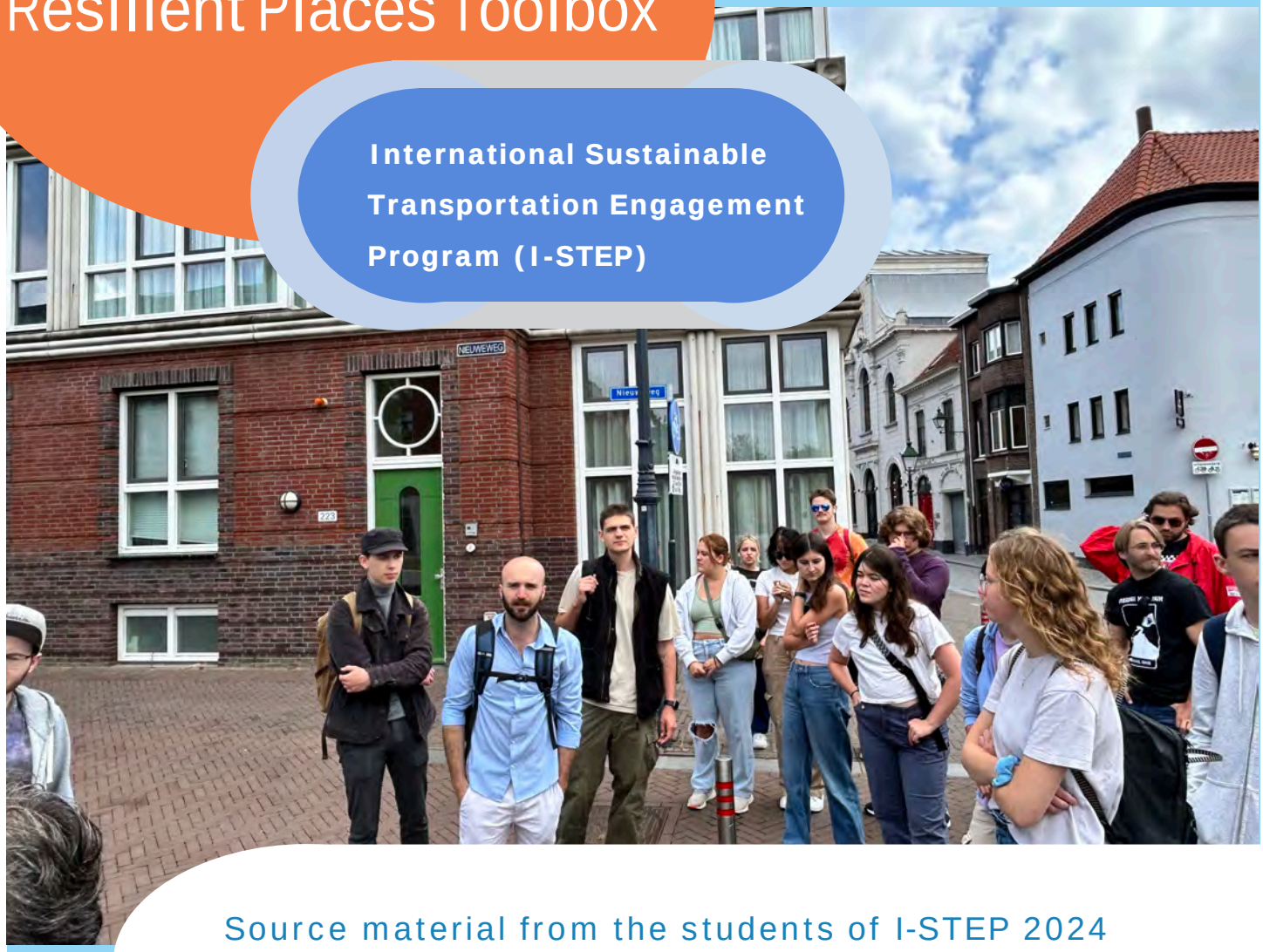
Resilient Places Toolbox

International Sustainable Transportation Engagement Program (I-STEP)



Source material from the students of I-STEP 2024

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Texas State University

Center for Research, Public Policy, and Training

The City of San Marcos Planning

and Development Services Department

Acknowledgements

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Introduction: Designing for Resilience

The Resilient Places Toolbox represents a collaborative effort to identify and adapt best practices in urban design for the City of San Marcos. Tasked by the San Marcos Planning and Development Services Department, the Texas State University Netherlands Program uncovered strategies for creating safe, vibrant, and climate-resilient streets and public spaces. The Netherlands was chosen as the focus due to its globally recognized leadership in designing streets that prioritize traffic safety, livability, and climate adaptation

In the summer of 2024, students from Texas State University, in partnership with Breda University and HZ University, visited Amsterdam, Breda, Delft, Rotterdam, and Utrecht to explore and evaluate resilient design practices. Through the Resilient Places Project Week, students worked in international teams to analyze case study areas in Rotterdam and Breda. Using structured place analysis tools, they recorded key features of the built environment and observed how these spaces were utilized by the public.

Upon returning to Texas, students compiled their findings into the Resilient Streets Toolbox, a resource that highlights promising street and public space designs from the Netherlands. This document includes descriptions of best practices, insights from collaborative research, and recommendations tailored to the needs of San Marcos. It also features links to the student presentations from the Resilient Places Project Week.

The work presented here demonstrates how lessons from Dutch urban design can be adapted to address San Marcos' unique challenges. By integrating these innovative practices, the city can foster safer, more sustainable, and more engaging spaces for its residents.

Project Description

The City of San Marcos Planning and Development Services Department has tasked the Texas State University Netherlands Program with identifying best practices for designing streets and public spaces that foster safety and vibrancy. The Netherlands was selected as a case study due to its numerous examples of resilient streets that integrate strong traffic safety principles while simultaneously creating highly livable urban environments. Dutch street designs increasingly incorporate green infrastructure and climate adaptation features to mitigate urban heat and manage stormwater, making them ideal models for sustainable urban planning.

As part of the program, Texas State University students traveled to Amsterdam, Breda, Delft, Rotterdam, and Utrecht to study best practice projects. The program included two primary tasks. First, Texas State students collaborated with Breda University students to develop resilient design scenarios for case study areas in Rotterdam and Breda.

During Resilient Places Project Week, the international student team conducted structured place analyses, documenting key features of the built environment and observing how public spaces were utilized. By the end of the week, they formulated targeted proposals to enhance the resilience of their case study locations.

Following their site work in the Netherlands, Texas State students compiled a Resilient Streets Toolbox, summarizing the most effective street and public space designs observed during the study tour. This toolbox highlights promising urban design strategies that could be adapted for the City of San Marcos to improve safety, sustainability, and livability.

This document includes the Resilient Streets Toolbox along with links to student presentations from Resilient Places Project Week. All research was conducted by students from Texas State University, HZ University, and Breda University in the summer of 2024. The final compilation was completed by Dr. Billy Fields.

Project Description

In the summer of 2024, Texas State University students embarked on a study abroad program in the Netherlands, visiting Amsterdam, Utrecht, Delft, Breda, and Rotterdam. The goal was to identify examples of resilient streets and great public spaces, analyze what makes these places successful, and explore how similar best practices could be applied in Central Texas. This experience was eye-opening, revealing how different, safer, and more comfortable streets are in the Netherlands.

Throughout the trip, we traveled to a variety of streets and public spaces, observing and analyzing them as we went. To conduct our place analyses, we used two key tools to evaluate the resilience and welcoming nature of these spaces:

- **Safe Resilient Streets Asset Evaluation** – A structured checklist assessing green/blue infrastructure (climate adaptation, water management) and Vision Zero/Safe Street elements (traffic safety, pedestrian-friendly design).
- **Street Interview Tool (SIT Tool)** –A unique method where we "asked the street" a series of questions to determine how welcoming and user-friendly it felt. This tool considers not just the physical design of a space but also how it is experienced and used by people in real time.

Our evaluations revealed that even the less resilient Dutch streets—such as those in Breda and Rotterdam—still far outperformed many Central Texas streets in terms of safety, sustainability, and overall livability. This document presents key findings and highlights best practices observed in the Netherlands, showcasing a range of resilient street typologies from downtown business districts to neighborhood streets (Table 1).

Resilient Place Typologies

The City of San Marcos is interested in improving designs for a variety of key locations across the City. After meetings with the City staff, Texas State students were asked to identify best practice examples for a number of different types of locations. The table below lists these types of locations that the City of San Marcos identified as important typologies for potential application in San Marcos.

Overall, the City of San Marcos was interested in better understanding how these different typologies of places were designed, how they function, and the key lessons that they should know about these best practice templates for the Netherlands. The students compiled this information through site visits across the Netherlands and through a joint project with students from HZ University and Breda University.

Table 1: Resilient Street Typologies

Street Typologies
Neighborhood business corridors
Downtown commercial districts
Public plazas/squares
Festival/market streets
Pedestrian streets
Alleys/woonerfs/shared streets
Residential streets
Adjacent cycletrack/greenway streets
Water square integrated streets
Green streets

Place Analysis Methodology

The students followed a structured approach to place analysis. The basic format for the research is based on the direct observation approach laid out by Jan Gehl and Birgitte Svarre (2013). Gehl is a pioneer of the public space analysis approach that involves counting and mapping activities, photographing and videoing what is taking place, and truly analyzing the public life of a street. This is a much broader way of evaluating the "success" a street based not only on movement, but also public values of the street as a place.

This direct approach to place analysis was augmented with more recent work that focuses on adapting communities to climate change. Fields and Renne (2021) lay out a series of tools in Adaptation Urbanism and Resilient Communities that can be used to assess how resilient streets function and feel. Students utilized two tools outlined Fields and Renne to examine a set of places in the Netherlands.

The Adaptation Urbanism Asset Mapping Tool and the Street Interview Tool (SIT) allowed students to take the direct observational approach outlined by Gehl and Svarre and "quantify" key components of the places to examine both the sociability of the places as well as their climate resilience.

In general, we found that many of the Dutch streets we examined were resilient, safe, and welcoming. Even streets that were not as resilient comparatively, like what we observed in Breda and Rotterdam, were still leaps and bounds ahead of some Central Texas streets in terms of resiliency. Through our evaluations, we collected many examples of great, resilient streets. To present some examples of resilient streets we found in the Netherlands, this document showcases what resilient street elements each example contains. We identified projects across the Netherlands with typologies ranging from downtowns busi-ness districts to neighborhood streets (Table 2).

Place Locations and Typologies

Table 2: Resilient Place Locations and Typologies

Locations	**Typology**
Blankenstraat, Amsterdam	Adjacent cycle track, green streets
Plantage Middenlaan, Amsterdam	Adjacent cycle track, green streets, transit streets
De Pijp Street Market, Amsterdam	Neighborhood business corridors, pedestrian streets, market streets
Jacob van Campenstraat, Amsterdam	Shared streets, Residential streets
Cornelia Vermuvdenstraat, Amsterdam	Cycle track
Moreelsehoek, Utrecht	Bioswale
Herr Bokelweg, Rotterdam	Green transit street
Benthemplein, Rotterdam	Water square
Oudegracht, Utrecht	Canal
Funnepark, Amsterdam	Planter boxes, greenway streets
Funnepark, Amsterdam	Façade garden, greenway streets
Gustav Maherlaan, Amsterdam	Downtown commercial district
Amsterdam Centraal	Transit, cycle track
Frans Halsstraat	Shared street, façade gardens
Die Nieu Mark, Breda	Pedestrian street
Harddraverstraat, Rotterdam	Residential street
C.M. Allen Parkway, San Marcos, Texas	Green streets

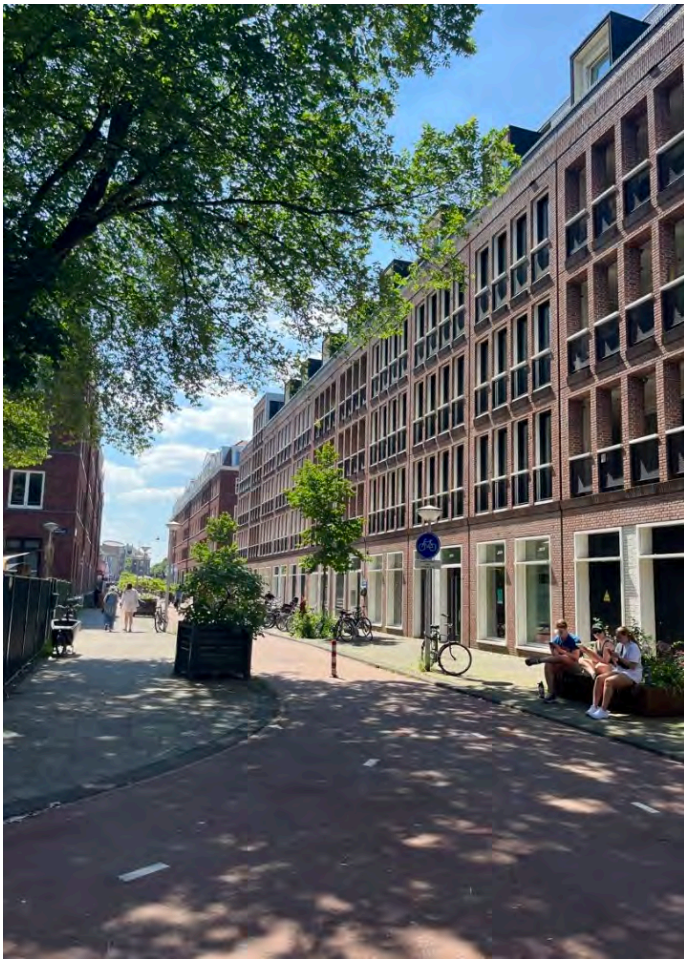
Blankenstraat, Amsterdam

Typology

Adjacent cycle track, green streets

Resilient Places Benefits

- Cycle streets are much safer for children going to and from school.
- Green infrastructure like planter boxes, street trees, and green medians up and down the street beautify the area while also providing shade and places to sit.
- Absence of cars reduces noise pollution for residents along the street.



Description

This is a cycle street with zero cars and is directly next to a school for young children. The surrounding area is primarily residential with few shops.

Application Considerations

- This example would be best implemented in a neighborhood close to a school, with higher bicycle usage already and a need for safer streets with more vulnerable populations.
- The greenery provides shade and cooling to neighborhoods that are mainly concrete and asphalt, reducing urban heat island effect.

Plantage Middenlan, Amsterdam

Typology

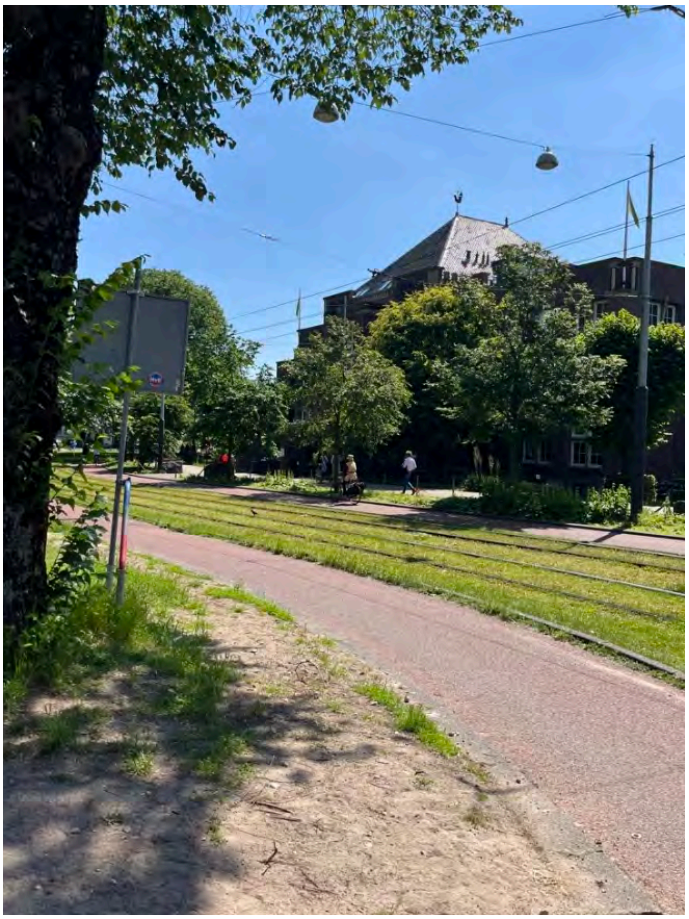
Adjacent cycle track, green streets, transit streets

Description

Tram line over a green median that separates two directions of cycle tracks.

Resilient Places Benefits

- The greenery soaks up water and acts as a noise dampener for the nearby area.
- The tram line provides easy transit connections to other parts of Amsterdam.
- Cycle track on either side makes biking safe and easy without the threat of cars.



Application Considerations

- This area would be a good example to refer to in areas that would have a high transit demand, as that would better justify a form of transit through the middle of the street.
- Areas in proximity to the San Marcos River would be a good fit for this, as car pollution negatively affects the river in ways that bicycles, and transit paired with greenery does not.
- This example may also be useful near the railroads in San Marcos that go through residential areas, in order make the surrounding neighborhoods quieter. Adding cycle tracks along the train tracks could improve connectivity across town in places cars cannot reach.

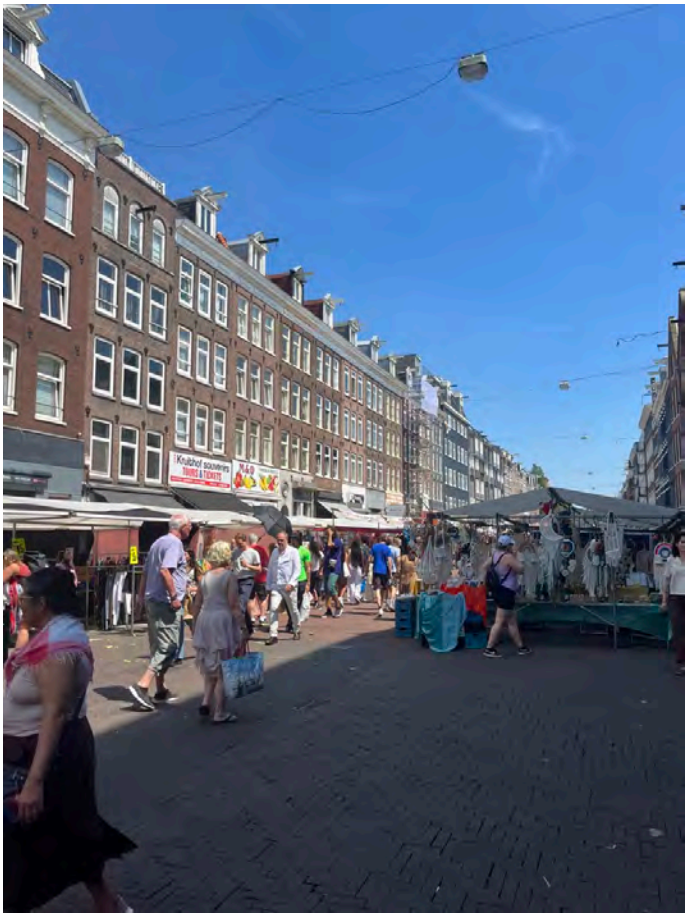
De Pijp Street Market, Amsterdam

Typology

Neighborhood business corridors, pedestrian streets, market streets

Resilient Places Benefits

- The pedestrian street is extremely safe, even from a non-vehicular perspective. People keep other people safe, and leads to the area feeling more comfortable to exist in.
- Brick pavement allows for water to pass through to the watershed/water facilities.
- Area in a densely populated neighborhood with efficient transit connections.



Description

Bustling daily street market in the De Pijp neighborhood along a pedestrian street.

Application Considerations

- Making market streets more pedestrian friendly, while providing more transit connections, can make for more busy and bustling markets.
- In more pedestrian oriented areas, streets can be laid with bricks to be easily converted to slower speed streets when markets are not happening if needed.
- Taller buildings provide more shade, cooling off the area. They do not have to be extremely tall, the ones shown in the photo are only five-story apartment buildings.

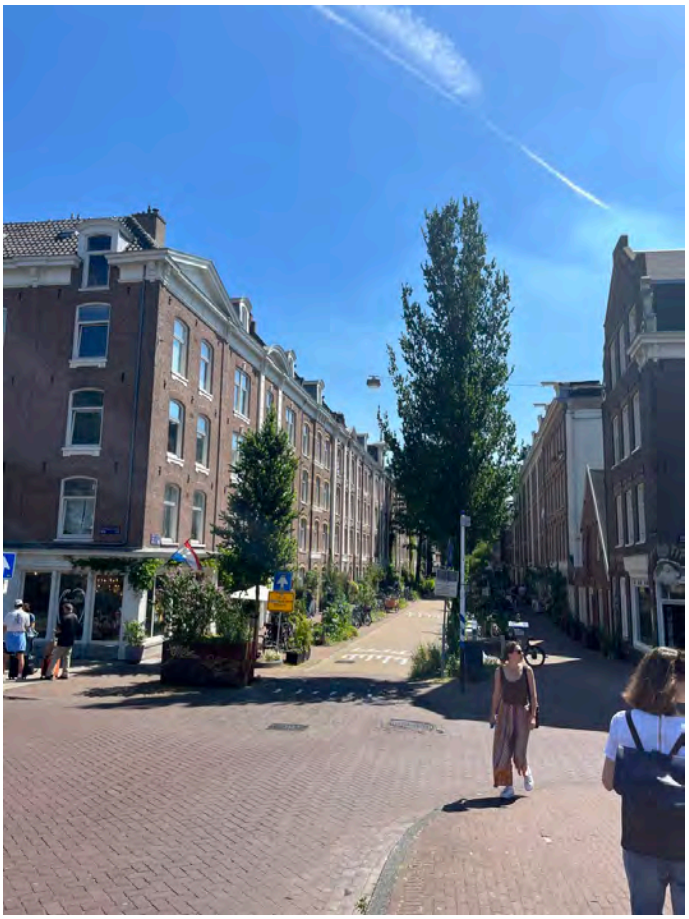
Jacob van Campenstraat, Amsterdam

Typology

Shared streets, Residential streets

Resilient Places Benefits

- Narrow road, brick pavement, plants, and speedhumps all work together to slow down car traffic significantly.
- Removing parking spaces in favor of greenery provides shade, adds an amenity to residents, and provides a buffer between pedestrians and the traffic on the other side.



Description

Small neighborhood street in De Pijp with a narrow road, speedbumps, and former parking spaces converted into gardens.

Application Considerations

- Removing parking spaces across town, while difficult, could be a possibility to add gardens of these kinds to beautify our streets and make them safer simultaneously.
- This design could be implemented in neighborhoods to slow down cars and provide better places at the same time.

Cornelia Vermuvdenstraat, Amsterdam

Typology

Cycle Track

Resilient Places Benefits

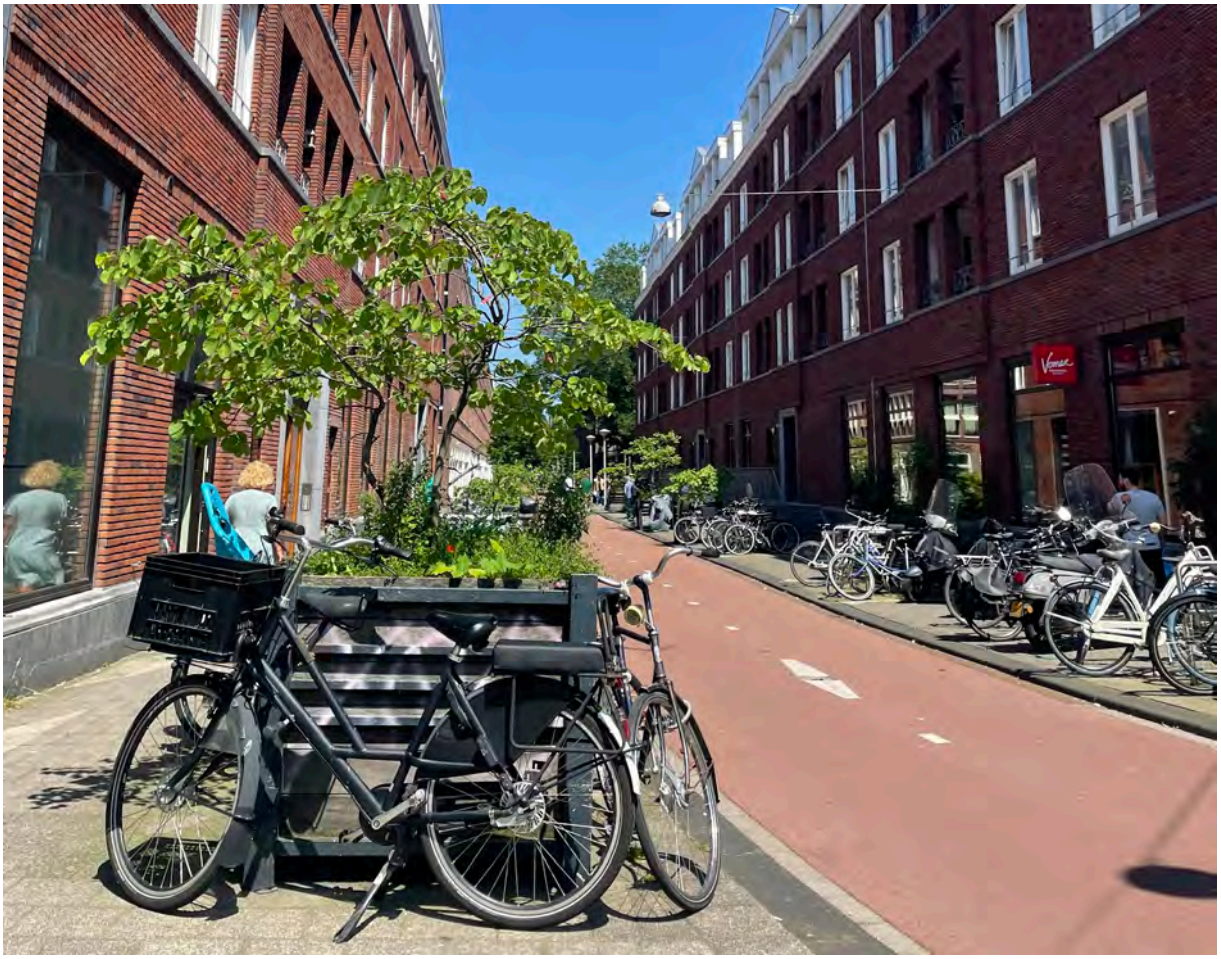
A safe intersection for cyclists and pedestrians traveling through.

Description

Two-lane intersection for bikes only surrounded by a pedestrian walkway, planters, and bicycle parking.

Application Considerations

Provides a greater incentive for people to ride their bikes without fear of inadequate and unsafe infrastructure. Limitation on car-traffic may be politically challenging, but may be effective in areas without much through traffic.



Moreelsehoek, Utrecht

Typology

Bioswale

Resilient Places Benefits

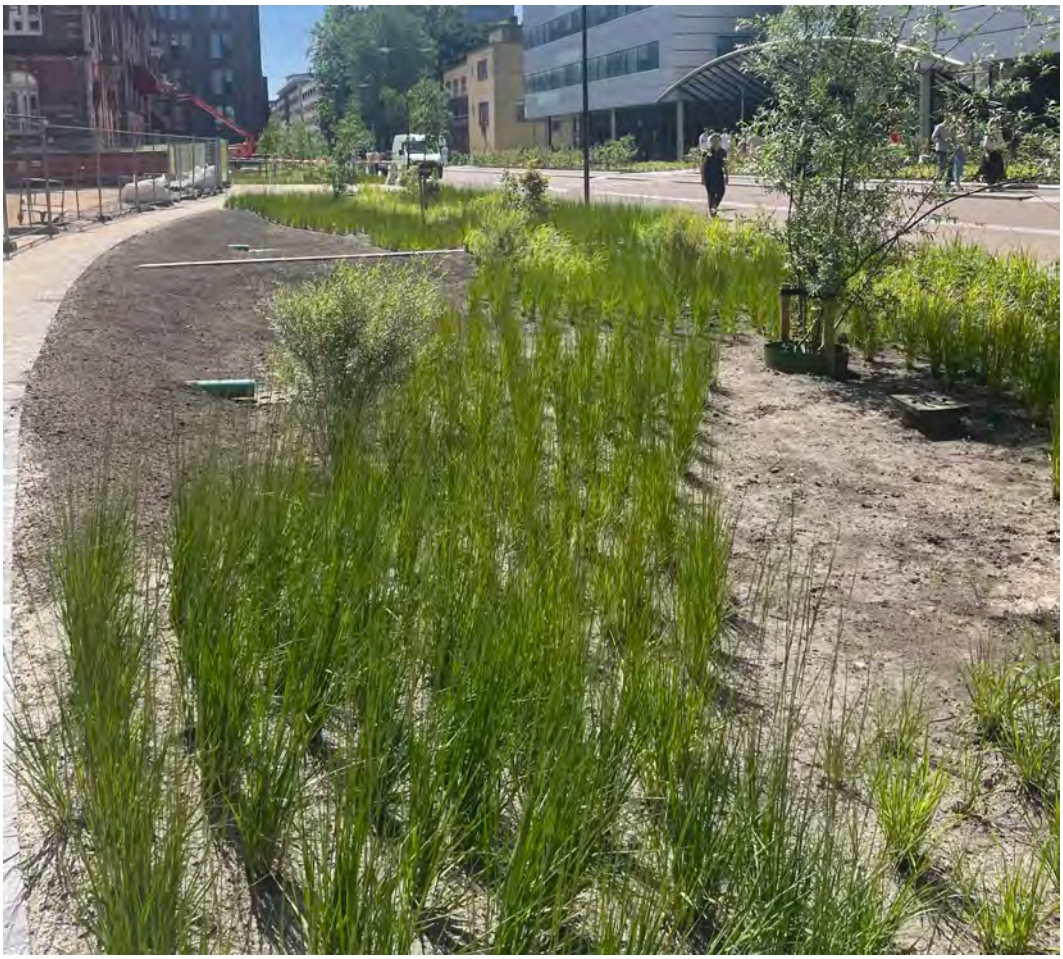
Helps manage the amount of water that would have covered the surrounding businesses. Slows car traffic and improves public space.

Description

This is a street refurbishment project repursing car parking spaces into a bioswale with small plants and trees to help mitigate flooding and improve area livability.

Application Considerations

This can be implemented on a larger or smaller scale in many different places. It is particularly suited to areas with excess parking and asphalt that can be repurposed.



Herr Bokelweg, Rotterdam

Typology

Green transit street

Resilient Places Benefits

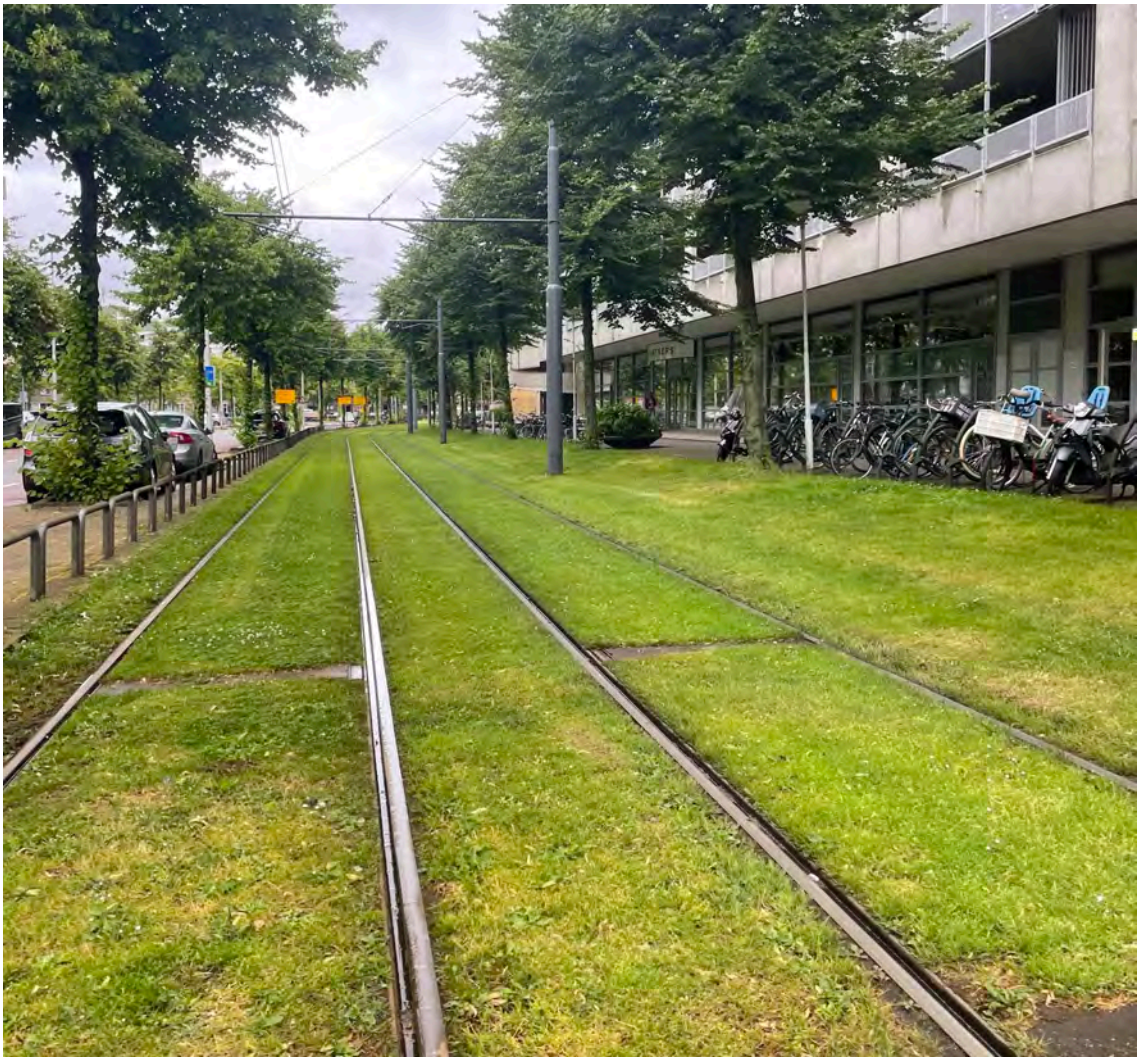
Decreases tram noise, improves area livability, and helps to decrease impervious cover. Also, decreases urban heat island impacts.

Description

Green tram tracks running for several blocks adjacent to the new Hofbogenpark.

Application Considerations

There is some increased maintenance cost to keep grass cut.



Benthemplein, Rotterdam

Typology

Rain gardens

Resilient Places Benefits

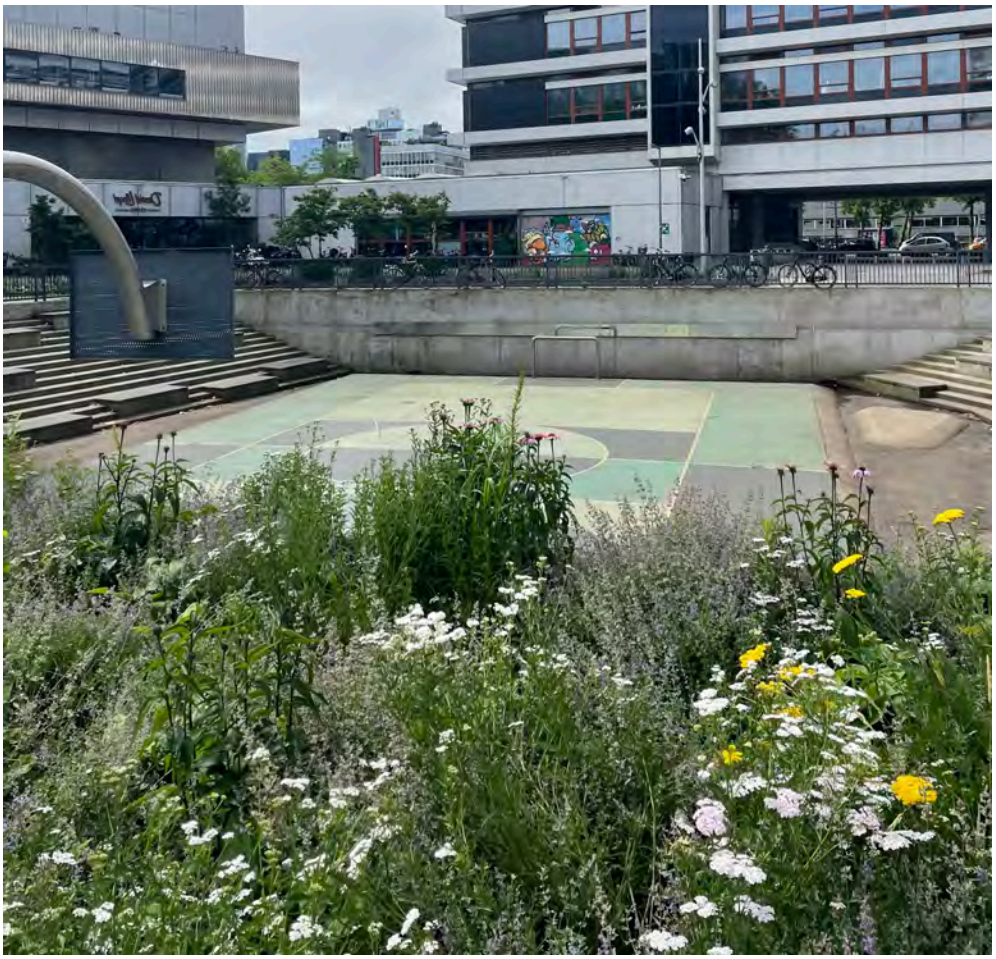
The plants are there to serve as absorption of water to mitigate flood potential, especially since there are commercial businesses nearby. Plants also help beautify the area. The concrete retention areas add capacity for water retention and are slowly drained after a major cloudburst event.

Description

This is a collection of various wildflower plants placed by a bioswale park with concrete retention areas for water that double as basketball courts. One of the world's first dedicated water squares.

Application Considerations

This is placed in an area that gets heavy rainfall and it is placed in an area with other forms of green/blue infrastructure. Maintenance costs to maintain a functioning system can be high.



Oudegracht, Utrecht

Typology

Canal

Description

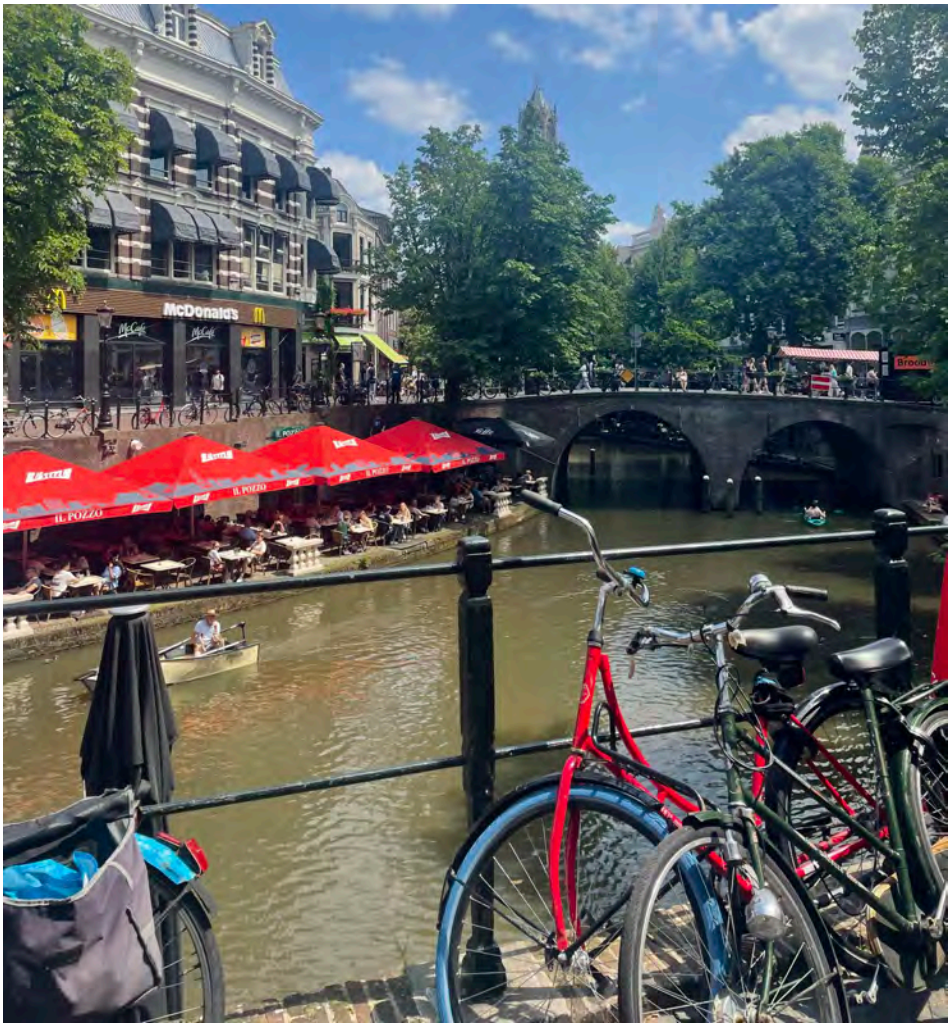
Historic canal with tunnels and lined up with various businesses.

Resilient Places Benefits

This canal allows for proper water management, as a mode of transportation, as a way to help mitigate flooding concerts, and as a form of entertainment for spectators.

Application Considerations

Without existing canals, a project like that may be too expensive and some will be hesitant. Could be useful for areas that deal with heavy rain and have a need for better water management.



Funenpark, Amsterdam

Typology

Planter boxes, greenway streets

Resilient Places Benefits

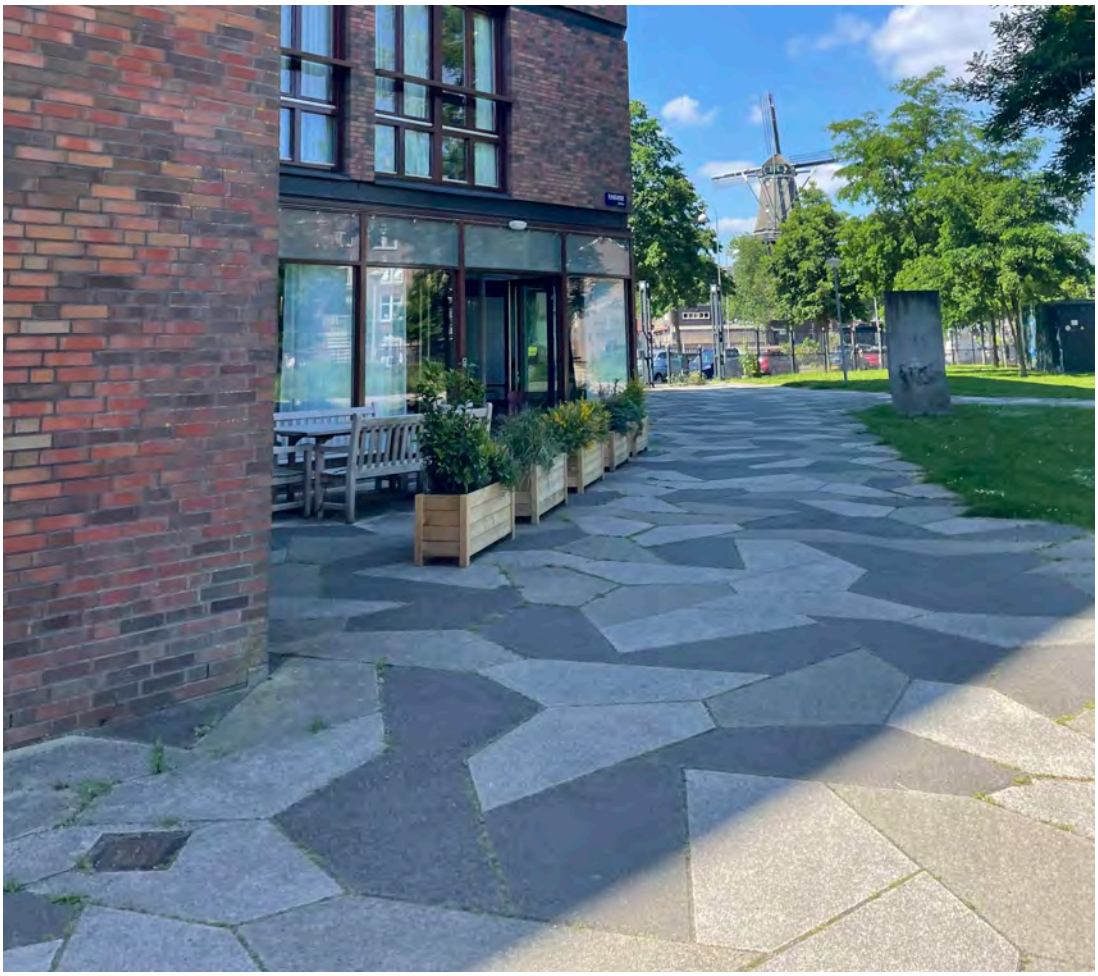
Creates a central greenway street area that is pedestrianized. Also includes planters adjacent to apartments that add micro-green elements to the landscape.

Description

Wood planter boxes with different types of flowers arranged in a row.

Application Considerations

Planets serve as a way to absorb water, increase/maintain biodiversity, and as a makeshift barrier. Central greenway street acts as public space and as an active transport corridor. Can be included in many apartment designs like a linear courtyard.



Funenpark, Amsterdam

Typology

Facade garden, greenway streets

Resilient Places Benefits

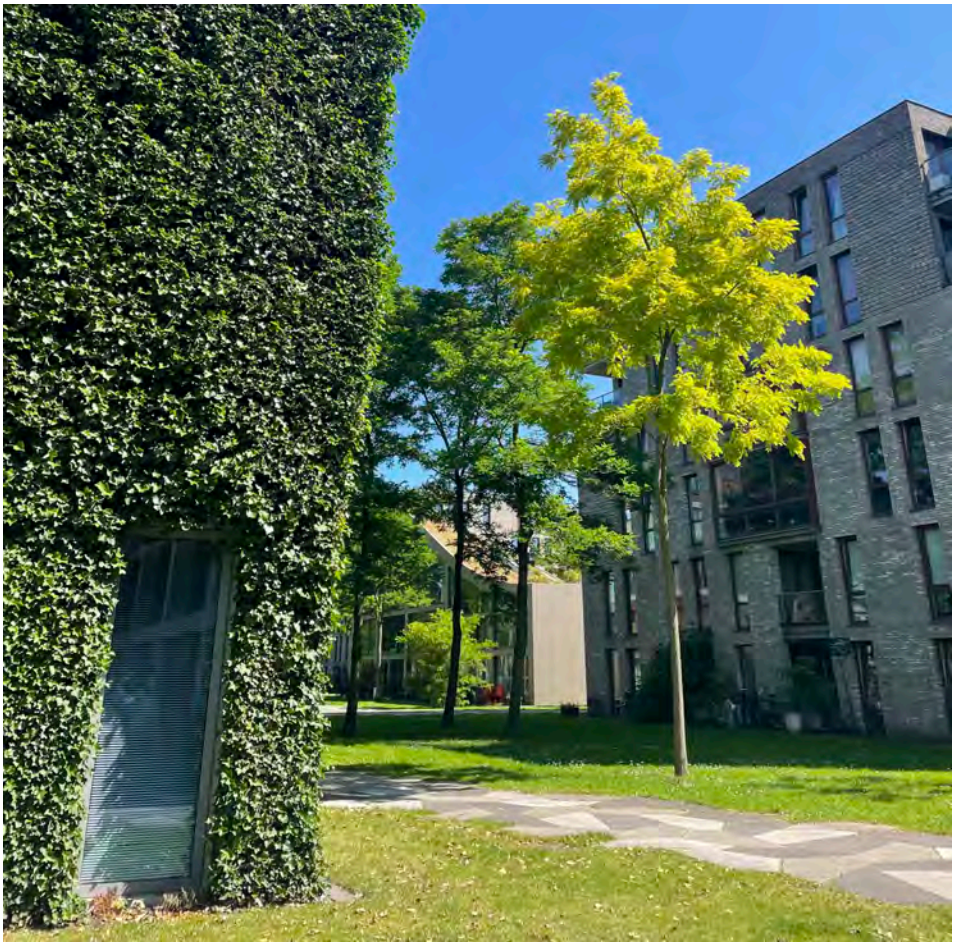
Allows for a unique look that seems inviting and comfortable. Helps absorb and slow water from storms.

Description

In addition to the benefits of the greenway streets discussed above, Funnepark includes a great example of a façade garden. This residential space has added greenery covering most available spaces.

Application Considerations

May not survive in warmer climates with stronger and more consistent sunny days. It would take awhile to implement and consistently maintain.



Gustav Maherlaan, Amsterdam

Typology

Downtown Commercial District

Resilient Places Benefits

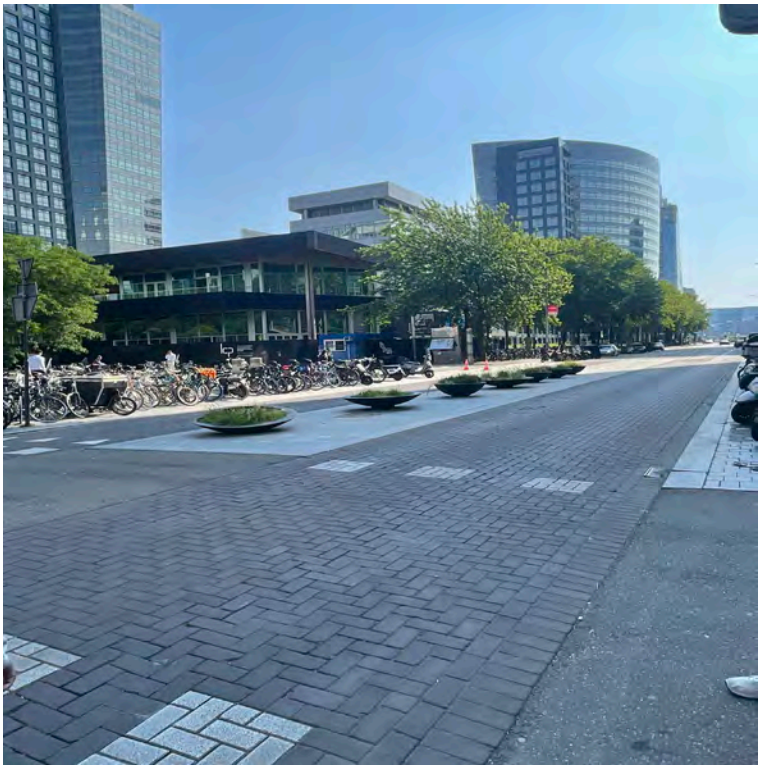
- Brick pavement helps disperse water while also calming traffic
- Street planters in median help absord rain water
- Pedestrian median for crossrings
- Cycle tracks to provide protected spaces for cyclists

Description

The "Main Street" of Amsterdam's modern financial district with adjacent sidewalks and cycle tracks on both sides. The heavily traffic-calmed street provides safe crossings for pedestrians, clear cycle tracks for bicyclists, and access for cars to the business district.

Application Considerations

- This kind of street is most appropriate in busy commercial areas; its design allows it to accommodate heavy volumes of foot, bike, and car traffic
- The street trees and parking provide a buffer for pedestrians, so it does not feel like you are walking on a busy street



Amsterdam Centraal

Typology

Transit, cycle track

Resilient Places Benefits

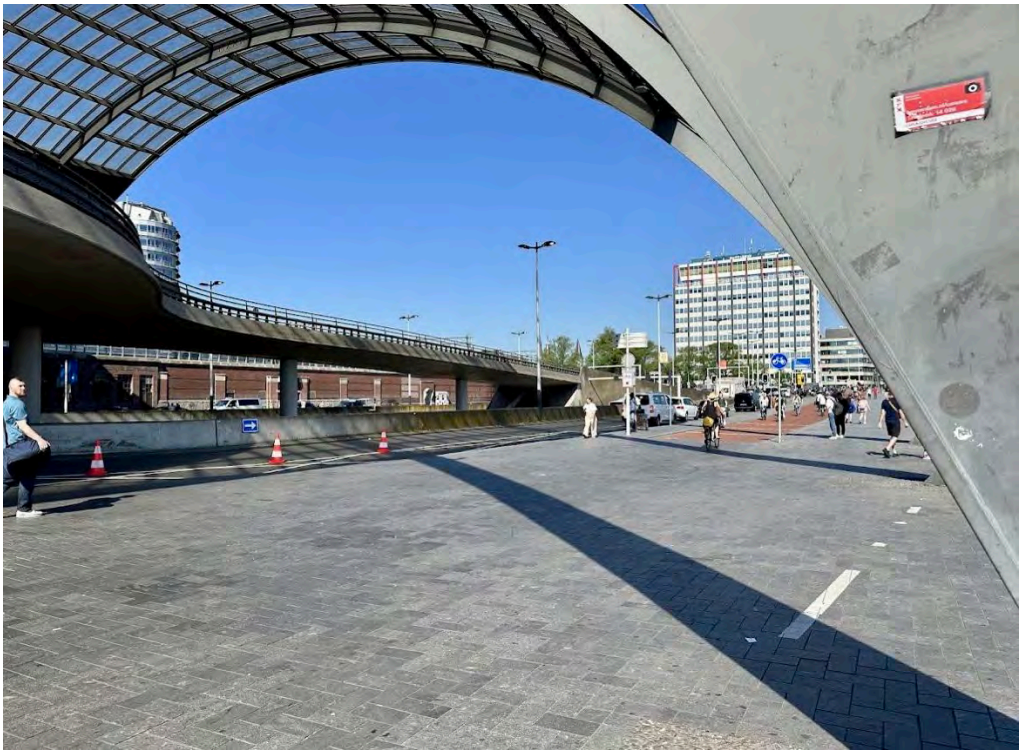
- Improved safety for active transport and clear, safe access to the ferry system.
- Water is managed through a drainage system below.

Description

This project was previously a two-way busy road behind Amsterdam Central Station. Through traffic was diverted to a road tunnel beneath the station with a continuous cycle track through the station. This provides safe access for bikes, pedestrians, and a linkage to the adjacent ferry berths. Taxis can also access the single-lane road along this area. With all of this movement infrastructure, there is, however, limited green infrastructure.

Application Considerations

- Improved safety for active transport and clear, safe access to the ferry system.
- Water is managed through a drainage system below.



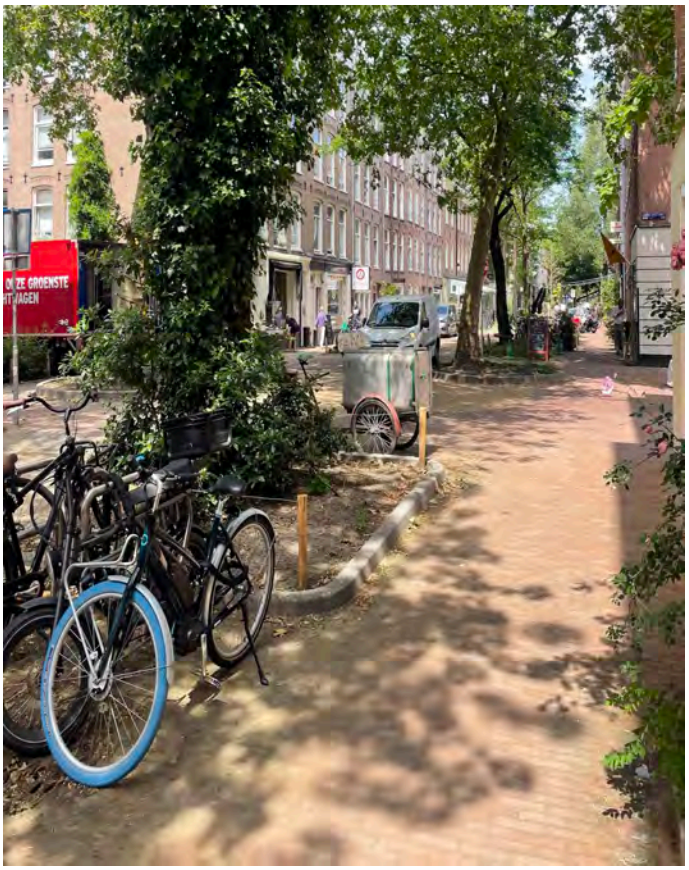
Frans Halsstraat, Amsterdam

Typology

Shared street, planter boxes, façade gardens

Resilient Places Benefits

- Trees keep the street cool, absorb noise pollution, and act as a buffer for pedestrians when cars pass through
- Planter boxes and façade gardens act as a sponge by absorbing rainwater
- Brick pavement helps disperse water while also calming traffic and improving neighborhood aesthetics.



Description

Street parking was moved to an underground garage and the space was re-envisioned with added green space. This project is intended to create a "rain proof" neighborhood by transforming its streets to reduce flooding in addition to lowering CO2 emissions. Improves safety for active transport users and livability for neighbors.

Application Considerations

- This project is most suited for a local mixed-use area with small scale commercial uses primarily serving residents.
- The street belongs to the people, and cars are treated as guests. The project benefits for an underground garage which helped to address political concerns.

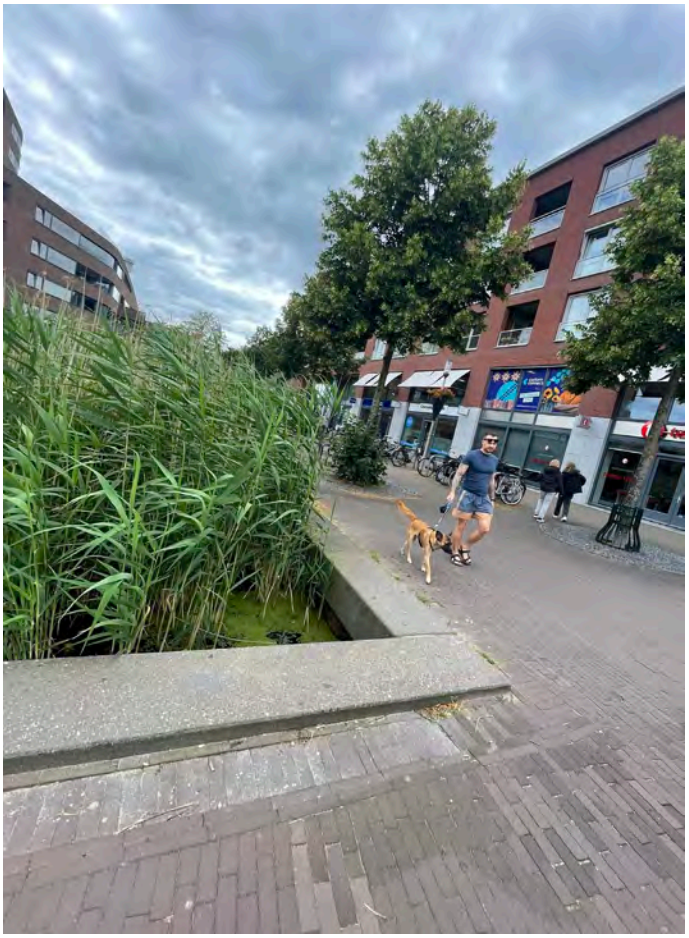
Die Nieu Mark, Breda

Typology

Pedestrian Street

Resilient Places Benefits

- Features both green and blue infrastructure such as the canal and street trees
- Plants in canal act as sponge absorbing runoff
- Permeable brick pavement helps disperse water
- Car access is restricted to delivery trucks and EMS



Description

This was a four-lane roadway that was converted to a pedestrian space adjacent to a new canal. This is a fully reinvented space that places water and pedestrian space as core elements of the neighborhood.

Application Considerations

- This project is utilized in a commercial corridor. Vehicular traffic is moved to the other side of the canal making ample room for foot traffic along shops.
- This is expensive. The historic canal was reinserted into the landscape. Could be utilized as a signature project in a commercial area.

Harddraverstraat, Rotterdam

Typology

Residential Street

Description

This quiet residential street only permits bikes and pedestrians through traffic

Resilient Places Benefits

- Limited car access reduces noise and air pollution
- Street trees and greenery act as a sponge while keeping the street cool
- Brick pavement helps disperse water while also calming traffic

Application Considerations

- Applicable to a short, solely residential street. Car access is restricted to residents only with several street parking spaces replaced by greenery.

Bellamyplein, Amsterdam

Typology

Water square, bioswales

Resilient Places Benefits

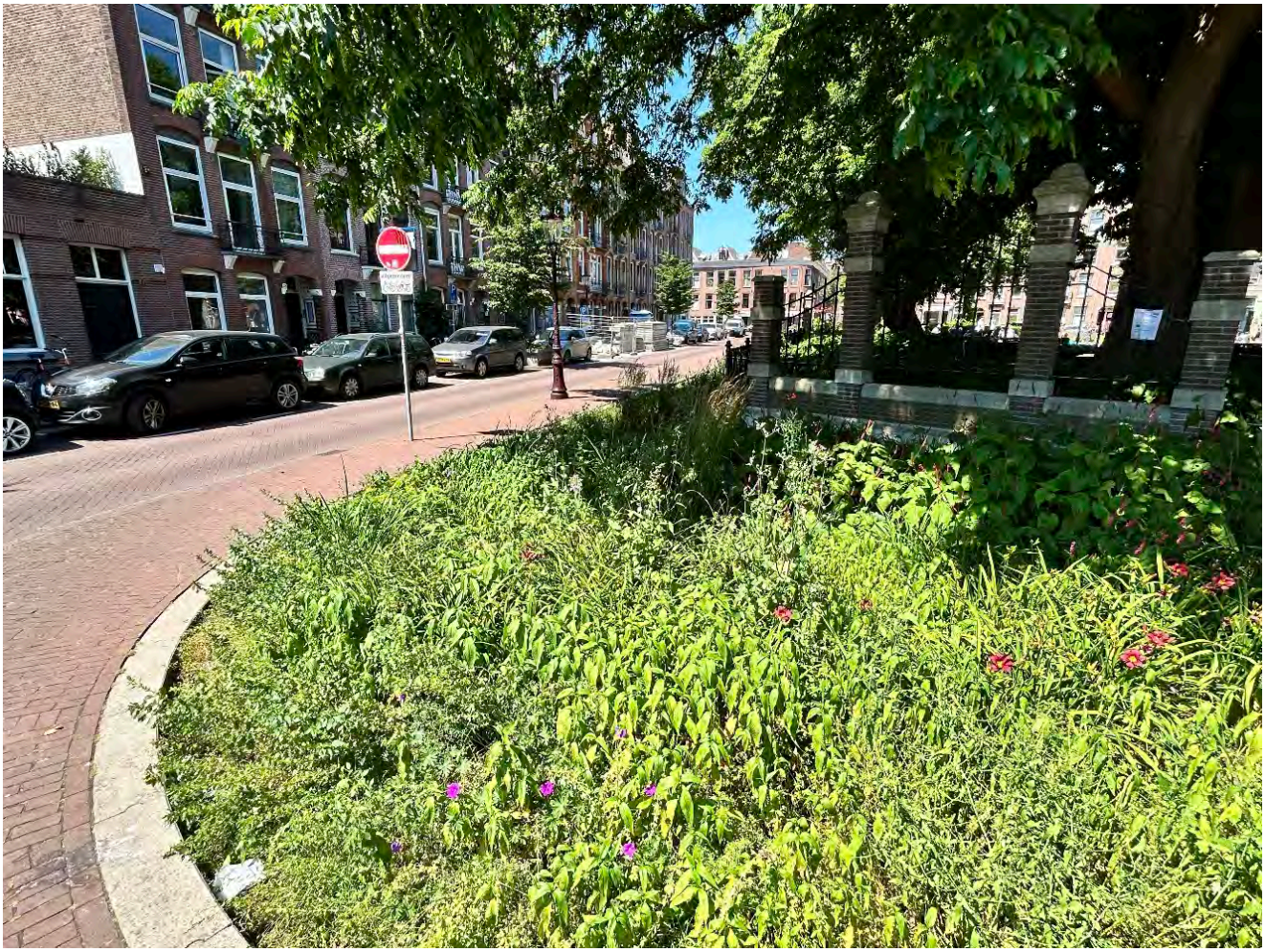
water management, public space, and heat management benefits.

Description

Urban park retrofitted as a water square rimmed by bioswales. Includes kid's water play area.

Application Considerations

True neighborhood amenity that doubles as water management and heat management tool. There are cost considerations, but the project could be inserted into almost any neighborhood.



C.M. Allen Parkway, San Marcos, Texas

Typology

Green streets

Description

A resilient street in San Marcos with bioswales and green medians.

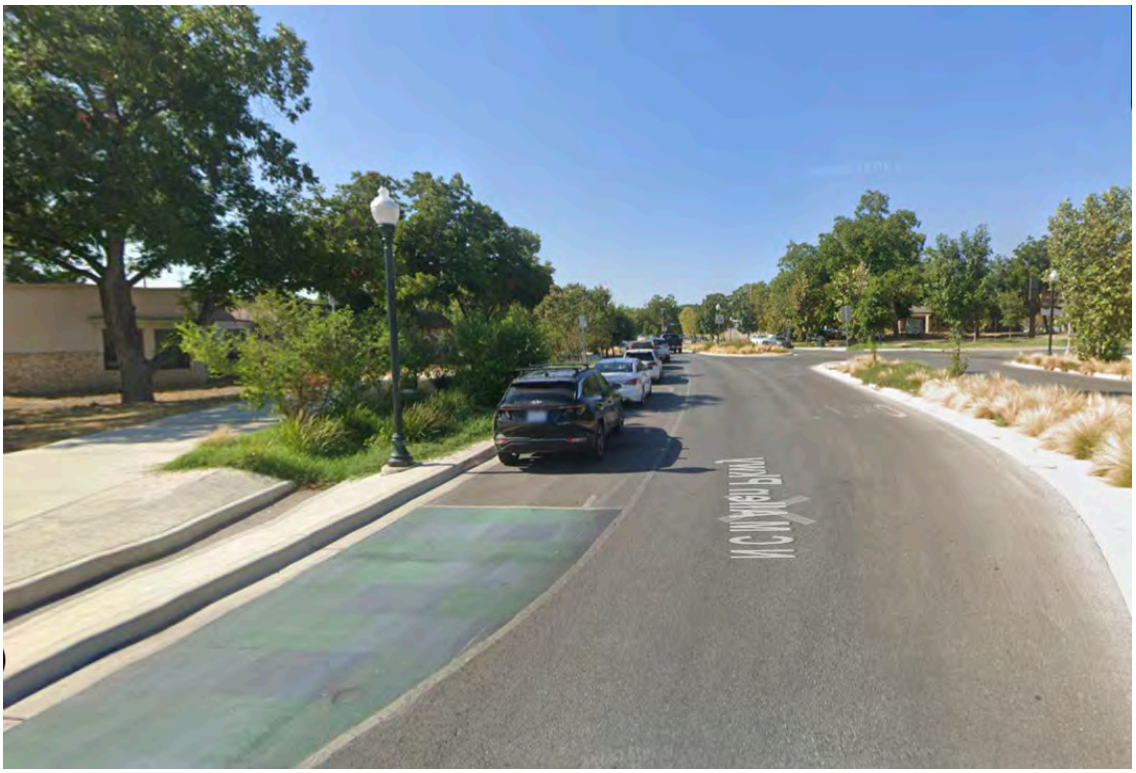
Resilient Places Benefits

- Bioswales near the San Marcos River improve climate resiliency and keep the river clean.
- The bioswale also provides a buffer between car traffic and pedestrians on the wide sidewalk.
- Median full of native plants dividing two directions of car traffic slows cars down.

Application Considerations

- This is a great example already in San Marcos, which could definitely be expanded further down C.M. Allen along the river. This might be easier to achieve politically because it ultimately keeps the river clean and not flooded.

- The green medians are perfect for slowing down cars and could be easily implemented along any medium speed road in need of traffic calming.



Conclusion

As San Marcos continues to grow, the city must address the environmental challenges posed by climate change. Integrating various methods of green and blue infrastructure across the city will enhance resilience and mitigate future risks. The Netherlands offers valuable lessons, having invested heavily in infrastructure to manage climate impacts. By adopting these best practices, San Marcos canalleviate potential environmental issues that arise.

The examples above provide important design precedents for San Marcos as it works to improve resilience. To conclude, we highlight two key projects that could be considered for wider adoption in the city.

The first example focuses on flood management. One of the most effective project types observed in the Netherlands is the water square, a form of blue and green infrastructure designed to collect rainwater during heavy storms. These spaces function as public squares that integrate water management with social and recreational uses.

A notable example is Bellamyplein in northwestern Amsterdam, which serves as both a water retention area and a public park during dry weather. Another example, Benthemplein in Rotterdam, operates as a basketball court and gathering space while also capturing excess rainfall to prevent flooding. Both projects, detailed in the Toolbox section above, offer adaptable solutions that San Marcos could implement based on specific site needs.

When comparing Bellamyplein and Benthemplein, it is important to note their distinct approaches to water management. Benthemplein primarily utilizes concrete basins to collect and store water during heavy rainfall events, while Bellamyplein relies more on green infrastructure for water retention. Both designs can be useful, with their effectiveness depending on the specific needs of the location.

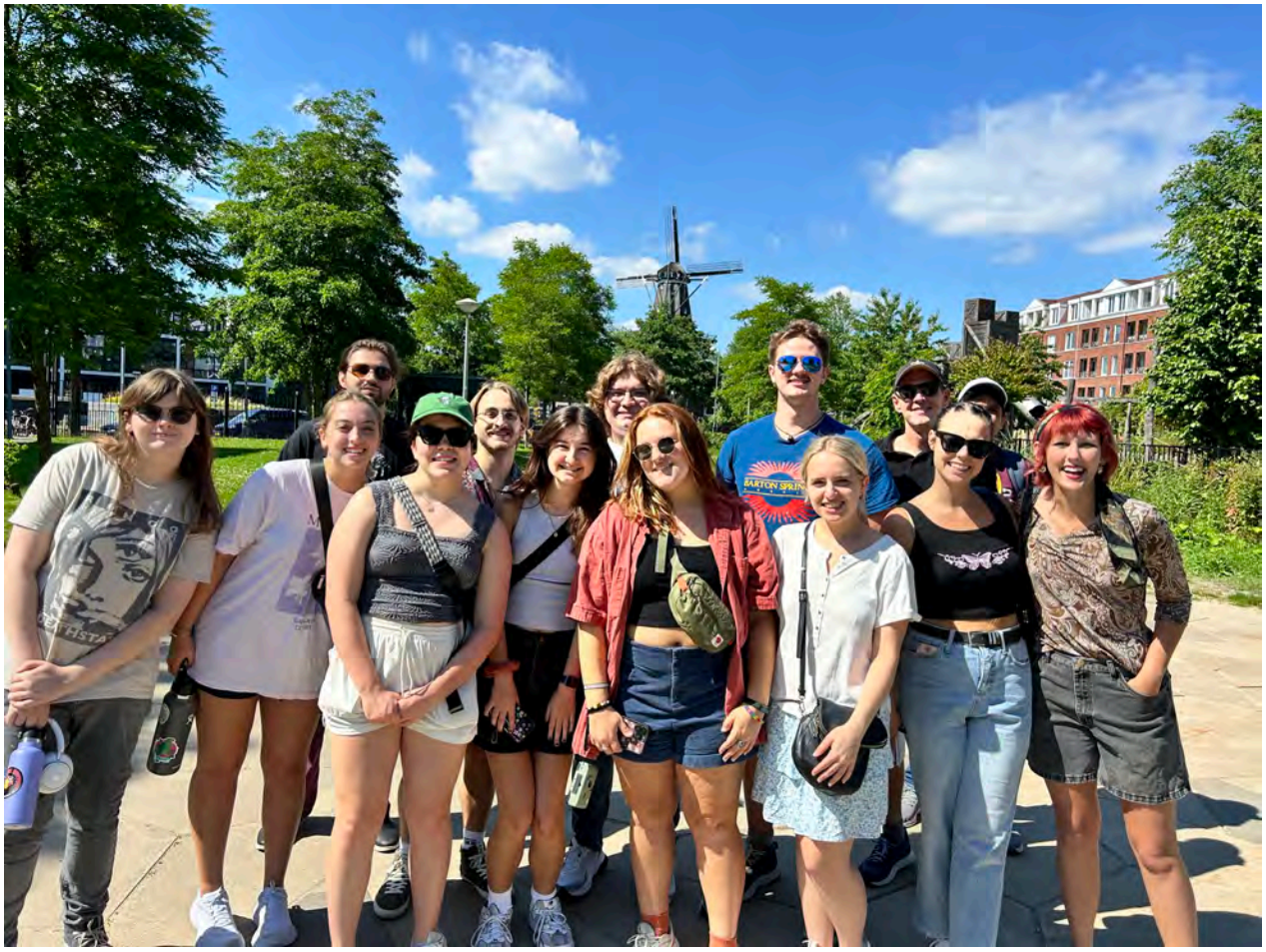
To mitigate the urban heat island effect, San Marcos should explore strategies to reduce paved surfaces, particularly in new developments.

Conclusion

While this may be challenging for a growing city, there are effective ways to limit impervious surfaces. A notable example from the Netherlands is Funenpark in Amsterdam, which is highlighted in the Toolbox examples. Funenpark is a residential neighborhood where apartment complexes are integrated within an urban park, minimizing traditional paved areas. It is connected to surrounding neighborhoods through a green bicycle street, as seen in the example of Cornelia Vermuydenstraat. By combining residential, park, and movement functions, Funenpark and its adjacent neighborhood reduce urban heat while providing gathering spaces and safe, active transportation options. Additionally, this design enhances property values, making it a valuable model for future developments in San Marcos.

While developments like Funenpark would benefit newer areas of the city, older parts of San Marcos can also be improved through strategic design changes, which are outlined in the Toolbox. Small changes, such as increasing street tree coverage, provide shade for pedestrians and lower temperatures. Bioswales, which are small roadside gardens, can be installed to collect polluted rainwater from streets and mitigate flooding. Additionally, reducing parking lots and replacing them with green spaces can enhance urban resilience. The final Toolbox example from C.M. Allen highlights the potential impact of these strategies in San Marcos.

As San Marcos continues to grow, the challenges it will face to increase resilience and combat climate change will continue to grow as well. The changes to San Marcos' urban landscape to promote resilience are not technologically or administratively infeasible, but the process of change can be politically challenging. Efforts to test designs through a process of pilot development can be a way to show how these designs can be incorporated in Texas and help to build political support. By investing in green and blue infrastructure projects now, San Marcos can help build a resilient and livable community for years to come.



Texas State University Summer 2024 Netherlands Student Team