

Road Closure as an Experimental Urban Design Tool Fostering Active Mobility

A Case of Frankfurt Mainkai Riverfront

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Fig. 1 Mainkai street before, during, and after road closure in 2019, 2020, and 2021, respectively. Note: The cycle lanes in 2021 were painted permanently after data supported the initial recommendations presented to the Traffic Planning Department of Frankfurt am Main. (Source: Urban Design and Planning Unit, Technical University of Darmstadt)

Globally, the car as a mode of travel has played a dominant role in the urban mobility scenario, but in recent years many European cities and agglomerations have taken measures to encourage a paradigm shift away from the car by supporting green and active mobility (that is, involving walking and cycling in travel, which also promotes health-related benefits). According to previous urban studies in Germany, the majority of citizens have prioritized a car-less existence for a better way of life and favor alternative urban practices over car-centric approaches for their city or neighborhood (BMUB 2017). This perspective enables planning bodies to take measures, with the support of public opinion, toward active mobility in the future.

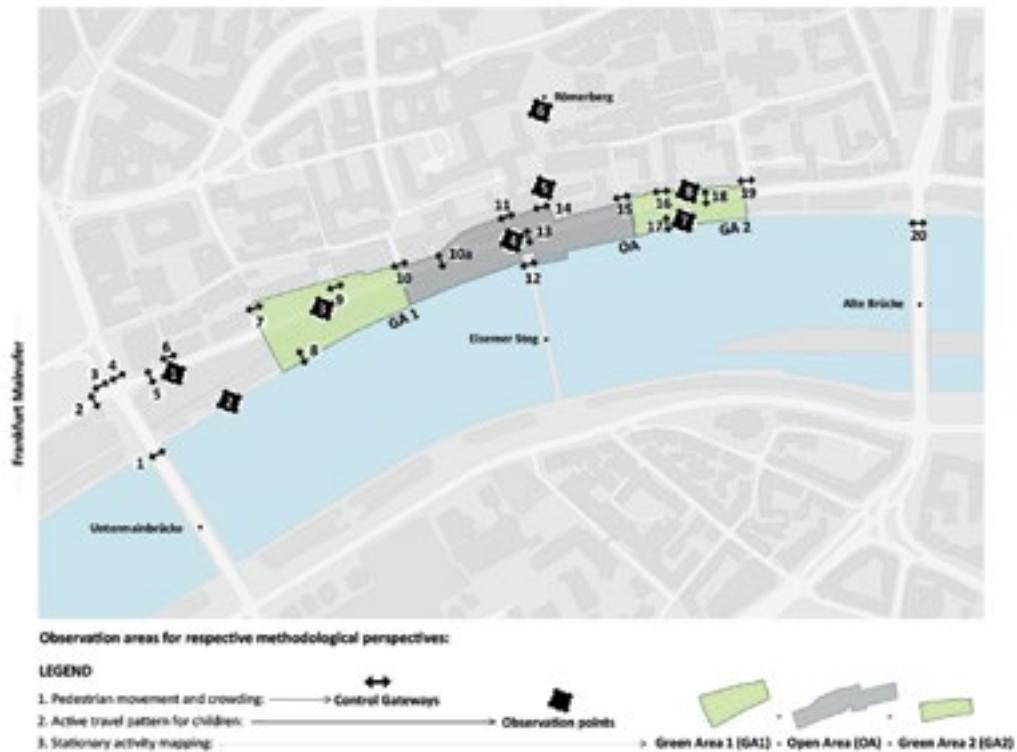
In 2019, one such measure was undertaken by the city of Frankfurt on the Mainkai riverfront. The northern stretch of 800 meters between the two bridges Untermainbrücke and Alte Brücke was closed to car traffic for a year, inviting diverse usage of space for the intermediate timeline. The closed street section was in proximity to the city center of Frankfurt, the Hauptwache plaza, and has

elements of open green spaces near the riverfront. While the street was open to public use, no permanent design changes were permitted due to the temporary nature of the road-closure experiment.

Prior to the road closure, Mainkai street, which had no cycle lanes, was mainly dominated by cars. Movement via active means of mobility mostly occurred along the riverside boulevard, used by cyclists, kids, wheelchair users, pedestrians, etc. The riverside was seen as a space of conflict where fast-paced user groups (cyclists and e-scooters) would share the same space with slow-paced user groups (baby strollers, users with reduced mobility, such as wheelchair users, etc.). In addition, the uneven ground surface and the rail track in the middle of Mainkai led to some bicycle accidents (Fig. 1).

With the road closure in place, an impact study was undertaken after a year of its implementation, allowing for people to get familiar with the nature of the new open space. To initiate the impact study of the road closure, certain points were identified on the Mainkai and nearby streets (including the three bridges) to study pedestrian

Fig. 2 Observation areas for on-site study in Mainkai, Frankfurt am Main (Pandit et al. 2020). Note: The Mainkai street was closed to vehicular traffic between gateway point 5 (near Untermainbrücke) and point 19 (near Alte Brücke). (Source: Pandit et al. 2020)

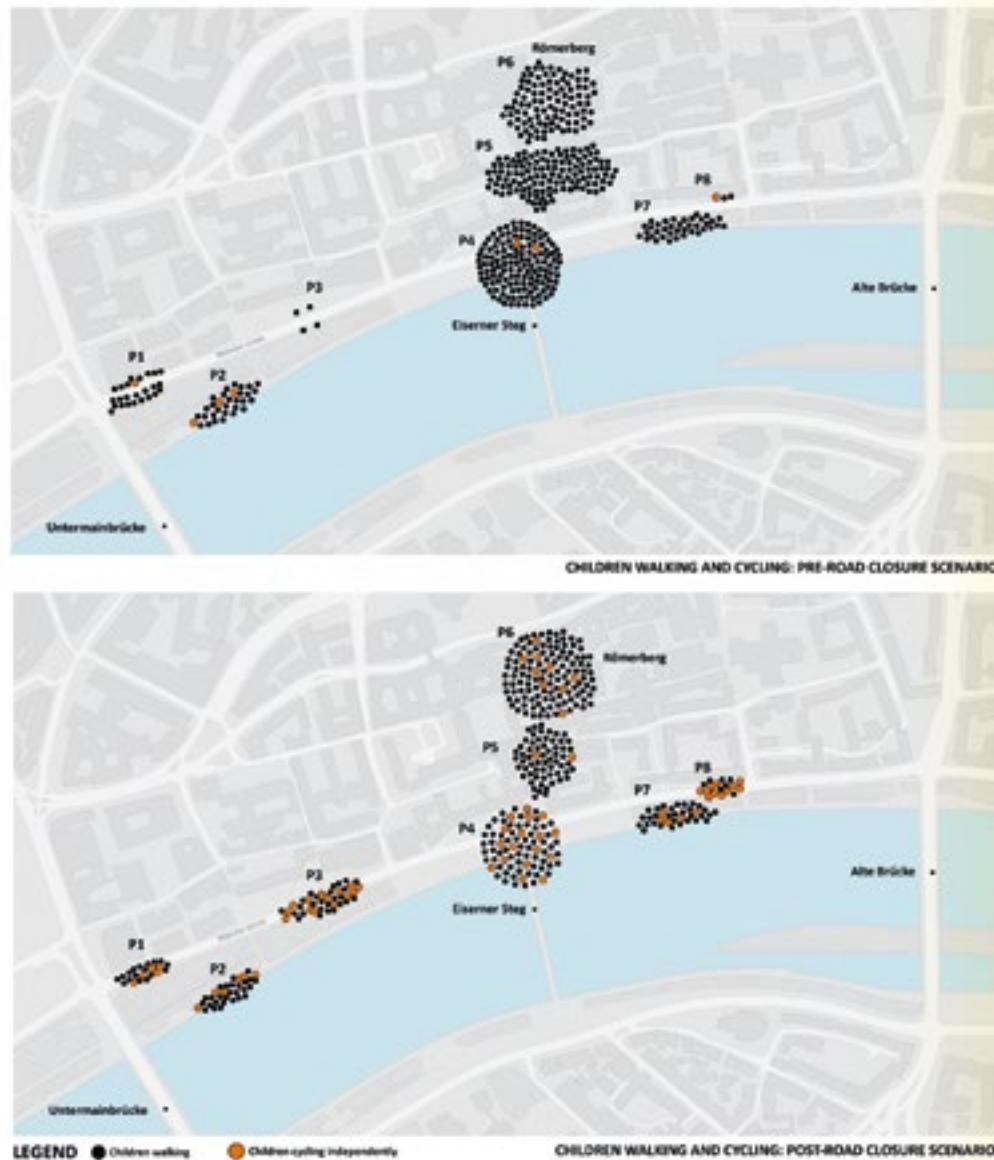


movement, the active travel patterns of children, and stationary activities (Fig. 2). The data collection was undertaken during the morning, afternoon, and evening peak hours on weekdays and weekends over a similar timeline over the course of three years, from 2019 to 2021. In 2020, with the onset of the COVID-19 pandemic, the closed stretch of Mainkai riverfront was seen as an opportunity for people to use the open space while maintaining social distancing. Overall, the open Mainkai street saw a 46 percent increase in cyclists and a 20 percent increase in pedestrians during the peak hours of the day after the road was closed. With respect to the vulnerable user groups children cycling independently increased by 1150 percent(!) and there were 25 percent more users with reduced mobility (URM) (Pandit et al. 2020). The results also showed a decrease among cyclists and e-scooters in the riverside area (gateway points 8 and 17 in Fig. 2), suggesting they moved away from the space of conflict because they had had to slow down to accommodate other user groups. This showed the difference in utility

of spaces among user groups based on differences in their speed of movement. It was clear that Mainkai street favored cyclists with a more direct path of movement, but it didn't have a dedicated bicycle pathway for them.

The road closure showed an increase of active modes of mobility on Mainkai street, supporting walking and cycling activities among children and adults. This in turn influenced the stationary activities, sitting and standing, which became more frequent around open spaces. More recreational activities on the street by local associations led to stationary activities, especially alongside the roadside edges, which were mostly unused open spaces prior to the road closure. The temporary benches installed on Mainkai street, which also became intermediate relaxation spots for cyclists on the street, propelled more activities. While the influx of tourists was reduced due to the lockdown measures in 2020, more local participation and availability of the street as a new open space enabled more utilization among pedestrians and other user groups (Fig. 3).

Fig. 3 Children walking and cycling independently during pre-and post-road closure scenario (Source: Pandit et al. 2020)



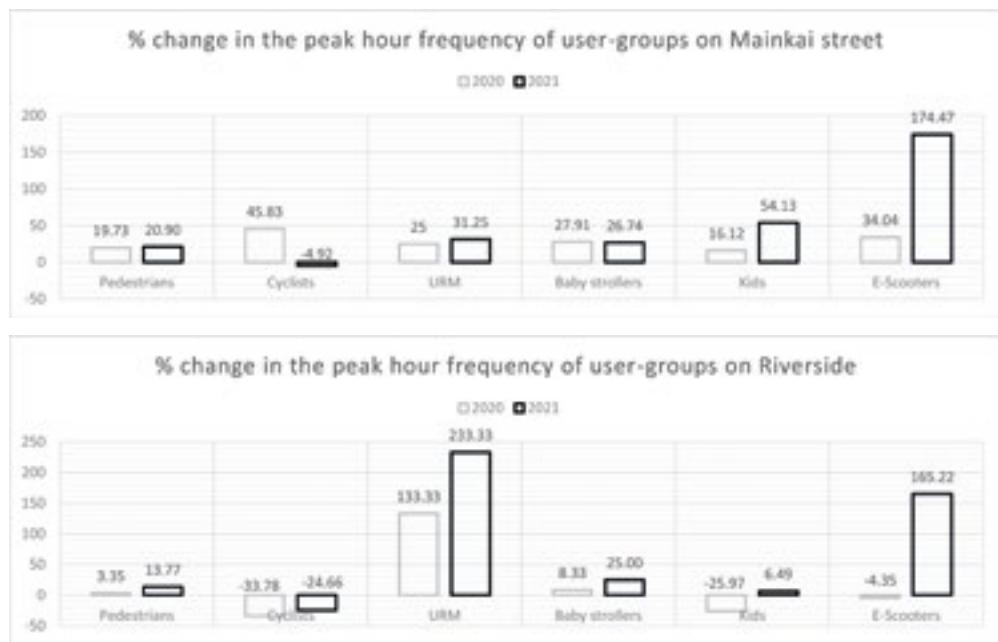
With the timeline of the road-closure experiment being temporary in nature, the Mainkai street was opened again to the car traffic later in 2020. This phase, the non-road closure scenario, was taken into consideration for data collection in 2021. After a year of opening Mainkai street back to cars, the situation led to decrease in cyclists' peak-hour density (down 8.2 percent compared to 2019) in the Mainkai area. While the number of cyclists reduced by around 5 percent on Mainkai street, the riverside area showed a greater drop of 25 percent. This shows the acquired movement of cyclists still favoring the

Mainkai street through the behavior learned during the road-closure experiment. On Mainkai street, there were more pedestrians (up 21 percent) along with e-scooter users, which showed the maximum growth in peak-hour density (a jump of 175 percent) in comparison to pre-road closure scenario. The vulnerable groups including users with reduced mobility showed an increase of 31 percent (in comparison to 2019) on Mainkai street. With cars being back on the road, the impact on cyclists using the street was clear and it showed the discomfort with a reduced peak-hour frequency of cyclists (↑Fig. 4).

Fig. 5 Active and stationary activities on Mainkai street during the road-closure experiment in 2020 (Source: Lakshya Pandit).



Fig. 4 Change in peak-hour frequency of user groups on Mainkai street and Riverside in 2020 and 2021 (in comparison to 2019)



While the slow-moving user groups (pedestrians, users with reduced mobility, people with strollers, kids, etc.) increased to a certain extent on the Mainkai street in 2021, the fast-moving user group—cyclists—decreased. The road closure might have been responsible for attained user behavior of using spaces in close proximity to the Mainkai street; though with car traffic back on the road, the reduced freedom of movement among cyclists without a dedicated bicycle pathway could account for reduced numbers. During the summer of 2021, a permanent change on the Mainkai street was observed; a car lane was replaced with a two-way red cycle lane on the sides of the Mainkai street. The move would influence the stationary activities taking place along the edges of Mainkai street, making them safer, as they were more distanced from the high-speed car traffic. The new bike lanes would also support the growing trend for bicycle users, which was observed in 2020 during the road-closure experiment, and propel movement toward achieving higher modal split for cycle as a mode of travel. While the dedicated bicycle pathways are not as wide as those seen in cycle-friendly cities like Copenhagen (2.5 meters) (Gehl 2010), the move would propagate the drive for having more cycle-friendly streets around the city.

The practice of street closures has been prominent in cities with a focus on population health, active modes of travel, and related subject areas. In the USA and other countries, many cities have undertaken large-scale road closure measures (also known as *ciclovías*) as a medium to promote physical activities within its population. A road-closure initiative via summer streets in New York engaged many people into walking, running, cycling, and other physical activities (Wolf et al. 2015). With cities trying to provide more space for children, the implementation of play streets, which provides a safe environment for children and their caretakers, has been another type of temporary road closure. Such measures have shown increased amounts of physical activities and a greater sense of community (Umstätt et al. 2019), which has a positive impact on an individual's health. The examples of *ciclovías* and play streets showcase the

practice of street closures in urban spaces becoming more frequent, especially with a focus on fostering more physical activities through different user groups involving children as well (Fig. 5).

Mainkai as a shared space has seen continuous changes over the years, with the experimental nature of the road closure showing its potential for different user groups favoring active mobility. Similar short-term experiments have been observed during the pandemic in neighboring cities forming the Rhein-Main agglomeration, offering an opportunity to check a street's potential toward active mobility modes and to find ways to improve its present modal share, ultimately supporting alternative urban practices over car-centric planning approach in cities and neighborhoods.

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