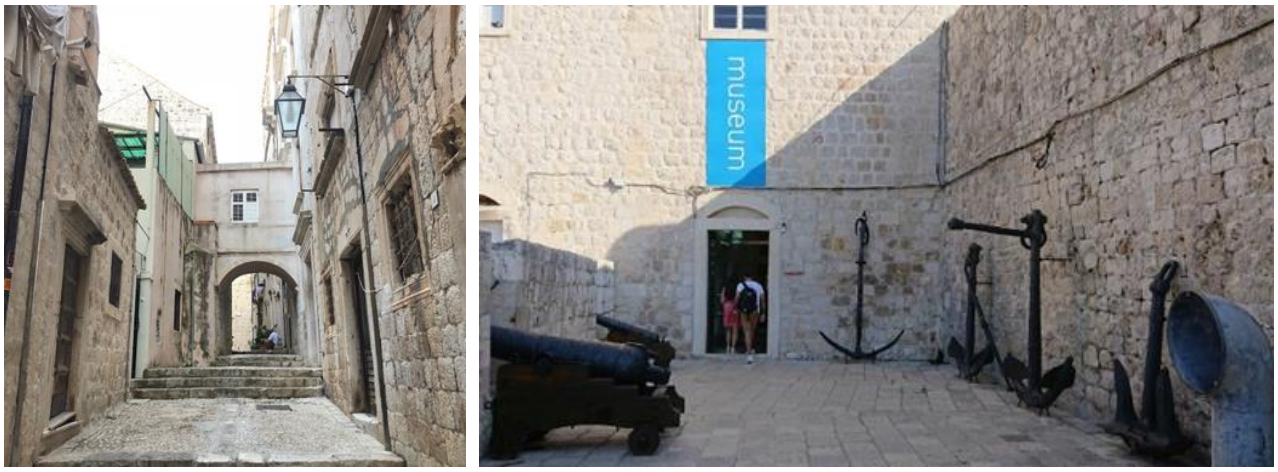

Figure 13. Ulicom od Pustijerne do Pomorskog muzeja (Street from Pustijerna to the Maritime Museum)

The Cool Noons Paths initiative represents a forward-thinking approach to enhancing urban sustainability and visitor experience in Dubrovnik. By strategically mapping and promoting cool spots such as shaded parks, historical fountains, and cultural landmarks, this project aims to mitigate the impact of urban heat islands during peak daytime hours. These pathways not only offer respite from the summer heat but also encourage tourists and residents alike to explore and appreciate the city's rich cultural and natural heritage. The implementation of these paths is expected to contribute significantly to improving local quality of life by fostering a more comfortable and enjoyable environment for all visitors. Ultimately, Cool Noons Paths serve as a testament to Dubrovnik's commitment to sustainable tourism practices and climate resilience, ensuring a positive impact on both tourism and the overall well-being of the community.

Furthermore, the successful implementation of a comprehensive survey initiative at key locations such as the Tourist Information Center (TIC), Park near Pile, and Pročelje Dvora (Portico of Rector’s Palace), informed by insights from a focus group with key stakeholders including representatives from the Administrative Departments of the City of Dubrovnik (Culture, Urban Planning, Tourism), and the Dubrovnik Tourist Board, has provided invaluable insights into visitor experiences and perceptions. This direct engagement with tourists not only enhances our understanding but also guides future enhancements to ensure continued success in enhancing visitor comfort and promoting sustainable tourism practices in Dubrovnik.

4. Lisbon

Lisbon, the capital of Portugal, boasts a population of approximately 546,000 inhabitants within its 100 km^2, divided into 24 parishes. The city's investment in Sustainable Tourism has led to a rethinking of existing attractions, leveraging its strategic location, historical-cultural points, favourable climate, and renowned hospitality. This includes enhancements in urban art, green and blue infrastructures, natural heritage, landscape, and more. Among other accolades, Lisbon was named Europe's Leading City Destination 2024 by the World Travel Awards.
As one of the 100 Mission Cities committed to being climate-neutral and intelligent by 2030, Lisbon has its Climate City Contract approved and serves as a mentor city in implementing solutions to reinforce sustainable tourism destinations. Through the Cool Noons project, Lisbon aims to align strategies that promote new tourist attractions in less popular areas, ensuring these new attractions are certified by the city. This initiative not only seeks to improve residents' quality of life but also to foster new behaviours for a healthier, more resilient, sustainable, shared, and inclusive future. By integrating these sustainable practices and promoting lesser-known attractions, Lisbon is not only enhancing the tourist experience but also ensuring that tourism benefits the local community economically, socially, and environmentally.

The Cool Noons Paths initiative in Lisbon was designed in line with the city's policies and strategies and developed because of an internal focus group within the municipality. The general methodology was applied after the focus group, specifically to identify the Least Cost Path between tourist origins (e.g., hotels) and the route to be promoted. Optimal Regional Connectivity approach was also applied by incorporating previously identified points of interest along the proposed path. This approach helped identify variants to the proposed Cool Noons path, which will be discussed with stakeholders in dedicated workshops. In these workshops, the path will be detailed, and new interventions will emerge. Workshop participants will be responsible for selecting the final path, considering path variations with cooler alternatives, or proposing interventions in initially suggested areas to reduce temperatures along those segments.

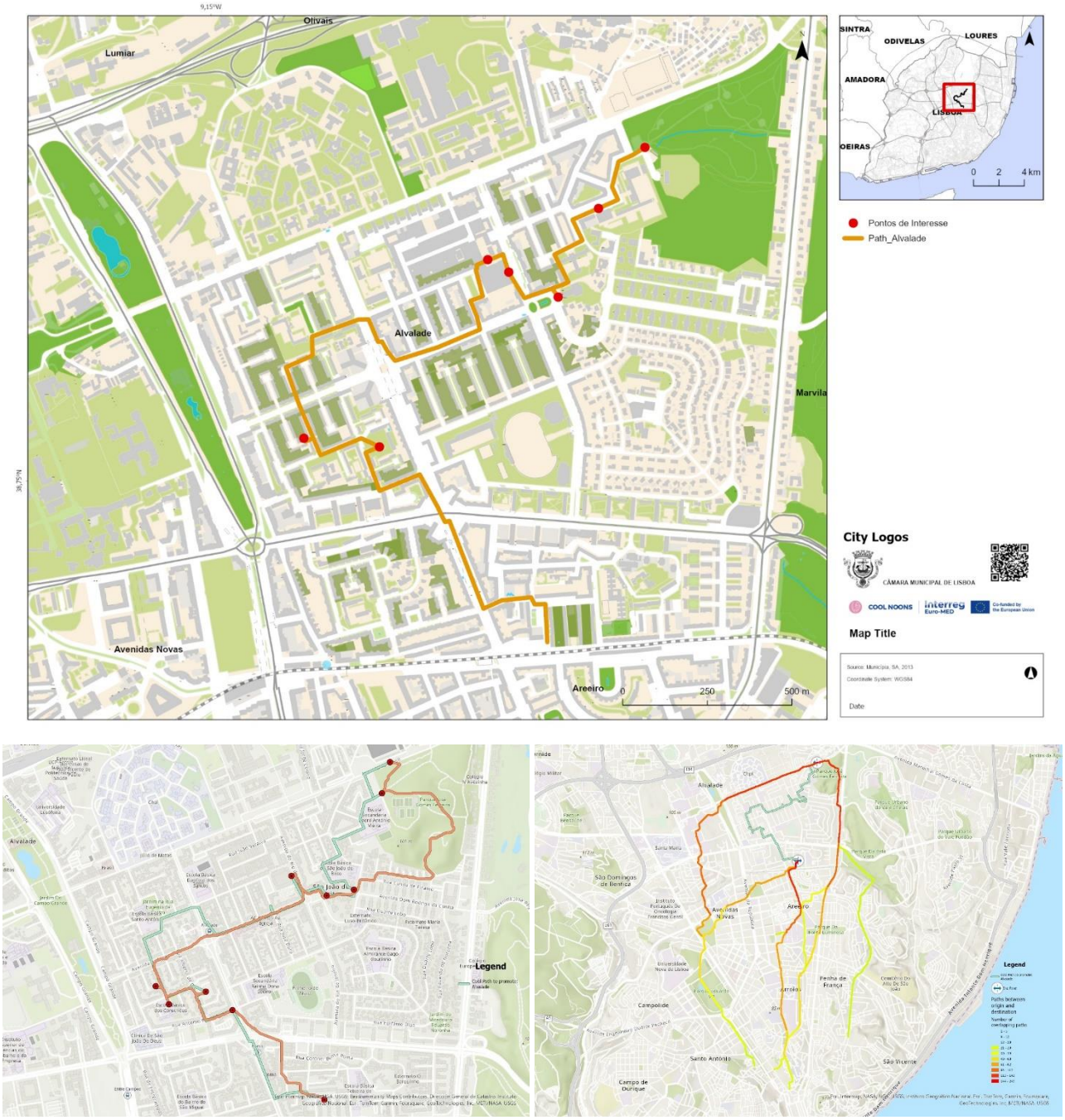

Figure 14. Lisbon Cool Noons Path to be tested. Application of the Optimal regional connectivity between points of interest. Least Cost Path between tourist origins (e.g., hotels) and the Cool Noons Path.

The Cool Noons Paths initiative in Lisbon was designed to offer an authentic experience of life in a modern and traditional neighbourhood, with a clear focus on sustainability. The route allows visitors to immerse themselves in the daily routines of locals, understanding the characteristics and

peculiarities of the local culture outside the more touristy and densely populated areas of the city. It is an opportunity to observe the coexistence of different generations in the same public space, feel the heartbeat of neighbourhood life, and enjoy a diverse local commerce that ranges from traditional to modern, including art galleries, good restaurants, green areas, and architectural and heritage elements of interest.

This itinerary is especially suitable for tourists who are conscious of their ecological footprint and seek to minimize it, respecting and benefiting the dynamics of the local community, economy, and social network. By following this route, tourists can integrate more into local life, assuming the perspective of the city's inhabitants and contributing to the sustainability of tourism. This route is part of Lisbon's sustainable itinerary, promoting responsible tourism practices that benefit both visitors and residents:

1. **Teatro Maria Matos (Maria Matos theatre):** Inaugurated on October 22, 1969, Teatro Maria Matos underwent significant renovations starting in August 2004. The project included the refurbishment of the auditorium and backstage, improvements in acoustics, lighting, climate control, security, and the removal of architectural barriers. The theatre's cool interior offers a break from the heat while appreciating its historical and architectural values or attending a cultural event. Coordinates: 38.745902, -9.138660

Figure 15. Maria Matos Theatre

2. **Galería dos Inesquecíveis (Gallery of the Unforgettable one's project):** is an initiative by the Lisbon Alvalade parish, aiming to honour prominent Portuguese artists through the

creation of urban art street art murals. This project seeks to celebrate the culture and history of Portugal, highlighting iconic figures and their contributions in various artistic fields.

Coordinates: 38.750324, -9.142631

Figure 16. Urban art mural of Paulo de Carvalho and Simone de Oliveira [Gallery of the Unforgettable one's project]

3. **The Coruchéus Studios and Library:** Inserted in an original and unique complex that integrates 50 studios for artists, the Quadrum Gallery, a library, and other public-use spaces, the Coruchéus Studios are dedicated to the promotion and development of artistic activity in the city of Lisbon. The Coruchéus Library is housed in a historic mansion dating back to the 18th century, formerly known as the Quinta dos Coruchéus. Currently, both cultural facilities are surrounded by large trees, an esplanade, a garden, an urban street art mural, and other shaded and pleasant areas to stay. Coordinates: 38.750805, -9.144583

Figure 17. The Coruchéus Library and surrounding urban art mural.

4. **Community and urban gardens:** The spaces between blocks form green, permeable pockets that enhance water infiltration into the soil, creating cooler microclimates. These areas offer leisure and recreation spots, fostering social interaction and strengthening neighbourhood bonds. Many of these spaces have been developed and maintained by residents, evolving into small gardens and urban farms—true oases amidst the urban landscape. They serve as refreshing spots and provide ideal opportunities for rest and relaxation. Coordinates: 38.751136, -9.146660

Figure 18. Community and urban gardens

5. **Alvalade Square:** The central part of the square is occupied by the Monument to Saint Anthony, one of the patron saints of Lisbon. Standing at a total height of 12 meters and weighing 78 tons, this work was executed between 1970 and 1972 by architect Carlos Antero Ferreira and sculptor António Duarte, the father of Filipe Duarte Santos. This convergence of streets features several climate-controlled points of interest, including neighbourhood-style shopping centres, street restaurants, and a local cinema. Coordinates: 38.753261, -9.144333

Figure 19. Alvalade Square

6. **Igreja Avenue:** The main commercial avenue of the neighbourhood is vibrant and dynamic, bustling with activity from various generations of city inhabitants. On both sides of the street, Linden trees (*Tilia*), known for their broad, voluminous canopies and aromatic flowers, are prominently featured. These alignment trees provide essential shading on hot days, playing a significant role in climate regulation and thermal comfort in public spaces. Coordinates: 38.753967, -9.141429

Figure 20. Igreja Avenue

7. **"Earth Hour" Urban Street Art Mural:** The initiative within the scope of 'Earth Hour' 2024 involved community participation in a collective painting, developed as part of a partnership between the Lisbon City Council, the Alvalade Parish Council, and the Worldwide Fund for Nature (WWF). The mural tried to convey a familiar message "They could be two siblings, two cousins, whatever. They are family. And this family is questioning

what the future of their home will be. The home, in this case, is our planet. The message conveyed is that we should treat the planet as if it were our own home". Coordinates: 38.755487, -9.141079

Figure 21. Earth Hour Urban Street Art Mural

8. **Alvalade Market:** This is another central facility of the neighbourhood. It spans about 3,000 square meters and has 219 sales spots (for vegetables, fruit, meat, fish, eggs, and flowers), remaining a reference today for the quality of its products. It frequently hosts organic product fairs, workshops, activities, and awareness campaigns related to healthy living and eating, resource preservation, and sustainability. There is a photovoltaic plant installed on the roof that helps reduce energy costs, and the building is air-conditioned. Coordinates: 38.755733, -9.139704

Figure 22. Alvalade Market

9. **The Mariazinha (Shops with History):** The coffee and tea shop located at Avenida do Rio de Janeiro, 25B, has been open since 1934 and is one of the historic traditional commerce shops in the neighbourhood. It is part of the Municipality's "Shops with History" program, which aims to preserve these establishments and their material, historical, and cultural heritage, as well as to promote and revitalize local and traditional commercial activities. Coordinates: 38.755171, -9.139314

Figure 23. The Mariazinha (Shops with History).

10. **São João de Brito Church:** The façade of the church has a gable shape, with a central window featuring diamond-shaped glass panes. There is a statue of São João de Brito and the arms of the Cardinal Patriarch of Lisbon above it. At the top of the façade, there is an iron cross approximately 5 meters high. The interior of the church has a Latin cross layout with a single nave, and the ceiling is a barrel vault. The church is naturally cool, providing a comfortable environment for visitors. Like other collective facilities and services in the neighbourhood, it is an important and structuring element of the neighbourhood's life. Coordinates: 38.755013, -9.138226

Figure 24. São João de Brito Church

11. **Portuguese Pavement:** Along approximately 100 meters of the route, colourful decorative elements can be observed in the Portuguese pavement (tulips, butterflies, geraniums, sunflowers), a public space covering art, particularly for sidewalks, very typical in the city. This pavement, dating approximately from 1956, illustrates the importance of biodiversity. The area is covered by large trees, enhancing its natural beauty. The rarity of this authentic work of art, one of the only polychromatic examples in Lisbon, deserves preservation and maintenance with the same care and dedication with which it was conceived. Coordinates: 38.756395, -9.137763

Figure 25. Portuguese Pavement

12. **José Gomes Ferreira Park:** A public green space designed by architect Gonçalo Ribeiro Teles, with free access, covers about 11 hectares and offers a diverse range of fauna and flora, as well as various types of facilities: two picnic areas (with tables and drinking fountains), a children's playground, a fitness circuit, leisure spaces, and a kiosk with a terrace. This green space is a structuring element of the entire neighbourhood, and plays an important role in preserving biodiversity, climate regulation, sustainability, and the quality of life for the residents and visitors of Alvalade. Coordinates: 38.759017, -9.135182

Figure 26. José Gomes Ferreira Park

5. Marseille

Marseille is the metropolis of southeastern France and the second largest city by population in France. Founded around 600 B.C. by Greek sailors from Phocaea in Asia Minor, it is still known today as the “Phocaean City”.

The ambition of the governance of the City of Marseille is to work towards the development of a “fairer and greener” city. This ambition is reflected in the city’s proactive commitment to the fight against social, territorial, and environmental inequalities, and to an ecological transition that can involve all residents.

With its sights set firmly on the future, Marseille’s future is now rooted in sustainable development, as demonstrated by the “Marseille 2030 Climate Objective” initiative, which is now the cornerstone of all the city’s public policies. In this respect, the new tourism strategy “Marseille, a sustainable and attractive destination: 2024-2030 strategy for the responsible development of tourism and leisure” provides the framework for renewed action by the city.

The Cool Noons Paths initiative in Marseille was developed in collaboration with the Marseille Tourist Office, particularly in preparation for the Olympic Games set to take place in the summer of 2024. The Tourist Office identified the touristic points of interest (POI), and the City of Marseille adapted the paths between each POI to ensure they are as cool and pleasant as possible, while balancing factors like car traffic and the charm of the streets.

In total, five paths were preselected by elected officials of the City of Marseille to be tested throughout the project. Two out of these five paths were finalized for testing during the summer of 2024: Path 1 - from Mucem to Palais Longchamp Touristic; Path 2 - from Old Port to the Olympic Marina.

Path 1: from Mucem to Palais Longchamp Touristic

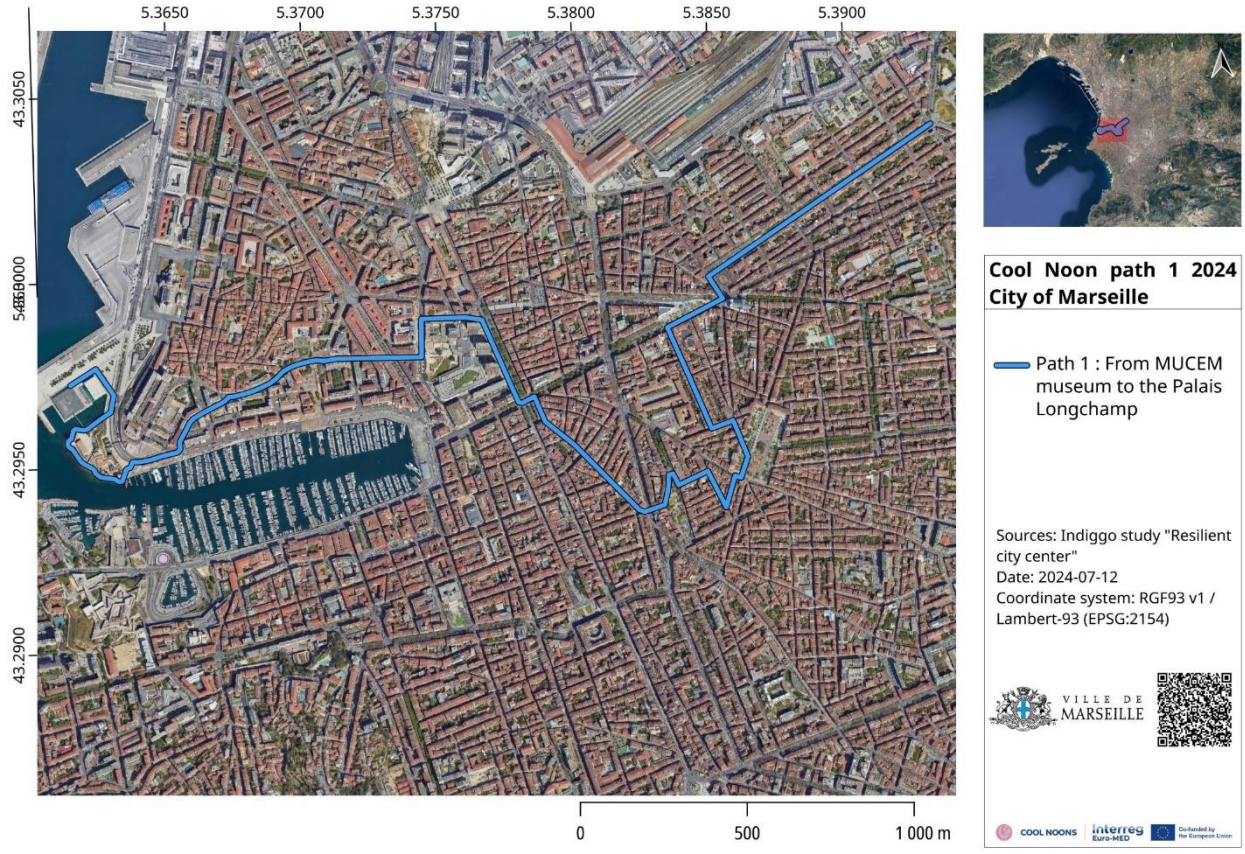

Figure 27. Marseille Cool Noons Path 1 to be tested: from Mucem to Palais Longchamp Touristic

This path is entirely located in the "Resilient city centre" study conducted by Inddigo that analysed which streets are sunny or shaded and what are the wind corridors and the canyon streets (Figure 28).

Regarding the summer comfort, shaded street without canyon effect[1] were preferred. The worst case is a street highly exposed to sunlight with a canyon effect. Sunny streets that are shallow with high buildings are in general more shaded and fresher than sunny streets with moderated mask effect if there is no canyon effect.

[1] A street canyon is a restricted space in an urban area formed by surrounding buildings on both sides of a street. It limits natural air ventilation, and then affects the air quality and the surrounding temperature.

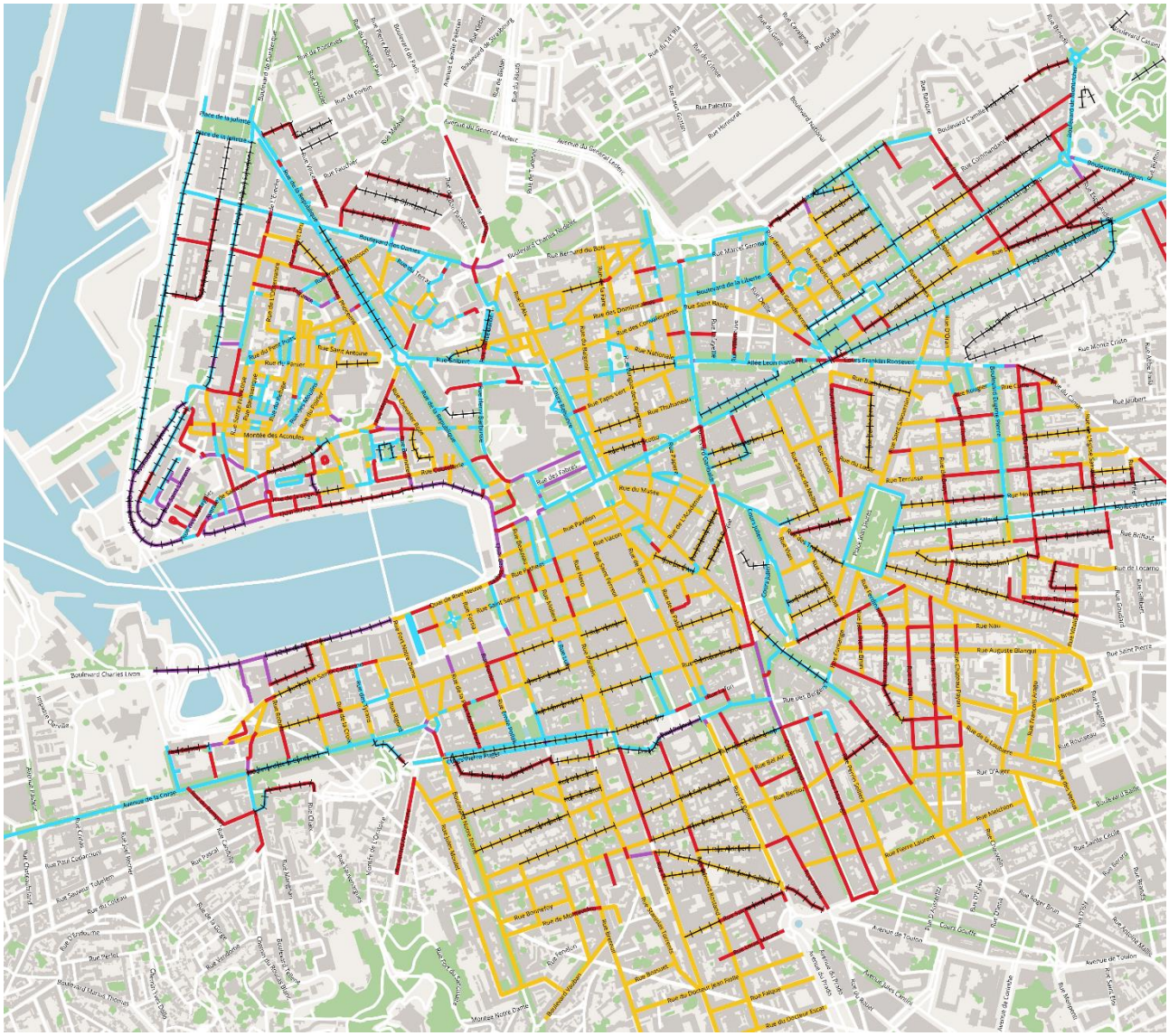

Figure 28. Resilient city centre study. legend of the map: shaded street (blue line); sunny street that is shallow with high buildings (yellow line), sunny street with moderated mask effect (red line) ; street highly exposed to sunlight (purple line); canyon effect (black hatch).

The points of interest in this path are:

1. MUCEM museum
2. City Hall (place Bargemon)
3. Centre Bourse
4. Cours Belsunce
5. Cours Julien and its stairs

6. Place Jean-Jaurès
7. Église des Réformés
8. Palais Longchamp

Starting from the MUCEM (Figure 29), an air-conditioned museum, the path extends to the beginning of Saint-Jean Avenue. Although this segment is sunny, it benefits from the sea breeze due to its proximity to the sea border, providing a refreshing effect. The section from Saint-Jean Avenue, continuing through Caisserie Street (Figure 30) to the Republique Street crossing, is primarily sunny with a moderate masking effect. This route was chosen over the nearby Panier area because it because it is a more peaceful area for consultation with neighbourhood associations and street improvements proposed by project focus groups will be better accepted.

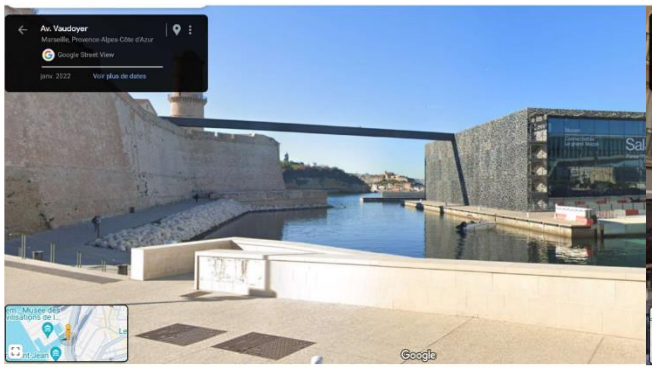

Figure 29. MUCEM and bypassing the Sint-jean Fort along the seafront

Figure 30. Rue Caisserie towards the City Hall (Bargemon Place)

Then the streets are shaded with numerous big trees, for example Henri Barbusse Street (Figure 31) and Cours Belsunce (Figure 32), until the Canebière crossing. The Centre Bourse mall is air-conditioned.

Figure 31. Rue Barbusse

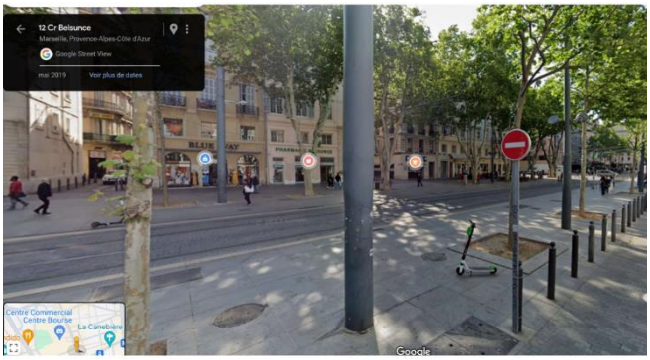

Figure 32. Cours Belsunce towards the Cabebière

The Aubagne street (Figure 33) is relatively fresh because it is shallow and with high buildings (Figure 33). This street is emblematic of the Noailles area, with a multicultural neighbourhood and shops. Then, the Cours Julien (Figure 34) is very fresh, with a lot of shady places, trees, and fountains. Between the Cours Julien (Figure 33) and the Jean-Jaurès Place (Figure 35), there are only sunny streets with moderate masking effect. The ones without canyon effect were selected (rue Crudère, rue des Trois Rois).

Figure 33. Rue d'Aubagne

Figure 34. Cours Julien

The Place Jean-Jaurès (see Figure 35) is shaded on its edges. Between the Place Jean Jaurès and the top of the Canebière, it was chosen to go through the Rue Senac de Meilhan (Figure 36) (more agreable than the parallel Curiol street) with little car trafic and that is planted by residents (see Figure 36).

Figure 35.Place Jean-Jaurès (La Plaine)

Figure 36. Rue Sénac de Meilhan

The end of the path from the Stalingrad Square (Réformés Church, a fresh cult place) to the Palais Longchamp is shaded and uses soft mobility only (pedestrian, bicycle, and tramway) (see Longchamp Boulevard - Figure 37). The end of the path is a shady park with trees (Longchamp Park). By taking the subway (line 1 station Cinq Avenues Longchamp) or the tramway (line 2), it is possible to go back to the Old Port area, not far from the City Hall and the Centre Bourse mall.

Figure 37. Boulevard Longchamp

Path 2: from Old Port to the Olympic Marina

This path is in the "Resilient city centre" study conducted by Inddigo only from the Old Port to the Corse Avenue, just before the POI Tour des Catalans (Figure 38).

Figure 38. Marseille Cool Noons Path 2 to be tested: from Old Port to the Olympic Marina

The points of interest in this path are:

1. Old Port
2. Cours Estienne d'Orves
3. Palais de Justice
4. Jardin de la Colline Puget
5. Tour des Catalans
6. Monument de l'Armée aux Morts
7. Vallon des Auffes
8. Marégraphe
9. Parc Valmer
10. Hélice de César

11. Marina Olympique

From the Old Port to the Cours Pierre Puget, the streets are mostly sunny. The choice was made to go through the Fortia street (Figure 39) as it is less car traffic than the parallel Breteuil Street and crosses the POI Cours Estienne d'Orves. The following street (Emile Pollak - Figure 40) is shaded and joins the Cours Pierre Puget (Figure 39), also shaded with trees on a central island.

Figure 39. Rue Fortia and Cours Pierre Puget

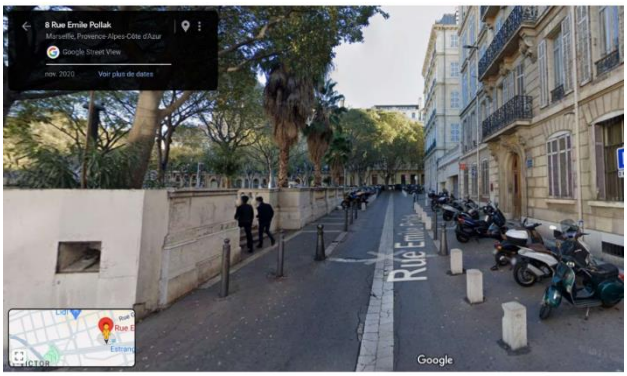

Figure 40. Rue Emile Pollak and the Palais de Justice on the left

The Parc Pierre Puget or Jardin de la Colline Puget (Figure 41) with a sloping ground is cool as it is shaded with trees. When leaving the park, there is no other simple way to go to the next POI (Tour des Catalans and the Catalans Beach) than going through the Lices street (Figure 42) (sunny with moderated mask effect and with a canyon effect). Then, the Endoume street and Corse Avenue (Figure 43) are shaded streets with big trees.

Figure 41. Parc Pierre Puget

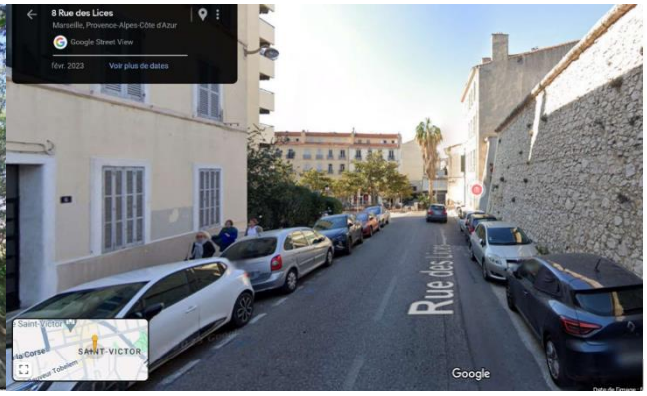

Figure 42. Rue des Lices

Figure 43. Avenue de la corse

At the end of the Corse Avenue, there is the Catalans Beach (Figure 44) where it is possible to swim to cool down.

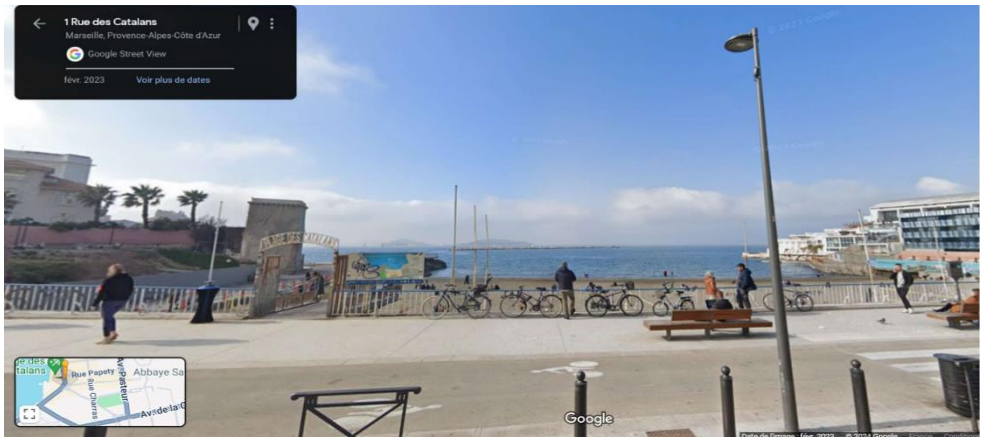

Figure 44. Plage des Catalans

From the Catalans beach, the path follows the Corniche Kennedy (Figure 45), that is sunny all along but relatively refreshed by the Seawinds, to find the last POIs of the path, that are the Monument de l'Armée aux Morts, the Vallon des Auffes, the Marégraphe, the Hélice de César and the Olympic Marina.

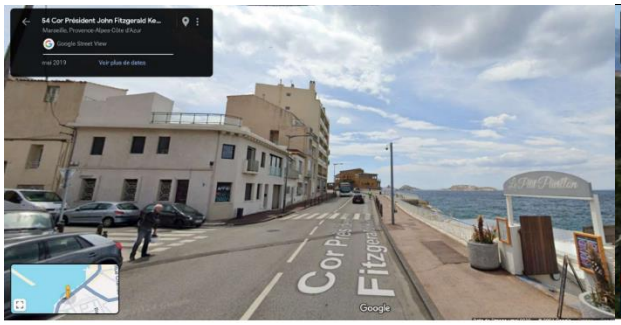

Figure 45. Corniche Kennedy

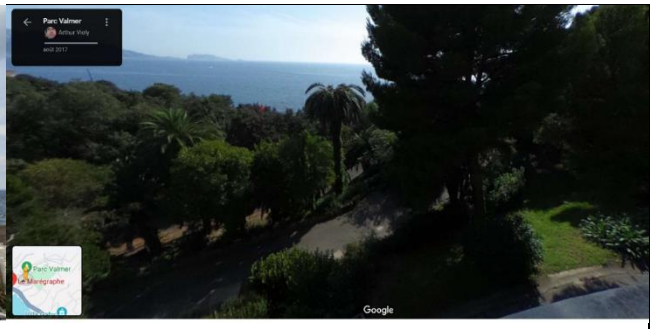

Figure 46. Parc Valmer

In front of the Marégraphe is the Parc Valmer (Figure 46), a big park with trees. Two beaches are available on the path to bath and cool down: the Prophète beach (Figure 47) and Prado beach (Figure 48).

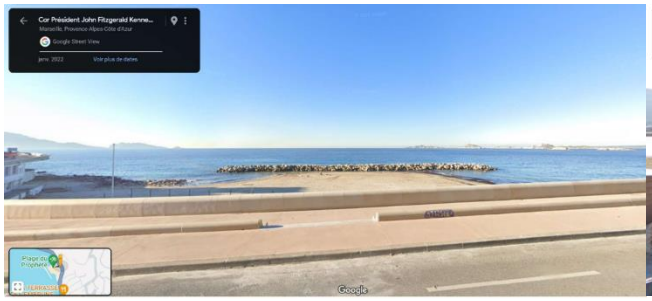

Figure 47. Plage du Prophète

Figure 48. Plage du Prado

As the last part of the path along the sea is mostly sunny, with little trees and shaded areas, it is possible to take the air-conditioned bus number 83, also called "summer bus", to shorten the walk. It follows the Corniche Kennedy from the Catalans beach to the Prado beaches. The last bus stop is located at the line 2 subway Rond Point du Prado and allows to go back to the point of departure of the path in the Old Port area (Noailles Line 2 subway or Old Port station Line 1 subway).

Conclusion

The Cool Noons aims to significantly enhance urban resilience and promote sustainable tourism in Mediterranean cities. Through innovative mapping and the development of Cool Noons Paths, the project addresses the pressing challenge of urban heat, particularly during the hottest hours of the day. By using scientific methodologies such as the Least Cost Path and Optimal Regional Connectivity, each pilot city has tailored solutions to their unique climatic and urban contexts.
The comprehensive mapping of green and cool areas, along with the integration of cultural and historical landmarks, ensures that both residents and tourists can enjoy a more comfortable and enriching experience. The project not only improves the thermal comfort of urban spaces but also fosters a deeper connection between visitors and the local environment.
Each city's single approach exemplifies the adaptability inherent in the Cool Noons initiative:

- Bologna previously focused on creating green infrastructure and cycling paths to mitigate urban heat islands. The city implemented strategies for planting trees and creating green spaces, integrating them with the sustainable mobility network. Two routes were selected, both starting from the train station and ending at the Enzo and Dino Ferrari Racetrack, passing through various historical and cultural points of interest.
- Budva mapped green areas, water points, museums, and libraries. Two Cool Noons Paths were pre-selected that include points of interest such as water bodies and refreshing buildings, to be evaluated using various temperature sensors.
- Dubrovnik's Cool Noons Path guide tourists and residents through shaded areas and cool spots, integrating cultural and historical landmarks with natural features. The city used meteorological data and focus group insights to develop routes aimed at improving thermal comfort and promoting a more enjoyable urban environment.
- Lisbon developed a Cool Noons Path to offer an authentic experience of life in both modern and traditional neighbourhoods, with a clear focus on sustainability. The routes allow visitors to immerse themselves in local life, observing the unique characteristics of local

commerce, green areas, and architectural elements. The initiative aligns with the city's policies to promote new tourist attractions in less popular areas.

- Marseille developed the Cool Noons Paths in collaboration with the Marseille Tourist Office, particularly in preparation for the 2024 Olympic Games. Five tourist paths were preselected, with two finalized for testing. The paths were planned to balance car traffic and the charm of the streets, ensuring a pleasant and cool environment for visitors.

As the project progresses, the ongoing collection of micro-location data and community engagement will refine and enhance these pathways, ensuring their effectiveness and sustainability. Ultimately, the Cool Noons Project underscores the importance of collaborative, cross-disciplinary efforts in tackling climate-related challenges. By promoting sustainable tourism and enhancing urban quality of life, the project aims to contribute to a greener, more resilient Mediterranean region.