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A comprehensive basis for determining the allocation of urban street space

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Abstract

There are many competing demands for the use of urban street space, but very little comprehensive research or guidance on how to allocate space between these various street user groups. Most guidance focuses on transport and is mode-specific (e.g. cycling, loading), with very little consideration being given to on-street activities (e.g. sitting or socialising), and space allocations are usually determined on the basis of political priorities (e.g. the needs of buses or cyclists have priority). The objective of this paper is to set out a more comprehensive framework for determining street user needs, taking into account both the Link/Movement and Place functions of urban streets. It considers some of the ways in which these can be met in different contexts, how competing demands might be reconciled and sets out different bases upon which decisions over final space allocations might be taken. It draws on several research projects and includes examples from different English cites.

1. Introduction

For many decades following the rapid growth of car ownership post World War Two in Western Europe, street design efforts in urban areas focused primarily on meeting the requirements of motorised traffic. This covered factors such as the number and width of traffic lanes and ways of maximising junction capacity for motor vehicles. In the process, kerbside parking and loading was restricted, if they impacted adversely on traffic capacity, and footways were often narrowed. This was a part of the ‘Stage 1’ urban transport paradigm (Jones, 2016).

Since then there has gradually become an increasing recognition that streets have functions other than just facilitating moving traffic and that, particularly on the busier urban shopping streets, there is a wide range of activities that take place and need to be provided for (e.g. Jones et al, 2007a). Such activities take place both on the carriageway and on the footway.

As a consequence, urban and national authorities have produced a wide variety of design guidelines in recent decades, but these usually only cover one type of street activity. In particular, provision for parking, for loading, for buses and/or for cyclists.

There are far fewer guides covering motorcycling or the needs of pedestrians (except when crossing the road), and there has been very little guidance from traffic engineers or even urban designers encouraging street activities – the main insights here have come from the Danish architect Jan Gehl (e.g. Gehl, 21001).

What virtually all these guides have in common is that they have each looked at the street from the perspective of one street user group. Very little thought has been given as to how to balance competing demands on urban streets, to come up with comprehensive guidance for determining the ‘best’ allocation of the limited space/capacity provided by a specific urban street.

However, it should be acknowledged that some academics have started to address this problem, by looking at the optimal allocation of space/capacity between a sub-set of urban street user groups. For example, Currie et al (2003) looked at situations where it would be economically advantageous to give public transport priority over other forms of motorised transport.

Figure 1 shows the extent to which the space between the building lines could be sub-divided for different uses, in cross section. Typically we would expect to find a footway on each side of the street, possibly with an area owned by the building for their own use and the use of their customers (e.g. by providing tables and chairs), plus space set aside for pedestrian movement and for ‘street furniture’ and the carrying out of street activities. The main carriageway might have a median strip, providing up to four interfaces where kerbside activities (particularly parking and loading) could be provided, plus one of more running lane in each direction.

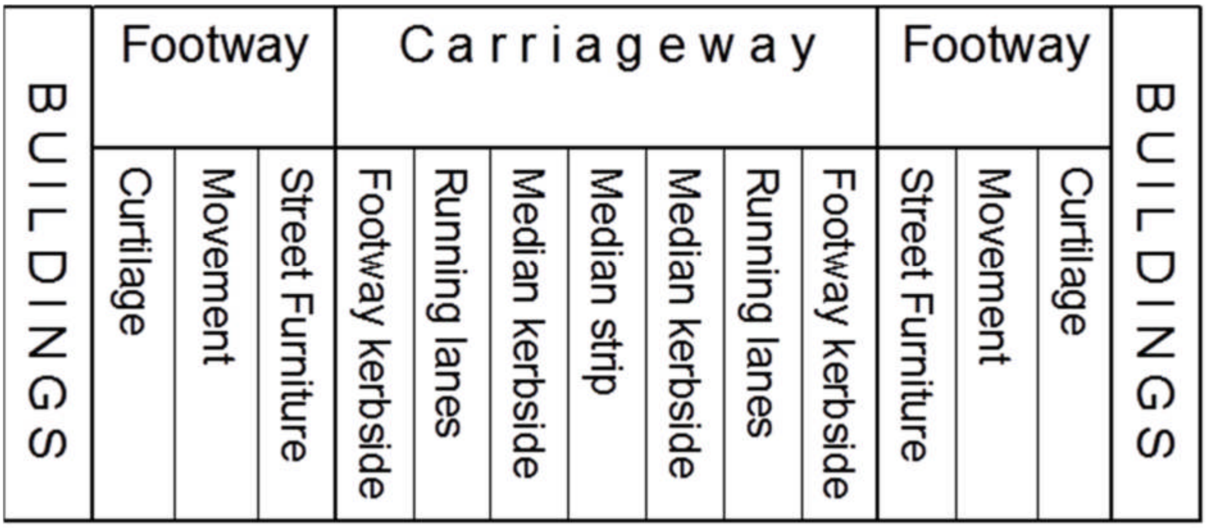

Figure 1: the street in cross section

At present we lack an overall framework and set of procedures for addressing the challenge of allocating such spaces to a range of street user groups, in a comprehensive manner. This is the topic which this paper sets out to address, in the following sections:

- Developing a more comprehensive urban street classification system
- Identifying street user groups and their design requirements
- Total demands and space-time sharing
- Ensuring context-sensitive designs

It then outlines four allocative mechanisms that the author has experimented with, including:

- Public engagement in street allocation
- Logic and hierarchies
- Multi-criteria analysis (MCA) through the application of and weightings
- Application of Cost-benefit analysis (CBA) methods

The paper concludes by discussing the merits of each mechanism and makes recommendations for research and practice.

2. A more comprehensive urban street classification system

Principles

The wide range of activities to be found on urban streets can be aggregated into one of two broad types of street function, characterised as ‘Link’ (or ‘Movement’) and ‘Place’. This approach is illustrated in Figure 2, and the concepts and applications are described in detail in Jones *et al* (2007b).

Figure 2: ‘Link’ and ‘Place’ street functions

As a **Link**, a street provides a conduit for general through movement. Each street forms an integral part of the whole urban street network and often supports other, more specialised, transport networks (e.g. a bus or on-street light rail network, or a cycle network). Link users may travel by a variety of modes, from private car or truck to bus, bicycle or on foot. Their primary requirement is to follow a continuous, linear path through the street network, with minimum disruption and a seamless connection from one street to the next, right from the beginning to the end of their journey (or to/ from a railway station). In general, street designers concerned with accommodating movement are seeking to minimise travel times along each section of street.

In contrast, as a **Place**, a street is a destination in its own right: a location where activities occur on or adjacent to the street, and where the buildings and spaces may have a social and cultural significance in their own right. A Place user is someone wishing to make use of certain facilities that are provided on or alongside that particular street, and will usually access them on foot. While such people are normally classified as ‘pedestrians’, they are not passing through the area – they are spending time in the area, and may be carrying out a wide variety of activities (e.g. shopping, working, eating, talking, waiting, resting). Such typical high street activities are described and illustrated in Jones *et al* (2007a).

However, not all of the traffic and transport-related activities that are observed on urban streets form part of that street’s Link function. There are also some types of Place-related activities that are directly connected with traffic and transport, and occur within and adjacent to the carriageway. For example: loading/unloading; parking by employees, customers, residents, etc.; and buses, trams and taxis stopping to drop off/pick up passengers. Pedestrian severance, cause by high traffic volumes and speeds, also restricts the ability of a street to carry out its Place function – either reducing footfall on one side of a high street, or inhibiting social contacts in residential streets.

Street Classification

Conventionally, the urban road network is only classified on one dimension, which reflects the importance of its traffic movement (Link) function for motorised vehicles, using categories such as ‘primary distributor’ and ‘local distributor’, as shown in Figure 3. ‘Environmental areas’ are protected from road traffic, which leaves them isolate from neighbouring areas due to severance and encouraged the concept of land use zoning policies.

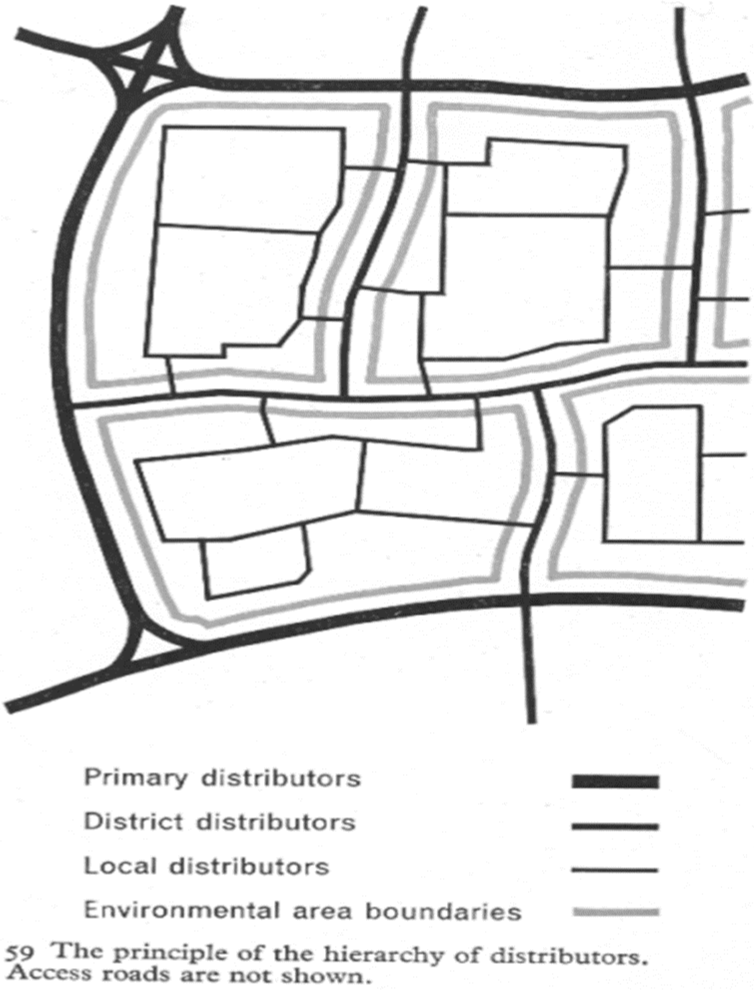

Figure 3: Urban road classification, as advocated by Buchanan and others (HMSO, 1963)

The complementary concepts of ‘Link’ and ‘Place’ provide the basis for developing a more comprehensive two-dimensional street classification, in which every kind of urban street is represented by a cell within a matrix. An equal number of Link and Place categories are first defined, which reflect the varying degree of importance of each function on a particular street. For example, the Link categories may make use of an existing road classification system (e.g. from principal routes down to local access roads); while Place categories may reflect the size of the catchment area for activities associated with that street (e.g. for shops and services) or the cultural or heritage significance of the buildings fronting that section of street.

This approach can be used to generate the kind of street classification matrix shown in Figure 4. Here a ‘5 x 5’ matrix has categories ‘I to V’ for Link and ‘A to E’ for Place, with a total of 25 cells covering a wide range of street types, from major arterials down to residential cul-de-sacs. A street network in a smaller urban area may be adequately reflected in a ‘4 x 4’ matrix.

These two dimensions are independent, covering both extreme cases of urban motorways (i.e. I-E) and pedestrianised regional shopping areas (V-A), as well as streets catering for both significant Link and Place activities (e.g. a traditional high street might be classified as II-C). In practice, additional factors are taken into account when classifying streets, such as the predominant type of land use as a component of the Place description, and any modal priorities (e.g. part of national cycle network) on the Link side.

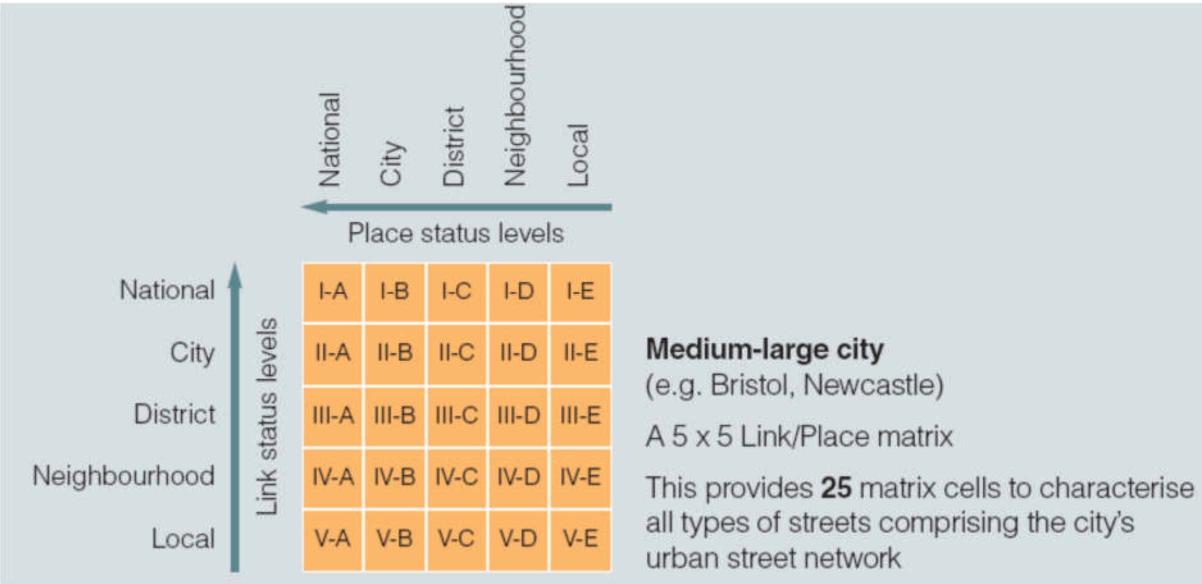

Figure 4: A five-by-five Link/Place street classification matrix
Source: Extracted from Jones *et al* (2007b), Example 6.

Using this matrix, an urban street network can be divided into discrete sections according to their varying Link/Place category levels – which in some contexts may vary by time of day, day of week, season, etc.

An application of this approach to the street network in Birmingham is shown in Figure 5.

Figure 5: Application of '5 x 5' street classification matrix to Birmingham
Source: Extract from Birmingham City Council (2014), Appendix B.

Other cities have chosen to modify the application of the principle. Figure 6 shows the matrix used to recently classify the whole of the London street network using nine 'family street types'.

Figure 6: Movement and Place street classification adopted in London; source TfL

Note that while this is generally applied to sections of street, there are also potential issues around defining the Place function of junctions – something which is generally overlooked.

3. Defining street user groups and their specific design requirements

Busier streets cater for a very wide range of street user groups, both under the Link/ Movement and Place categories. The former are better understood, and include drivers (and passengers) of the following modes: cars, trucks, vans, buses, motorcycles, cycles – and pedestrians.

Place users are often ignored and include people who wish to park and load, drop off and pick up passengers (buses, taxis, etc.), as well as predominantly people on foot who are carrying out a variety of activities (from selling/buying to resting and watching), either stationery or walking at low speed. An example of Place activity is shown in Figure 7.

Having identified user groups, the next steps are to identify the nature of the activities which they want to participate in, and what design requirements this might generate. By definition, all activities taking place on the street take up a certain amount of space, for a given period of time. But, in addition, street users may benefit from – or require – some specific street design elements (e.g. a lane for movement, or a seat to rest).

Table 1 provides example of the types of street users, street activities and street design elements associated with Place-related activities.

In practice, the same street design element may meet the needs of several street user groups, as illustrated in Table 2.

The street design elements take up physical street space, either on a permanent basis or for a limited period of time. In most cases there is some discretion as to how much space is required – at 'minimum', 'desirable; and 'maximum' levels of provision. Table 3 provides examples of such measures for cycle lane widths in the UK.

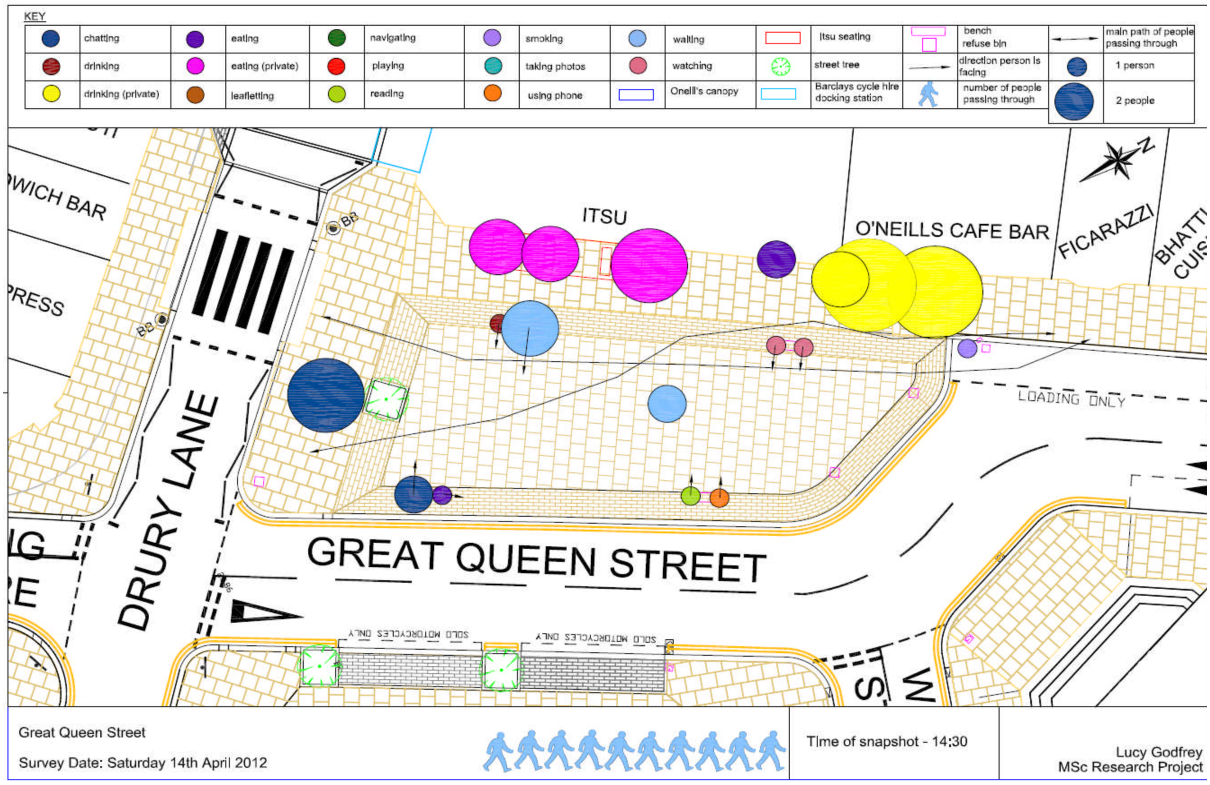

Figure 7: Recorded Place activity in Central London.
Source: Godfrey & Jones (2013), Figure 5.

Place street user groups	**Street activities**	**Street design elements**
• Car users • Motorcyclists • Cyclists	• Parking vehicle	• Parking space • Adequate lighting
• Van/lorry driver	• Loading/unloading	• Loading provision • Adequate lighting
• Bus operator	• Boarding/alighting	• Protected kerbside at stops • Easy access for mobility restricted passengers • Adequate lighting
• Bus passengers	• Waiting	• Shelter and seating • Lighting and security • Service information
• Pedestrians (‘strollers’)	• Window shopping • Queuing for services • Chatting to friends • Waiting for friends • Resting • Comfort break	• Adequate lighting • Space to carry out activities • Weather protection • Seating • Public toilets • Litter bins

Table 1: Design requirements of Place-related street user groups

	Lanes			Kerbside provision					Other		
	General traffic lanes	Bus lanes	Cycle lanes	Parking bays	Disabled parking bays	Loading bays	Bus bays	Crossing places	Traffic islands	Street seating	Cycle stands
Pedestrians								●	●		
Pedestrians who have mobility difficulties								●	●	●	
Those using the street to socialise/relax										●	
Cyclists	●	●	●								●
Bus users visiting the street	●	●					●	●	●		
Those travelling to other destinations – all modes	●										
Car users (non-disabled) visiting the street	●			●							
Disabled car users visiting the street	●			●	●					●	
Shopkeepers						●					

Table 2: Examples of street design elements required by different street user groups
Source: Jones and Paskins (2008), Table 1.

	Minimum	**Recommended**	**Maximum**
Mandatory, with flow	1.2m	1.5m	2.0m
Advisory, with flow	0.8m	1.2m	1.5m
Mandatory contra-flow	1.5m	2.0m	2.5m

Table 3: Recommended standards or cycle lane widths in the UK

One further factor to take into account is the ‘footprint’ of street furniture when in use. For example, a much larger space is usually taken up on the footway by an occupied cycle stand than by an empty one. Some examples are provided in Table 4.

	Size of Furniture (width x length)	**Total Footprint**
Cycle stand	0.10m x 0.60 m	0.60m x 1.30m
Bench	0.48m x 1.06m	1.18m x 1.18m
Rubbish bin	0.50m x 0.50m	1.20m x 1.50m
Bus stop area	1.30m x 3.25m	2.40m x 3.90m

Table 4: ‘Footprint’ of some types of street furniture. Source Jones and Palfreeman, 2009.

In addition, further design requirements might be determined by the existence of particular local problems which are not user-group specific (e.g. a high accident rate at a junction), or by local policy objectives (e.g. improve the quality of the urban realm).

4. The street design challenge

The challenge faced by the street designer is to accommodate as many of these competing demands as possible within the constraints of the physical space between building lines. Here there are three main dimensions:

a) The **width** of the street
b) The **length** of the street, and
c) The **timing** of provision

Where space is tight, more can be fitted in through various compromises, including:

(i) Limiting the number of street design elements and their size. For example:

- **Desirable**:
  - Bus lane
  - Cycle lane
  - Z Loading bays
  - X large seats
- **Minimum**:
  - Peak bus and cycle lane
  - Off-peak 60% of Z loading bays; buses and cycles use general traffic lane
  - 50% of X smaller seats

(ii) Sharing space among street user groups:

- Bus + cycles and taxis in dedicated lane
- Pedestrian + cycle paths

(iii) Sharing time:

- Peak period bus lane vs. off-peak parking and loading bays
- On-footway loading bays, restricted to times of limited pedestrian use
- Pedestrianised street, during main shopping hours

The Link/Place 'Trade-off Triangle'

By summing the various space requirements for the relevant Link and Place street user activities on a particular street section, it is possible to identify total Link and total Place requirements, in the street cross section, at minimum and desirable levels of provision. Since the width of the street usually represents the more physically challenging design constraint, this results in the need to trade-off provision for Link and for Place activities in cross section, as illustrated in Figure 8.

The triangles shows the envelope of opportunities for allocating the available cross sectional space between building frontages. At one extreme, the full width could be allocated to Link activities, on the Y axis (e.g. an urban motorway); at the other extreme it could all be allocated to Place activities, on the X axis (e.g. an urban square). Usually, however, a proportion of space is allocated to both functions, which has to be contained within the grey line.

The figure illustrates four possible outcomes of matching requirements against the available space, at minimum and desirable levels of provision. In Case 1, there is more than enough space to meet desirable levels of Link and Place provision; in Case 2 there is just enough space to meet minimum levels of provision, and in Case 4 there is insufficient space to accommodate even the minimum levels of provision. Here the best solution is likely to be to downgrade either the Link or Place function of that street segment – as was done in the case of Trafalgar Square in London, where the Link status was downgraded (and traffic capacity reduced by 40%), in order to provide sufficient space to re-design the space as a 'world square'.

Case 3 is likely to be the most common, where the available space is more than sufficient to meet the minimum Link/Place requirements, but insufficient to accommodate desirable levels of provision. Here there is scope for discretion, ***with the relative Link and Place status levels on that segment being used as a guide to influence the balance of space allocation***.

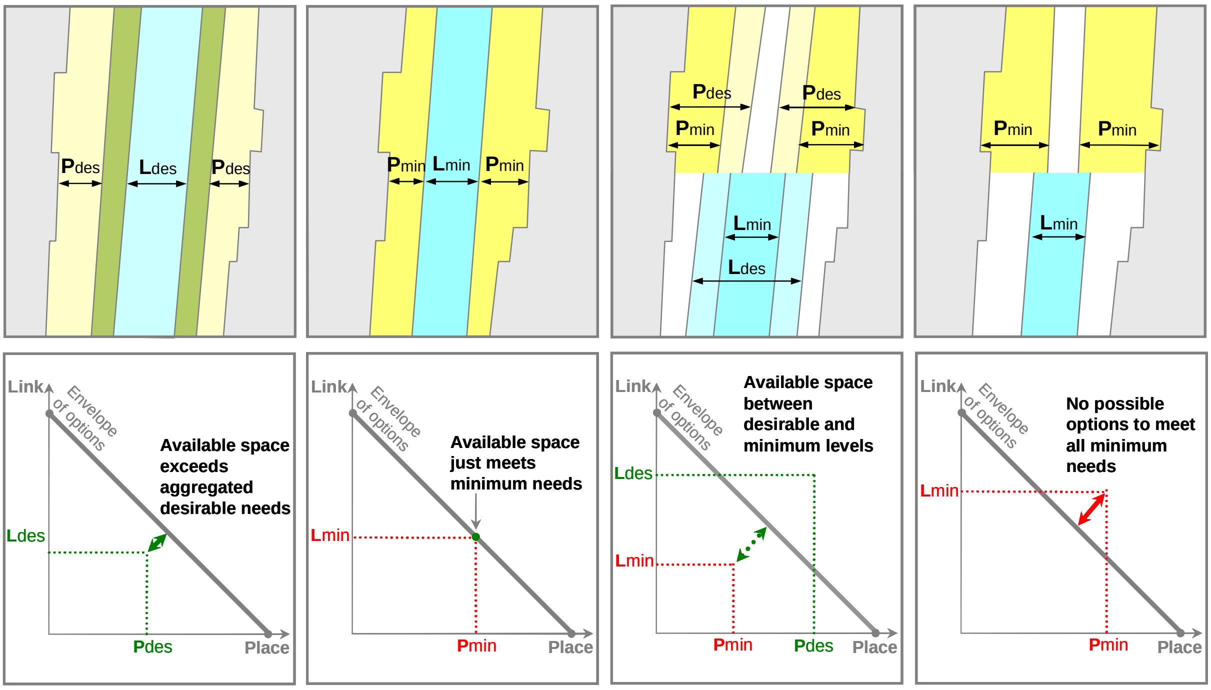

Figure 8: Allocating Link and Place space within the constraint of the 'trade-off triangle'.
Source: Jones *et al* (2007b), Example 60.

5. Context sensitive street designs

Some urban authorities have determined that street design should be based on a fixed street user priority (e.g. pedestrians first), but this is too simplistic to be rigidly applied. Basing design on the relative importance of the Link/Movement and Place function of a street provides a basis for developing a more context-sensitive design.

This is illustrated in Figure 9, which shows two streets of similar width between building lines, but with a completely different street layout design. While there are many factors contributing to this (including German vs. UK design standards), the difference can also be partly explained in terms of the different balance of Link/Movement and Place functions. In the left hand street, the place function is the more important, so the design provides copious loading and parking spaces, an attractive public realm and only two running lanes and a median strip. The right had street is a major radial route, so the priority is on moving motorised traffic, with five running lanes in all including two directional peak period bus lanes, available for parking and loading in the off peak periods. Provision for pedestrian crossing is poor.

Figure 9: Contrasting designs reflecting differences in the relative importance of the Link/Movement and Place functions. Source: Jones *et al* (2007b), Example 51.

This principle is further illustrated in Figure 10, based on a study in Freiburg, Germany. It shows two street segments which form part of the same traffic corridor into the centre of the urban area and along which there is a priority tram route. They differ, however, both in terms of the available street width and in their Place status and characteristics. Segment One is quite wide (26.6 metres), and mainly residential in character, while Segment 2 is narrower (at 21.6 metres) and contains a major district shopping centre.

In Segment One, these considerations have enabled separate traffic lanes to be provided for cyclists, cars/general traffic and for trams, with limited parking (on one side of the street). In contrast in Segment Two, the additional Place requirements coupled with the more limited space has led to a solution where there are still separate cycle lanes, but trams and general traffic share the same physical carriageway space but are separated in time (using tram priority signals up-steam and down-stream of the street segment), and parking/loading spaces are provided on both sides of the street.

6. Alternative approaches to overall streetspace allocation

Section 5 has provided some examples of how street design can be sensitive to the varying functions of streets and the requirements of the street user groups taking part in activities on that street, but has not considered ***how*** those designs were arrived at. This question is addressed in this section, by briefing looking at four allocation mechanisms that the author has employed in studies, with researcher and student colleagues. This mechanisms are:

a) Public engagement
b) Application of rules and formal prioritisation
c) Multi- criteria analysis approach, with explicit weightings
d) Cost-benefit analysis, using estimates of valuation of impacts

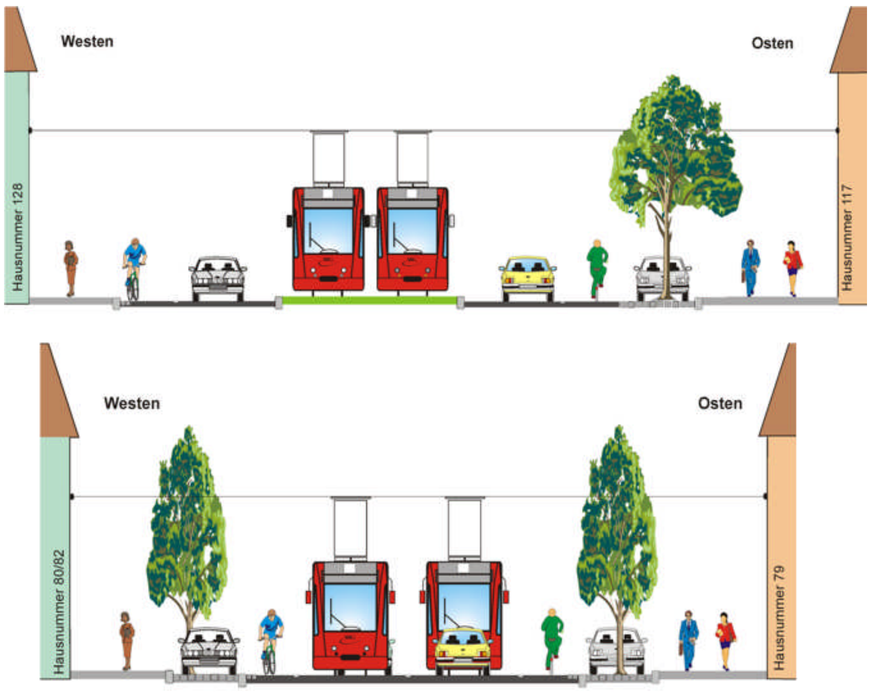

Figure 10: Design solutions at different points along the same corridor in Freiburg. Source: Jones *et al* (2007b), Example 52.

(a) Public engagement

This approach to street design was trialled on Bloxwich high street, in the Walsall area of the English West Midlands. The exercise involved three stages and two sequential workshops: (i) project briefing, (ii) the initial option generation design exercise, and (iii) refinement and selection of the preferred option(s). Stages (i) and (ii) were covered in the first design workshop, and stage (iii) in the second. Both workshops lasted for around two-and-a-half hours.

For the Option Generation Design Exercise, the participants (drawn from local businesses and residents, and various interest groups) were divided into two smaller design groups. The design exercise involved the following steps:

(i) Each group was provided with a street plan of the high street at a scale of 1:250, showing the road layout, building line and individual premises. The plan labelled every building, showing the shop/business name and marking any area to the rear of the premises that was available for loading or private parking. To help participants in orienting themselves on the plan, some photographs were provided and they were invited to identify on the plan their premises or the shops/businesses they usually visited.

The plan marked out a minimum set of requirements that constrained the design exercise, namely:

- The fixed building line, and a minimum clear footway width in front of the buildings on either side of the carriageway of 2.0 metres (2.5 metres in all, to allow for street lighting, etc);
- The minimum amounts of kerbside 'no stopping' (double red) markings were shown on the plan around side road corners and at major junctions, that were required for traffic safety or congestion reasons; and the plan also showed

- Areas that could be allocated for additional parking and loading spaces on the side roads adjoining the high street, and the availability of private loading/parking spaces behind the buildings.

(ii) The groups were then invited to decide on how the space along the high street should be allocated, both in terms of the traffic running lanes (e.g. by adding a cycle or bus lane) and the use of the kerbside (e.g. for parking, loading or for footway widening). Each group had at least one facilitator and one engineer available to them.

This part of the exercise was subject to two further design constraints:

- There should be one continuous traffic lane in each direction along the full length of the high street, in recognition of Bloxwich High Street being a major traffic artery in the West Midlands. However, the lanes could be varied horizontally in their position within the highway.
- A minimum number of parking/loading bays, bus stops and pedestrian crossings should be provided along the high street (or adjacent to it), for particular user groups. Participants were shown both the current provision and the minimum requirements for their new designs.

To carry out the design task, each group was provided with a box containing a series of design aids, in the form of a tool kit. This is shown in Figure 11 below, and consisted of:

- A set of blocks depicting general street features including; parking bays, disabled parking bays, loading bays, bus stop bays, bus shelters, refuges, bike stands and benches.
- A set of acetates showing running lanes for general road traffic, bus lanes cycle lanes, and different kinds of pedestrian crossings
- A set of stickers depicting all the above features
- A set of coloured pens.
- A book of "Post-it" notes

Figure 11: Set of tools given to each group. Source: Jones and Thoreau (2007), Figure 3.

For ease of identification, the blocks and acetates used symbols and were coded in a colour similar to those that applied to the relevant UK signs and markings for each type of facility. For example, a blue badge disabled parking bay was coloured blue and included a wheelchair symbol. The acetates and perspex blocks were also made to 1:250 scale, to exactly match the street plan of the area, so that each block and acetate represented the size of surface area needed for that particular feature. This method enabled participants to readily see how much space would be required on the street to accommodate a particular design suggestion, and to consider what might have to be foregone to provide sufficient space.

(iii) Once a consensus had been reached regarding the allocation of space to different features along the high street, the perspex blocks and acetates were replaced with stickers identical in size and colour that were permanently stuck onto the plan. This avoided the problem of the chosen design shifting or being lost when the maps were moved. Any kerblines that need to be widened or modified were drawn on at this point.

In preparation for the second design workshop, the option developed by each design group was entered by the traffic engineers into the LineMap GIS-based computer program, and checked for feasibility (see Figure 12). To their surprise, the engineers found that both of the schemes were largely practical and technically feasible, and required very little adjustment. The use of the scale blocks and acetates had ensured that space allocations met design requirements, and it was only in a small number of cases where adjustments had to be made to allow enough space for the swept paths of large turning vehicles at junctions.

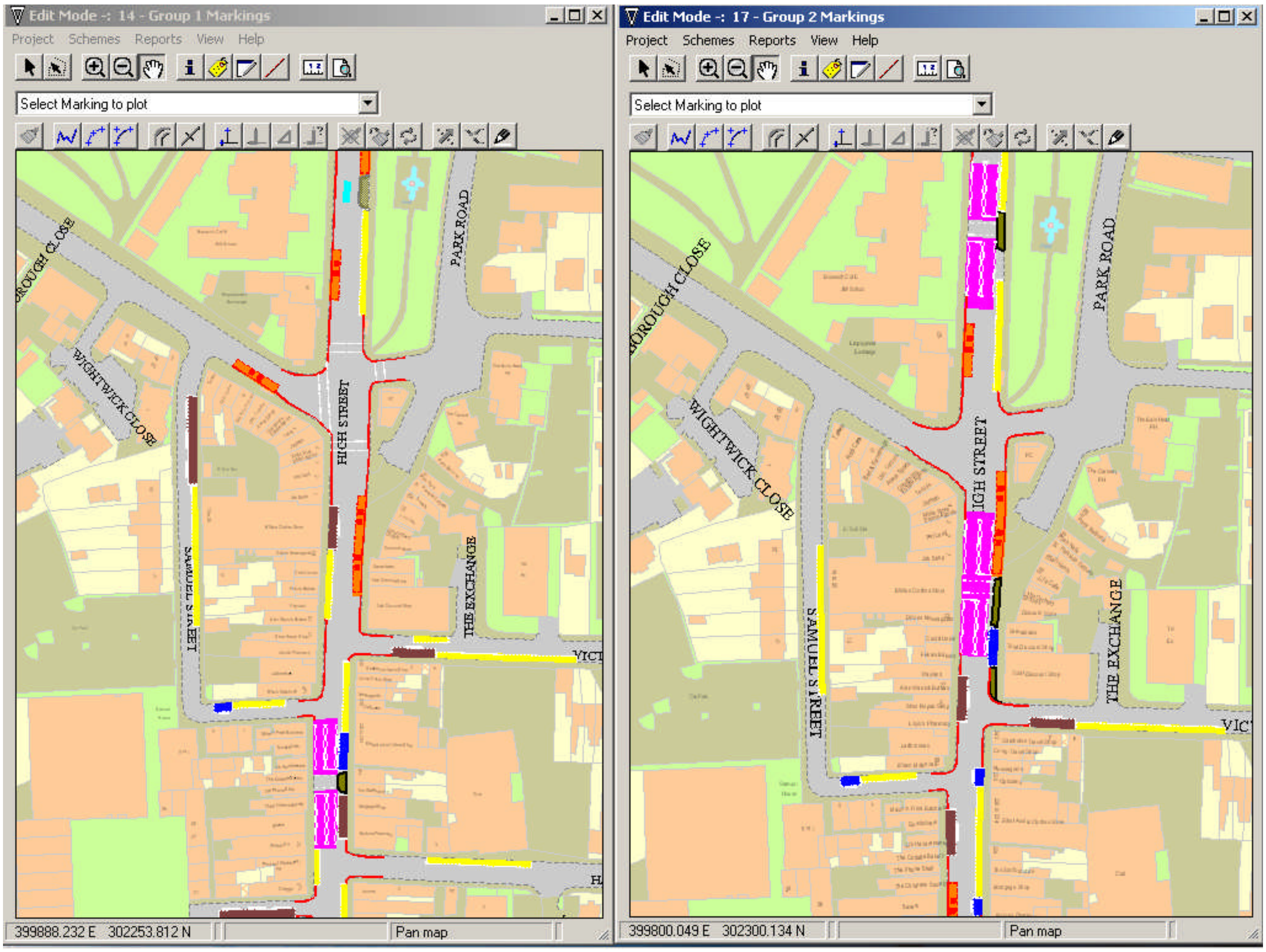

Figure 12: Computer-based comparison and editing of design options. Source: Jones and Thoreau (2007), Figure 6.

(b) Application of rules and formal prioritisation

Rather than empowering the public to generate designs and prioritise among competing groups, the second approach is carried out by professional traffic engineers and designers, taking into account existing design guidance and any priorities established as policy by the city council. This was the approach adopted for consultants working for Birmingham City Council (see network classification in Figure 5).

Figure 13 shows a street section in a shopping area on a radial route into the city centre, with a by-pass for general traffic. Here the priority was to provide good access for a new express bus system and adequate on-street loading and parking facilities (including for cyclists) to support the local shops and services.

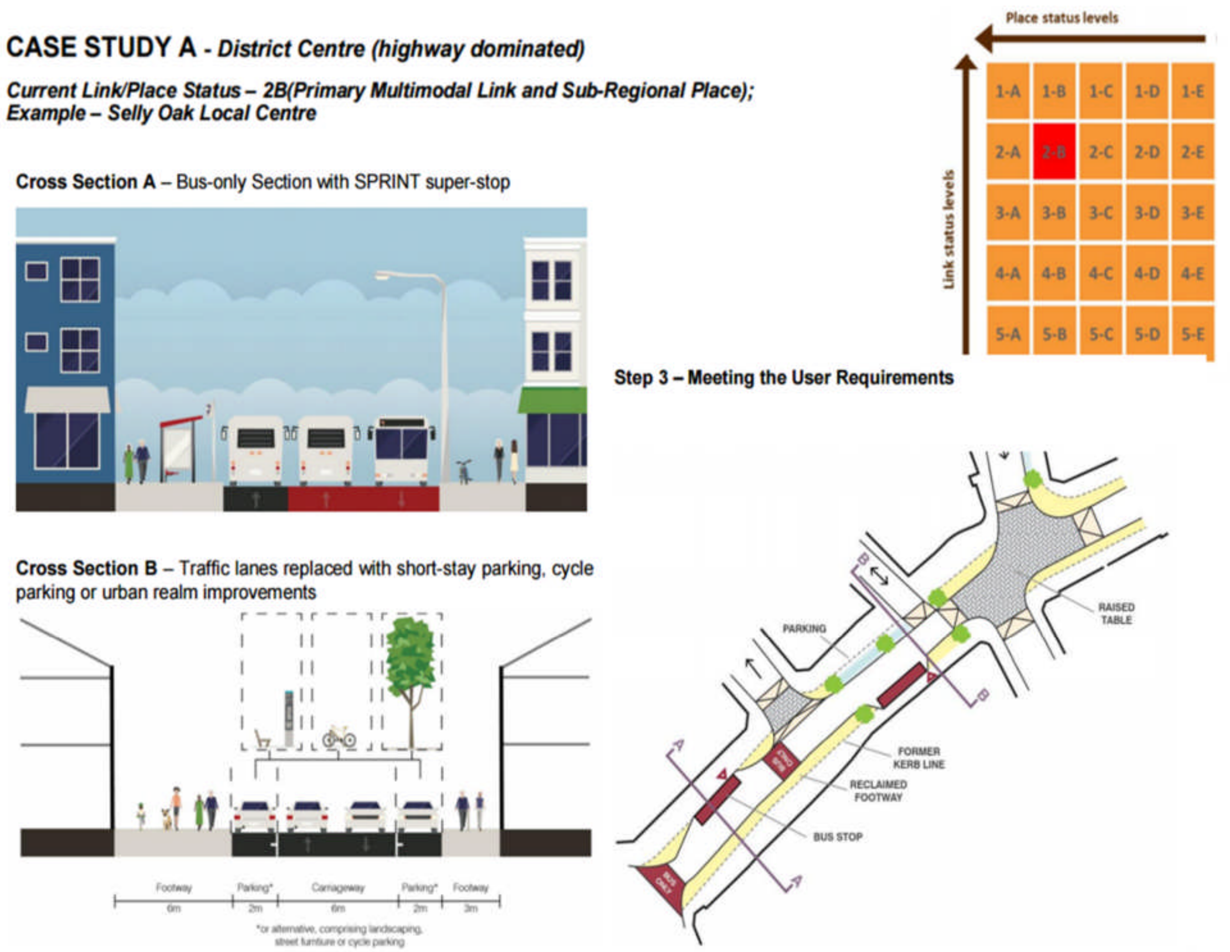

Figure 13: Design recommendations for one section of high street.
Source: Source: Birmingham City Council (2014), page 33.

A related approach involves setting out a set of design requirements for each street type (Link and Place category), and identifying situations where it would be appropriate to share space (e.g. bus + cycle lane) where there is not sufficient space to provide for each user separately.

Figure 14 shows the process developed by Sidiropoulos (2011) to allocate street space on a logical and systematic basis, in his MSc dissertation. Design requirements are identified for each street user group, their relative importance related to the street type, and these are then combined to look at potential combinations of street elements, with the final choice being based on a set of criteria. In some cases this may lead to multiple design options which could then form the basis for a formal public consultation exercise.

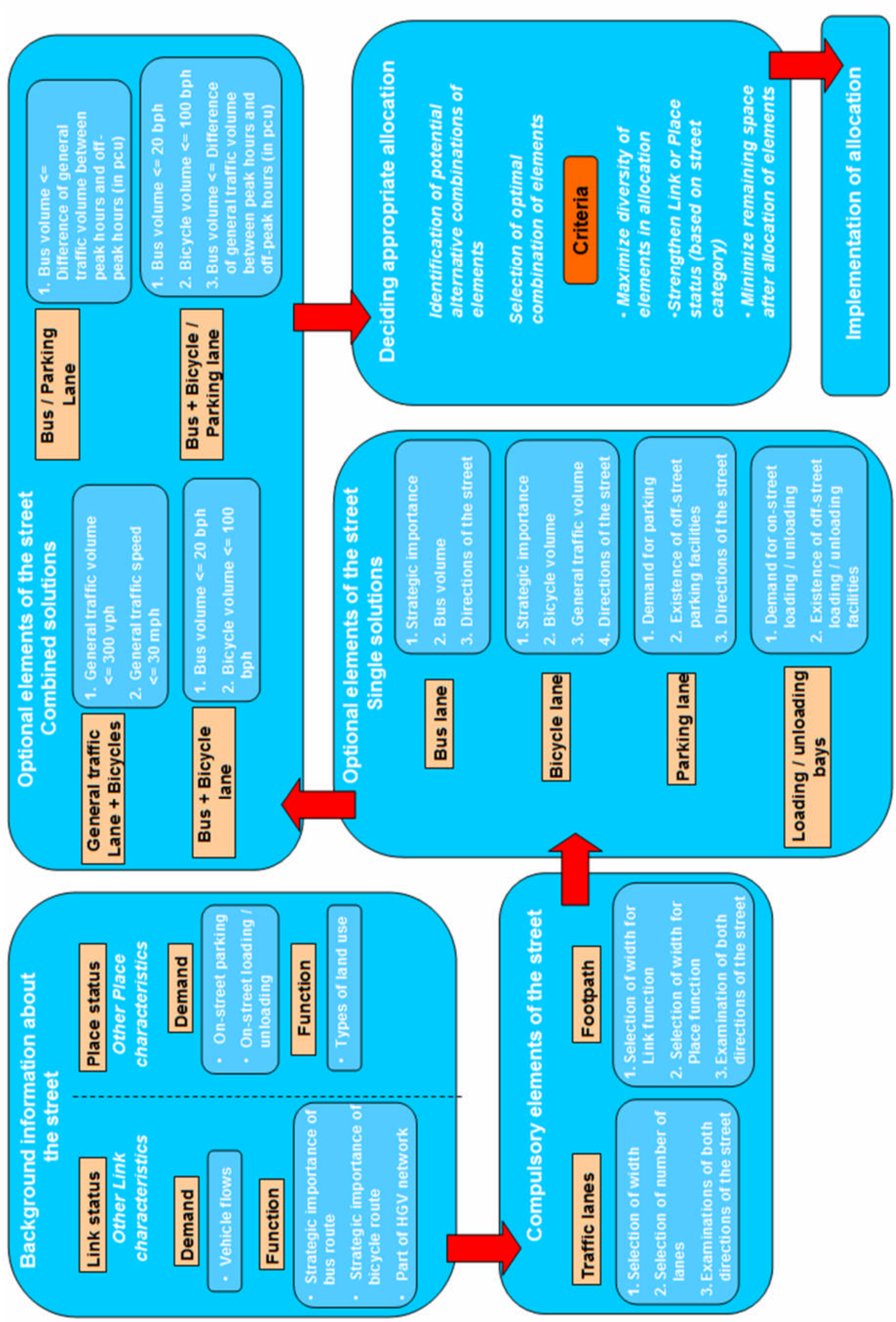

Figure 14: Process for developing and prioritising options.
Source: Sidiropoulos (2011), Figure 4.11.

(c) Multi-criteria analysis (MCA) approach, with explicit weightings

This approach is illustrate from a study which developed a spreadsheet to apply MCA to the Bloxwich case study area outlined in section 6(a).

It has three main stages:

(i) Identifying which street user group benefits (or disbenefits) from the provision of each street design element required by one of more groups of street users.

Figure 15 shows a simple version of the Street User/Design Elements Benefits Matrix, with the key Street User Groups relevant for that case study street depicted along the columns, and a selection of relevant street design elements on the rows. The relationship between users and street design elements is simply captured at this stage based on scores of ‘0’ for no impact/relevance (these cells have been left blank in Figure 14), +1 (benefit) and -1 (disbenefit).

Here there are no weights reflecting (i) any differences in priority given to the needs of different Street User Groups, nor (ii) the extent to which a design element meets a user need, nor (iii) any diminishing returns from increasing provision.

Return to Inputs & Impacts sheet | Return to Select Relationships | Reset All to Overall SDE | Reset All to Linear

User Group/Design Elements Matrix: Basic Relationships

User Group / Street Design Element	Pedestrians	Pedestrians who have mobility difficulties	Those using the street to socialise/relax	Cyclists	Bus users visiting the street	Those travelling to other destinations - all modes	Car users (non-disabled) visiting the street	Disabled car users visiting the street	Shopkeepers
Lanes									
General traffic	-1	-1		1	1	1	1	1	
Bus lane				1	1				
Cycle lane				1					
Bays and Crossing Places									
Parking bays							1	1	
Disabled parking bays								1	
Loading bays									1
Bus bays					1				
Crossing places	1	1			1	-1			
Other Design Elements									
Traffic Island	1	1			1				
Street seating		1	1					1	
Cycle stands	-1	-1		1					

Figure 15: Benefits Matrix of Street Design Elements for different Street User Groups (without weighting). Source: Jones and Paskins (2008), Figure 14.

(ii) Applying weights to reflect different priority to be given to different street user groups

To reflect differences in the priority given to meeting the needs of different street user groups (e.g. resulting from policy priorities or the numbers of each category of people on the street), or the suitability of different design elements to meet a given type of requirement (e.g. a blue badge bay would be more suited to the needs of a disabled driver than a normal parking bay), we can apply weights to each street user group (SUG) and street design element (SDE). Figure 16 shows the part of the spreadsheet that is used to change the default weightings of 1.0 for the street user groups and street design elements.

It is also possible to apply a specific weight to an individual SUG/SDE cell (i.e. to reflect the particular importance of a specific street design element for one street user group, over and above the general user group and design element weightings), by editing the individual cells in the benefits matrix (shown in Figure 15). For example, a Traffic Island might be considered to be of particular benefit to ‘Pedestrians who have mobility difficulties’, and given a score of ‘2’ for that group only.

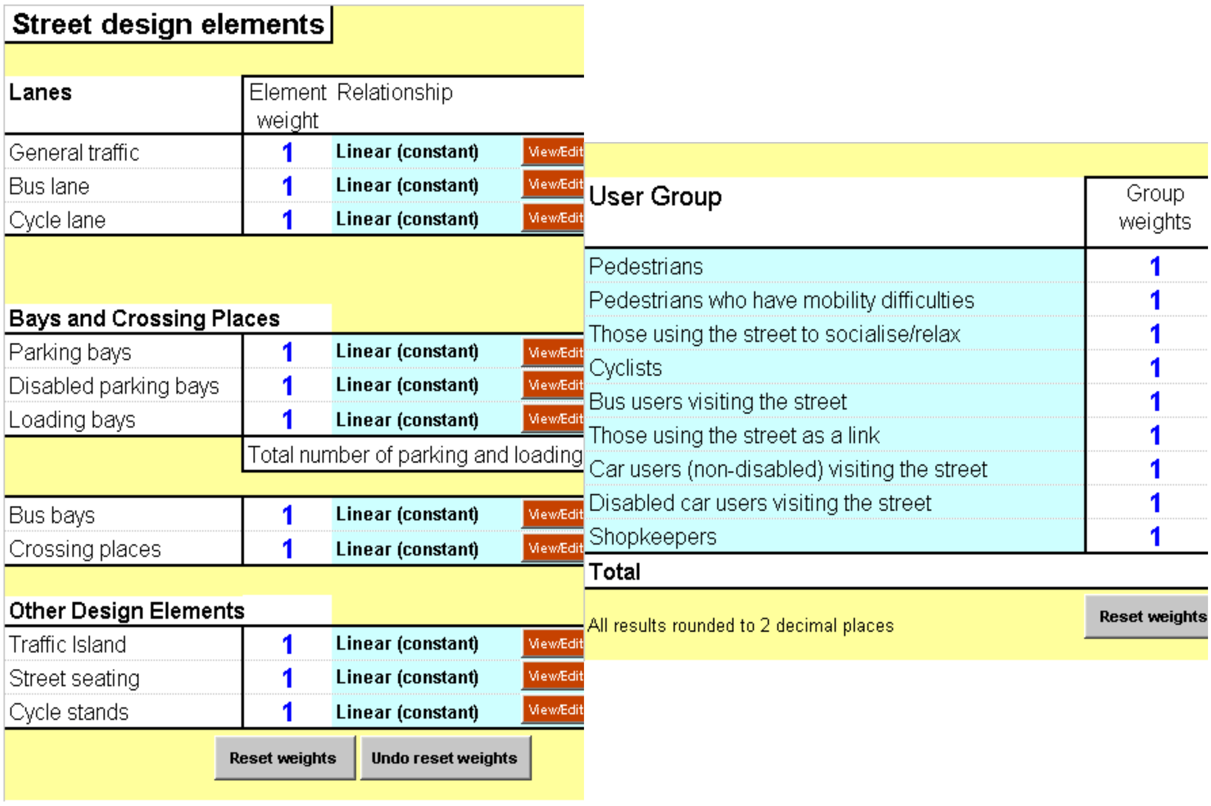

Figure 16: Detail showing street design element (left) and user group (right) weighting.
Source: Jones and Paskins (2008), Figure 16.

(iii) Adding in a weighting for diminishing marginal utility

Other things being equal, we would expect a decreasing marginal utility as additional street user elements of the same type (e.g. seats or parking spaces) being added.

Example of application

Table 5 summarises the scores for Bloxwich High Street (current situation plus the two design options partly shown in Figure 12), first unweighted (i.e. all elements with a score of 1.0) and then weighted, to reflect:

- A diminishing return of 10% per space for additional car parking spaces after 20 for all user groups – to represent the diminishing usefulness of additional parking spaces
- A weight of 2 given to bus stops for all user groups – to prioritise bus use
- A weight of 0.5 given to standard parking spaces for disabled car users – to represent the decreased usefulness of standard parking bays for disabled car users

Taking these weightings and relationship into account has a significant impact on the overall scores, resulting in a change in priority order and a substantial drop in the overall score in each case. In particular, the score from the design scheme drawn up by Group 1 drops well below Group 2 - which now becomes the highest scoring option – whereas previously the Group 1 and Group 2 schemes had similar overall scores.

Also the difference in overall score between the proposals from the two stakeholder groups and the final proposal as refined and consulted on by Council has been considerably reduced.

Street user group	Existing provision	Group 1 scheme	Group2 scheme	Final proposal
Pedestrians	Reference case	0	0	0
Pedestrians who have mobility difficulties		0	0	0
Those using the street to socialise/relax		0	0	0
Cyclists		0	0	0
Bus users visiting the street		-4	-2	0
Those using the street as a link		0	0	0
Car users (non-disabled) visiting the street		11.94	10.86	9.22
Disabled car users visiting the street		2.97	7.43	0.61
Shopkeepers		1	1	1
TOTAL (NET) SCORE – Unweighted		*34*	*32*	*19*
TOTAL (NET) SCORE – Weighted		**11.91**	**17.29**	**10.83**

Table 5: Summary of the relative impacts for each design option in the Bloxwich case study (unweighted and weighted). Source: Jones and Paskins (2008), Table 11.

(d) CBA approach

This study uses cost-benefit analysis to look at the relative benefits of retaining or removing on-street parking on a radial route in Melbourne (see Sutanto and Jones…), with consequences for vehicle delay. The study took into account four elements:

LINK IMPACTS:
- Road capacity and operations (including travel times and reliability)
- Road safety

PLACE IMPACTS:
- Local businesses
- Pedestrian environment

The overall results of the detailed assessment are shown in Table 6. It can be seen that this analysis indicates that the extension of clearway hours and associated restrictions on on-street parking would have a net negative impact of approximately $1.8 million per year.

Impact	Value (2010$/year)
LINK IMPACTS:	
Road capacity and operations	863 898
Road safety	26 840
Sub-total	*890 738*
PLACE IMPACTS:	
Local businesses	-2 701 031
Pedestrian environment	-4 994
Sub-total	*-2 706 025*
Total	*-1 815 287*

Table 6: Overall assessment results. Source: Sutanto and Jones (2013), Table 6-10

7. Conclusions

Determining the appropriate allocation of urban street space is becoming an increasingly critical issue as pressure on space increases, both due to growing populations and a recent policy recognition that streets also perform an important range of non-movement functions that also need to be provided for – linked to 'Stage 3' thinking (Jones, 2016).

Surprisingly, virtually all street design guidance relates to the 'movement' functions of streets and is on a mode-specific basis: engineers and planners are given detailed guidance, for example, on the requirements of cyclists, without any consideration of the impacts of meeting these standards on bus performance, loading provision, etc. The issue is made more complex by the fact that 'one size does clearly not fit all', so this raises the question of how to decide what would be an appropriate balance of different types of streets.

This paper has proposed that this could fruitfully be addressed by taking into account the varying mix and importance of Movement and Place activities on different parts of the urban street network, and to design with that context in mind. While the applications used are from Western Europe, the Link and place approach has also been trialled in China.

The paper has illustrated four different methods for prioritising street space allocation, based on public engagement, policy and professional judgement, a more formal use of multi-criteria analysis and the application of cost benefit methods. None of the more formal methods has yet been developed to the point where it can be comprehensively applied, so there is considerable scope to develop the methodology – particularly around systematic option generation and the use of CBA.

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