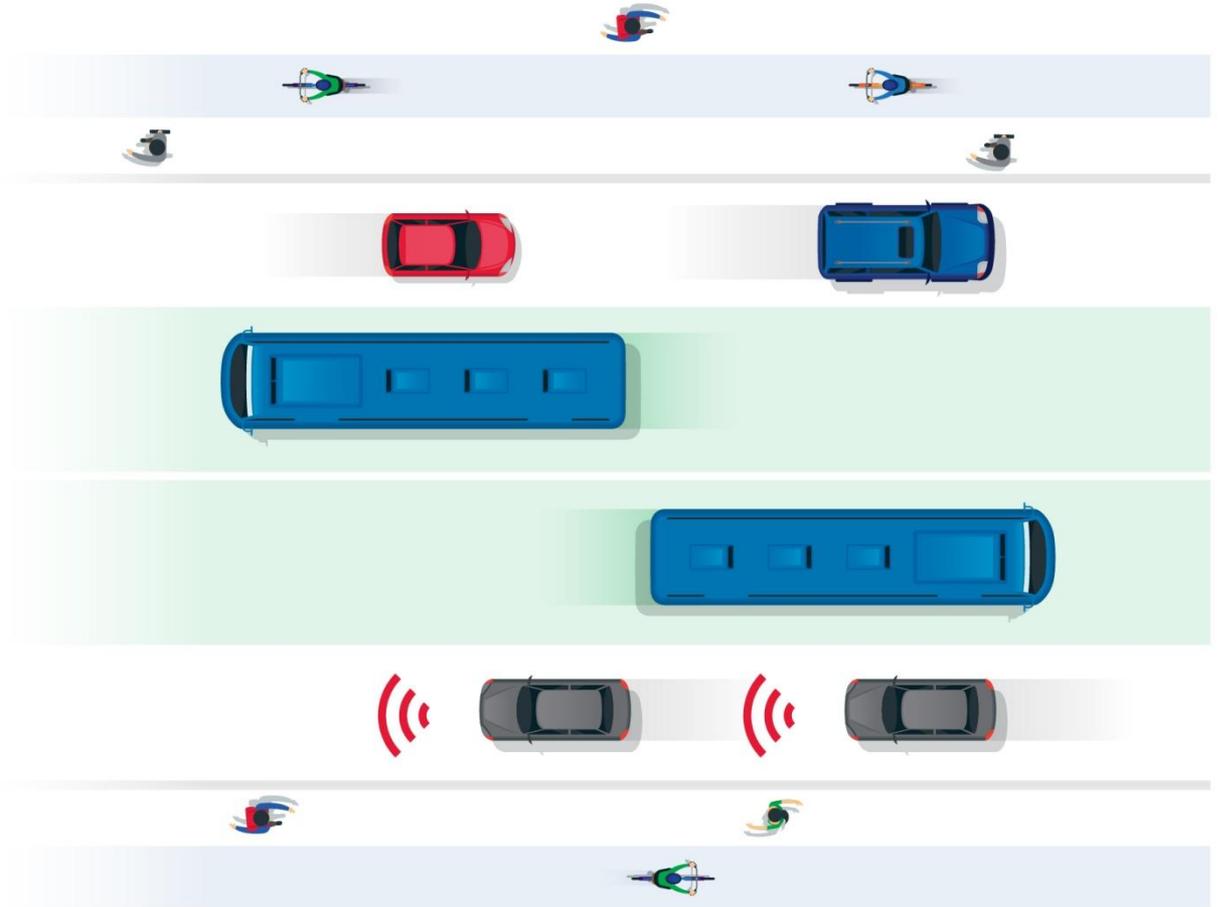


Generating options for roadspace allocation in busy urban roads

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UCL (University College London)

19th Transport Practitioners Meeting
07-07-2021



Roadspace allocation

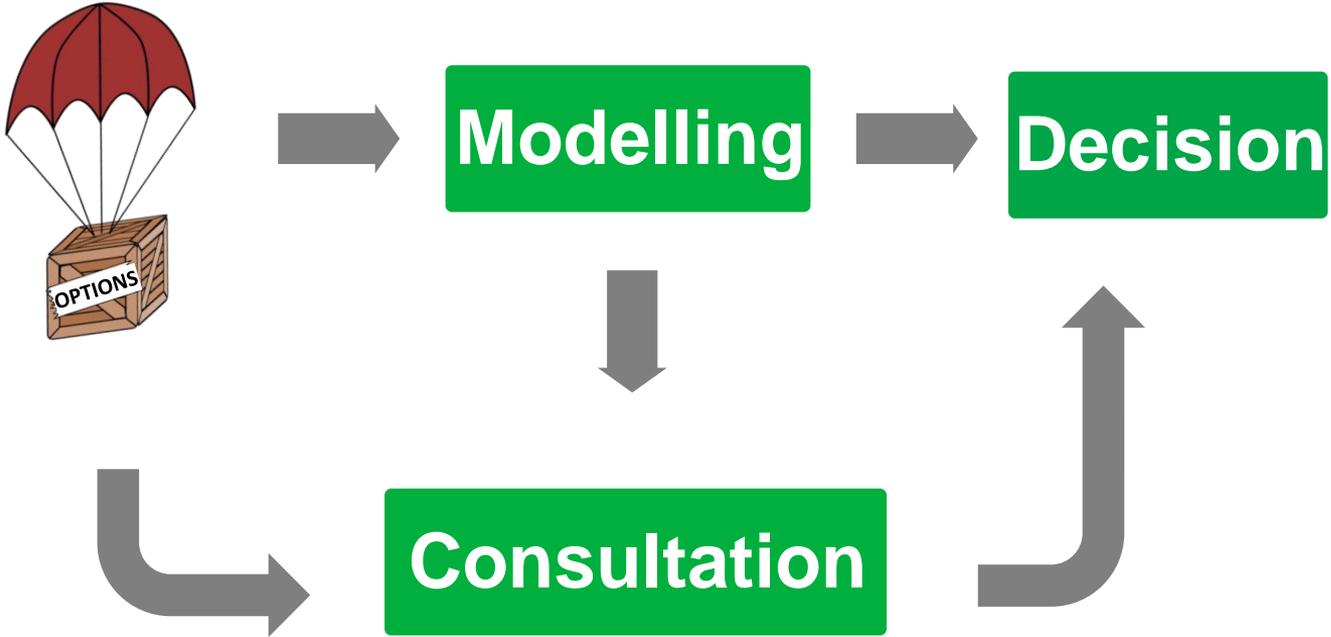
always
controversial



now even
more

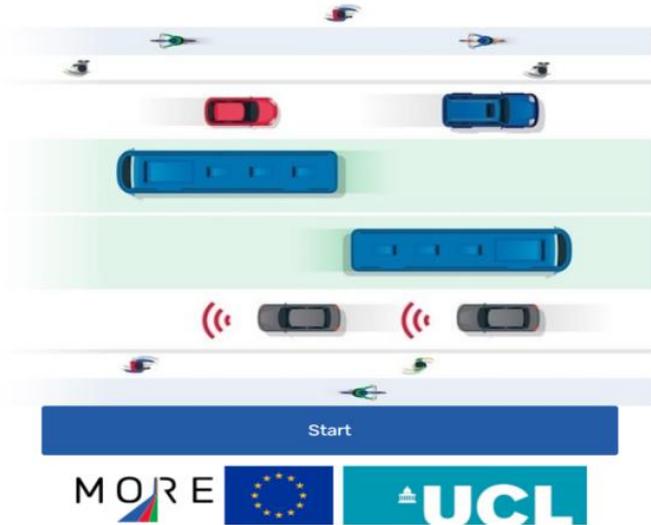


Option generation: a neglected stage of roadspace allocation



A new set of option generation tools

ROADSPACE ALLOCATION OPTION GENERATION TOOL



now is at:

<https://more.traffwebdev.uk>

from 2022 will be at :

<https://www.roadspace.eu>

Part of **MORE**
Multimodal Optimisation
of Roadspace in Europe

**Multimodal Optimization
of Roadspace in Europe**

Funded by



Option generation tools

```
graph LR; A[Option generation tools] --- B[Tool 1: Policy interventions]; A --- C[Tool 2: Road layout designs];
```

Tool 1: Policy interventions

Tool 2: Road layout designs

A database of 210 possible interventions. Examples:



Contraflow, bidirectional, etc



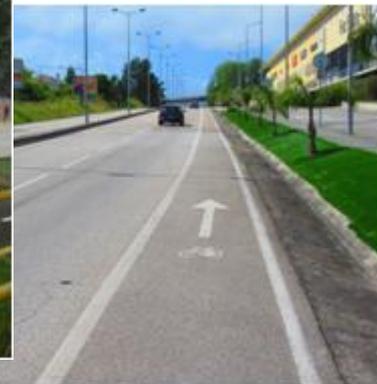
Unusual solutions, considering all uses
(including greenery, underground utilities, etc)



Shared solutions



Various possible positions for a design element



Various degrees of segregation between design elements

Policy Interventions tool: Behind the scenes

210 interventions

(...)

ID	W01	W02	W03
policy	Pedestrianisation	Part-time pedestrianisation	Walkways
type	Space allocation	Time reallocation	Space allocation
counterfactual	<i>Road open to all modes</i>	<i>Road always open to all modes</i>	<i>No walkways. All pedestrian links along road</i>
description1	Street for the exclusive use of pedestrians. It usually has level surfaces, seating, on-street commercial areas (e.g. kiosks, outdoor cafes, stands), street furniture (e.g. information boards, bins), public art, greenery, and good-quality lighting.	Streets for the exclusive use of pedestrians at certain hours of the day or days of the week. At other times, the street is open to motorised traffic, including private cars. However, car parking may be banned.	Space for walking separated from the road, elevated or underground, or across buildings are also known as skywalks. Some sector walkways or escalators. Many at-level and
description2	Pedestrianised areas are common in city centres and high-density	In shopping streets, the pedestrianised times may be mornings	Walkways can form a network, connecting
(...)			
evidence3ref	European Commission 2004 Reclaiming city streets for people - Chaos or quality of life?	ITS University of Leeds and Atkins 2011 Valuation of townscapes and pedestrianisation. Report for UK Department for Transport.	Cui et al 2013 The development of grade-separated systems: a review. Tunnelling and Underground Space Technology 38, 151-160.
image_ref	MORE	MORE	MORE
peds_walk	+	+	-
peds_walk_why	More space to walk	More space to walk at the restricted times	Change of levels, causing detours, delays
peds_cross	+	+	-
(...)			
emergency_move	-	-	+
emergency_move_why	Can use road but usually many pedestrians	Can use road but usually many pedestrians	Gain of carriageway space by releasing foot
service_stop	-	-	+
service_stop_why	Can use road but usually many pedestrians	Can use road but usually many pedestrians	Gain of carriageway space by releasing foot
trips	+	+	-
trips_why	More public transport and walking trips to city centres	More public transport and walking trips to city centres	Discourages some people from walking
time	-	-	+
(...)			
climate_why	Less emissions, more space for green areas	Less emissions	More and faster traffic, less green
energy	+	+	-
energy_why	Less use of motorised modes	Less use of motorised modes	Less walking, more scope for motorised t
regional	+	+	-
regional_why	Less emissions	Less emissions	Less walking, more scope for motorised t

127 fields

210 interventions
26670 cells

Description, examples, evidence, references

Likely effect on all road uses (and reason)

Likely effect on all objectives (and reason)

Policy Interventions tool input 1: Road use priorities

Choose from the green dropdown menus the degree of priority of each type of road user or road use

0 Can be worse off than now, if needed

1 Should not be worse off than now

2 Should be better off than now

Choose a maximum of 3 road uses with level 1

Choose a maximum of 3 road uses with level 2

Road user	Road use	
Pedestrians	Walk	0 ▾
	Cross the road	0 ▾
	Stroll	0 ▾
	Sit (street furniture)	0 ▾
	Sit (outdoor cafe)	0 ▾
Pedestrians with restricted mobility	Walk	0 ▾
	Cross the road	0 ▾
Cyclists	Move	0 ▾
	Park	0 ▾
	Rent (dock)	0 ▾
	Rent (dockless)	0 ▾
Micromobility users (scooters, skates, etc.)	Move	0 ▾

Road user	Road use	
Bus drivers	Move	0 ▾
	Stop	0 ▾
Bus Passengers	Interchange	0 ▾
	Wait	0 ▾
Rail/metro/bus passengers	Interchange	0 ▾
Car drivers	Move	0 ▾
	Park	0 ▾
	Stop	0 ▾
Car share users	Move	0 ▾
Motorcyclists	Move	0 ▾
Taxi drivers (inc. ride-hailing)	Wait	0 ▾
Taxi passengers (inc. ride-hailing)	Wait	0 ▾
Goods vehicles	Move	0 ▾
	Stop	0 ▾
Emergency vehicles	Move	0 ▾
Service vehicles	Move	0 ▾

Policy Interventions tool input 2: Policy objectives

Fill the checkboxes of the objectives the intervention aims to achieve
Choose only the main objectives (Maximum of 5)

Movement

- Increase number of trips
- Reduce travel time
- Increase travel time reliability
- Reduce congestion
- Improve trip quality
- Achieve a more sustainable modal split

Place

- Facilitate place activities (e.g. people sitting)
- Facilitate kerbside activities
- Improve access to local buildings

Road operation

- Improve resilience (to weather conditions)
- Increase flexibility (to different road uses)

Wider objectives: economic

- Reduce costs of transport
- Promote local economy

Wider objectives: social

- Improve traffic safety
- Reduce community severance
- Increase personal security
- Promote physical activity/health
- Promote social interaction
- Promote social inclusion
- Increase wellbeing

Wider objectives: environmental

- Increase green space
- Improve air quality
- Reduce noise
- Improve visual environment
- Protect soil/water and reduce flood risk
- Improve local climate
- Reduce energy consumption
- Improve regional/global environment

Policy Interventions tool output

POSSIBLE INTERVENTIONS

[Print to PDF](#)[Back](#)[Restart](#)[Save and Finish](#)

- Scroll to see more interventions
- Click on intervention for further information
- Click the checkboxes of the policies that are feasible in your road section

Policy Description

+ Pedestrianisation

+ Part-time pedestrianisation

+ Walkways

+ Greenways

+ Widen footway

+ Raised/kerbed footway

+ Add or widen median strip

+ Walkable median strip

+ Pedestrian fast/slow lanes

Policy Interventions tool output: *Description* page

— Add or widen median strip

Description

Examples and evidence

Effect on road uses

Effect on policy objectives



Source of image: MORE

Type of policy: Space allocation

Also known as central reservation. Space between traffic lanes in different directions. It can be painted, raised with kerbs, or planted. Physical barriers (e.g. guardrailings) may be added, or kept, if already existent, to separate vehicles.

If the median has no physical barriers, it allows vehicles to pass cyclists or slower vehicles; emergency vehicles to cross over into the opposite lane; and pedestrians to stop and cross in two stages (at crossing facilities or informal crossings)

If the median is raised, wide enough, and has few gaps, it also allows pedestrians to walk along the road. Alternatively, it can provide space for place activities (e.g. seating areas), car parking, bicycle parking, or street furniture (e.g. lighting).

Median strips can be green spaces (e.g. trees, swales, grassed strips). If wide, they can be used as a cycle track or as a corridor for trams, light railway systems, or buses. Underground rivers can also be restored to run at-surface along the median.

The presence of a median strip, especially if kerbed, may reduce travel speeds, as gives drivers less flexibility. Kerbed medians without ramps also become a barrier to pedestrians with impairments at informal crossings.

Policy Interventions tool output: *Examples/evidence* page

– Add or widen median strip

Description

Examples and evidence

Effect on road uses

Effect on policy objectives

Examples

- Restricted-access roads (e.g. motorways) and multilane roads usually have wide medians, with barriers at the carriageway edges, and sometimes a grassed strip in the middle.
- In 2013, a long and wide median strip was added to Avenida 9 de Julio in Buenos Aires (one of the widest urban streets in the world), with a busway, greenery, and pedestrian paths.
- The space between Carretera 7 and Calle 32 in central Bogota is a wide median accommodating a cycle lane, several clear paths for pedestrians, benches, a planted strip, and a station entrance.

Evidence

- The redesign of a 4-lane road in New Jersey, adding a raised median, reduced pedestrian exposure risk and increased driver predictability, and little effect on traffic speed and volume.
See: King et al 2003 Pedestrian safety through a raised median and redesigned intersections. Transportation Research Record 1828, p56-66.
- A study in 24 cities in California found that the proportion of streets with (raised or painted) medians is associated with only small changes in the walking and cycling modal share.
See: Marshall and Garrick 2010 Effect of street network design on walking and biking. Transportation Research Record 2198, 103-115.
- Adding a median strip to a road has an estimated monetary benefit for pedestrians crossing the road of £1.08 for each walking trip.
See: Ancaes and Jones 2018 A stated preference model to value reductions in community severance caused by roads. Transport Policy 64, 10-19.

Policy Interventions tool output: *Effect on road uses* page

— Add or widen median strip

Description

Examples and evidence

Effect on road uses

Effect on policy objectives

Likely impact of intervention on road uses

Compared to: Do not add or widen median strip

Road user	Road use	Impact	Reason
Pedestrians	Walk	+	Median strip can be walkable
	Cross the road	+	Can stop in middle of road when crossing. Lower traffic speed
	Stroll	+	Median strip can be walkable
	Sit (street furniture)	+	Median strip can accommodate seating area
	Sit (outdoor cafe)	+	Median strip can accommodate tables
Pedestrians with restricted mobility	Walk	+	Median strip can be walkable
	Cross the road	+	Can stop in middle of road when crossing. Lower traffic speed
Cyclists	Move	+	Fewer unsafe crossing movements by pedestrians
	Park	+	Median strip can accommodate bicycle parking

(...)

Policy Interventions tool output: *Effect on objectives* page

— Add or widen median strip

Description

Examples and evidence

Effect on road uses

Effect on policy objectives

Likely impact of policy intervention on objectives

Compared to: Do not add or widen median strip

Objective	Impact	Reason
Movement		
Increase number of trips	+	Encourages more walking. Easier to cross the road
Reduce travel time	-	Probably delays to motorised modes
Increase travel time reliability	-	More probability of queues
Reduce congestion	-	More probability of recurrent congestion, less space
Improve trip quality	+	Easier to cross for pedestrians. Safer for cars
Achieve a more sustainable modal split	o	No evidence on impact on mode choice
Place		
Facilitate place activities (e.g. people sitting)	+	Space can be used for place activities
Facilitate kerbside activities	-	Space probably taken from kerbside area
Improve access to local buildings	-	More difficult to access the opposite side of road
Road operation		
Improve resilience (to weather conditions)	+	Fewer motorised vehicles. Scope to add greenery
Increase flexibility (to different road uses)	-	Fixed element of infrastructure
Wider objectives: economic		
Reduce costs of transport	+	Requires only regular maintenance

(...)

Option generation tools

```
graph LR; A[Option generation tools] --- B[Tool 1: Policy interventions]; A --- C[Tool 2: Road designs];
```

Tool 1: Policy interventions

Tool 2: Road designs

All possible combinations of design elements (which can assume different sizes)

Walking			Place activities		Green area	General purpose		Bus lane	
Narrow	Medium	Wide	Narrow	Wide		1 lane	2 lanes	1 lane	2 lanes
									
2m	3m	4m	2m	3m	1.5m	3m	6m	3m	6m

Cycling		Bus + cycle	Parking/ loading	Tram line	
1 lane	2 lanes			1 track	2 tracks
					
2-3m	3-4.5m	4m	2.5m	3m	6m

- Elements assigned to alternative positions on footways, carriageways, and median strip
- Unfeasible combinations removed, buffers between elements (e.g. cycle lanes and parking spaces) added

Road Designs tool: Behind the scenes

30,300 designs

ID	ri	Lpav1	(...)	Rpav2	Rpav1	Ww	Sw	(...)	Bw	Xw	Cw	w	Mov	Place	ParkLoad	
1	S1	V	(...)	1	S1	4	4	(...)	0	6	0	4	21.5	295	50	0
2	S1	V		1	S1	6	4		0	6	0	4	22	330	45	0
3	S1	V		1	S1	6	4		0	6	0	4	23.5	330	50	0
4	S1	V		1	S1	7	4		0	6	0	4	23	345	45	0
5	S1	V		1	S1	7	4		0	6	0	4	24.5	345	50	0
6	S1	V		1	S1	4	4		0	6	0	6	23.5	310	50	0
7	S1	V		1	S1	6	4		0	6	0	6	24	345	45	0
8	S1	V		1	S1	6	4		0	6	0	6	25.5	345	50	0
9	S1	V		1	S1	7	4		0	6	0	6	25	360	45	0
10	S1	V		1	S1	7	4		0	6	0	6	26.5	360	50	0
11	S1	V		1	S1	4	4		6	6	0	0	22	280	45	0
12	S1	V		1	S1	4	4		6	6	0	5.5	27.5	320	45	0
13	S1	V		1	S1	4	4		6	6	0	0	23.5	280	50	0
14	S1	V		1	S1	4	4		6	6	0	4.5	28	310	50	0
15	S1	V		1	S1	6	4		6	6	0	4.5	30	345	50	0
16	S1	V		1	S1	6	4		6	6	0	7.5	33	365	50	0
17	S1	V		1	S1	7	4		6	6	0	4.5	31	360	50	0
18	S1	V		1	S1	7	4		6	6	0	7.5	34	385	50	0
19	S1	V		1	S1	6	4		6	6	0	0	24	310	45	0
20	S1	V		1	S1	6	4		6	6	0	4.5	28.5	345	45	0
21	S1	V		1	S1	6	4		6	6	0	0	25.5	310	50	0
22	S1	V		1	S1	7	4		6	6	0	0	25	330	45	0
23	S1	V		1	S1	7	4		6	6	0	4.5	29.5	360	45	0
24	S1	V		1	S1	7	4		6	6	0	0	26.5	330	50	0
25	S1	V		1	S1	4	4		2	6	0	0	28	290	45	0
26	S1	V		1	S1	4	4		2	6	0	5.5	33.5	330	45	0
27	S1	V		1	S1	4	4		2	6	0	0	29.5	290	50	0
28	S1	V		1	S1	4	4		2	6	0	4.5	34	325	50	0

(...)

Design element (type and size) occupying each position across the road

Total width assigned to each type of design element (metres)

Total road width occupied (for movement, parking/loading) activities, per 75m2

Road designs tool input 1: *Current situation*

Indicate in the green boxes the road width currently allocated to each design element (counting both sides of the road and the median strip)

- * Leave field as 0 if the road does not have that design element
- * Insert values in metres
- * The total road width should be more than 15m and less than 35m

Space for walking	<input type="text" value="6"/>
Space for place activities (stalls, benches, outdoor cafés, etc.)	<input type="text" value="0"/>
Green area	<input type="text" value="0"/>
Lane for general traffic	<input type="text" value="12"/>
Bus lane	<input type="text" value="0"/>
Space for cycling (cycle lane or cycle track)	<input type="text" value="0"/>
Mixed bus and cycle lane	<input type="text" value="0"/>
Space for parking and loading	<input type="text" value="0"/>
Tram lines	<input type="text" value="0"/>
Total width:	18 metres

Road designs tool input 2: *Priorities*

Choose from the green dropdown menus the degree of priority of each design element

0: Not relevant in this road (no space provided)

1: Relevant, but not priority (will have some space but not more than now)

2: Relevant and priority (will have at least the same space but more, if possible)

The tool will show designs with these widths:

These values are calculated automatically

		Minimum	Maximum	
Space for walking	1	4	6	
Space for place activities (stalls, benches, outdoor cafés, etc.)	2	0	6	
Green area	0	0	0	No road designs will include this element
Lanes for general traffic	1	3	12	
Bus lane	0	0	0	No road designs will include this element
Space for cycling (cycle lane/cycle track)	0	0	0	No road designs will include this element
Space for parking and loading	0	0	0	No road designs will include this element
Tram lines	0	0	0	No road designs will include this element

Road designs tool output

POSSIBLE ROAD DESIGNS

Back Restart Next

Legend

Walking			Place activities		Green area	General purpose		Bus lane		Cycling		Bus + cycle	Parking/ loading	Tram line	
Narrow	Medium	Wide	Narrow	Wide		1 lane	2 lanes	1 lane	2 lanes	1 lane	2 lanes			1 track	2 tracks
2m	3m	4m	2m	3m	1.5m	3m	6m	3m	6m	2-3m	3-4.5m	4m	2.5m	3m	6m

Notes

- All designs include a 0.5m kerbzone between the footway and carriageway and a 0.5m frontage zone between footway and building frontages
- The width of a single cycle lane is 2m if on the carriageway and 3m if on the footway/kerbside (cycle track)
- The width of a double cycle lane is 3m if on the carriageway, 3.5m if on the median strip, and 4.5m if on the footway/kerbside (cycle track)
- A buffer of 1m is added between cycle space and moving or parked vehicles and between parked and moving vehicles

Fill the checkboxes of all options you think are feasible in the road subsection

Left footway and kerbside Feasible	Left carriageway	Median strip	Right carriageway	Right footway and kerbside	Total road width (m)	Width of Design Elements (m)							Capacity per 75m ² of roadspace			
						Walking	Place activities	Green area	General purpose	Bus lane	Cycling	Parking/Tram loading	line	Movement (people)	Place activities (people)	Parking/loading (vehicles)
					18	6	4	0	6	0	0	0	0	110	45	0
					18	6	4	0	6	0	0	0	0	110	45	0
					18	6	4	0	6	0	0	0	0	110	45	0
					18	6	4	0	6	0	0	0	0	110	45	0
					18	4	0	0	12	0	0	0	0	90	0	0
					18	4	6	0	6	0	0	0	0	80	65	0
					18	4	6	0	6	0	0	0	0	80	65	0

(...)

Tool development and refinement

Trial in five cities, in busy roads linking to the European Transeuropean Transport Network



Feedback from road user groups:

International Federation of Pedestrians

European Cyclists Federation

International Association of Public Transport (UITP)

Feedback welcome!

Tools:

<https://more.traffwebdev.uk>

Project website:

(from 2022, will also include tools)

<https://www.roadspace.eu>

Contact:

p.anciaes@ucl.ac.uk

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