Quest Journals
Journal of Architecture and Civil Engineering
Volume 11 ~ Issue 2 (February 2026) pp: 76-86
ISSN(Online): 2321-8193
www.questjournals.org

Research Paper

Flexible Street Redesign in London Using the Place and Movement Matrix

Sara Humaid Aljarwan

I. Introduction

More than 80% of public spaces in cities are comprised of streets, yet they often fail to provide their surrounding communities with a space where people can safely walk, bicycle, drive, take transit, and socialize [1]. With the continuously changing urban ecosystem and the conflicting claims for urban space, reconciling the different transport demand and functions of streets became a difficult task. However, cities can always reallocate their street spaces based on the transport modes they prioritize and their policy objectives.

Nowadays, roads and streets have become more than transport corridors to move people and goods; they are liveable places. Therefore, cities started looking into ways transport networks could be used more efficiently to meet the fundamental policy objectives of sustainable mobility: liveability, multimodality, and environmental sustainability.

A few decades ago, streets were designed to favour motorcars; however, with the increased level of congestion and awareness about the global impacts (e.g., climate change and pollution), policies started prioritizing sustainable mobility. The term "sustainable" in transport goes far beyond reducing emissions. Actually, sustainable mobility refers to the notion of access to mobility, regardless of income or location. It also includes equity in accessibility, with particular attention to more vulnerable population groups and geographical areas at risk of social exclusion [2]. Therefore, in this report, two types of streets were chosen to be redesigned in a more sustainable way that encourages multimodality and liveability. The first section passes through a dense residential conservative area, whereas the second section is a busy inner-suburban shopping high street.

In a broader urban context, these streets are represented in a matrix that specifies the street type with a specific combination of a Link and Place status level. This movement/link and place approach reflects the reality of the urban street operation and recognizes the varying mix of functions of street functions across the network. In this project, the route was classified as linklevel II, which means that the link has city-level importance in transporting to/from a major town centre. Unlike the link hierarchy, the place attributes of a street can vary along its length. Section 1 is best classified as place level D, neighbourhood level, since it passes through a dense residential conservation area, meaning the place is important for the local community (neighbourhood). Whereas section 2, which is surrounded by a busy innersuburban shopping high street, is described as place level B, city level, indicating that the street is important for the whole city as a place. Figure 1 highlights the cells of both sections. Finally, both sections are redesigned to provide links to other locations as part of a wider network, yet still be places in their own rights.

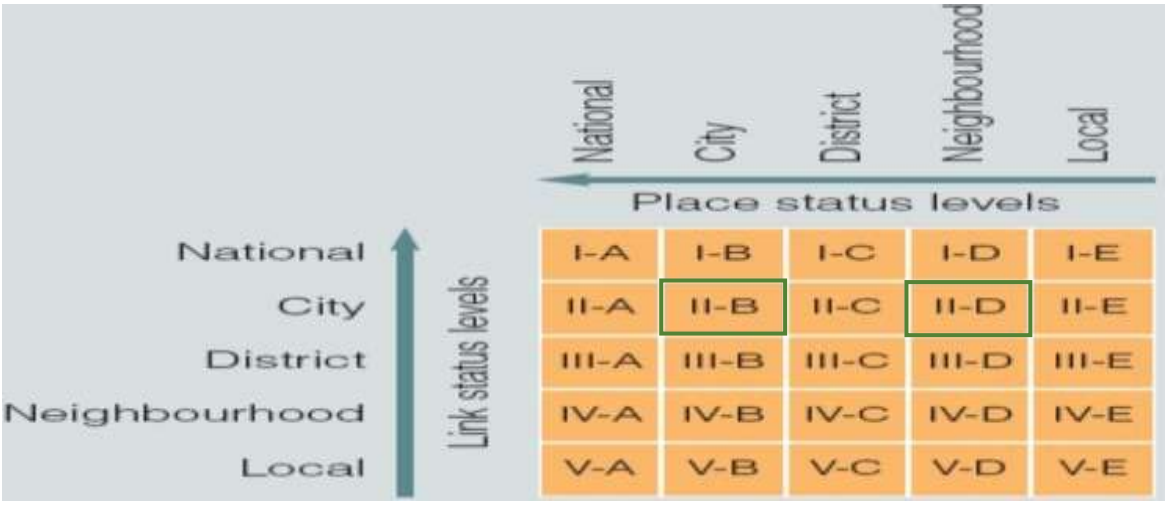

Figure 1: 5X5 Link/Place Matrix, indicating sections 1 & 2 classification

In the upcoming sections, the different street designs will be explored in detail; however, a few design principles will be taken into consideration to achieve the link and space function along the route. For example, an adaptive lane reversal approach for tidal flow was implemented to accommodate the substantial bus and general traffic directional demand along the corridor (inbound in the morning peak and outbound in the afternoon peak directions). This technique was done by increasing the carriageway capacity in the direction with higher demand, while the capacity of the opposite direction is decreased. A recent study proved that the lane reversal approach could decrease the total travel time of the vehicles in the various networks by up to 81% [1].

Apart from the tidal flow consideration, the proposed design of both sections also considers the "healthy street approach," which is a system of policies implemented in the city of London to help Londoners use cars less, walk, cycle, and use public transport more [2]. In this approach, 10 evidence-based indicators are used to list what makes streets attractive places, working towards a healthier city, promoting equity. Figure 2, lists the 10 indicators taken into consideration in the design.

Figure 2: The 10 indicators of a healthy street

II. Residential Area Street Redesign

a)User Table

Area	Busy radial route leading to/from a major town centre, passing through a dense residential conservation area				
User Group	**Activity Undertaken**		Space requirement per way		provided space per way (m)
			Minimu m (m)	Maximu m (m)	
Pedestrians	**AM peak**	striders (usually going to work or school)	2	5	3
	Interpeak	striders (running errands, hospital visit etc.)	2	5	3
	PM peak	striders (usually coming from work or school)	2	5	3
	Evening	striders (running errands, hospital visit etc.)	2	5	3

People in street activity	**AM peak**	neighbourhood strollers (e.g., exercising), & doing other activities like playing, reading, eating, watching etc.	2	5	3
	Interpeak	neighbourhood strollers, socializers, and doing other activities	2	5	3
	PM peak	neighbourhood strollers, socializers, and doing other activities	2	5	3
	Evening	neighbourhood strollers, socializers, , and doing other activities	2	5	3
Private & Shared bikes (& E-scooters if allowed)	**AM peak**	cycling (usually going to work or school)	1.5	-	1.5
	Interpeak	cycling (running errands, etc.)	1.5	-	1.5
	PM peak	cycling (usually coming from work or school)	1.5	-	1.5
	Evening	cycling (running errandsetc.)	1.5	-	3 (shared)
Public Transport Buses	**AM peak**	transporting passengers (busy)	3	4.5	3 (left) 3 Shared (right)
	Interpeak	transporting passengers	3	4.5	3 Shared
	PM peak	transporting passengers (busy)	3	4.5	3 Shared (left) 3 (right)
	Evening	transporting passengers	3	4.5	3 Shared
Private Vehicles (conventional & electric) & motorbikes	**AM peak**	driving (usually going to work)	2.75	3.5	3
	Interpeak	driving (running errands, hospital visit etc.)	2.75	3.5	3
	PM peak	driving (usually coming from work)	2.75	3.5	3
	Evening	driving (running errands, hospital visit etc.)	2.75	3.5	3
Vans & Trucks	**AM peak**	Banned during peaks	3	4.5	0 (banned)
	Interpeak	driving to transport goods to/from town centre or for refuse collection	3	4.5	3
	PM peak	Banned during peaks	3	4.5	0 (banned)
	Evening	driving to transport goods to/from town centre at late evening or for refuse collection	3	4.5	3

Table 1: Section 1 street users

b)Street Cross-Sections

1. AM Peak

Figure 3: Section 1, AM Peak

2. Inter-Peak

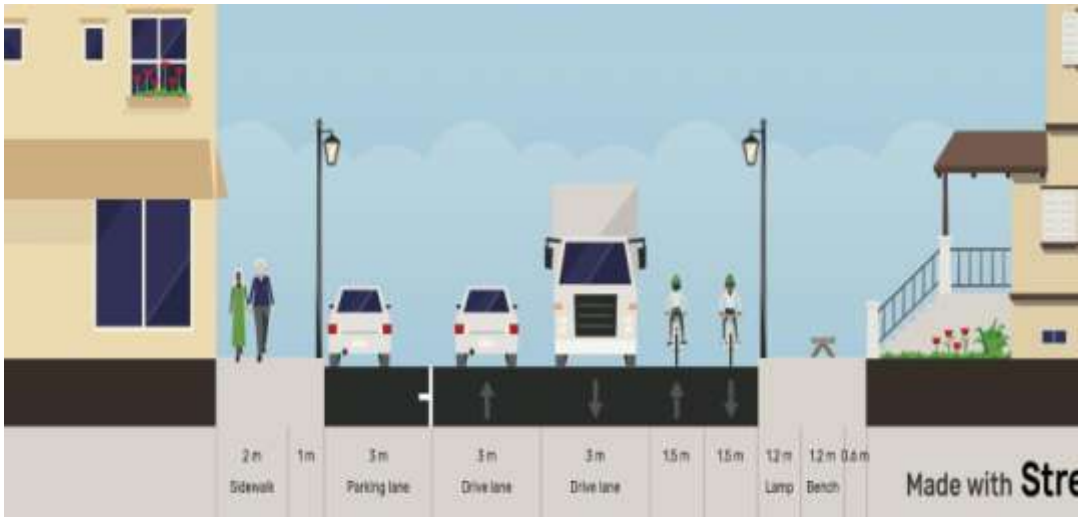

Figure 4: Section 1, Inter-Peak

3. PM Peak

Figure 5: Section 1, PM Peak

4. Evening/Night Time

Figure 6: Section 1, Evening/Night Time

c)Discussion of design

In this section, a dense residential conservation area with three-four-storey housing and limited off-street parking was redesigned. The present carriageway width is 14 m, and the footways on either side are currently 2 m, which means that the total distance available from building to building is 18 m. Therefore, to encourage multimodality and liveability in the area, a space reallocation is proposed that adheres to TfL standards of urban street design. Also, a setback of 450 mm is taken from all kerb edges. Regarding speed, a limit of 20 mph is enforced to help reduce the dominance of motor vehicles and create streets and places that are more attractive for people to walk, cycle, and enjoy [3]. Additionally, frequent pedestrian crossing along the street is assumed. Accessible parking, resting places, green spaces, and shaded waiting areas will be discussed in this section, which are important indicators of a healthy street.

Carriageway

The proposed space reallocation focused on active modes of travel in the neighbourhood, like walking and cycling. For this reason, the distance from kerb to kerb was reduced from 14 to 12 m. The design proposes 4 lanes, all having a width that would fit a bus/Heavy Good Vehicle (HGV), 3 m, to allow for flexible, functional change through the different periods of the day. This section is part of a radial route leading to/from a major town centre. Town centers tend to attract trips in the morning (e.g., going to work/school) and produce trips in the evening (e.g., back from work/school), as mentioned earlier.

During the morning peak (figure 3), the demand is expected to be higher towards the town centre; therefore, two lanes were designated to carry traffic to the centre, one lane for general traffic (cars and motorbikes) and the other lane dedicated for buses. Whereas, only one 3 m-lane for cars, buses, and motorists was provided in the other direction as the demand is expected to be lower away from the centre. To prevent any congestion, vans and trucks will be banned from using the street during the peaks. Also, 2-way cycling lanes are operated, one per direction, to encourage active travel. These cycling lanes will have a "stop/slow down" mark or a bus island in front of each bus shelter to allow for safe boarding and alighting of bus passengers, similar to figure 7. It is worth noting that there will be no stopping allowed on any of the lanes during peaks, so taxi and uber will only be permitted to pickup or drop off passengers on minor roads.

Figure 7: Bus stop island on the cycling lane

In figure 4, inter-peak, the 2-way cycling lanes will continue to operate. The bus lanes will allow general traffic off-peaks. Meaning, two general traffic lanes will operate, one in each direction. These traffic lanes would now allow for HGV, in addition to the cars, buses, and motorists, since the traffic volumes are expected to be lower than peak hours. During this period, one lane will be converted to parking for residents because the area has limited offstreet parking; this will also allow for any emergency stop or even taxi and uber pickup/drop off. The parking width will be 3 m, the minimum for accessible parking. This parking area will be partially allocated for private vehicles. Food trucks, if any, will be allowed to park (if any). Also, in front of each bus shelter, there is a bus stop bay to allow for safe boarding and alighting and prevent any road blockage.

HVG will be banned again during the afternoon peak (figure 5). During the PM peak, heavier traffic flow is expected away from the town centre. To accommodate this demand, more lanes compared to the other direction were allocated: one lane for buses and one lane for cars and motorists. Whereas, only one lane for cars, buses, and motorists is provided towards the town centre as the flow is expected to be lower. And the 2-way cycling lane will continue to operate.

On the other hand, during the night time (figure 6), 2 lanes in each direction are provided for all traffic, including cyclists. Also, 2 parking lanes on each side are designed. Activities like food trucks will also be allowed during the early evening to promote socialization in the neighbourhood and achieve the aim of liveability. In addition, the parking space will be accessible at night since residents tend to need parking spaces to park their cars.

That said, lane functions should be communicated very well to the street user, as the lanes will continuously change to serve different users. This could be done through dynamic LED boards or conventional street signage, as shown in figure 8.

Figure 8: Street signage

Footway

To encourage active travel in the area, the footway was increased from 2 to 3 m per side. Although walkability depends on other factors like the mixed use of the area and accessibility of destinations, block size, and the built environment, the footways were still designed to encourage walking, social interaction, and liveability by creating a life in the street. For example, by providing frequent benches, more people will be encouraged to spend time on the street. Benech can also include some greenary (figure 9), which can encourage exercise, provide spaces for socializing, decrease noise and air pollution, and improve immune function by providing exposure to beneficial microbiota [4].

Figure 9: Green bench

Additionally, incorporating intelligent features with street furniture, such as device chargers and Wi-Fi, is expected to positively impact "life" in the area. The footway is also proposed to have bike racks for residents with limited in-house storage. Chargers for electric vehicles are also to be installed by the parking lane. Apart

from these facilities, public transport (i.e., bus) shelters with benches and shading are placed on the footways to promote bus use further. The footway was even designed wide enough to accommodate all street furniture along with its footprint. Finally, all mentioned facilities have the potential to reduce car use, achieve a healthy street, and the main objective of sustainable mobility.

III. Shopping High Street Redesign

a)User table

Area	Busy shopping high street with shops on both sides				
User Group	**Activity Undertaken**		**Space requirement per way**		**Provide d space per way (m)**
			Minim um (m)	**Maxim um (m)**	
Pedestrians	**AM peak**	striders (e.g., could pass through the street going to work or school)	2	5	2.1(left) 4 (right)
	Interpeak	striders (e.g., going to work – change of shifts in street shops)	2	5	4
	PM peak	striders (e.g., could pass through the street going to work or school)	2	5	4 (left) 2.1 (right)
	Evening	striders (e.g., going to work – change of shifts in street shops)	2	5	4
People in street activity	**AM peak**	traders, some: customers and strollers	2	5	2.1 (left) 4 (right)
	Interpeak	traders, customers, browsers, entertainers, strollers, etc.	2	5	4
	PM peak	traders, customers, browsers, queuers, entertainers, strollers, socializers, observers, waiters, resters, inhibiters.	2	5	4 (left) 2.1 (right)
	Evening	traders, customers, browsers, queuers, entertainers, strollers, socializers, observers, waiters, resters, inhabiters (busiest state)	2	5	4
Private & Shared bikes (& E-scooters if allowed)	**AM peak**	cycling (passing through the street usually going to work or school)	1.5	-	1.5 (left) 3 shared (right)
	Interpeak	cycling (e.g., to go shopping)	1.5	-	3 shared
	PM peak	cycling (passing through the street usually coming from work or school or shopping)	1.5	-	3 shared (left) 1.5 (right)
	Evening	cycling (e.g., to go shopping)	1.5	-	1.5
Public Transport Buses	**AM peak**	transporting users (busy)	3	4.5	3 (left) 3 Shared (right)
	Interpeak	transporting users	3	4.5	3 Shared
	PM peak	transporting users (busy)	3	4.5	3 Shared (left) 3 (right)
	Evening	transporting users	3	4.5	3 Shared

Private Vehicles (conventional and electric) & motorbikes	**AM peak**	driving (passing through the street usually going to work or school)	2.75	3.5	3
	Interpeak	driving (e.g., to go shopping)	2.75	3.5	3
	PM peak	driving (some coming from work, others might drive from work to go shopping)	2.75	3.5	3
	Evening	driving (e.g., to go shopping)	2.75	3.5	3
Vans & Trucks	**AM peak**	Banned during peaks	3	4.5	0 (banned)
	Interpeak	Can use the drive lane to transport good	3	4.5	3
	PM peak	Banned during peaks	3	4.5	0 (banned)
	Evening	refuse collection at late evening	3	4.5	3

Table 2: Section 2 street users

b)Street Cross-Sections

1. AM-Peak

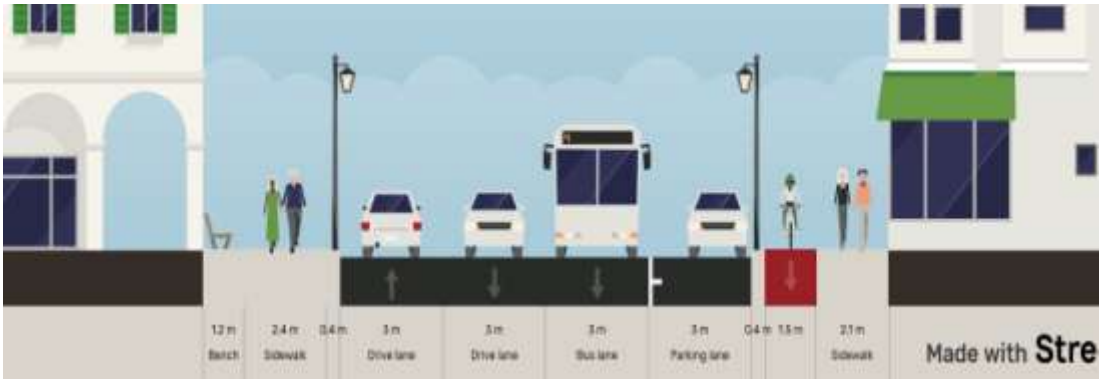

Figure 10: Section 2, AM Peak

2. Inter-Peak

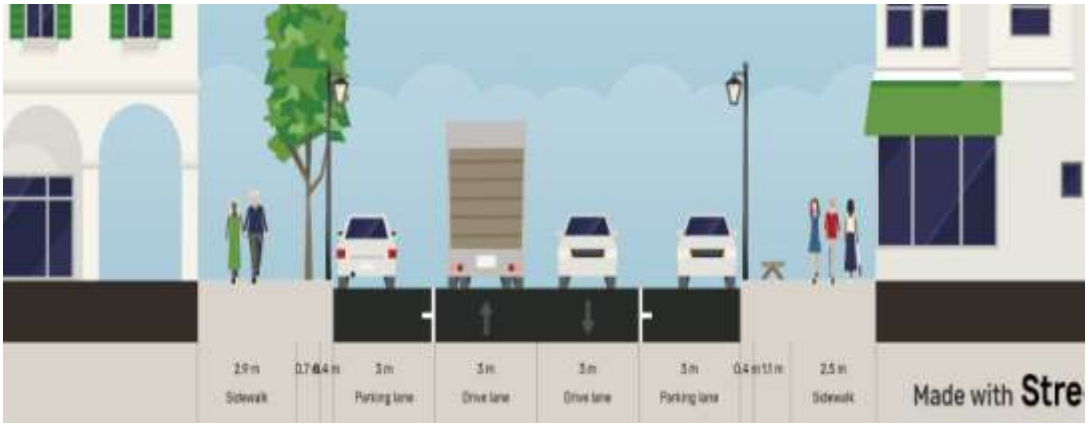

Figure 11: Section 2, Inter-Peak

3. PM Peak

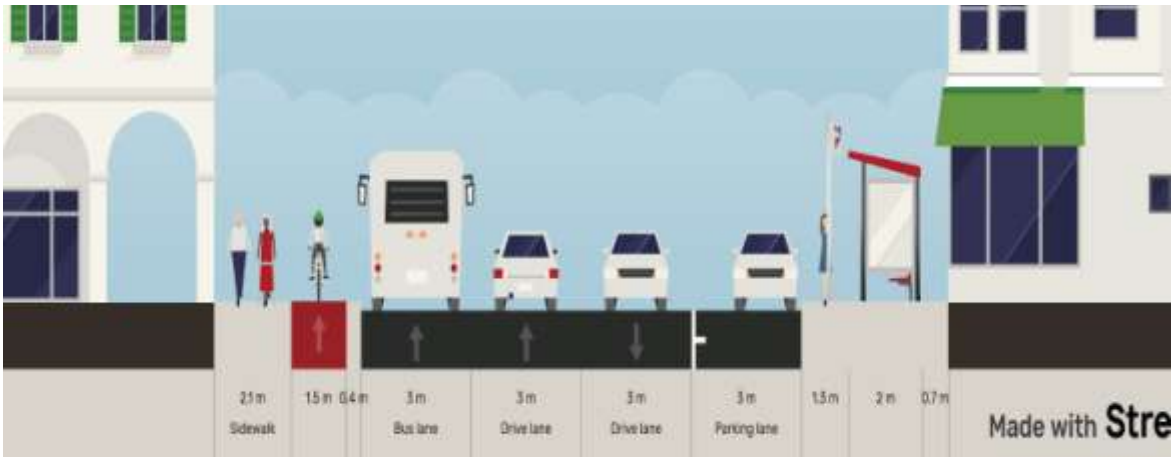

Figure 12: Section 2, PM Peak

4. Evening/Night Time

Figure 13: Section 2, Evening/Night Time

c)Discussion of design

In this section, a busy inner-suburban shopping high street, with limited off-street parking and loading provision was redesigned. The present carriageway width is 14 m, and 3 m footways on either side, which means that the total distance available from building to building is 20 m. Therefore, similar to section 1, space reallocation that adheres to TfL standards and the tidal demand is proposed, with a setback of 450 mm from the kerb and a speed limit of 20 mph to achieve the main objective of sustainable mobility and healthy street design.

Carriageway

The space reallocation in this section also focused on active modes of travel in the street, like walking and cycling. For this reason, the distance from kerb to kerb was reduced from 14 to 12 m. The design proposes 4 lanes, all having a width that would fit a bus, 3 m, to allow for flexible functional change through the different periods of the day.

During the morning peak (figure 10), higher traffic demand is expected towards the town centre, as mentioned earlier. Therefore, a bus lane, a traffic lane for vehicles and motorists, and a cycling lane (on footway) will operate towards the city centre. Cyclists will have to stop in front of bus shelters to allow safe boarding and alighting of passengers (figure 7). On the other hand, one 3 m lane will carry the traffic, including cars, buses, and cyclists, in the other direction. Vans and trucks are banned during peaks. Additionally, a parking lane is provided as shopping streets usually experience frequent stopping and drop off; this will prevent congestion, especially since the street has limited off-street parking. The parking lane will also have a bus stop island in front of each shelter. Additionally, a fee of 2 pounds/20 minutes will be applied to regulate the demand and discourage car use. People with disabilities will be able to park for free, but for a maximum of 3 hours to prevent long occupation.

In figure 11, inter-peak, dedicated bus, and cycling lanes will be closed. Two lanes operate for general traffic, including buses, cars, HGV, and cyclists. All lanes are 3 m wide, so this would ease the movement for cyclists and motorists. Additionally, the other two lanes will be used for loading and unloading for a maximum period of 20 min. However, loading will be banned at bus stops to avoid conflicts with the bus operation.

Loading and unloading are allowed on both sides of the road since high streets have shops on either side. It would be challenging to assign one parking lane for loading/unloading as transferring goods from one side of the road to the other would be impractical. In addition, having loading/unloading bays at fixed positions, as illustrated in figure 14, is not an ideal option in this case. These bays are usually built at specific points along the street, which sometimes leads to vehicles stopping along the drive lanes if the bays are full or far from their point of interest. Also, loading bays built in footways reduce the footway width, which is undesired.

Figure 14: Built loading/unloading bay

Moreover, the two parking lanes would also allow free disabled parking for up to 3 hours, and paid parking for all other users (2 pounds/20 minutes). To communicate this functional change, a sign similar to figure 15 could be used with additional paid parking indications or by smart LED signs, as illustrated in the previous section.

Figure 15: Inter-Peak Parking Restriction

Through the afternoon peak, HVG will be banned again (figure 12). During this period, 2 traffic lanes for vehicles and motorists will run in each direction; in addition to a dedicated bus lane and a cycling lane in the direction of the heavier flow, away from the city centre. Cyclist will have to stop for passengers to board or alight the bus at each bus stop, which could be communicated through sign boards or floor markings. Similar to the AM peak, a parking lane with a fee of 2 pounds/20 minutes will be provided as high streets tend to experience frequent stopping, and will be free for disabled drivers for 3 hours.

During the night time (figure 13), 1 lane was kept to serve all traffic per direction. One lane was converted to extra space for activity when needed; for example, restaurant dining - chairs and tables or even food trucks. When the space is not needed for any activity, it will be used as paid parking for street visitors and free for people with disabilities. The fourth lane will be switched to a 2-way cycling lane, but cyclists will have to stop when a bus arrives at a bus stop, which again could be communicated by signage.

Footway

In section 2, there was an increased focus on the footway, as places like shopping streets tend to be destinations at their own end. With increased walking comes more socialization and busier streets, which supports the economy and open up commercial opportunities for the city's businesses. Therefore, the footway was increased from 3 to 4 m per side for pedestrians and shoppers to move freely. The footways are designed to encourage social interaction by providing facilities like green benches, wifi, device charging spots, public toilets, and outside dining. Other street furniture, like seasonal decoration, could also attract more people, creating life in the place. For example, the streets of London are famous for the Christmas lights that have become a destination for every visitor. Research proved that aesthetic and placemaking features are essential for environments encouraging pedestrian activity. These features tend to create streetscape texture, which helps to maintain pedestrian interest [5]. Apart from street aesthetics, it is also proposed to have electric car charging and bike racks for private and shared bikes, further encouraging cleaner modes. Public transport (i.e., bus) shelters are also placed on the footways. It was ensured to have a pedestrian crossing/bus stop island in front of each shelter to minimize the conflict between drivers or cyclists and pedestrians when the cycling lane is activated.

IV. Comparison of Designs

Streets are often vital elements in every city, yet they are the most underutilized public spaces. Therefore, streets should be designed as places and spaces for travel. This report redesigned one corridor that passes through two different sections, serving different groups of people and activities.

In the first section, the corridor passes through a dense residential area. Although the main aim of the redesign was to achieve sustainable mobility, it was also focused on preserving the spirit of the community living there. The proposed design took the traffic flow into account by providing peak-hour bus lanes, tidal lanes, cycling lanes, and parking at certain hours of the day, but it also focused on the community's needs. For example, dedicated cycling lanes are operated all day except during the evening to promote cycling in neighbourhoods as an official mode of transport for the residents. Also, night time parking is usually needed in residential areas.

Additionally, the footways are designed to provide greater opportunities for social interaction, either planned or unplanned with other members of the neighbourhood or community (e.g., by providing frequent benches and greenery) [5]. The proposal eliminated using any rail for transport to prevent separating the communities. For instance, having a tram or a BRT running on the street could minimise the interaction between people living on the left- and right-hand side of the street. It could also create noise pollution in the community and hinder safety. Other considerations include using public spaces for multiple purposes during weekends, which will help maximise the area's value to the local people by creating more vibrant, safer, and inviting places, such as Saturday market on one of the parking lanes.

The design of the residential section was aimed at preserving the community and local life. On the other hand, the design of the high street was targeted towards creating life by targeting more people to the street while still maintaining the movement level required. The carriageway had the same width as the residential area, 12 m. However, the footway was 1 m wider on each side of the high street. The footway was enlarged mainly because more people are expected to use the sidewalk compared to the residential area. The main aim behind the design was to make the high street not only a shopping area but also a leisure destination.

Additionally, dedicated bus and cycling lanes were operated in the direction of peak flow to supply the traffic demand. Moreover, shopping streets experience frequent stopping (by private vehicles, taxis, uber, etc.); for this reason, during all times of the day, parking was provided on either side of the street, which was not the case for section 1. During interpeak, restricted parking facilities were provided on both sides, especially for the loading and unloading goods. Unlike the residential area, 2-way cycling lanes are proposed to run during the evening peak on the high street due to the limited car parking spaces provided, especially since some restaurants and food trucks will also share the parking lane. Moreover, the number of parking spaces would also vary between the two sections, but more data is required to decide on that.

Both section designs aimed to create a city where streets provide urban circulation, without degrading the street life through traffic. Nevertheless, it is important to note that for a better allocation of space, more data like volumes of movement of vehicles and people along the carriageway and footway by various modes of transport are needed. Based on the data and available space, effective policy intervention could be implemented, such as flexible working hours to spread the peak or even vehicle type restrictions. Finally, the proposed design was seen to be the most equitable for the current state; however, cities are constantly adapting to new circumstances and challenges. Patterns of demand are likely to change with the aging population, working from home, etc. The supply is also likely to change with further technological advancements such as autonomous vehicles, new forms of micro-mobility, and footway robots. With that being said, urban cities are very dynamic, which streets take a big part of. Therefore, planners should always consider that streets are now places equally as channels for movement.

References

[1]. S. Striewski, I. Thomsen and S. Tomforde, "Adaptive Approaches for Tidal-Flow Lanes in," Future Transportation , vol. 2, p. 567–588, 2022.
[2]. T. f. London, "Healthy Streets for London," Transport for London, London, 2017.
[3]. Sustrans, "sustrans.org.uk," sustrans, 1 January 2019. [Online]. Available:
[4]. https://www.sustrans.org.uk/our-blog/policy-positions/all/all/our-position-on-20-mphspeed-limits-in-built-up-areas. [Accessed 12 January 2023].
[5]. N. E. Observatory, "earthobservatory.nasa.gov," NASA Earth Observatory, [Online]. Available: https://earthobservatory.nasa.gov/images/145305/green-space-is-good-formentalhealth#:~:text=It%20can%20encourage%20exercise%2C%20provide,providing%20exposure%20to%20beneficial%20microbiota.. [Accessed 26 January 2023].
[6]. L. M. Braun, A. Read and A. Ricklin, "The Benefits of Street-Scale Features for Walking and Biking," American Planning Association, 2015.