ARTISTS

Arterial Streets Towards Sustainability

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D1.1
A First Theoretical Approach to Classification of Arterial Streets

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Preface

The research reported in this document has been conducted by the ARTISTS consortium, funded by the European Commission and part of Key Action "City of Tomorrow" in the 5th Framework.

The ARTISTS consortium consists of the following contractors;

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Municipality of Kalamaria, Greece
City of Porto, Portugal
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This document is written by Stephen Marshall, University of Westminster, for the first work-package within the ARTISTS project.

WP1 is led by Ian Plowright at University of Westminster and deals with the Design of an Assessment Framework. Besides University of Westminster, specific task contributors to WP1 are Christine Krämer and Ulrike Huwer at University of Kaiserslautern and Emmanuel d'Iteren and Sylvaine Morelle at Université Libre de Bruxelles. Beside these major contributors all partners in the ARTISTS consortium contribute to some extent to all deliverables.

Contents

1. Introduction

1.1 The ARTISTS project is concerned with the design and management of arterial streets towards sustainability. In a broad sense this relates not only to environmental quality but to social and economic vitality and urban quality of life. The purpose of this Deliverable is to give a first theoretical approach to *street classification* that better meets the current needs of managing and promoting sustainable arterial streets.

1.2 The practice of *classifying* streets has both a descriptive element and a prescriptive element: it concerns not only the recognition of a variety of characteristic types of streets across different contexts, but allows consistent decisions to be made about their design and management over space and time. This can allow a diversity of ongoing measures, perhaps by different agencies along the length of a street and through time, to reinforce each other progressively towards the overall intended role of the street.

1.3 Street classification is important to this project because the kinds of street or road type that are explicitly recognised are those that form the basis for design and management of the street network. If a particular kind of street is not recognised, then it may be difficult or impossible to direct resources towards maintaining or enhancing those desired street functions. This is especially the case where even the existence of the 'street' – which is so much more than simply an 'urban road' – is absent from official categorisations.

1.4 Therefore, although the issue of 'street classification' is a rather abstract one, it has had very concrete consequences in the last few decades, as for years many main roads in urban areas were recognised only in terms of their traffic function, and progressively denuded of urban frontage functions, often in the expectation that these would be 'upgraded' to form superior traffic routes such as urban expressways.

1.5 Classification is specifically significant to ARTISTS because our aim is to explore and analyse the concept of the 'sustainable arterial street' with a view to designing and promoting its use in urban areas. This is currently difficult to do, as we shall see, because there is no clearly fitting category corresponding to 'sustainable arterial street' in the official classifications of any country investigated. Indeed, in some countries, even the term 'street' does not exist in some classification systems, denying not only the possibility of recognising streets, but also arterial streets and sustainable arterial streets too.

1.6 Yet, equally clearly, there are some streets and street categories that relate reasonably closely with the 'sustainable arterial street'. One of the purposes of ARTISTS will therefore be to find out which existing categories most closely match the desired characteristics of the 'sustainable arterial street'. This will allow, in the first case, discussion

about ‘what is a sustainable arterial street’ and secondly, the ability to study and compare those existing classifications to see if they could be adopted or adapted to suit our purposes, and perhaps used as ‘best practice’ exemplars for future use.

1.7 One of the purposes of classification, then, is to demonstrate explicitly possible viable ‘types’ of street that represent combinations of compatible forms, functions and uses, eg, where a certain street form is compatible with a certain amount of traffic flow and with a given level of pedestrian comfort, safety and quality of life.

1.8 We might say that each street type in a classification system represents an ‘ideal situation’ and thereby a ‘rationale’ for onward application. Each type has different roles to play in the overall street network. Often when traffic planners identify ‘problems’ on streets they focus on the differences between the existing and ‘ideal’ situation. And when ‘solutions’ are suggested they focus on the rationale for the particular street type. So, a classification system is a tremendous help for planners in identifying problems and solutions. Then, it is important that the ‘ideal’ types available match the actual aspirations.

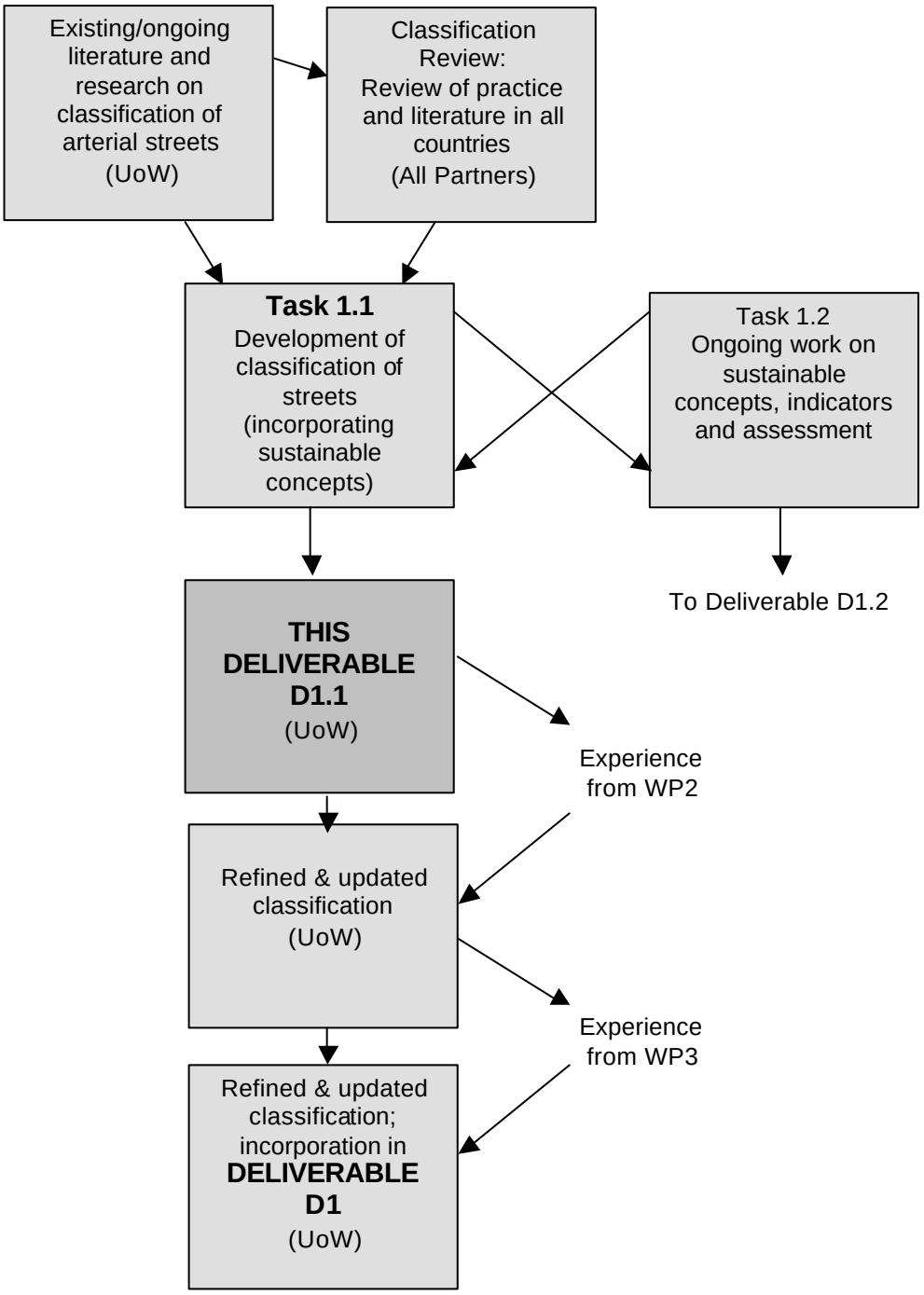
Project context

1.9 This document represents “A first theoretical approach to develop functional classification and sustainable concepts for describing the arterial streets”. It addresses the first Objective O1 of the ARTISTS project: “Devising objective definitions of the forms of different arterial streets, their functions and the various user groups involved”. It is associated primarily with Task 1.1 - “Development of functional classification and sustainable concepts”.

1.10 This Deliverable D1.1 has been developed in parallel with Deliverable D1.2 (A First Theoretical Approach to Develop Assessment Tools). There has been an iterative process where intermediate work towards one Deliverable has fed into the work of the other. Ultimately the material and messages from these Deliverables will be brought together formally in the final Deliverable D1.

1.11 Figure 1.1 shows the iterative development of material in this document in relation to other stages of the project.

Figure 1.1 This Document within Project Context



Content

1.12 This Deliverable first provides a brief review of the principles of classifying streets, which is based primarily on existing research findings on this topic. This is followed by the presentation of findings from a dedicated in-depth study of street classification systems in the countries represented in the ARTISTS project. This "Classification Review" was based on contributions by all partners for their respective countries. The Classification Review analysis has appeared in full in earlier internal project documents and is reproduced in part in this document, primarily in the Appendices.

1.13 The Deliverable then goes on to discuss the direct challenge of classification as faced by the ARTISTS project, in reconciling conventional classification principles with the need to incorporate a wider and more sustainability-oriented set of themes, and tying these together with sustainability concepts and indicators developed as part of the overall Assessment Framework of Workpackage 1. Finally, the Deliverable proposes a first theoretical classification system.

2. Principles of Classification

Introduction

2.1 There are innumerable ways of describing and potentially classifying streets (see box below). We can classify by form, by function, by use or provision, by traffic role or urban role, to name but a few of the broadest kinds of classification. Any one of these could be used to classify a particular street, and any one theme could have a multitude of criteria by which to do so. There are an almost limitless number of subdivisions and permutations of transport and urban form and function. The question is: which one(s) shall we use?

The 'Multiple Personalities' of Marylebone Road
University of Westminster, London

Marylebone Road is an arterial street, major road, a strategic traffic artery; it is an all-purpose road, also a priority or Red Route, a Ring Road, a classified road - an 'A' class road (the A501) - while simultaneously being a primary route and a principal road of the Transport *for* London network.

Marylebone Road is a wide road, it is a dual carriageway, lined with trees, it is a boulevard. It is a major public transport corridor - a major bus route (and a few metres underneath the road lies an underground railway - the first in the world); it forms a direct east-west pedestrian route and bicycle route.

Marylebone Road is a by-pass route originally built to by-pass London; when it was a New Road; it is planned to be a boundary route to the proposed road-charging cordon area. In some ways it is a barrier separating the districts to the north and south, but it is also an urban 'seam', common to both. It is a frontage street, in part a shopping street and commercial street, a place for sightseers to queue to get into Madame Tussauds and the London Planetarium.

At one end, Marylebone Road (under a sequence of different names) ends up a relatively narrow congested street in the City of London… at the other end, it becomes the Westway, an elevated urban motorway, that eventually becomes the A40, crossing the breadth of England and ending on the west coast of Wales.

The Task of Classification

2.1 The task of classification – from typologies of cities to taxonomies of species – has at times been associated with futility, ambiguity, acrimony, effort and controversy. Far from being a simple neutral activity, it may in practice be a highly charged, complex one. When it comes to classifying roads and streets, we find a multitude of ways of

categorising individual types and assembling these in sets or 'hierarchies'.[1]

2.2 The complexity of the task is not least because roads and streets tend to have 'multiple personalities'[2] – ie, simultaneously combining different attributes, some of which are ambiguously specified in the first place. (For example, a particular street might be a *radial*, *arterial*, *shopping* street, where radial, arterial and shopping are independent attributes, each of which might be specified in a variety of conflicting ways). Moreover, there is sometimes ambivalence as to whether we are specifying design characteristics to help define road types, or vice versa.[3]

2.3 From the examination of the diversity of classification systems encountered in the literature, it is apparent that there is no single optimal means of classifying street types. Examples of different themes for classification include:

- ownership and management
- traffic function (volume, composition)
- role in network (location and connectivity)
- physical form – dimensions, alignment, etc.
- physical form – in relation to buildings, enclosure etc.
- urban function
- people's activities on the street

2.4 The attributes expressed in a classification system will reflect the purpose of that classification. While the individual themes above may be easily enough agreed on, the structure with which they are assembled within a classification system will vary according to different points of view, as different categories and sub-categories are formed (Figure 2.1). The very flexibility found in assembling and subdividing systems of types fuels the 'effort and controversy' which may accompany the diversity of alternative schemas proffered by different individuals or schools of thought.

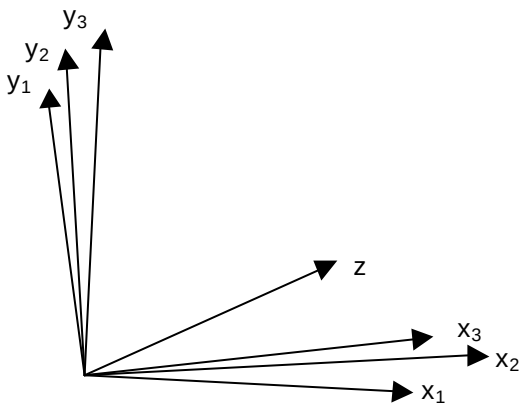
2.5 The act of classification is to some extent a 'political' act. A classification reveals the priorities and biases (intentional or unintentional) of those making the classification.

2.6 *Therefore, the classification of arterial streets to be developed herein could be seen as no more than – but no less than – a faithful reflection of the priorities of the project.*

[1] Fuller discussion appears in Brindle (1996), Marshall (1998) and Marshall (2001).
[2] Institution of Civil Engineers (1996:8).
[3] Brindle (1996:69)

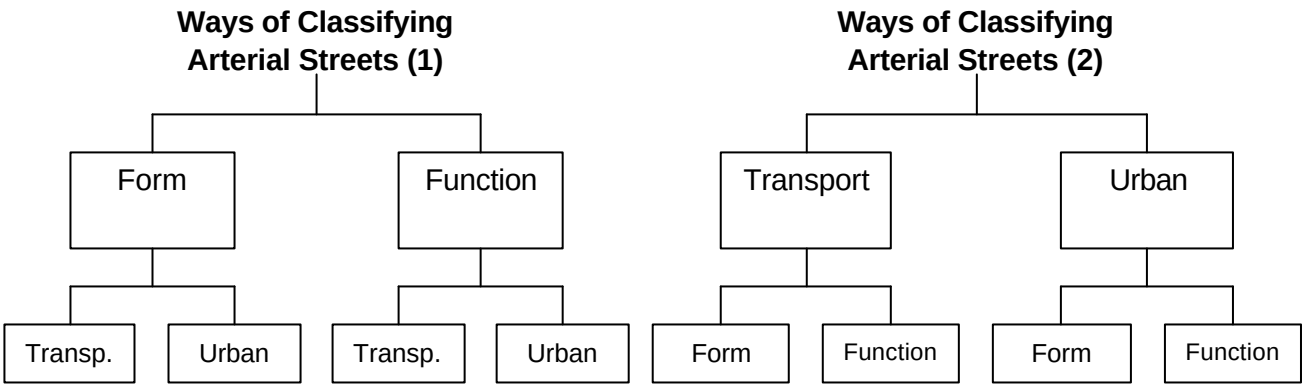
Figure 2.1 Classification phenomena

We can recognise a multitude of different properties, some of which are closely linked. The task of classification involves selecting one set or structure in preference to other theoretically possible sets or structures. In a sense there is no 'right' or 'wrong' way of doing this - it all depends on the purposes and application of the classification.



(a) "Field of Axes"

We are faced with choosing from a series of closely related (but in principle separate) themes by which to classify streets. Theme x_1 might be pedestrian flow, while x_2 is pedestrian activity and x_3 pedestrian amenity. One or other could be contrasted with a traffic criterion (y_i). But we could also distinguish criterion z (say, environmental amenity) separately from x or y, creating three axes.



(b) Alternative Structures

The same set of classification themes can be structured in different ways to reflect different emphases. The lowest level categories may well be in agreement, but how they are grouped and weighted may be contentious.

Conventional Classification and Road Hierarchy

2.7 Given that any classification system can be seen as a reflection of its own purpose, we may now consider how streets have been conventionally classified.

2.8 In the conventional practice of traffic and highway engineering, the form of classification used goes beyond description (such as description in terms of urban character) but is oriented towards prescription. This prescription relates to the intended function of the roads. It conventionally concentrates on rather narrow traffic functions of streets - it is effectively a road classification, applied to urban streets and other roads alike.

2.9 Classification is often set up in conjunction with a system known as *road hierarchy*. Road hierarchy is a system of network design and management which not only identifies different types of road (or street), but sets them in relation to each other, in terms of allowable connections between them in the network.

2.10 Road hierarchy is basically set up to avoid conflicts between different road users, their speeds and paths of movements, thereby promoting safe, efficient traffic flows. Road hierarchy guides relationships between different types of *route*, and between those route types and *adjacent frontage development*.

2.11 Conventional road hierarchy[4] has traditionally restricted frontage development and access to certain road types – basically the road types 'lower' in the hierarchy – such as those termed ACCESS ROADS and DEVELOPMENT ROADS. Conversely, the roads higher in the hierarchy – main roads forming the strategic road network, plus some intermediate roads – are traditionally designated as DISTRIBUTOR ROADS, which in theory should have no development/frontage access.

2.12 The effect of this system was to create a 'superstructure' of main roads for through traffic, within which would be sited 'environmental areas' where the interactions between traffic, pedestrians and buildings would take place.

2.13 In practice, the clearly applied distinction between distributor roads and access roads has typically only been achieved for new development (post 1960s housing estates, new towns, plus some comprehensively replanned redevelopment areas in inner cities) and has only had limited, piecemeal application to the retrofitting of traditional urban street networks.

[4] Conventional road 'hierarchy' in the UK was first set out in *Traffic in Towns* - also known as The Buchanan Report (MoT, 1963). It has evolved though subsequent publications in the following decades, including *Roads and Traffic In Urban Areas* (DoT/IHT, 1987) and most recently *Transport in the Urban Environment* (IHT, 1997).

2.14 In particular, the traditional street, and especially the traditional arterial street, did not easily fit the theoretical categories, either as a pure distributor road, or as a pure access road; some major urban streets were converted to expressways, others to pedestrian precincts. In some cases traditional streets were removed during redevelopment, and new development was created without traditional streets featuring at all. However, in general, most main roads (eg, A roads and B roads) – excepting those purpose-built as distributor roads – typically still have street frontages, as in the typical case of the radial route shopping street.

2.15 Over the last couple of decades, there has been a realisation that, not only is it difficult to apply the 'idealised' conventional hierarchy in practice, but it may not even be desirable in theory, given the contemporary drive towards reconciling issues of movement with those of local amenity, environment and sustainability. Accordingly, traditional mixed-use streets have been retained, and even reintroduced as positive role models. For example, the status of many roads could be 'downgraded' to allow them to be prioritised for slow movement/non-motorised modes. Additionally, the case has been made for deliberately encouraging frontage streets even on main roads, to promote the idea of development focused on public transport corridors.

2.16 As part of this contemporary movement, the ARTISTS project will explicitly investigate how street classification can be used as a tool to assist the design and management of urban arterial streets towards more sustainable ends, accommodating the more sustainable transport modes, and non-transport functions, social and economic activity, in an enhanced environment.

Interpretation of 'Functional Classification'

2.13 The term 'functional classification' can have two interpretations:

- a 'functional classification' could simply and generally mean any workable classification, devised to serve a function.
- a 'functional classification' could mean specifically a classification *by function*, as opposed to, say, a classification by form, or classification by origin.

2.17 Classification by function is sometimes stressed as being the ideal means for classifying road types[5]. This is in the sense that roads should be classified not according to their present form, but their future function. This is fair enough in principle, in the context of the design and future management of roads.

[5] This is the conventional case in the United Kingdom (see for example, Institution of Civil Engineers, 1996).

2.18 However, this attitude to 'function' has sometimes been associated with a narrow traffic-flow function. In the past, it allowed traffic engineers to draw up futuristic networks of 'primary arterials', in the anticipation of a network of upgraded traffic routes, ignoring their existing present form and function (eg, local high street, congested and lined with parked cars, service vehicles; perhaps narrow and substandard as a highway but with its own character and functionality as a public space).

2.19 In a project aiming to encompass the breadth of functions of arterial streets, it may be argued that a variety of aspects of both form and function are significant to the understanding of that street's wider function: as a tree-lined avenue; as a street with numerous shopfronts, and so on. Therefore, the definition of 'functional classification' will be kept flexible, to keep options open as to how best to classify streets in practice.

Discussion

2.20 We have seen that streets have 'multiple personalities'. Therefore, by describing or classifying according to one aspect, we suppress or ignore another. Therefore, in our treatment of the street, we must at the outset clearly aim to capture the full nature of streets, which are much more than 'urban roads'.

2.21 From consideration of the literature of classification systems, it has been concluded that there is no single optimal way of classifying streets. Any classification system can reflect the priorities and purpose of its own objectives, rather than conform to any pre-existing model.

2.22 This means that, in the context of the ARTISTS project, the classification of streets must be (or put another way, has the freedom to be) tailored to the specific objectives of the project.

2.23 Given the broad scope of the project, addressing the social and economic roles as well as transport roles of arterial streets, it is likely that any classification(s) adopted should reflect the full diversity of forms and functions of streets. This should go beyond (but also incorporate) the conventional designations relating to traffic function or carriageway type, and consider non-transport use of the street space, the form and function of adjoining buildings, and the wider urban/network context.

3. Street Classification Review

3.1 In order to gain an insight into a range of actual classification systems, a dedicated Classification Review exercise was carried out for the ARTISTS project. This reviewed the principles and practice of street classification in all nine ARTISTS countries. It compared different classification systems - in part though generating a new 'Common Reference Classification' into which all existing types of street could be fitted. Finally, the Classification Review explored a more diverse range of novel and non-conventional possibilities for classifying streets.

3.2 The Classification Review and its analysis has been written up in full detail in previous internal documents[6]. Some of the main conclusions are reproduced, with illustrations, in the rest of this section and section 4. Other parts of that material are reproduced elsewhere in this Deliverable, notably in the Appendices.

Overview of findings from Classification Review

Classification themes (in conventional classification systems)

3.3 Each country or city has a *classification set*, sometimes referred to as a hierarchy, which organises a set of *street types*. For example, in Spain, there are four types in the set: MOTORWAY, ARTERIAL, DISTRIBUTOR and LOCAL STREET. The different sets in the different countries distinguish between individual street types in a number of ways. Usually there is a single primary *theme* which systematically orders all types, usually with individual types further distinguished by other themes. For example, in Spain, the four street types are consistently ranked by trip length (a spectrum from long distance traffic to local traffic), while individual types such as motorways are further distinguished by traffic speed or destinations served.

3.4 Criteria such as 'traffic speed' are here termed *classification themes*. There is a diversity of classification themes used in the nine countries studied, yet within the individual variations, there is a fairly consistent pattern, and similar types and roles recur across the different contexts. Fourteen such themes have been identified in conventional classification systems in the ARTISTS case study analysis. (Table 3.1a,b).

[6] ARTISTS Documents 1.1.1 and 1.1.2 (Marshall, 2002a, b)

Table 3.1(a). Systematically applied classification themes in ARTISTS countries

Systematically Applied Classification Themes - distinguish street type across the whole spectrum of types in a classification set.	
1. Traffic Speed	eg, streets with a given design speeds or speed limit
2. Trip Length	eg, streets associated with long distance or local traffic
3. Destination Status	eg, streets linking cities or neighbourhoods
4. Strategic Role	eg, streets connecting different levels of network with different levels of urban scale
5. Circulation v Access	eg streets intended primarily for circulation or for access
6. Administration	eg, streets administered by national or local authority

Table 3.1(b) Partially applied classification themes in ARTISTS countries

Partially Applied Classification Themes - ie, themes used to distinguish some individual street types
7. Network role - eg forming strategic network or local network 8. Access control - eg access controlled or uncontrolled 9. Traffic Volume - ie, vehicle flows 10. Transport Mode - presence of/ provision for vehicles, PT, pedestrians, etc. 11. Other Urban Users - eg, presence of/ provision for frontage users 12. Environment - sensitivity of environment 13. Built Frontage - presence of built frontage 14. Road Width - width of road or street

3.5 The existing classifications studied are strongly related to traffic and transport related criteria, to the strategic role of streets (relating position in network to inter-urban or intra-urban linkages) and to the generally applicable 'inverse relationship' between traffic circulation function and access function of streets. That said, traffic *volume* hardly features at all as a criterion for distinguishing street type.

3.6 Explicit sustainability criteria do not feature strongly in the classification themes of the existing classifications. They feature intermittently, often in relation to individual cases, but in no case are they used as the primary basis for organising all types in a classification.

3.7 In general, there is no strong presence of public transport. No dedicated public-transport related categories were found. The presence of sustainable modes is mainly recorded in the case of pedestrians and cyclists, and these are limited to the bottom end of the hierarchy – not the middle to upper range in which arterial streets would be found.

3.8 Similarly, such environmental criteria as there are tend to be at the lower end of the hierarchy. In particular, the recognition of the built-frontage function of streets is weak – the classifications could easily be mistaken for *road* classifications. Non-transport uses of streets are very limited (to occasional references to residents or 'frontagers'). The public space aspect of streets is more or less entirely absent.

Diverse Catalogue

3.9 In addition to the first 14 themes noted earlier (Table 3.1), the Classification Review exercise generated a further 'diverse' range of classification themes, found in practice or the literature in the ARTISTS countries or beyond (but not forming official classification systems).

3.10 These themes are typically (though by no means wholly) more urban and/or form related than the 14 listed in Table 3.1. A few possible new classification themes were also devised, in order to stimulate exploration of territory in a variety of new (or so far unreported) directions. In total 15 further 'diverse' themes were distinguished (Table 3.2), giving rise to a total catalogue of 39 themes.

Table 3.2. Further 'diverse' classification themes (presented in Appendix 2)

15. Street Name	27. Corridor Role
16. Street in Cross-Section	28. District Role
17. Frontage Form	29. Land Use or Frontage Function
18. Planting	30. 'Towncentredness'
19. Street Character	33. Urban Uses and Users
20. Urban Character	34. Living Space
21. Spatial Shape or Character	35. Neighbourliness
22. Visual Axis	36. Pedestrian Use of Streets
23. Civic Role	37. 'Diverse' Vehicular Classification
24. Space Syntax 'Spatial Integration'	38. Public Transport
25. Urban Morphology (Formation)	39. Sustainability
26. Structural Role	

3.11 Therefore, a more diverse range of possibilities exists than is currently employed in conventional classification systems. This suggests there is potential for ARTISTS to fulfil a classification wider than those currently practised - though we will also later bear in mind possible reasons why some themes are preferred over others in practice.

Classification Structure

3.12 Returning to the conventionally applied classification systems, it was found that most systems are structured as simple *linear rankings*, from major roads (with no frontage access function) at the 'top' of the hierarchy to minor roads with access function at the 'bottom' (the latter sometimes corresponding to 'streets') (Figure 3.1).

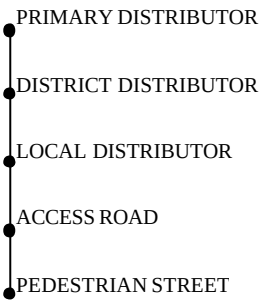


Figure 3.1 Linear hierarchical structure. (Marshall, 2001)

3.13 Two classifications - in the cases of Germany and Denmark - are effectively two-dimensional matrices (Figure 3.2). This means that street types are defined as a combination of two separate attributes.

3.14 However, despite this distinction between 'linear' and 'two-dimensional' classification structures, the reality is not as clear-cut as this:

- it is found that in several cases the apparently 'linear' rankings actually embody more than one dimension - ie, other variables are present but pegged to values on a single spectrum. For example, even in Figure 3.1, there is a distinction between all-purpose and pedestrian-only routes, and between 'distributors', 'roads' and 'streets' which are both effectively pegged to through traffic function (from primary to zero);
- Conversely the 'two-dimensional' matrices in Figure 3.2 are not fully filled out with types, but have a spread or band of viable types, which in some senses resembles a linear banding.

3.15 In particular, there appears to be a typical correlation of high traffic function with low urban function, and vice versa that is a recurring feature of the different classification systems. This association, which may be general enough, might find expression in either type of classification. In the 'two-dimensional' case, 'traffic function' and 'urban function' are nominally independent variables, but some permutations are not found in practice (eg, coincidence of maximum traffic and urban function). In the 'linear' case, urban function is equated simply with the inverse of traffic function, giving rise to a single spectrum or ranking of types from high traffic/low urban function to low traffic/high urban function.

3.16 This issue of classification structure is potentially important because it is anticipated that the 'Sustainable Arterial Street' – which combines both relatively high traffic function and relatively high urban/access function – may lie outside the conventional linear banding of types. This suggests that a two-dimensional matrix may be useful at least for expressing its position relative to existing types. However, it is also possible that the 'Sustainable Arterial Type' would thereby lie in a zone of conflict deliberately eschewed by conventional practice.

Figure 3.2. Two examples of "Two-dimensional" classification systems.

(a) Danish and Copenhagen classification of street types

		Danish national categories (7)					
Copenhagen categories (5)	motorways	Traffic roads			Local roads		
		High speed	Medium speed	Low speed	Medium speed	Low speed	Very low speed
Motorways	✍	✍					
Regional roads		✍					
Primary roads		✍	✍				
Distributor streets			✍	✍	✍		
Local streets					✍	✍	✍

Source: Response from city of Copenhagen (combining table and interpretation)

(b) German case. Source: EAHV (1993:8) (redrawn)

Category-group		Outside Built-up areas	Inside built-up areas			
		Non frontage street		Frontage street		
		Connection			Access	Stay
Level of link function		A	B	C	D	E
Major link	I	AI	BI	CI		
Interregional/regional link	II	AII	BII	CII	DII	
Link between communities	III	AIII	BIII	CIII	DIII	EIII
Link to access the area	IV	AIV	BIV	CIV	DIV	EIV
Minor connection (link)	V	AV	-	-	DV	EV
Paths	VI	AVI	-	-	-	EVI

-	typically not existing
	Problematic
	especially problematic
	not reasonable

A feature of these cases is that although they are in principle two-dimensional, in practice the shaded areas - representing non-viable permutations - constrict the available typological possibilities to what almost represents a linear banding (see text).

Assessment of Degrees of Provision

3.17 To assist with comparative characterisation of different street types, a system of thirteen functional criteria and five 'degrees of provision' was set up (Table 3.3). This system was used in the analyses reported below.

Table 3.3 Thirteen functional criteria and five 'degrees of provision' used to frame the Common Reference Classification and compare street types across countries

Functional criteria	Degrees of provision
(a) General traffic (b) Heavy goods (through movement) (c) Public transport (d) Cycling (e) Pedestrians - along (f) Pedestrians - across (g) Servicing (h) Parking (i) Access to minor streets (j) Access to buildings (k) Commercial street/market place (l) Public/social space/civic functions (m) Living area/activities	✍✍✍ Prioritisation (eg, over-riding or reversing normal priority, over and above promotion); Score = 3 ✍ promotion (eg, dedicated cycle lane); Score = 2 ✍ ✍ provision; Score = 1 ✍ no provision (ie, that function not anticipated or explicitly accommodated - eg, lack of footway); Score = 0 X prohibition (ie, positive legal and/or physical prevention) Score = -1
Derivative scores: Urban role = (k) + (l) + (m) Net sustainable mode score = (c + d + e + f) - (a + b)	

Common Reference Classification of Street Types

3.18 A 'Common Reference Classification' has been devised in order to attempt to represent all kinds of existing street type in a single classification system, for comparative purposes. This classification has 11 categories (which may be styled 6 primary and 5 intermediate categories) in a simple linear ranking from Motorway to Pedestrian Route (Table 3.4). This is sufficient at least to accommodate and reflect *existing* categories.

Table 3.4. Common Reference Classification attributes

	Suggested Name	Defining feature (rule of thumb)	Gen. Traffic	Bicycle	Ped.
0	MOTORWAY	Non-motor traffic prohibited	✍✍	X	X
0.5	MOTOR TRAFFIC ROAD	Non-motor traffic not provided for (but not prohibited)	✍	✍	✍
1	MAJOR ROAD/STREET	The all-purpose road with the highest traffic function	✍	✍	✍
1.5	MAJOR-INTERMEDIATE	Intermediate sub-divisions based on traffic function	✍	✍	✍
2	INTERMEDIATE		✍	✍	✍
2.5	MINOR-INTERMEDIATE		✍	✍	✍
3	MINOR ROAD/STREET	The all-purpose road with normal priority with lowest traffic function	✍	✍	✍
3.5	MIXED PRIORITY	The road tolerating traffic with lowest traffic function *and/or* road with pedestrian priority	✍/✍ ✍	✍	✍/ ✍✍
4	BICYCLE	Bicycles only	X	✍✍	✍
4.5	PEDESTRIAN & BICYCLE	Pedestrians and bicycles	X	✍✍	✍
5	PEDESTRIAN	Pedestrians only	X	X✍	✍✍

Key: ✍✍✍ Prioritised; ✍ promoted; ✍ provided for; ✍ not provided for; X prohibited.

3.19 With this common reference classification it is possible to more or less place every street type from each country within a common framework. The resulting catalogue of all the individual street types in the Classification Review is given in Appendix 3.

4. The Sustainable Arterial Street

Attributes of the envisioned Sustainable Arterial Street

4.1 In order for the ARTISTS classification system to address the classification of sustainable arterial streets, it was first necessary to gain an impression of the nature of the "Sustainable Arterial Street" envisioned. This was gained firstly as part of the Classification Review, in which partners from each country expressed their interpretation of the "Sustainable Arterial Street" (SAS), and secondly, by consideration of sustainable concepts in general, which was considered by means of a dedicated literature review of sustainable concepts[7].

4.2 From the Classification Review, an impression was gained of the envisioned attributes of the 'Sustainable Arterial Street' (Table 4.1)

Table 4.1 General Attributes of the 'Sustainable Arterial Street'

Street	Arterial Street	Sustainable Arterial Street (SAS)
?? Urban character ?? All-purpose transport role (all modes, and giving access to land uses and buildings) ?? Public space/ uses ?? Other associations (history, identity)	?? Multi-functional ?? Transport role (connecting different parts of the city) ?? Access (to side streets and/or land uses ?? Urban role	?? Use of sustainable modes ?? Attractive and safe place to walk and cycle ?? Market place ?? Public space (accessible to all) ?? Quality of life

4.3 The Sustainable Arterial Street incorporates attributes associated with the 'street' and the 'arterial street' and in addition the dimensions of sustainability:

- ?? mobility and accessibility, including use by 'sustainable modes', short trips (eg, local use of facilities);
- ?? local economic development;
- ?? social values ; social equity;
- ?? environmental quality; etc.

4.4 Yet, it is notable that in addition to the explicit references to dimensions of sustainability *per se*, there are also aspirations to more general qualities of urban environment:

- ?? attractive place for market, social relations and housing;
- ?? compatibility and harmony of functions, including compatible traffic loads;
- ?? compatible and/or controlled speeds;
- ?? comfortable and safe walking and cycling environment;

[7] This work on sustainable concepts is written up in full in an internal document (d'Iteren and Morelle, 2002). It has been used to inform the sustainability aspects of both this Deliverable and Deliverable D1.2.

?? equal access and use for all different users;
?? quality of life (residents and travellers)

4.5 These seem to reinforce the notions of urbanity that the 'street' traditionally embraces, and also hint at the wider urban terms and conditions under which the desired sustainable activities (including sustainable travel and sustainable local economy) might be realised. In other words, these additional items are helping to express the conditions under which people might naturally choose to walk and use urban public space, use local facilities, and live in urban localities in the first place (as opposed to commuting from suburban or exurban locations).

4.6 In order to relate the envisioned Sustainable Arterial Street in relation to existing street types, a more systematic assessment was undertaken, whereby the profile of an 'archetypal' Sustainable Arterial Street was created the using the thirteen functional criteria introduced previously (Table 4.2). (This is discussed more fully in Marshall, 2002a).

Table 4.2. Profile of the archetypal 'Sustainable Arterial Street'
This was derived from median values (on scale from 'Prohibited' to 'Promoted') across responses of partners participating in the Classification Review

Functional criterion	Relative degree of provision
1. General traffic	Provided for
2. Heavy goods (through movement)	Not explicitly provided for
3. Public transport	Promoted
4. Cycling	Promoted
5. Pedestrians - along	Promoted
6. Pedestrians - across	Promoted
7. Servicing	Provided for
8. Parking	Provided for
9. Access to minor streets	Provided for
10. Access to buildings	Provided for
11. Commercial street/market place	Promoted
12. Public/social space/civic functions	Promoted
13. Living area/activities	Promoted

4.7 In a tentative selection, ten existing street types were seen to broadly reflect the profile of the envisioned Sustainable Arterial Street, and three in particular were found to resemble the Sustainable Arterial Street archetype quite closely. However, even these near matches, on close inspection, were not necessarily catering for the particular combination of strong arterial role as well as sustainable urban role. Overall, there was no clearly identified place for the "Sustainable Arterial Street" within existing classifications. This points to the relevance of pursuing new classification possibilities in ARTISTS.

Relationships between the Sustainable Arterial Street and conventional types

4.8 In order to systematically relate the position of the envisioned Sustainable Arterial Street relative to existing types of street, relationships between *position in hierarchy*, *general traffic*, *urban role* and *sustainable modes* were been plotted for every street type in the Classification Review - including all the conventional types plus a set of Sustainable Arterial Street types envisioned.

4.9 This exercise generated a graphical impression of the scatter of types, and the position of 'sustainable arterial street' types within them (Figure 4.1).

4.10 From Figure 4.1 it can be seen that – in general – street types occupying positions higher in the hierarchy are positively associated with high general traffic function, and low urban role and low sustainable mode score. Conversely, there is a positive association between urban role and sustainable modes. This shows the traffic-oriented tendency of existing classifications, and the lack of representation of street types with both high traffic function and high sustainability or urban function.

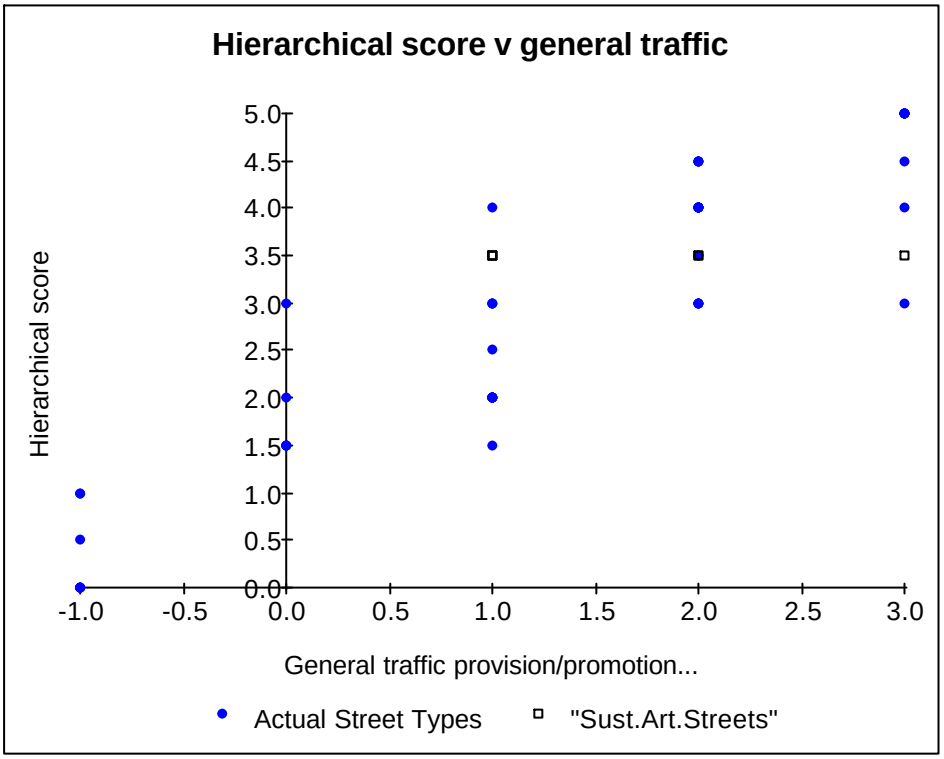
4.11 The Sustainable Arterial Street (SAS) types in some cases lie at the edge of the scatter of existing types – this implies both proximity to existing types, while pointing to the possibility for new departures.

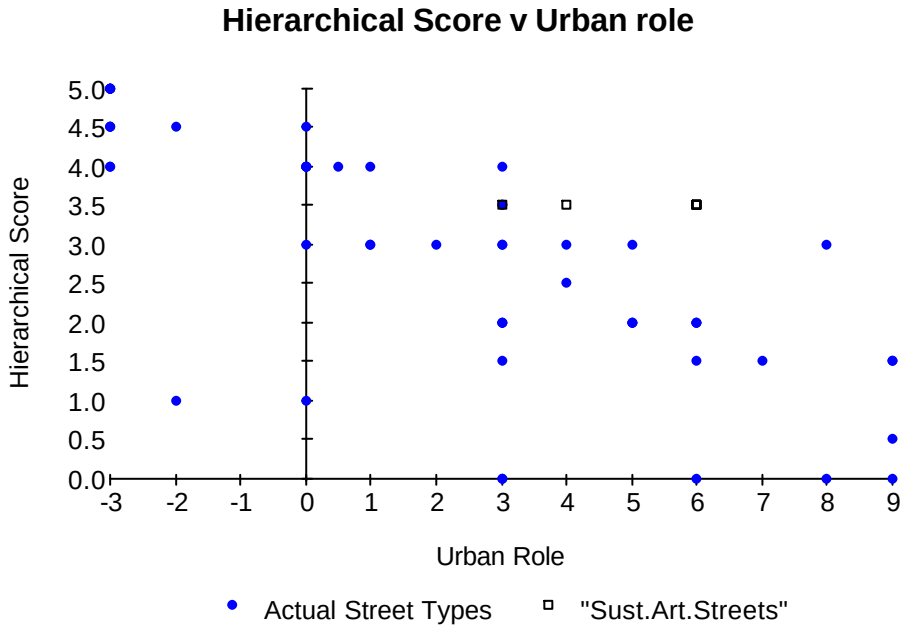
4.12 The first plot shows the *arterial* nature of the SAS – the SAS types either have a positive provision, promotion or prioritisation for general traffic.

4.13 The second plot shows the *urban* nature of the SAS – the SAS types tend to have a mid range value of urban role – greater than for conventional traffic distributors, but less than for dedicated access streets or *woonerven*. In one of the SAS cases (the most urban) the type is close to the edge of the scatter of existing types, suggesting it is heading towards the territory conventionally vacated due to conflicts between traffic and urban roles.

4.14 The third plot shows the sustainable nature of the SAS - it has an above average 'net sustainable mode score'. The Sustainable Arterial Streets are at the edge of the scatter, signifying that the adoption or promotion of this type could mean pushing out the envelope, ie, creating types with characteristics not currently existing in official hierarchies.

Figure 4.1. Relationships between street types.



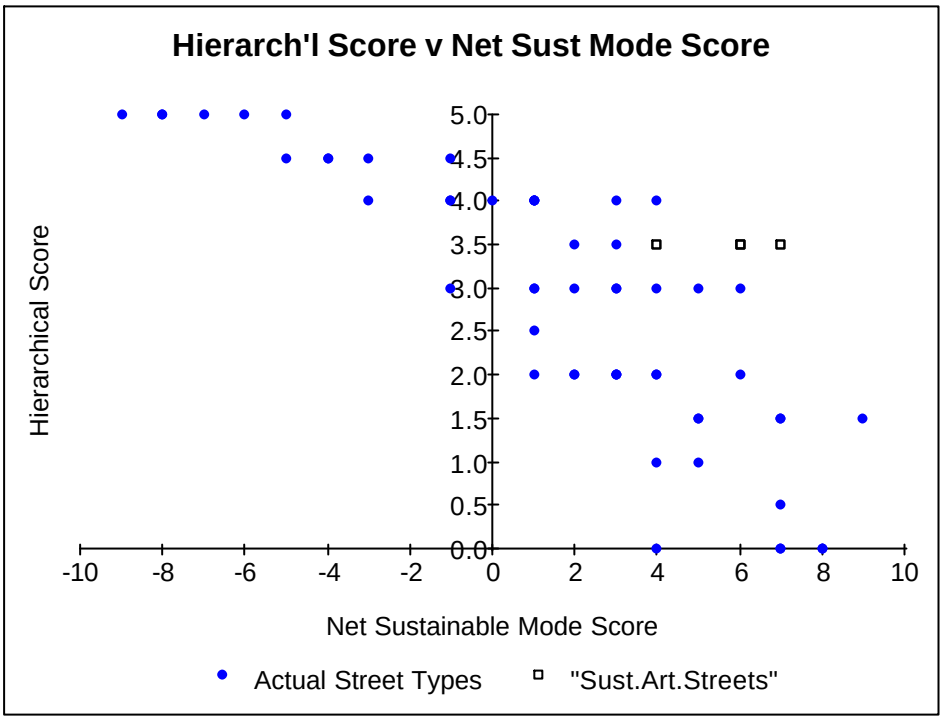


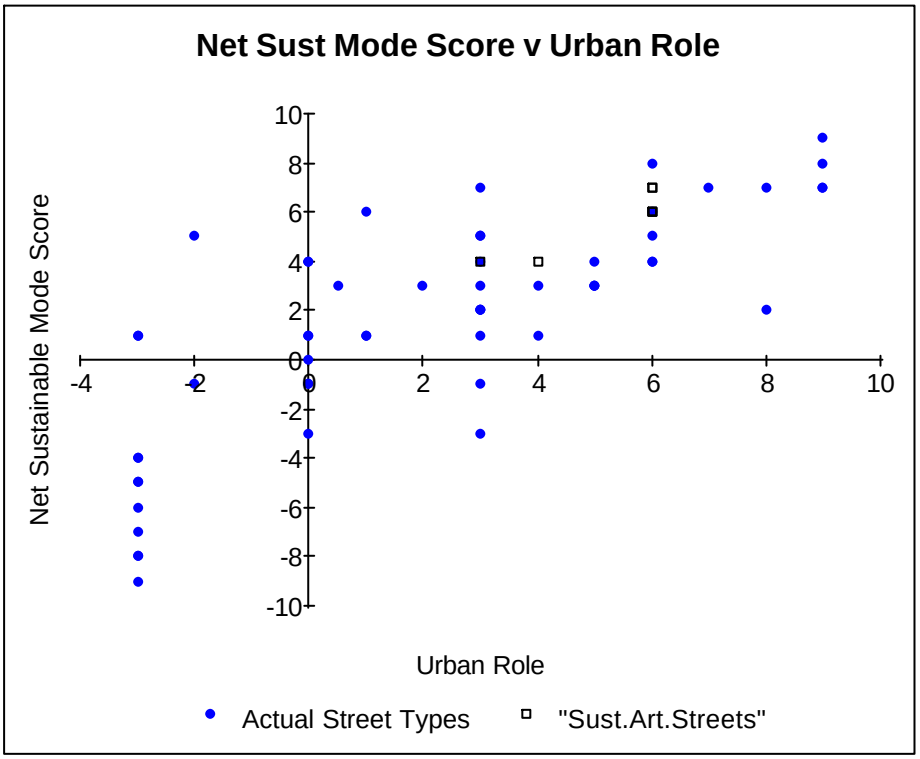
Notes

?? Solid dots represent the positions of actual street types found in practice (eg, COLLECTOR STREET, Sweden)

?? Hollow boxes represent the positions of different expressions of "Sustainable Arterial Streets" as suggested by ARTISTS partners in the Classification Review exercise.

(explanation continued over)





Notes (continued from previous page)

?? Hierarchical Score = position in the hierarchy (5 = 'top', 0 = 'bottom')

?? General traffic = degree of provision (-1 = Prohibition to 3 = Prioritisation)

?? Urban role = combined score for degree of provision (-1 to 3) for commercial, social/civic and living functions

?? Net Sustainable Mode Score = combined score for provision (-1 to 3) for "more sustainable modes" minus "less sustainable modes" (see Table 3)

4.15 In the fourth chart, the hypothetical Sustainable Arterial Streets do not lie at the edge, but 'within the pack' of existing street types. Note that the 'most sustainable most urban' street types will tend not to be arterial streets, ie, they will tend to be intermediate or minor street types which clearly prioritise urban role and sustainable modes over general traffic (rather than attempting to balance these).

4.16 Figure 4.1 also graphically demonstrates how the distribution of types could be interpreted either as a 2-D scatter or a linear banding. This reflects the earlier observation that a theoretical typology based on either linear ranking or a 2-D matrix could be used to approximate to the 'underlying reality' of actual street types.

Discussion

4.17 The Classification Review has shown a diversity of possibilities for street classification (section 3). However, the conventional systems actually practised in the different countries could, for the most part, be simply termed *road* classifications. These classification systems still largely reflect their original development as optimising road layout in idealised 'hierarchies' of 'distributor roads', associated with low density open-plan layouts of segregated roads largely devoid of buses or significant pedestrian activity. *Once, that was perhaps the ideal model for urban development, but whatever its merits, it is almost diametrically opposite the vision of sustainable urban streets which this project is addressing.*

4.18 There is a need to take forward the variety of theoretically possible classification themes and structures, while at the same time considering the reasons why some themes are used in practice rather than others.

4.19 For example, all of the existing official classifications (which tend to be primarily distinguished according to just six systematically applied themes) could also have had their individual street types graded in terms of other criteria (eg, frontage form or pedestrian presence). Yet, in general, these street types were not *defined* by these urban role criteria, but by traffic or network related roles. Therefore, the question arises as to the methodological and 'structural' reasons why some types of classification are preferred over others.

4.20 As well as the types of theme (eg, traffic volume, urban role) that might be used to classify streets, there must be consideration given to the structure of any such classification. It is necessary to develop possible ways of constructing a classification system for sustainable arterial streets, by combining components from the 'long list' of 39 themes into a classification structure, in order to create a coherent, meaningful and workable classification system for the ARTISTS project.

5. The Classification Challenge

5.1 This section provides a bridge between the earlier sections relating mainly to existing classification practice and the generation of a new street classification system for ARTISTS.

5.2 The challenge is to represent the diversity of street types and street functions in a single classification system for representing and addressing Sustainable Arterial Streets.

5.3 The main angles to cover are:

- The challenges inherent in any classification system (section 2)
- The strong points of existing (roads-oriented) systems (section 3)
- The need to take on board more diverse roles of sustainable streets (section 4), and explicitly make use of sustainability concepts and indicators devised as part of Task 1.2, reported in Deliverable D1.2.
- Tying these together into a single coherent, meaningful, workable classification system.

General Considerations

5.4 In general, any classification system would consider:

- Whether to employ a single classification theme, or a series of classification themes addressing different purposes;
- Whether to employ a simple listing of classification themes, or a more complex structuring of themes;
- Whether to attempt systematic classification of all theoretically possible types, or to concentrate on the main types (or most frequently found permutations);
- Whether to employ categories defined by indicators (qualitative or quantitative), or permit broader interpretations.

5.5 From the scope of the ARTISTS project, it is immediately possible to suggest that specific consideration is given to:

- A combination of traffic-related and urban-related attributes;
- A combination of form-related, function-related and use-related attributes;
- Whatever complexity or diversity is intended in principle, the system must be clear and workable in practice.

Lessons from Existing Classification Systems

5.6 The strong points from the existing classifications, which we may learn from or at least take note of, are now discussed.

5.7 Each classification has a relatively small, manageable number of types. This ‘strength’ is of course also a weakness in the sense that it cannot

adequately cater for all types, but there is some virtue in simplicity which should at least be recorded.

5.8 The existing classification systems use classification themes which can be used systematically to distinguish streets across the whole spectrum. For example, Traffic Speed is a sufficiently 'variable' quantity that it can meaningfully differentiate both at the 'top' end of the hierarchy and the 'bottom' end. In contrast, a theme such as 'urban character' may be difficult to consistently specify across cases, while a theme such as 'neighbourliness' (although quantifiable) is really meaningful only for residential streets.

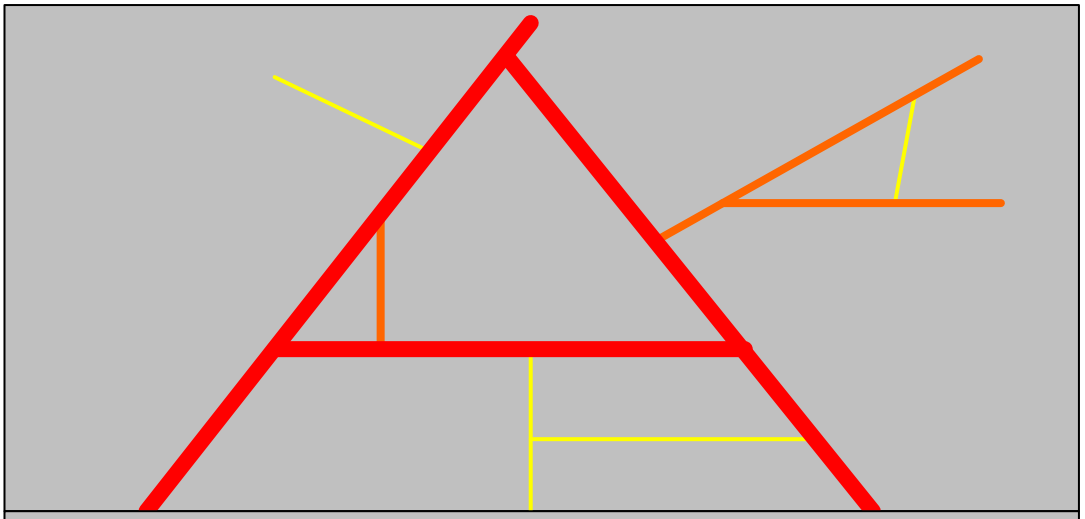
5.9 The existing classification systems also, conversely, use themes that are not *too* variable over space and time. Put another way, they tend to use criteria based on *designation* rather than *observation*. For example, the Traffic Speed criterion really refers to designated speed or design speed, which would apply indefinitely to a substantial length of road, rather than measured 'spot speeds' which would fluctuate with every passing vehicle. Similarly, Strategic Role refers to the status of the route in linking urban destinations, which again will tend to apply to substantial lengths of road indefinitely, as opposed to Traffic Volume which will vary over relatively short lengths of street and vary by time of day and year.

5.10 This relates to a further point, also one of simplicity, which is that for appropriate themes streets may be relatively easily allocated categories in practice, almost as a desk exercise. The strategic network and local networks may be more or less picked out on a map by eye, as opposed to requiring any dedicated survey work. (This presupposes mapping of the significant qualities is available in the first place).

5.11 A final point is that the types of road specified in existing classification systems tend to be arranged to form a definite spatial logic. This is referred to as *hierarchical contiguity*. It means that all the routes 'highest' in the hierarchy form a single contiguous network, and indeed all routes down to any given level in the hierarchy form a single contiguous network (Figure 5.1; see Appendix 4 for fuller description and discussion of significance).

5.12 This property of hierarchical contiguity may be considered 'obvious', once stated, while at the same time being 'invisible' in the sense of it almost never being explicitly referred to, either as a phenomenon or as a strategy for structuring a classification system. Yet it is arguably an important underlying structuring device that is used intuitively in network design/road classification - for example, it applies to (or can be made to apply to) all of the first six ('systematically applied') themes in Table 3.1a. Awareness of this property of hierarchical contiguity will be useful when it comes to proposing the structure of the classification systems.

Figure 5.1 Illustration demonstrating 'hierarchical contiguity'



The above network has a specific structural property that may be referred to as *hierarchical contiguity*. This means that the set of all roads *down* to any given level in the hierarchy form a single contiguous network. That is:

- the highest tier in the hierarchy (A class roads) forms a single contiguous network;
- the set of all (A + B) roads forms a single contiguous network
- the set of all (A + B + C) roads forms a single contiguous network
- however, the set of all B roads, or the set of all C roads *do not* necessarily form a single contiguous network.

Sustainability Concepts and Indicators

5.13 A wide range of sustainability concepts and indicators has been considered as part of the development of Assessment Tools and the wider Assessment Framework being developed elsewhere within Workpackage 1. These directly address a wide variety of themes relating to sustainability, social and economic considerations, urban vitality and viability, quality of life, and so on, all of which are crucial to the role of streets over and above and beyond the basic traffic function which has been mainly concentrated in existing practice and to a large extent in this Deliverable so far.

5.14 Deliverable D1.2 contributes at least three important inputs to the classification exercise of this Deliverable. Firstly, it consciously sets out to look at streets from the *broadest urban and sustainability perspectives*. In this sense it arrives at a set of themes which is not constrained by or immediately derived from existing classifications of road systems. The proposed ARTISTS classification system should therefore take account of these alternative perspectives ('where they are coming from' and 'what they are getting at').

5.15 Secondly, D1.2 sets out a conceptual framework considering streets in terms of three thematic elements: their *form*, *function* and *use*. This is derived from the overall specification of the ARTISTS project. The proposed classification should reflect or address these dimensions.

5.16 Thirdly, D1.2 sets out a detailed series of *descriptors*, which themselves could be regarded as potential criteria for the classification of streets. Indeed, many of these provide ready-made descriptions of attributes which can plug in to the classification system being devised here.

5.17 A significant distinction between the work presented in Deliverable D1.2 and in this Deliverable is the 'destination' or purpose to which the thematic distinctions and descriptors are being put to use. Ultimately, Deliverable D1.2 is directed towards the task of performance assessment, whereas the task of this Deliverable is the creation of a classification system. Assessment and classification imply different *structures* for their descriptors (as well as possibly different descriptors).

5.18 In essence, the purpose of classification is to group together like items into classes and distinguish between different classes. It is therefore strongly concerned with bases for distinction and difference, rather than necessarily with absolute values. Assessment, in contrast, is perhaps more concerned with absolute values for a given context. For example, classification would be concerned whether a particular road is a 'busy' or a 'quiet' road in order to determine how it should be treated relative to other 'busy' or 'quiet' roads. Assessment would be concerned more with *how* busy a particular stretch of road is, of itself[8].

5.19 Not all descriptors collected for the purposes of assessment are necessarily appropriate for use in classification. For example, descriptors relating to absolutely aspired-to properties (such as safety, and possibly sustainability) are useful for assessing the performance of streets. However, they are less appropriate for classifying (distinguishing) types, because in principle all streets aim to possess those qualities (safety, to some extent sustainability).

5.20 The consequence of this is that while assessment may take advantage of as much data as is possible to give a full picture, classification is more like caricature, concerned with generating recognisable types. In the case of street classification, this implies a *manageably finite selection* of types for the purposes of developing guidelines for their design and management.

5.21 In classification, then, there is a balance to be struck between having too few broad categories or too many narrow ones. In the first case, taken to the extreme, we have a single category, into which all actual streets fit. Clearly, this fails to differentiate and is not much use as a classification system. At the other extreme, we could have such a

[8] The task of classification also involves an assessment component, since the specification of a 'high flow' street in principle requires the assessment of flow.

multitude of finely defined categories, each of which either contains a unique actual case (eg, a 'Marylebone Road') or is an empty cell. This is not much use as a classification either, and it does not allow any generalisations to be made across cases.

5.22 In conclusion, it should be said that any proposed new classification system must address the scope and themes of Del D1.2, and where appropriate make use of the same indicators or descriptors, but the proposed classification must work in its own right as a classification, and as such should find its own optimal structure and content, taking on board considerations of classification systems in general and lessons learned from existing road/street classifications in particular.

Conclusions and Ways Forward

5.23 The proposed classification has to be detailed enough to reflect the complex diversity of features and activities of arterial streets, yet it must be simple enough that it is comprehensible and workable in practice.

5.24 The workability in practice includes the simplicity of the system, the ability of the classification themes to adequately differentiate types, and the ease with which the different attributes or descriptors may be specified and measured.

5.25 For example, it is necessary to consider the relative variability of the attributes of the different themes. Some attributes (eg, strategic role of a street) are relatively impermanent, while flows of people and vehicles fluctuate significantly over space and time.

5.26 In terms of content, the proposed classification should combine (or contrast) the movement function of streets with the urban use function of streets (in preference to one excluding or dominating the other, or assuming that one is the inverse of the other).

5.27 This is salient because one of the uses of classification is to express *trade-offs* between different competing uses or roles. If it is decided to prioritise a given street for through traffic, or to prioritise its urban role as a social space or commercial street, then a street could be classified as a 'through traffic street' or a 'commercial street'. Classification can assist in maintaining consistent decisions towards those priorities.

5.28 Another use of classification is to recognise explicitly a variety of *viable permutations* of form, use and functions, and/or viable permutations of potentially conflicting functions or uses. For example, if a certain amount of traffic is compatible with a certain amount of shopping or play activity, then we can set out or 'fix' that combination as a specific type which can be designed for through provision of a particular form.

6. The Proposed Classification System

6.1 The classification system proposed here is a 'first theoretical approach' that is informed both by the consideration of classification systems in general in this Deliverable, and by considerations developed (to some extent in parallel and to some extent iteratively) in Deliverable D1.2.

6.2 The proposed classification system is set out in the following manner:

1. Baseline principles are itemised at the outset.
2. A set of 'strategies' is then outlined, which set out the rationale or methodological devices used in construction of the classification.
3. The classification approach is then set out in a sequence of four components.
4. The 'final' classification system is then summarised as a whole.

Baseline Principles

6.3 The three baseline principles of content are:

(i) The classification system should take account of function, form and uses/users.

(ii) The classification system should take account of the 'urban role' of streets separately from the movement role. This suggests two theoretically independent components or dimensions.

(iii) The movement role should not be (solely) based on traffic function, but should be weighted towards more sustainable modes, and/or be based on flows of people (including flows of people across as well as along streets).

Strategies

6.4 The strategies for the classification structuring are:

(i) The classification system is proposed to be structured in such a way that recognisable types are identifiable. This implies a discrete typology (eg, named types, classes or categories), rather than a continuum of individually quantified attributes or permutations.

(ii) Where possible a graphical and/or tabular approach is preferred, where this can explicitly show relative positions of different street types in relation to each other. A graphical approach would have the benefit of being based on detailed quantitative data, while being able to give a direct visual impression of types in relation to each other.

(iii) The classification system is proposed to relate in some recognisable way to existing road classification systems, to assist eventual application (comprehension and adoption).

(iv) The classification system could usefully be devised so that it may be used at a variety of different *levels of resolution* – in other words, so that one could apply a 'simple version' or a 'fine tuned version' where circumstances demand. In the classification system devised here, the idea is that there will be the potential for simple versions and a more complex/detailed versions. This means that it should at any point be understandable and applicable as a simple system, but should simultaneously also be able to accommodate further elaboration. In effect, the classification at its 'lowest resolution' can act like a most basic first approximation of the underlying reality, where simplicity and speed of delivery are the priorities, while this low resolution can at any time be elaborated into a higher resolution when circumstances permit.

The Proposed Classification Approach

I. Streets as Arteries and Locales

6.5 The proposed classification firstly recognises that a street contains at least two spatially distinct aspects or roles: that of an *artery* and that of a *locale*.

6.6 The first aspect relates to the street's role as a through route or artery. The **arterial role** here implies a combination of:

- movement (circulation, traffic flow, link role etc.) and
- strategic function (connection beyond immediate locality), city-wide or network-wide significance.

6.7 The second aspect relates to the street's role as an urban space or place, incorporating the use of space for non-through (local) activity, its local urban role (neighbourhood role) and its role as a destination. This aspect will be referred to as **locale role**. The term 'locale' signifies the immediate use of the particular locality[9].

6.8 The distinction between arterial and locale role corresponds to some extent with various other contrasting pairs encountered in classification systems (Table 6.1). In fact, these can be seen as representing slightly different axes in the potential 'field of axes' (section 2, Figure 2.1).

[9] A 'locale user' could include, for example, a shopper who had travelled from outside the city to access a particular shop. Such a user is not 'local' in the sense their trip is not local, but they are users of the locale as a destination, as opposed to being through users.

Table 6.1 Different aspects of the arterial v locale distinction

Arterial	Locale
Movement	Access
Circulation	Occupation
Passage	Place
Street as Link	Street as Destination
Transport-related (Transport planning, traffic engineering, etc.)	Urban-related (Urban planning, urban design, etc.)
Flow (Vehicles/People)	People Activity/Land Use
'Through' Users	'Locale' Users

6.9 The term *arterial* is proposed for adoption since it alludes to both the concept of movement and of strategic or 'through' use. That is, it relates to users/patterns of behaviour relating to the functioning of the city as a whole. (Arterial function is clearly necessary, since if all 'local' sections of street were given over for local use only, the city could not function 'as a whole'.)

6.10 The term *locale* is proposed for adoption since it most precisely embodies the sense that use is being made of a particular place (as opposed to 'link') for an immediate (non-through) activity.

6.11 The distinction between *arterial* and *locale* is considered fundamental because it represents one of the major conflicts or trade-offs between uses that is one of the main reasons for functional classification in the first place[10]. The arterial and locale roles are to some extent complementary and indeed synergistic (the position of a locale on a strategic route can generate local activity). However, due to the physical constraint on street space available, in practice there will often be trade-offs between the allocation of space to one function or the other.

6.12 Additionally, this is considered a viable and useful distinction in practice since it is a theme used explicitly or implicitly in existing road/street classifications.[11]

6.13 The distinction between the arterial and the locale is also significant in terms of the different spatial and structural connotations of their layout. Put simply, arterial role relates to streets as linear links, connected in a particular continuous and connective manner within a wider network, whereas locale role relates to streets as discrete segments of urban public space (Figure 6.1).

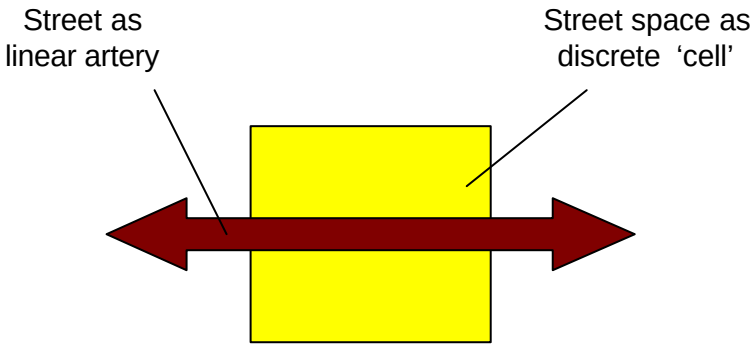
[10] It has been pointed out that, in a sense, any local resident would always prefer their street to be classified as a 'neighbourhood space' rather than an arterial street - while everyone else would prefer it to be classified as an 'arterial' to expedite their own passage elsewhere in the city (from discussion at project meeting).

[11] The distinction and conflict between through passage and immediate occupancy of space is also recognised historically. Urban historian Spiro Kostof (1992) refers to the conflict that would take place in the cramped streets of medieval cities where those wishing to extend their premises out into the precious right of way of street space would risk clogging the artery.

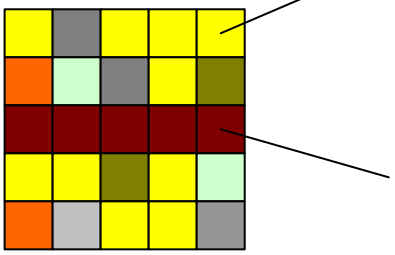
6.14 This spatial and structural aspect can be illustrated by considering arterial role in terms of linear **arteries** and locale role in terms of discrete **'cells'** (Figure 6.1).

Figure 6.1. The artery and the cell

(a) Spatial aspect



(b) Structural aspect



6.15 The word 'cell' here is chosen deliberately to characterise the street space explicitly as part of the local user environment (or 'habitat') – echoing the use of 'environmental cells' in urban planning literature. This also has resonance with the traditional planning concept of the 'neighbourhood as cell'. (There is also conscious contrast, since in the original conceptions of environmental or neighbourhood cells, the cells are *divided* or bounded by arterial roads, whereas here the cells *are* the street space – where the street space embodies the nature of public space and neighbourhood. The cell is in a sense turned inside out – the neighbourhood 'resides' or is located in the streets)[12].

[12] A final connotation of the use of the cell is that of *cellular automata*, a computational device formed by an array of discrete cells (cf. pixels) where the state of any particular cell will in some way be influenced by the state of adjoining cells. The message here is simply that each 'cell' must take account of what is happening in the adjoining cells. Where there is a linear array of these cells of streetspace, they function as a single linear 'artery', whose functioning is related to the functioning of the whole city/network.

6.16 There will be circulation *within* a particular 'cell' and circulation *through* the cell. The potential conflict between through movement and locale use can therefore be seen at two levels.

6.17 Firstly, at the local internal level, it is a localised conflict between specific flows competing for limited street space (Figure 6.2). This is seen, for example, in deciding between allocating a strip of street space for traffic as opposed to allocating it for seating and flowerbeds, or deciding how to allocate the time allowed for use of the space in a junction between through traffic or crossing pedestrians.

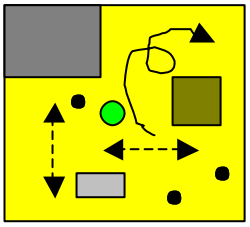


Figure 6.2. Interior of a 'cell' of streetspace.
This gives a visual impression of the character, activity and use of space. This includes pedestrian activity (and inactivity), use of buildings, street forms, movement along and across the street space. This is potentially a complex cocktail of uses. There needs to be local assessment of *internal compatibility* of function, form and use.

6.18 Secondly, at the strategic level, we see a conflict between the use of a street (as a linear sequence of spaces) for through movement – as an artery of a city – as opposed to the use of the same street as a local space or neighbourhood place.

6.19 The strategic level issue impinges on the local issue because, whatever locally is decided as the balance between through flow versus other uses within a particular 'cell', that decision must also take account of the decisions in the neighbouring cells regarding the through flow (Figure 6.3).

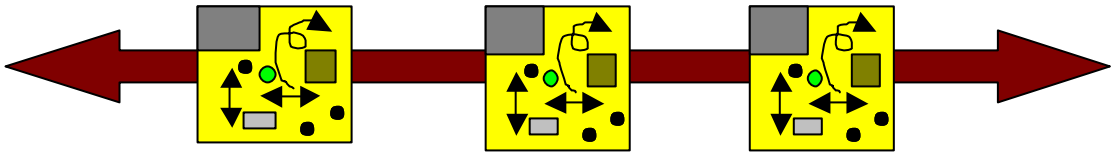


Figure 6.3. The street as a continuous artery.
Here the required compatibility is between adjacent 'cells' or sections of streetspace, aiming for linear consistency of function.

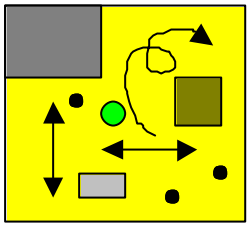
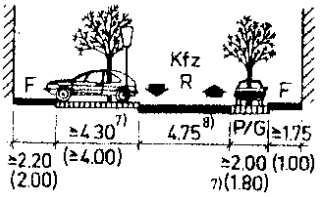
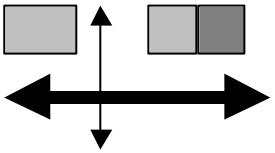
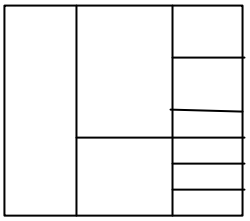
6.20 In the classification system proposed here, then, the street as artery and street as locale (or cell) will be dealt with separately, and the results overlain, as will be demonstrated in the following sections.

II. Locale classification

6.20 The classification of the street as locale is based on the set of descriptors developed in the general Assessment Framework (Deliverable D1.2). This means that the set of descriptors of function,

form and use appearing in the Review Frame may be applied to discrete sections of streetspace (or 'cells') (Table 6.2). These can be thought of in principle as planar spaces (though in practice they may be elongated to take on a somewhat linear aspect) and may be distinguished by urban character.

Table 6.2. Elements of classification of the street as a locale

Street as locale Classified in terms of forms and use(r)s 	Quantitative descriptors of form, eg height, width 	Qualitative descriptors of form, eg, street character 
	Descriptors of flows and land uses, etc. 	Descriptors of users 

6.22 Any particular locale can be described and potentially classified in terms of the set of indicators presented in the Review Frame of Deliverable D1.2. These descriptors tend to relate to the form and use of the space - things that may be directly observed - for example, building height or pedestrian activity.

6.23 It is proposed to further develop the employment of these descriptors by arranging these in a particular kind of classification, based on *users* - ie, people. This is consciously part of the people-oriented approach referred to in Deliverable D1.2. A people-oriented classification can address (and express) both 'through flow' and 'locale use' aspects of the use of streetspace. In other words, both through movement and locale uses can be classified or expressed in terms of people as users (ie, in terms of people flow along and across the street, and other users of street space and users of frontages). In this way, a 'shopping street' becomes a street used by shoppers, or defined in terms of people engaged in shopping. People become the 'common currency' of the classification, allowing different functions or uses to be weighed in terms of people (as opposed to, for example, vehicles, time or money).

6.24 Indeed, it is possible to make any or all classification divisions and subdivisions on the basis of different users (see graphic below, more detail in Appendix 5).

All Users of the Street	Locale Users	Users of buildings (who may also use street space and have non-local origin/ destination)	Residential Users	Residents
				Visitors to residences
			Shop users	Shop owners
				Shop employees
				Shoppers
			Office users	Office users
		Users of street space (who do not access buildings, and who may have non-local origin/ destination)	Users of side space	Social activities
				Other activities, sightseeing, etc.
				Play
				Pedestrians (passing but engaged with street activity)
			Other circulating pedestrians	Interchangers
				Pedestrians crossing
	Users passing through only	Users of carriageway and footway only for through movement (both origin a and destination outside street segment)	Users of footway	Pedestrians (disengaged from other street activity)
			Users of carriageway	Car drivers and passengers
				Bus passengers, etc.

Table 6.3. A first theoretical classification of all users of the street as locale. This incorporates both 'locale users' and through users. See also Appendix 5.

6.25 This structure allows any number of successive subdivisions to be created, thus allowing any degree of resolution to be expressed. This provides a 'bridge' between simpler typologies based on polarisation (through traffic v access) towards the left-hand side of the diagram (cf, existing classifications) and detailed subdivisions of activity descriptors on the right (cf D1.2) (Figure 6.5).

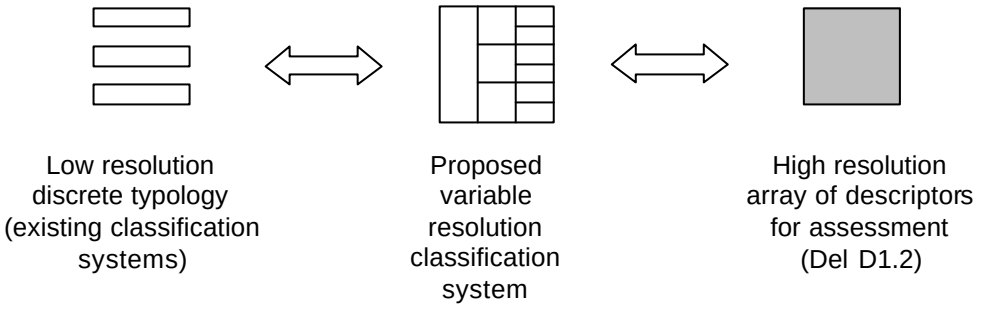


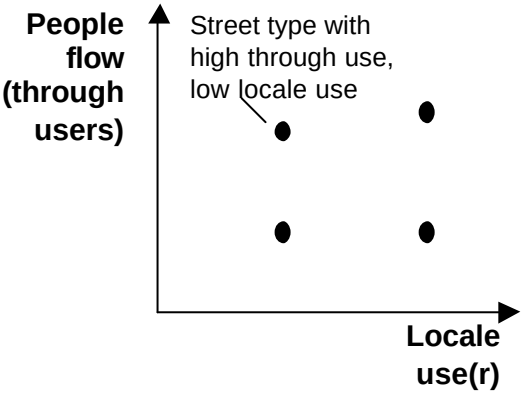
Figure 6.5. Proposed classification as bridge

6.26 At this stage, we have generated the potential to finely define all functions or uses according to the types of user, defined to any degree of resolution. This means that any set of users considered too aggregated (eg, shoppers) can be disaggregated to any desired level (eg, shoppers; shoppers with shopping trolleys, etc), while maintaining

the same overall structure used for the lower resolution version of the classification.

6.27 The structure, in its array of subdivisions, allows contrasting pairs or sets to be identified at any level (eg, users of buildings may be divided into occupiers versus visitors, etc.).

6.28 At the first level of subdivision of types of user, we can generate the most basic distinction between 'through user' and 'locale user' which echoes the distinction between arterial and locale in the first place. Indeed, this division (at the simplest level) can be used to generate a simple two-dimensional *array* or *matrix* of types which may be used to classify streets as locales.



(a) array of types

Street type with high through use(r), low locale use(r)	Street type with high through use(r), high locale use(r)
Street type with low through use(r), low locale use(r)	Street type with low through use(r), high locale use(r)

(b) matrix of types

Figure 6.6 Simple two-dimensional classification by user

6.29 The classification by user can be used to help decide priorities for design of a particular street space.

6.30 When it comes to the design of the street space in the context of the overall network, it will also be necessary to take account of the arterial function of the street[13].

[13] The through users, who feature in the user classification (as just one kind of circulating people), are part of a wider system. In a sense the priority accorded to the through users of street space (relative to other users within the locale) will be a function or weighting according to the strategic nature of the artery in its network context.

III. Arterial classification

6.31 As we saw in earlier sections of this Deliverable, conventional classifications tend to be functional rather than being based on form (eg, number of lanes) or use (eg, number of vehicles per day). This relates to the fact that a street will tend to have a certain role in the overall urban street network that will remain constant along its length, irrespective of variations in form or use along it. It means that a street will often be classified as having the same function along its length. The function tends to equate to a kind of arterial function, based on a spectrum ranking from high to low arterial function for traffic. This has the advantage that the resulting network has a recognisable structural logic (referred to as hierarchical contiguity).

6.32 It is considered appropriate to retain the use of arterial function to classify streets as arteries. That is, in the proposed classification system, we recognise the distinct role of streets as locales and streets as arteries, and in the latter case we can classify according to arterial function.

6.33 However, with the intention of recognising and promoting the Sustainable Arterial Street, we can choose to express this arterial function not through recognition of strategic routes for general vehicular traffic, but through strategic routes for public transport.

6.34 In principle, in terms of our overall purposes, this seems appropriate since public transport is weighted towards sustainable travel (since in general public transport modes are 'more sustainable' than other forms of motorised traffic) and travel on the more arterial routes (since public transport tends to service the main streets and strategic routes in a city).

6.35 Methodologically, this use of public transport is useful in three ways. Firstly, it is a simple single indicator to represent arterial function (and no more simplistic than using, say, Strategic Role or Trip Length to represent arterial function). Using a single indicator, if sufficiently representative, can cut down the data collection burden.

6.36 Secondly, because public transport typically involves the use of a smaller number of higher occupancy vehicles than traffic in general, it is more compatible with locale functions, in terms of use of space than general vehicular traffic. In other words, by concentrating a given flow of people into a smaller number of buses and trams, this frees up space (or time) for other street road users and other street uses – narrower carriageways can leave more space for greenery, seating areas, etc, and shorter 'green time' at signals allows more time for pedestrians to cross the street.

6.37 Significantly, this issue of compatibility means that it is possible to have street types that simultaneously have a combination of high arterial (public transport) function in conjunction with high locale function. This expands the possible number of viable permutations in a two-dimensional matrix of types (Table 6.4). In other words, our classification can recognise 'more' (actual types) with 'less' (less complexity or data).

6.38 Thirdly, by using a *designated scale of public transport significance*, rather than outright public transport flow variables, this not only further cuts down data requirements, but allows the resulting network of routes of different levels to be organised according to the principle of hierarchical contiguity. In this way, we shall be using arterial function in the same way that it is used in existing 'functional classifications' of urban roads and streets.

Table 6.4. Example of possible construction of a typology based on arterial (public transport) function

Generic Level	Actual Designation	Possible basis for designation
I. Highest arterial (public transport) function	MAJOR PUBLIC TRANSPORT ARTERY	Route with high flows of passengers and/or number of services and/or number of modes (eg, bus + tram + trolley)
II.	PUBLIC TRANSPORT ARTERY	Route with average flows or number of services, or used by (only) one mode (eg, bus)
III.	MINOR PUBLIC TRANSPORT ARTERY	Route with low flows or intermittent services or minor modes (eg, minibus only)
IV. Lowest arterial (public transport) function	NOT A PUBLIC TRANSPORT ARTERY	Route with no regularly scheduled public transport.

6.39 Structurally, this classification takes the form of a 'linear ranking' (corresponding to the structure of existing systems which classify on the basis of Strategic Role, Trip Length, Circulation v Access, and so on). Spatially speaking, arterial function lends itself to being treated in a *hierarchically contiguous* fashion.

6.40 This means that the proposed system should be as simple to understand and use as existing systems. The structure is the same; only the theme differs (and this varies in any case between countries).

6.41 The result of applying this system of classification is that streets (as arteries) are recognised explicitly and primarily in their role as public transport corridors. This should serve to support the prioritisation of public transport where appropriate, highlighting the need for crucial linkages of continuity of capacity or level of service - as being fundamental to the efficiency of the system - rather than these being afterthoughts fitted in after the road system has been optimised for general traffic flow.

IV. Combined classification

6.42 A combined classification can finally be obtained by overlaying the two roles of the street – the arterial role and the locale role. The result is a two-dimensional array or matrix of types (Figure 6.7).

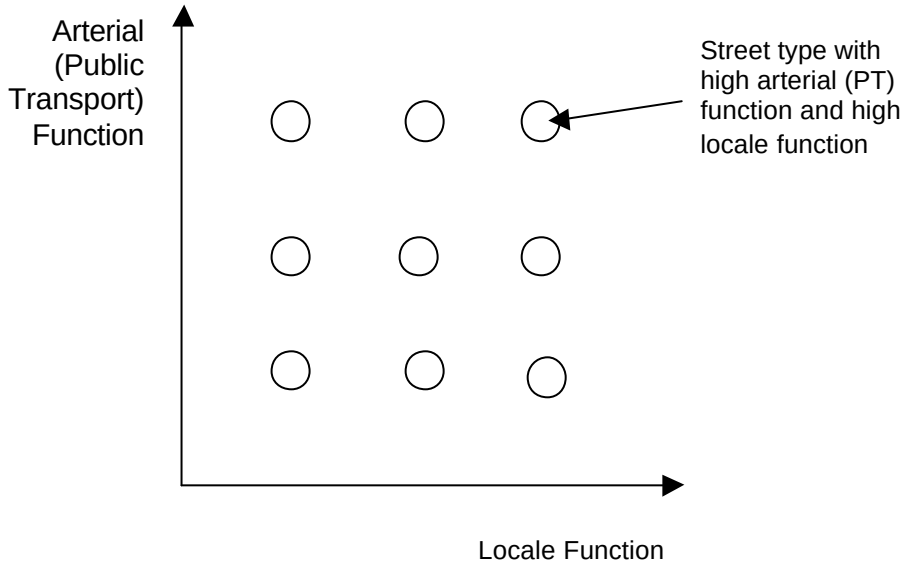


Figure 6.7. Classification combining arterial and locale functions

6.43 Hence we have established a two-dimensional classification that embodies two more or less independent variables. This means that any permutation should be viable as an actual street type. In particular, it means that we can have a street type that combines high arterial (PT) function with high locale function, because (unlike high *traffic* function and locale function) these are not necessarily incompatible. The combination of high or relatively high values of both arterial and locale function could be regarded in principle as the 'target area' for the "Sustainable Arterial Street".

6.44 In this classification, we could recognise all street types from about halfway up as 'arterial' street types.

6.45 In this classification, we can further propose that streets should be connected such that they form a hierarchically contiguous network. In other words, all routes with a designated 'high arterial (PT) function'

should form a single contiguous network. This is intended to boost the high-level and strategic connectivity - and hence efficiency and performance - of the public transport system.

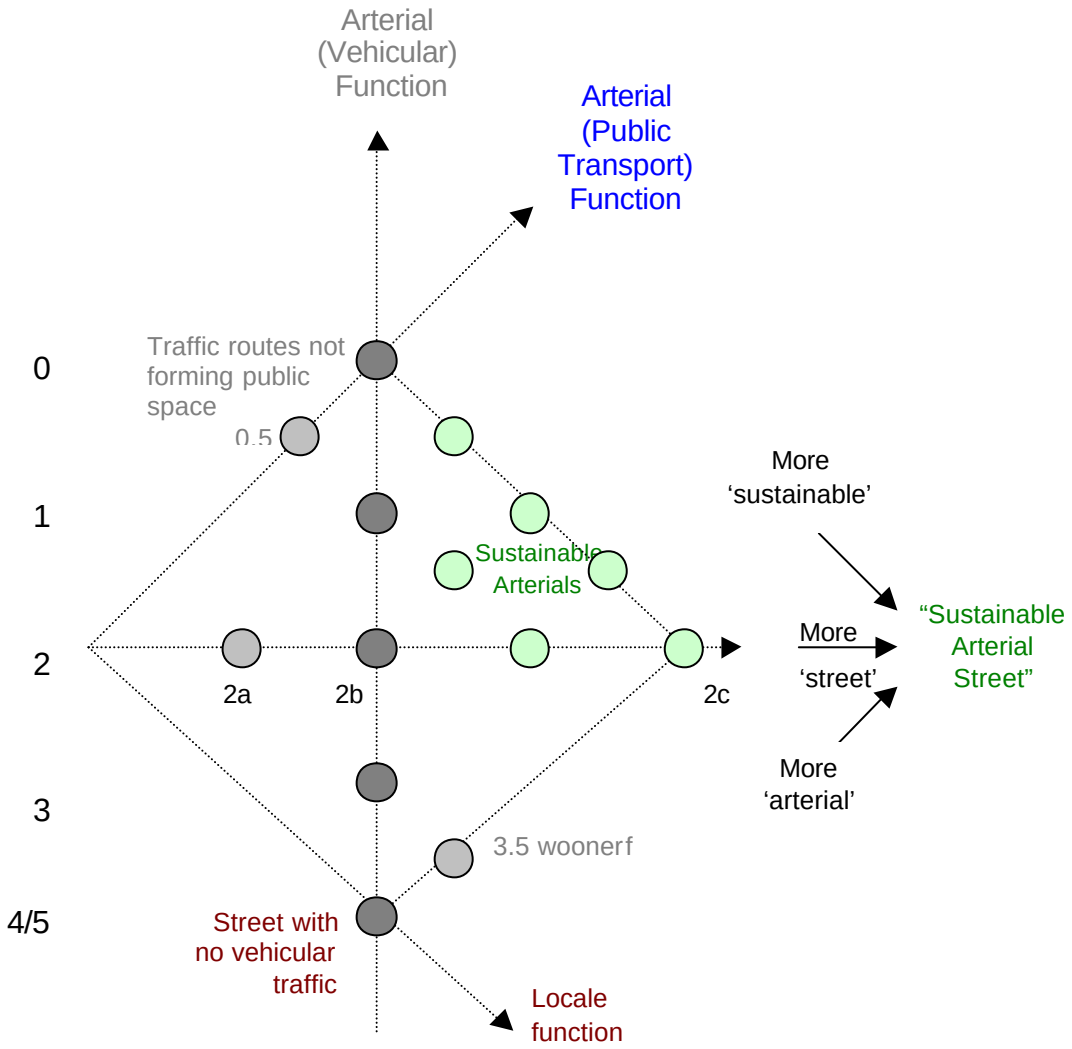
6.46 We can also note that within this set of types, we can distinguish a conventional 'linear' spectrum from high arterial function/low locale function to low arterial function/high locale function (shaded, Figure 6.8). Therefore this can be seen as an elaboration of the existing type of classification system, rather than a completely new departure.

Street type with high Arterial (PT) Function, low Locale Function	Street type with high Arterial (PT) Function, medium Locale Function	Street type with high Arterial (PT) Function, high Locale Function
Street type with medium Arterial (PT) Function, low Locale Function	Street type with medium Arterial (PT) Function, medium Locale Function	Street type with medium Arterial (PT) Function, high Locale Function
Street type with low Arterial (PT) Function, low Locale Function	Street type with low Arterial (PT) Function, medium Locale Function	Street type with low Arterial (PT) Function, high Locale Function

Figure 6.8. Combined classification as matrix of types.
The shaded areas represent possible association with conventional road types, where it is assumed that high level public transport arterials happen to correspond with the high level traffic arterials.

6.47 The result is that we can effectively form a combined classification system which explicitly contains both the conventional type of classification in it, on one axis, and the Sustainable Arterial Street on the other axis (see over, Figure 6.9).

Figure 6.9. Combined classification demonstrating conventional (arterial traffic) axis and new "Sustainable Arterial Street" axis



?? The vertical axis represents conventional linear ranking according to arterial (vehicular) function. This is shown in terms of the Common Reference Classification as a linear ranking of five types (0-1-2-3-4/5).

?? Superimposed diagonally on this is 5x5 array based on 'arterial (PT) function' v 'locale function' (independent dimensions - see Figures 6.7, 6.8)

?? In this array (as in the conventional case), type 0 has high arterial function but low locale function, while type 4/5 is the converse.

?? A new horizontal axis emerges, pointing in the direction of the "Sustainable Arterial Street". See discussion in text.

The emergence of the "Sustainable Arterial Street Axis"

6.48 In Figure 6.9, Type 2a represents a theoretical mid-range road type (for example, district distributor) which has a mid-range arterial (vehicular) function but relatively low through flow of people because the traffic is composed mainly by (low-occupancy) vehicular traffic, with little public transport and pedestrian presence. This might once have been regarded as 'idealised' in original sense where pedestrians and possibly public transport were expected not to use the distributor roads (each possibly being allocated to their own dedicated movement systems). Type 2a would have little or no locale role and would effectively not be a 'street' in any conventional sense.

6.49 Type 2b represents the typical actual case where in traditional urban areas, streets with mid-range arterial function also have a mid-range level of through flow (due to actual presence of public transport and pedestrians) - ie traditional street with footways and buses, etc. In the past, Type 2a was perhaps seen as an idealised future version of Type 2b, but type 2b has persisted.

6.50 Type 2c represents a possible idealised case (for today's aspirations) where both through flow of people and locale role are relatively high. Here, due to the presence of public transport (high vehicle occupancy), through flow of people is high relative to arterial (vehicular) role (medium).

6.51 In effect, this plots out a new horizontal axis, where type 2c is most like the target "Sustainable Arterial Street" and type 2a is, perhaps, its antithesis. The significance of this is that whereas the single linear classification of the conventional case would grade all three types 2a, 2b and 2c simply as type 2, the proposed classification here explicitly recognises the variation between these in the direction towards the "Sustainable Arterial Street".

6.52 We could say that the shift from upper left to lower right represents an increase in 'sustainability' since it implies greater use of more sustainable modes; the shift from lower left to upper right represents an increase in arterial function (by definition), and finally the shift from 2a to 2b and 2c can also be seen as a shift in the direction of the street.

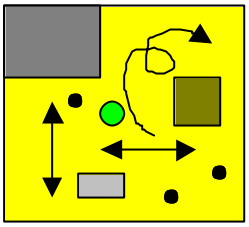
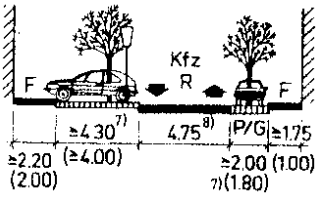
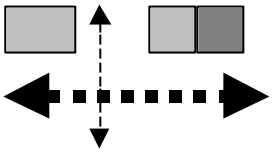
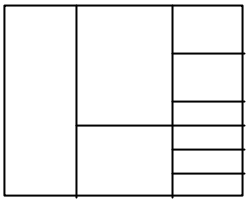
6.53 While this system may have some appeal in theory, what is needed is for this to be tested as a classification in practice.

Recap of 'final classification' expressed as a whole

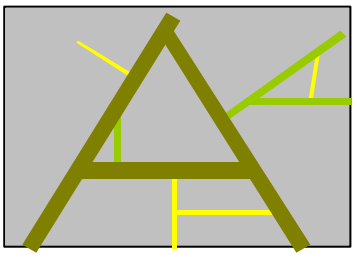
Figure 6.10. Recap of overall classification components

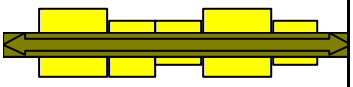
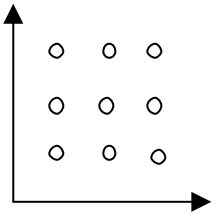
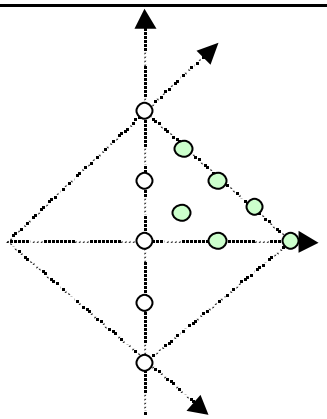
<table>
<tr>
<td rowspan="2">Streets as 'locales'
(Streetspace 'cells')

Classified in terms of forms and use(r)s

  </td>
<td>Quantitative descriptors of form, eg, height, width
 
</td>
<td>Qualitative descriptors of form, eg, street character
  </td>
</tr>
<tr>
<td>Descriptors of flows and land uses, etc.
  </td>
<td>Descriptors of users
  </td>
</tr>
<tr>
<td>Streets as arteries

Classified in terms of arterial function

  </td>
<td>Arterial function expressed in terms of strategic PT network
  </td>
<td>Linear ranking from most strategic public transport Arteries to streets with no public transport
  </td>
</tr>
<tr>
<td>Overlay of 'arteries' and 'cells': combined 'arterial' and 'locale' based classification

  </td>
<td> 
Classification representing trade-off between 'arterial' and 'locale' function</td>
<td>  </td>
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</table>

7. Concluding Discussion

7.1 The proposed classification system relates to several of the points that ARTISTS seeks to address, as discussed below.

7.2 It is partly a *functional classification* in the sense that it deals with the different functional roles of streets as *arteries* - functional roles that apply consistently to whole lengths of route, taking account of their role in the wider urban network, and independently of local variations in form or use.

7.3 It also incorporates a classification which explicitly addresses the *form* and *use* of the street as a *locale*. The aspect of urban use may be expressed from a *user* perspective. The latter therefore addresses the *user group* dimension that is called for in the Description of Work but that is somewhat absent from existing classifications. It also addresses urban function/land use, through reference to *users* of shops, other land uses, etc.

7.4 By addressing people, rather than vehicles, this is more in accord with *sustainability*, since it effectively relates to flows of people (whether in vehicles or on foot) rather than traffic. This weights things towards the more sustainable modes, by giving greater weight to high capacity public transport modes, while also giving a more decent weighting to non-motorised modes than is conventionally the case (ie, a pedestrian or bicycle would be equally weighted with a vehicle of occupancy 1.0). Also by addressing people, rather than vehicles (or network role, traffic speed, etc.) it more directly relates to social and economic issues, which may also be seen as dimensions of sustainability.

7.5 The urban use(r) dimension is so fashioned that it can simultaneously embody a variety of degrees of resolution. This means that at its simplest, the classification of urban use(r)s can be aggregated to a sufficient level of simplicity (eg users of local street space versus 'through users') to fit with simple applications of hierarchy. Yet the full elaboration of the disaggregate subdivisions of use(r)s allows a more detailed, sophisticated appreciation of street use to be presented.

7.6 The classification of arterial function in terms of strategic public transport routes (rather than general vehicular routes) reflects the desire to explicitly recognise the role of more sustainable modes of transport. Yet, by retaining arterial function, the proposed classification retains the useful convention of arranging route types in a 'hierarchy' which can be arranged according to a structural logic (referred to as 'hierarchical contiguity') that results in all the highest level strategic (public transport) routes forming a single contiguous network.

7.7 The arterial and locale functions seem to be reasonably independent, in the sense that we may easily expect to encounter streets with where

both values are high or low (rather than a set of axes where a high value on one implies a lower value in the other). This boosts the utility of the proposed system, since the resulting 'matrix of types' is more fully filled out with viable permutations meaning that the classification by two variables is doing greater 'work' in distinguishing types.

7.8 This is also significant because the Sustainable Arterial Street can now appear explicitly as an axis (perpendicular to the conventional axis) and a set of viable types distinguishable as Sustainable Arterial Streets may be represented. These viable types appear when expressed as a combination of arterial function (expressed through public transport) and locale function. This is in contrast to the more conventional pairings (eg traffic v urban function, circulation v access) in which high values of both attributes appear incompatible, and in which the Sustainable Arterial Street is not explicitly recognised as distinct from conventional road types.

7.9 The structure of the classification is felt to be potentially robust and flexible. This is due to the open way in which the street as artery and the street as locale may each be classified according to their own nature (ie, arterial function lends itself to linear ranking; user classification lends itself to successive subdivisions). The street's arterial role and locale role can be assessed separately, and then brought together in a single classification.

7.10 The *locale* classification is flexible in that it may be built up with a range of possible elaborations (or variations), and can be applied in a simpler or more sophisticated degree of resolution to fit circumstances of application.

7.11 The *arterial function* classification can be seen as an elaboration of the existing conventional street classifications, ie, it accommodates a wider variety of street types that includes the conventional types as well as Sustainable Arterial Street types. This link back to conventional systems may assist the ease with which the classification system could be adopted or adapted to fit with or evolve from existing practice.

7.12 The proposed classification system as outlined in section 6 herein represents a first theoretical approach to the classification of sustainable arterial streets. The classification system would be further developed iteratively by testing its application to actual street cases. This application stage will form the immediate next steps of the work, prior to further theoretical development and ultimate finalisation of the system.

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ARTISTS Deliverable D1.1 Appendices

Appendix 1 Catalogue of Street Types

Appendix 2 Catalogue of Classification Themes

Appendix 3 Common Reference Classification

Appendix 4 Classification and ‘Hierarchical Contiguity’

Appendix 5 A User-Based Classification System

Appendix 1 Catalogue of Street Types

Summary table of fourteen classification themes used to classify street types in existing practice in ARTISTS cities and countries.

Classification Theme (basis for differentiation of street type)	Country or City Classification Set													
	B	BA	D	DK	K	G	H	P	E	S	UK	UR	L	LC
1. Traffic Speed	✍✍	✍	✍	✍✍	✍✍	✍✍	✍✍	✍✍	✍✍	✍✍	✍✍	✍	✍	✍
2. Trip Length (OD)	✍✍	✍	✍	✍	✍	✍✍	✍	✍✍	✍✍	✍	✍✍	✍	✍	✍✍
3. Destination Size	✍	✍	✍✍	✍	✍	✍	✍	✍	✍	✍	✍	✍✍	✍	✍
4. Strategic Role	✍✍	✍	✍✍	✍✍	✍✍	✍	✍	✍✍	✍✍	✍✍	✍✍	✍	✍	✍✍
5. Circulation v Access	✍	✍	✍✍	✍	✍	✍	✍	✍✍	✍✍	✍	✍	✍	✍	✍
6. Administration	✍	✍✍	✍	✍	✍	✍	✍	✍	✍	✍	✍	✍✍	✍✍	✍✍
7. Network Role	✍	✍	✍	✍	✍	✍	✍	✍✍	✍✍	✍	✍	✍	✍	✍
8. Access Control	✍	✍	✍	✍	✍	✍✍	✍	✍✍	✍✍	✍✍	✍✍	✍	✍	✍
9. Traffic Volume	✍	✍	✍	✍	✍	✍✍	✍✍	✍✍	✍✍	✍	✍	✍	✍	✍
10. Transport Mode	✍✍	✍	✍	✍	✍✍	✍	✍✍	✍✍	✍	✍✍	✍✍	✍	✍	✍✍
11. Other Urban Users	✍✍	✍	✍	✍	✍	✍	✍	✍	✍✍	✍	✍✍	✍	✍	✍
12. Environment	✍	✍	✍	✍	✍✍	✍	✍✍	✍	✍	✍	✍	✍	✍	✍
13. Built Frontage	✍	✍	✍✍	✍	✍	✍	✍	✍	✍	✍	✍	✍	✍	✍
14. Road standard	✍	✍	✍	✍	✍	✍	✍	✍✍	✍✍	✍	✍	✍	✍	✍

✍✍ = Primary: used systematically to grade all street types in set;
✍ = Partial: used to distinguish some individual street types

Catalogue of Classification Sets and Street Types

Set Ref	**Country/City & Name/Origin of Set**	**Summary of classification purpose /context of use**	**Types in set (Native)**	**Types in set (English)**	**Primary basis of differentiation between types** (common to definition of all or most types)	**Other items of distinction of types** (feature in at least one definition of type)
B	Belgium Functional classification	?? accessibility ?? comfort of living ?? quality of life in neighbour-hoods adjacent to main roads ?? shielding from through traffic.	B1. AUTOROUTE B2. VOIE METROPOLITAINE B3. VOIE PRINCIPALE B4. VOIE INTER-QUARTIER B5. COLLECTEUR DE QUARTIER B6. RUE LOCALE	B1. MOTORWAY B2. METROPOLITAN ROAD B3. TRUNK ROAD B4. INTER-DISTRICT ROAD B5. THROUGH STREET B6. LOCAL STREET	Strategic Role – ie, connecting cities, districts, local access to land uses, etc.	?? Speed (high end) ?? Trip length ?? Users (Residential access)
BA	Belgium Administrative classification	Determines the level of competency/ responsibility for the management of the network		BA1. Regional network roads (Brussels Capital Region) BA2. Local network roads (Communes)	Administrative	
D	Germany EAHV and RAS-N (Selected from wider series)	-	D1. B III+IV ANBAUFREIE HAUPTVERKEHRSSTRAßE D2. C III HAUPTVERKEHRSSTRAßE D3. C IV HAUPTSAMMELSTRAßE D4. D IV SAMMELSTRAßE D5. D V ANLIEGERSTRAßE D6. E V ANLIEGERSTRAßE D7. E VI ANLIEGERWEG	D1. B III+IV NON FRONTAGE ARTERIAL STREETS D2. C III ARTERIAL STREETS D3. C IV MAIN COLLECTOR STREETS D4. D IV COLLECTOR STREETS D5. D V ACCESS STREET D6. E V ACCESS STREET D7. E VI ACCESS WAY	1. Strategic Role (partly incorporating destinations served) 2. Circulation versus access function (partly incorporating built frontage)	

DK	Denmark Road Directorate – Road Standard Committee (1991, 2000):	National guidelines for use in municipalities	TRAFIKVEJ DK1. - DK2. - DK3. - LOKALVEJ DK4. - DK5. - DK6. -	TRAFFIC ROADS DK1. TR-HIGH SPEED DK2. TR-MEDIUM SPEED DK3. TR-LOW SPEED LOCAL ROADS DK4. LR-MEDIUM SPEED DK5. LR-LOW SPEED DK6. LR-VERY LOW SPEED	1. Strategic Role 2. Speed	
K	Kopenhagen Municipality Plan (master plan) for The City of Copenhagen 2001	Strategic planning tool and local guidelines to ensure a coherent network	K1. MOTORVEJE K2. REGIONALE VEJE K3. FORDELINGSGADER K4. BYDELSGADER K5. LOKALGADER	K1. MOTORWAY K2. REGIONAL ROADS K3. PRIMARY ROADS K4. DISTRIBUTOR STREETS K5. LOCAL STREETS	Strategic Role	?? Modes ?? Speed (low end) ?? Environment (low end)
G	Greece Greek Ministry of Environment & Public Works "Town Planning Guidelines"	To be used in Town Planning Studies	G1. ????T??? ?????? ????????? ??OF???S G2. A????? G3. S?????????? ???S G4. ?????? ???S	G1. FREEWAY G2. ARTERIAL STREET G3. COLLECTOR STREET G4. LOCAL STREET	1. Trip length 2. Speed	G1. Access control G1. Traffic volume
H	Hungary Hungarian Road Planning Technical Guidance Public roads in built-up areas	Hungarian Road Planning Technical Guidance	H1. AUTÓPÁLYA H2. AUTÓÚT H3. I. RENDU FOÚT H4. II. RENDU FOÚT H5. GYÜJTOÚT H6. KISZOLGÁLÓ ÚT H7. KERÉKPÁRÚT H8. GYALOGÚT	H1. MOTORWAY H2. SEMI-MOTORWAY H3. I. CLASS MAIN ROAD H4. II. CLASS MAIN ROAD H5. COLLECTOR ROAD H6. SERVICE ROAD H7. BICYCLE ROAD H8. FOOTPATH	1. Network function (series of factors) 2. Environmental condition (combination of built-up area and sensitivity of environment) 3. Speed	H5, H6. Traffic volume H7, H8 Transport mode

P	Portugal	To highlight and solve problems associated with functions of different roads.	P1. VIAS COLECTORAS P2. DISTRIBUIDORAS PRINCIPAIS P3. DISTRIBUIDORAS LOCAIS P4. VIAS DE ACESSO LOCAL P5. RUAS DE PEÕES	P1. COLLECTOR ROADS P2. MAIN DISTRIBUTOR ROADS P3. LOCAL DISTRIBUTOR ROADS P4. ACCESS ROADS P5. PEDESTRIAN STREETS	Traffic function v. access function	P1, P2 Trip length P1, P3 Urban scale/Link role in network P1, P3, P4, P5 Modes/provision P1, P2, P4, P5 Speed/capacity P1, P2, P3, P4 Intersection control
E	Spain	Traditional classification of streets according to function	E1. AUTOPISTAS E2. CALLE ARTERIAL E3. CALLES COLLECTORAS-DISTRIBUIDORAS E4. CALLE LOCAL	E1. MOTORWAYS E2. ARTERIAL STREET E3. DISTRIBUTOR E4. LOCAL STREET	From definition: OD (trip length) From other Table: 1. Traffic v Access (%) 2. Trip length on the street 3. Distance between streets 4. Type of intersections	E1, E2 Urban scale (population) E3 Link role in network E1 Road standard (width) E1, E4 Speed E1, E2 Access E2, E3 Crossing/intersection control
S	Sweden/ Malmö Set used in Malmö (National + some additional local)	Requirements and quality for different user groups Guidelines recommended by *Svenska kommunforbundet* the Swedish Association of Local Authorities	S1.GENOMFART/INFART S2. HUVUDGATA S3. UPPSAMLINGS-GATA S4. LOKALGATA S5. GAARDSGATA S6.GAAGATA	S1. THROUGHFARE/RADIAL ROAD S2. MAIN STREET (ARTERIAL STREET) S3. COLLECTOR STREET S4. LOCAL STREET S5. "WOONERF" S6. PEDESTRIAN STREET	Network role	S4. Access to buildings S5. Speed S5, S6. Modes/users

UK	UK national guidelines, evolved from long standing conventions *Transport in the Urban Environment*	To reconcile the needs of different modes of movement in a single design for a network; to minimise intrusion of traffic in neighbourhoods and living areas.	-	UK1. PRIMARY DISTRIBUTORS UK2. DISTRICT DISTRIBUTORS UK3. LOCAL DISTRIBUTORS UK4. ACCESS ROADS UK5. PEDESTRIAN STREET UK6. PEDESTRIAN ROUTE UK7. CYCLE ROUTE	Trip length OD	UK1, UK4. Speed UK1, UK2, UK4, UK5, UK6, UK7. Mode UK1. Access control UK2. Strategic role UK4, UK5. Other urban users
UKR	UK national guidelines for residential roads "DB32"	Extension of lower end of general urban road hierarchy.	-	UKR1. MAJOR ACCESS ROADS UKR2. MINOR ACCESS ROADS UKR3. SHARED SURFACE ROADS UKR4. SHARED DRIVEWAYS UKR5. DRIVEWAYS	No. of houses served (Destination size)	
L	London Mayor for London/ Transport for London	Responsibility for road ownership and management.	-	L1. NATIONAL ROADS (MOTORWAYS) L2. TRANSPORT FOR LONDON ROAD NETWORK (TLRN) L3. BOROUGH ROADS	Administrative	
LC	London Borough of Camden	?? amenity and environment ?? conditions for pedestrians and cyclists, bus services ?? safety	-	LC1. STRATEGIC ROADS LC2. LONDON DISTRIBUTOR ROADS LC3. BOROUGH DISTRIBUTORS LC4. ACCESS ROADS	1. Strategic role	Modes LC1, 3. Trip length LC1. Administrative

Appendix 2. Catalogue of Classification Themes

This catalogue lists a series of some 39 themes by which streets may be classified. This has been used to build up a diverse a bank of material from which to inform the form of classification being developed in the ARTISTS project.

Many of the classification themes as presented here are closely related and could overlap or nest within each other. However, they are presented in a long list here in order not to prematurely fix these in any particular classification structure. They are mostly kept as 'one-dimensional' as possible – avoiding complex composite themes – since possible combination themes would be considered as part of the onward development process towards a new classification system within the project.

The catalogue is instead presented in a single list of 39 themes, divided into three parts for convenience in this document, which relate to how closely they fit conventional street classification systems (see table overleaf).

Part A represents classification themes used to systematically differentiate different street types over the whole spectrum of types (or the whole spectrum of vehicular types, at least). Part B represents those used partially in conventional classification systems.

Part C contains a more diverse range of classification themes, found in practice or in the literature in the ARTISTS countries or beyond. These themes are typically (though by no means wholly) more 'urban' and/or form related than those in Parts A and B. These themes are often less well established, or less well defined, than the official categorisations. In some cases, these just represent the start of an idea, or the tip of an iceberg. Also included here are a few themes devised as part of the project, in order to stimulate exploration of territory in a variety of new (or so far unreported) directions.

In many of the cases following in this Catalogue, there is firstly a description of the classification theme, and some commentary on its value and/or workability as a classification theme, and finally in indication as to where the Arterial Street or Sustainable Arterial Street may lie on the spectrum, and/or whether the theme could be used to differentiate between different types of Sustainable Arterial Street.

Index of Classification Themes

Part A Systematically Applied Classification Themes	1. Traffic Speed 2. Trip Length 3. Destination Status 4. Strategic Role 5. Circulation v Access 6. Administration
Part B Partially Developed Classification Themes	7. Network role 8. Access control 9. Traffic Volume 10. Transport Mode 11. Other Urban Users 12. Environment 13. Built Frontage 14. Road Width
Part C Diverse Themes	15. Street Name 16. Street in Cross-Section 17. Frontage Form 18. Planting 19. Street Character 20. Urban Character 21. Spatial Shape or Character 22. Visual Axis 23. Civic Role 24. Spatial 'Integration' 25. Urban Morphology (Formation) 26. Structural Role 27. Corridor Role 28. District Role 29. Land Use or Frontage Function 30. 'Towncentredness' 33. Urban Uses and Users 34. Living Space 35. Neighbourliness 36. Pedestrian Use of Streets 37. 'Diverse' Vehicular Classification 38. Public Transport 39. Sustainability

Part A

1. Traffic Speed

Traffic speed is important because it relates to traffic safety and efficiency and environmental quality. It is associated with design speed (as a basis for geometric design) and in relation to the setting of speed limits. Its basis as a classification criterion may therefore be regarded as being a *designed* or *designated* attribute rather than a *measured* attribute.

Speed may be used to systematically differentiate all types on a spectrum, or may be associated with the definition of the highest or lowest category. Note that in the three cases in the first table (1.1), speed is not used as the sole criterion, but is combined with other criteria.

Speed may be graded into as fine a spectrum as required, making it a versatile classification criterion.

The Arterial Street and Sustainable Arterial Street would be likely to fall into the mid-range between the highest and lowest speed bands; speed might also possibly differentiate between different types of Sustainable Arterial Street.

1.1 Traffic Speed

Classification criterion		Categories	TYPES
Traffic Speed	Denmark In the Danish case speed is combined with traffic road or local road.	High speed	TRAFFIC ROADS, HIGH SPEED
		Medium speed	TRAFFIC ROADS, MEDIUM SPEED LOCAL ROADS, MEDIUM SPEED
		Low speed	TRAFFIC ROADS, LOW SPEED LOCAL ROADS, LOW SPEED
		Very low speed	LOCAL ROADS, VERY LOW SPEED
	Greece	> 70 km/h	FREEWAY
		50-70 km/h	ARTERIAL STREET
		40-50km/h	COLLECTOR STREET
		< 40 km/h	LOCAL STREET
	Hungary	90-110km/h	H1. MOTORWAY
		80-90km/h	H2. SEMI-MOTORWAY
		60-80km/h	H3. I. CLASS MAIN ROAD
		40-70km/h	H4. II. CLASS MAIN ROAD
		30-60km/h	H5. COLLECTOR ROAD
		30-40km/h	H6. SERVICE ROAD

1.2 Traffic Speed: Along Route and Through Junctions

Traffic along route and across intersections related to type of living area.
Strictly speaking the road types are here related to the areas they pass through; it is the areas that are distinguished by acceptable speed. Supplied by Malmö Stad.

Classification criterion	Speed along route/ Through junctions	Living Space Category	Street Types Associated
Traffic speed along route and through junctions Sweden *Livsrumsmodellen* "The Living Space Model" + "Lugna gatan" Note: finer distinctions apply. Normal case in general given here. See also later in Living Space section.	> 70	Traffic areas (good conditions)	MAIN STREET
	70 / 50	Traffic areas (normal conditions)	MAIN STREET
	50 / 50	Mixed priority areas/ Traffic areas	MAIN STREET/ LOCAL STREET
	50 / 30	Mixed priority areas	MAIN STREET/ LOCAL STREET
	30 / 30	Living areas/ Mixed priority areas	LOCAL STREET/ WOONERF
	 Walking speed	Living areas	PEDESTRIAN STREET

A further point is suggested with respect to speed. Often roads may be associated with idealised design speeds. But in urban conditions, speeds may vary considerably between daytime (low speeds due to congestion) and night time (more freely flowing conditions). This means that in practice, some strategic arterial routes may, due to congestion, operate at a lower speed that is sub-optimal with respect to through traffic capacity, but more optimal with respect to compatibility with pedestrians (along and across the street) and non transport uses of the street (eg, pavement cafes). Therefore a further possible speed-related set of categories is possible (1.3).

1.3 Traffic Speed: Congested Conditions

Suggested within ARTISTS project for illustrative purposes.

Actual Traffic Speed accounting for congestion	Street with free-flowing traffic at all times
	Street with free-flowing traffic mostly but reduced by congestion at peak times
	Street with congestion reducing speed to low speed during majority of daytime
	Street generally with low speed traffic at all times (due to short length, traffic calming, etc.)
	Street for walking speed (pedestrians and vehicles) by design and enforcement

2. Trip Length

This refers to distinction of street type by the kind of traffic they are intended to carry, where this traffic is defined in terms of trip length (eg, long distance traffic, local traffic). Trip length may be associated to some extent with strategic role (the assumption that long distance trips use the strategic network) and also with 'destinations served'. However, it is distinct in that it implies knowledge of, or assumptions about, individual trips and routeing.

Two types of classification are distinguished here. These are Trip Length O-D (origin and destination) and Trip Length on-street. The latter case is based on the typical distance that any particular journey is assumed to use that street. The former goes further and makes assumptions about the total length of journey as well as on-street routeing, implying knowledge (or assumption) about trip origins and destinations.

While strategic routes such as motorways may tend to cater for longer distance traffic, and local routes may tend to cater for shorter distance trips, the strength of these relationships is not necessarily satisfactorily established[14]. Even if correct, it is questionable how useful this criterion is. Main streets in urban areas, such as radial arterials, will carry a significant proportion of local traffic, while minor streets however small will carry their own share of long distance (albeit originating or terminating traffic). Even trip length on-street, which may be more logically defensible, seems not a particularly meaningful way of classifying streets, with respect to the ultimate purpose of street design, which is surely more concerned with traffic flow, speed, presence of pedestrians, etc.

The use of trip length perhaps relates to an idealised functional traffic networks where it is assumed that all access functions take place on 'local' or 'access' roads possibly within local traffic precincts, assuming that higher level routes do not have an access function and therefore do not serve as trip ends in themselves. In a 'tributary' style network pattern, where the roads higher in the hierarchy form a complete network, but the roads (such as access roads) are discontinuous, there is a reasonable correlation, in the sense that higher hierarchy roads have longer distances between junctions and no direct access, implying minimum trip lengths, while discontinuous access roads bar through traffic and therefore necessarily cater only for originating or terminating traffic. In 'normal' messy hybrid networks in reality, this neat distinction will not hold.

A possible alternative criterion is **route length**, rather than trip length. In practice this may be effectively linked to strategic role.

[14] Road hierarchy on presumed trip length has been described as a 'fantasy' (Goodwin, 1995).

2. Trip Length			
Classification criterion		Category	TYPE
2.1 Trip Length (O-D)	Greece	Long distance trips	FREEWAY
		Medium to long distance trips	ARTERIAL STREET
		Short distance urban trips	COLLECTOR STREET
		Direct access to origin or destination of trip	LOCAL STREET
	United Kingdom IHT (1997)	Long distance through traffic	PRIMARY DISTIBUTOR
		Medium distance traffic	DISTRICT DISTRIBUTOR
		vehicle movements near beginning or end of all journeys	LOCAL DISTRIBUTOR
		Use of highway by frontagers (implies terminating trips parking or servicing)	ACCESS ROAD
	Spain	Trips > 5km	MOTORWAYS
		Trips > 2km	ARTERIALS
		short trips	DISTRIBUTORS
		Mostly short trips	LOCAL STREETS
2.2 Trip length (on-street)	Spain Balaguer Camphuis, Enrique et al (1984)	> 5 km	MOTORWAYS
		1-2 km	ARTERIALS
		500-1000 m	DISTRIBUTORS
		< 500 m	LOCAL STREETS

3. Destination Status

Here the road or street is classified according to the status of the destinations served (rather than the properties of the street itself). This includes street types defined by the size of city served right down to the number of houses on a plot of land. Destination status may be considered in terms of general type of status of settlements or a specific quantified number of houses served by an access road (UK residential road guidance). In the latter case, this is the primary criterion used for defining road types (all at the low end of the conventional hierarchy). City size may be associated with Strategic Role, while number of houses served may be a proxy for Traffic Volume.

The German cases seem to cater for the traffic function of inter-urban roads, while the UK cases refer to minor residential roads. These no not seem to fit well with the idea of an urban arterial street (or sustainable arterial street) which is typically envisaged in its role serving a single/whole urban area rather than linking to individual dwellings or linking different settlements (albeit that it may lead out from a city to external settlements).

3. Destination Status		
Case	TYPE	Explanation
3.1 UK-Residential DoE/DoT (1992) Page 12	ACCESS ROADS (this type occurs at the lower end of the UK hierarchy in *Transport and the Urban Environment* - IHT, 1997)	Residential roads with footways that may serve up to around 300 dwellings and provide direct access to dwellings.
	MAJOR ACCESS ROAD	Access road serving 100-300 dwellings.
	MINOR ACCESS ROAD	Access road serving up to around 100 dwellings.
	SHARED SURFACE ROADS	Residential roads without footways that may serve up to around 50 houses.
	SHARED DRIVEWAYS	Unadopted paved areas that may serve the driveways of up to 5 houses.
	DRIVEWAYS	Unadopted paved areas that provide access to garages and other parking spaces within the curtilage [bounded area of ownership/rights] of an individual house.

3. Destination Status (continued) Supplied by University of Kaiserslautern.	
3.2 German case There is not a one-to-one relationship between road type and destination served but relates to how destinations link into the network. See under Strategic Role.	Destination status OZ(OZ‘) central city, highest level of centrality, (city center, highest level of centrality) MZ(MZ‘) central city, medium level of centrality, (city center, medium level of centrality) GZ(GZ‘) central city, basic level of centrality, (city center, basic level of centrality) GE(GE‘) community, no central functions (parts of a community, no central functions) Grst site GEG major recreational area (significance above regional level) REG recreational area of regional significance NEG recreational area of local significance GVP major knot (significance above regional level) RVP knot of regional significance

4. Strategic Role

This refers to the role played by a street or road in connecting places within the network context. This combines reference to Destination Status (from cities to individual land use units) and to Network Role (role of a route within the network itself). Although termed ‘strategic’ role the term is intended and applied at all scales from ‘strategic’ scale (ie, large scale) to ‘local’ scale.

Strategic role is the single most used criterion as a primary basis for classification. It is useful in allowing a full gradation from strategic to local, as noted above, while it is relatively invariant.

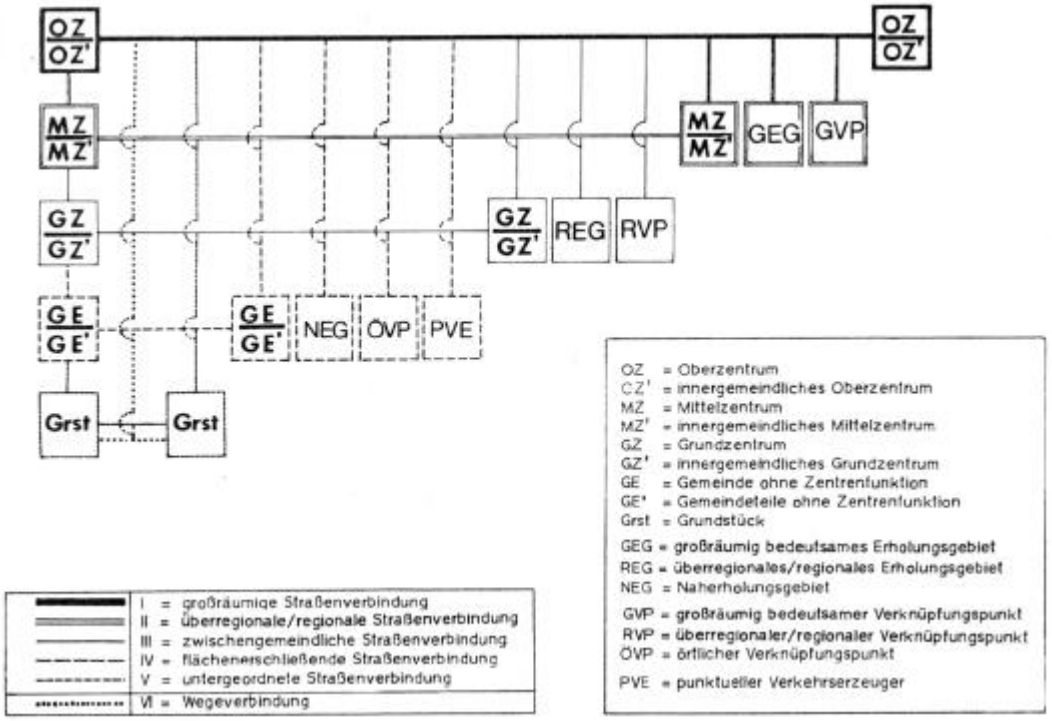
The Arterial Street and Sustainable Arterial Street would be assumed to occupy a position (or positions) in the mid to upper range of categories presented here.

4. StrategicRole		
Case	Type	Explanation
4.1. Belgium	MOTORWAY	Provides fast road link between cities or way round the urban region for through traffic
	METROPOLITAN ROAD	Provides access to main metropolitan amenities
	TRUNK ROAD	Completes the network of metropolitan roads to provide long journeys in the city.
	INTER-DISTRICT ROAD	Provides connections between neighbouring districts, allows traffic through the districts and connects to regional roads
	THROUGH STREET	Provides access traffic in a district.
	LOCAL STREET	Provides access for local residents.
4.2 Denmark	TRAFFIC ROADS	The roads that constitute a municipality's main road network. They serve the through-traffic, traffic between the municipality and the region, between towns, and between individual neighbourhoods or quarters of large towns.
	LOCAL ROADS	All other roads in the municipality are designated local roads. They serve local areas, neighbourhoods and houses, workplaces, institutions, and shops.
4.3 Copenhagen	REGIONAL ROADS	Regional roads ensure the connection between Copenhagen and the rest of The Øresund Region.
	PRIMARY ROADS	Primary roads ensure the connection between the different districts of Copenhagen.
	DISTRIBUTOR STREETS	The distributor streets guarantee the connection between the main roads (regional and primary) to the local streets.
	LOCAL STREETS	The main part of the streets in the city is local streets.
4.4 Sweden	THROUGHFARE/RADIAL ROAD	Street, which connects the city/town with the national or regional road network
	MAIN STREET (ARTERIAL STREET)	Street, which connects the urban districts
	COLLECTOR STREET	Street, which collects traffic in the local street network into the main streets
	LOCAL STREET	Street, which provides car accessibility to buildings, parking etc.
	"WOONERF", PEDESTRIAN STREET	Local street
4.5 London Borough of Camden	STRATEGIC ROADS	Provide the distributor network for longer distance vehicle movements within London to the national road network.
	LONDON DISTRIBUTOR ROADS	Provide links to Strategic Roads, for journeys between boroughs and access to town centres.
	BOROUGH DISTRIBUTORS	Provide for movement within Camden, between London Distributor Roads and Local Access roads
	ACCESS ROADS	Provide links to land and buildings.

4. Strategic Role (continued)

Supplied by University of Kaiserslautern.

4.6 Germany Strategic role as explicit combination of network role and destination status.	?? Link function is defined by combination of position in network relative to destinations served ?? Link Function is elsewhere combined with criteria relating to circulation v access and frontage function to generate specific types.



Network role (Level of link function)

I	major link
II	interregional/regional link
III	link between communities
IV	link to access the area
V	minor connection (link)
VI	paths

Destination status

OZ(OZ‘)	central city, highest level of centrality, (city center, highest level of centrality)
MZ(MZ‘)	central city, medium level of centrality, (city center, medium level of centrality)
GZ(GZ‘)	central city, basic level of centrality, (city center, basic level of centrality)
GE(GE‘)	community, no central functions (parts of a community, no central functions)
Grst	site
GEG	major recreational area (significance above regional level)
REG	recreational area of regional significance
NEG	recreational area of local significance
GVP	major knot (significance above regional level)
RVP	knot of regional significance

5. Circulation versus Access Function

A street may be classified according to the extent to which it lies on the theoretical spectrum from providing exclusively for circulation of through traffic through to exclusively providing access to land uses and frontages. Several existing classification systems use this kind of theme either explicitly or implicitly.

By definition this is a spectrum which makes it methodologically useful for ranking all types of street. However, the extent to which the access is a 'smooth curve' (extending from 0% to 100%) has been questioned – it may be better represented as a yes/no function. Also, it is perhaps something of a generalisation to assume an exact and consistent inverse relationship between circulation and access. Nevertheless, with careful definition of 'circulation' and 'access', a close match could be obtained, at least for either end of the spectrum[15].

As with other classification themes, the Arterial Street may be interpreted as lying in the mid to 'upper' range of the hierarchy, where 'upper' here means (as per common usage) in the direction of higher through traffic route status. The conventional Arterial Street might thus be located between 75% circulation: 25% access and 50%:50%.

However, it is suggested here that what a Sustainable Arterial Street is attempting is something that is relatively balanced, but at a higher level than 50%:50%. That is, if we can allow it for the sake of argument, a Sustainable Arterial Street is perhaps something more like a street with a circulation function equivalent to a conventional main traffic route (circulation function 60-70%) and an access function that is more like that of a mid-range route (access function 40-50%). The figures 60%:60% and 70%:50% may look uncomfortable, but such a labelling perhaps gives an indication of the actual problems that real arterial streets are having to reconcile[16]. They are trying to squeeze in 120%, as it were.

It is also suggested that in aiming to create a 'new' type (or new recognition of type), we need to depart from the current linear function for which circulation + access = 100% (or, for which circulation function is inevitably the inverse of access function).

[15] For example, 'Access' can have a variety of associations, including access to (and hence presence of) building frontages; stationary vehicular activities such as parking and servicing; and allowance for minor roads to connect directly with major roads. With appropriate definition, 'access function' could be defined as the inverse of 'circulation function'.

[16] It is also suggested that some road types that have appeared in theory, such as the district or local distributors in the UK, have over-capacity: while their circulation functions may be 75% and 50% respectively, in terms of actual traffic volume and network role, their access functions are close to zero.

5. Circulation versus Access Function		
Case	**Criterion**	**Type**
5.1 Spanish case Balaguer Camphuis, Enrique et al (1984)	100% traffic flow function 0% access function	MOTORWAYS
	75% circulation function 25% access function	ARTERIALS
	50% circulation function 50% access function	DISTRIBUTORS
	75% circulation function 25% access function	LOCAL STREETS
5.2 German case Forschungsgesellschaft für Straßen- und Verkehrswesen - FGSV (1988) [RAS-N]. Forschungsgesellschaft für Straßen- und Verkehrswesen - FGSV (1993) [EAHV 93]	5.2.1 Connection (*Verbindung*)	Categories A, B, C eg, C III ARTERIAL STREET C IV MAIN COLLECTOR STR.
	5.2.2 Access (*Erschließung*)	Category D D IV COLLECTOR STREET D V ACCESS STREET
	5.2.3 Stay (*Aufenthalt*)	Category E E V ACCESS STREET E VI ACCESS WAY
5.3 Portuguese case	Circulation towards 100%	COLLECTOR ROADS
	Circulation function > 50%	MAIN DISTRIBUTOR ROADS
	Access function >50%	LOCAL DISTRIBUTOR ROADS
	Access towards 100%	ACCESS ROADS
	(Access function ~ 100%)	PEDESTRIAN STREET

6. Administration

The administrative criterion relates to the ownership and management of, and responsibility for, particular roads or road networks. It properly falls outside the strict definition of 'functional classification'. It is included here for completeness.

The administration theme is a coarse but robust theme for classification in that it can account methodically for every street in a network or sub-network, regardless of actual physical form or use. In one sense, it is potentially arbitrary in that an administrative designation could be made with little sensitivity to conditions on the ground. However, in practice, administrative designations are likely to be the product of careful scrutiny and deliberation, bearing in mind the long term legal and financial responsibilities that are attached to a road's administrative status.

For any particular roads authority – who may be the most significant users of road classification systems – the basic condition of who is responsible for a particular road may be of particular importance.

The administrative theme tends to be divided 'vertically' between more local and more strategic authorities, and 'horizontally' between neighbouring authorities. Administrative themes could also be distinguished by classifying the type of administrations concerned: whether these are departments of traffic, or street management, or public space, etc.

6. Administration		
Case	**Type**	**Explanation**
6.1 Belgium (Administrative)	BA1. Regional network roads (Brussels Capital Region)	Under administration of (Brussels Capital Region)
	BA2. Local network roads	Under administration of the Communes
6.2 London (Transport *for* London)	L1. NATIONAL ROADS (MOTORWAYS)	Under administration of national Highways Agency
	L2. TRANSPORT FOR LONDON ROAD NETWORK (TLRN)	Under administration of Transport for London
	L3. BOROUGH ROADS	Under administration of 33 individual London boroughs
6.3 UK Residential Roads	MAJOR ACCESS ROADS MINOR ACCESS ROADS SHARED SURFACE ROADS	Adopted roads, ie, under administration of local roads authority
	SHARED DRIVEWAYS DRIVEWAYS	Unadopted roads, ie, the responsibility of private property owners

Part B

7. Network Role

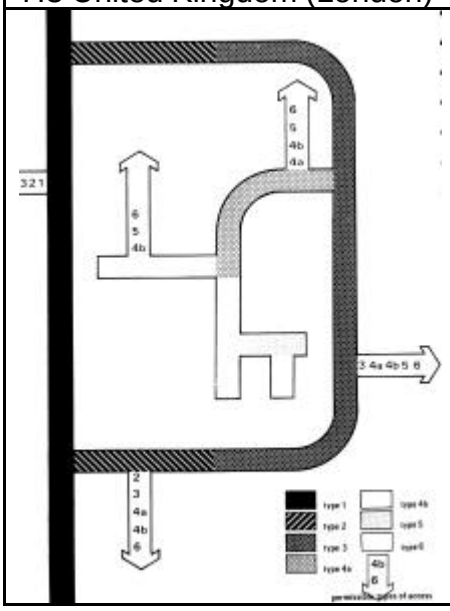
A street may be defined in terms of the connective role it plays in the transport network. This is similar to strategic role except that it does not contain the urban dimension, relating purely to the road network and the connections between types of route and types of network (eg, trunk road, connecting street).

This is used in a few cases, but not consistently across the whole spectrum. In the case of Spain and Portugal, this relates to mid range street types, the definition relating to the transition from the strategic to the local street network.

The official defined cases are given here. Street types whose names are suggestive of network role or configuration are given in Part C.

7. Network Role		
Case or criterion	Type	EXPLANATION
7.1 Spain	DISTRIBUTOR	The distributors gather the traffic that comes/goes goes to local streets.
7.2 Portugal	LOCAL DISTRIBUTOR ROADS	Distributes traffic from local network to structural network and vice-versa

It is possible in principle to construct a hierarchy of types that are purely defined by their network role, and no other factor. However, in practice, there are usually some other kinds of role woven in, even if network role is the main consistent means of differentiation over the spectrum.

7.3 United Kingdom (London)	
	Here the individual route types are illustrated in a way that more or less defines their role in the network. The types are: Type 1 Type 2 Type 3 Type 4 Type 4b Type 5 Type 6 GLC (1978) It is also theoretically possible that route types could be purely defined by their relationship to other route types.

8. Access Control

Access control may be specified on at least three distinct fronts.

- Firstly, there is frontage access control in terms of the allowance for building frontages to adjoin the street.
- Secondly, there is the degree to which other road types (side roads) may be permitted to gain access (to a main road) at junctions.
- Thirdly, it might refer to the degree to which access to the road is permitted or prohibited for use by different transport modes.

Cases where frontage access appears as a stand-alone criterion (as opposed to being part of the Circulation v Access theme) are tabulated here. Side road access and intersection control is also tabulated here. Access by different transport modes is dealt with separately under theme 10, Transport Mode.

8.1 Frontage Access

This includes actual reference to frontage access or implied access to adjacent land use (whatever physical form). It does not include access as in "circulation v access" cases.

Case or criterion	TYPE	Explanation
8.1.1 Spain	MOTORWAY	Prohibited
	ARTERIAL STREET	Controlled
8.1.2 UK	PRIMARY DISTRIBUTOR	No frontage access
	ACCESS ROAD	Use of the highway by frontagers
8.1.3 Greece	LOCAL STREET	Direct access to the origin & destination of the trip
8.1.4 Sweden	LOCAL STREET	Street, which provides car accessibility to buildings, parking etc.

8.2 Side Road Access and Intersection Control

Case or criterion	Attributes	TYPE
Spanish case Balaguer Camphuis et al (1984)	[Grade-separated] Connections	MOTORWAYS
	[Grade-separated] Connections or intersections with traffic lights	ARTERIALS
	Intersections with traffic lights or traffic signs (stop or give way)	DISTRIBUTORS
	Intersections with traffic signs (stop or give way) or without signing	LOCAL STREETS

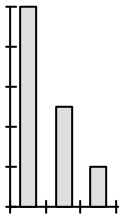
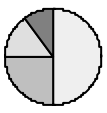
9. Traffic Volume

Perhaps surprisingly, the Classification Review found no consistent distinction of street type across the spectrum that was based on traffic flow (therefore this falls in part B). Therefore, although arterial streets may intuitively be considered to be those all-purpose streets carrying the major traffic volumes in a city, it may be that other criteria (such as strategic role in city network) are more useful as actual for classification purposes.

Classification by volume may be further distinguished by mode. Indeed, "Volume" could be regarded (or redesignated) as "Transport Mode by Use (Demand)" as opposed to "Transport Mode by Provision (Supply)".

Volume is in principle a measurable variable (rather than a designed or designated attribute). Its fluctuation in space and time makes it potentially unsuitable as a classification criterion since in principle a street could switch from one category to another several times over its length over the course of a day (or any other time period).

Many fine variations and permutations possible (eg, high bus flow/high pedestrian flow/medium traffic flow). The number of permutations of *categories* would generate an unmanageably large number of types. Therefore, some sort of prioritisation would be necessary, eg, to stick to traffic volume, or to use a proxy value for flow. The latter is tantamount to using an alternative theme altogether, eg, strategic role.

9. Traffic Volume		
Criterion		Type or attributes
9.1 By flow of vehicles (or pedestrians) 	9.1.1 Traffic Flow	High traffic flow
		Medium traffic flow
		Low traffic flow
	9.1.2 Public Transport Flow	High flow of buses, trams, etc.
		Medium flow of buses, trams, etc.
		Low flow of buses, trams, etc.
	9.1.3 Bicycle Flow	High flow of bicycles
		Medium flow of bicycles
		Low flow of bicycles
	9.1.4 Pedestrian Flow	High pedestrian flow
		Medium pedestrian flow
		Low pedestrian flow
9.2 By flow of people *in* vehicles (or pedestrians) 	9.2.1 Total Flow of People (all modes)	High total flow of people (all modes)
		Medium total flow
		Low total flow
	9.2.2 Flow of people by greatest percentage share	Greatest % in private vehicles
		Greatest % in buses, trams, etc.
		Greatest % on foot, etc.
	9.2.3 Flow of people in 'more sustainable modes'	Mostly in 'more sustainable' modes
		Intermediate
		Mostly in 'less sustainable' modes

10. Transport Mode

Transport Mode is used in some of the classification systems encountered in the case study countries. However, it is not used as a consistent factor distinguishing types over the whole spectrum in any case. It tends to be used mostly to distinguish types at the 'top' end of the hierarchy (eg, motor vehicles only) or 'bottom' end (eg, pedestrian only streets).

Some theoretically possible systems addressing the whole spectrum are now presented here. These refer to Transport Mode by Provision (Supply). This Provision could be seen in at least three aspects:
1. By general functional role or significance;
2. By designation in the spectrum from prioritisation to prohibition;
3. By specific infrastructure supply.
Clearly, the three of these are closely linked in practice, though separable in principle.

10.1 Transport Mode: Permutations of Role

This would in practice reflect *use* (demand) to some extent, but in principle is considered to reflect the intended functional role or significance. That is, it would be a designated attribute rather than a measured one.

In terms of this classification, both the Arterial Street and Sustainable Arterial Street would be Type 7, featuring general traffic, public transport and pedestrians. Some major Type 3 streets (lacking public transport) might also be considered arterial streets, though such types are less likely to fit the profile of the Sustainable Arterial Street. Some Type 2 routes might loosely be referred to as being 'arterial' in practice, although they might not be recognisable as 'streets'.

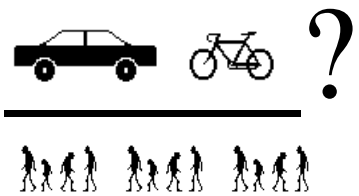
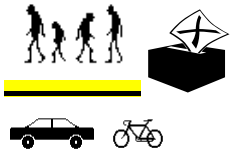
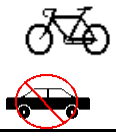
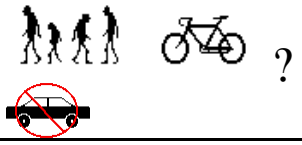
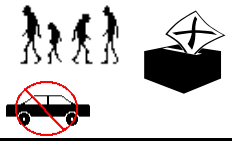
10.2 Transport Mode Provision/Prioritisation/Prohibition

This is most clearly based on *designated* attributes (which in some respects may be regarded as independent of form or function). The 'Common Reference' Classification (section 3; Appendix 3) uses this as a basic ordering theme, although is an 'impure' version of this since it also allows for grading, in its middle range, by traffic function.

Both the Arterial Street and Sustainable Arterial Street should be placed in this mid range, corresponding to the Vehicular Priority Road/Street – ie, an all-purpose street with 'normal' priority of vehicles over pedestrians.

This classification criterion seems useful because it may in principle be designated using legally defined entities such as 'motor vehicles'.

10.1 Transport Mode: Permutations of Role Here only three 'transport modes' are recognised, for the purposes of illustrating a full set of permutations of different modes.	
Type	Explanation
0. No modes	Example: Inaccessible space not used for transport purposes.
1. Pedestrians only 	Example: pedestrian street, pedestrian route.
2. General traffic only 	Example: motorway or dedicated 'distributor road' with no bus service.
3. General traffic and pedestrian 	Example: urban street with no bus service
4. Public transport only 	Example: busway, bus gate.
5. Public transport and pedestrians 	Example: 'transit mall'; city centre shopping street with bus or tram but general traffic excluded.
6. Public transport and general traffic 	Example: motorway or dedicated 'distributor road' with bus service.
7. Public transport, general traffic and pedestrians. 	Example: all-purpose arterial street with bus or tram.

10.2 Transport Mode Provision/Prioritisation/Prohibition This relates to the Common Reference Classification presented in section 3/Appendix 3.	
Type	Explanation
Motorway 	**Common Reference Class 0.** Non motor and non vehicular traffic prohibited.
Motor Traffic Road 	**Common Reference Class 0.5** Non-motor traffic not provided for (but not prohibited). May physically prevent pedestrians from crossing at-grade, with bridges or underpasses provided instead.
Vehicular Priority Road/Street 	**Common Reference Classes 1 to 3.** All-purpose traffic provided for, with priority to vehicular traffic ('normal vehicular priority)'.
Pedestrian Priority Road/Street/Area 	**Common Reference Class 3.5.** Priority not to motor traffic (priority to non motor traffic, priority to pedestrians, or equal priority); motor traffic may not be explicitly provided for, but not prohibited.
Bicycle Route 	**Common Reference Class 4.** Bicycles only. Not intended for pedestrian use. Motor vehicles prohibited.
Pedestrian & Bicycle Route/Area 	**Common Reference Class 4.5.** Pedestrians and bicycles provided for. Motor vehicles prohibited.
Pedestrian Route/Street/Area 	**Common Reference Class 5.** Pedestrians only. Not intended for bicycle use. Motor vehicles prohibited.

Note: Further categories could be Busway – prohibited to all traffic but buses – and some combination of buses and non motor traffic. However, the intention here is to present a single 'linear' listing. Then other dimensions can be added later when the whole breadth of classification possibilities are being considered.

10.3 Transport Mode: Infrastructure Supply

This relates to the specific provision, such as provision of bus lanes, cycle lanes, etc. It is based on *designed attributes*, and most clearly a theme relating to *supply* or *form*.

A large number of distinctions may be made, and hence a large number of permutations may be generated.

Another potential drawback is that the nature of the infrastructure may change over relatively short distances – such as cycle lane or footway intermittent along a given section of road. This would mean in principle a given street would vary in type along its length, unless a separate category for 'intermittent' was used. This would tend to further multiply possible categories.

The Arterial Street and Sustainable Arterial Street would be assumed to be Standard Streets; in the case of the sustainable Arterial Street, beneficially with explicit provision for buss and/or trams and/or bicycles.

10.3 Transport Mode: Infrastructure Supply Theoretical suggestion for illustration in ARTISTS project.	
Type	Explanation
10.3.1 Footpath (or Foot Street)	With provision for walking and cycling
10.3.2 Cycle path, way or track	With provision for cycling
10.3.3.Shared foot/cycle path (or street)	With provision for walking and cycling
10.3.4 Road or Way	With a carriageway for general vehicular traffic (this may be shared by other modes, but these not explicitly provided for; contrast 10.3.8)
10.3.5 Standard Street (ie, with footway)	With carriageway for general vehicular traffic and footway alongside
10.3.6 Road with Cycle Lane	With carriageway for general vehicular traffic with cycle lane alongside
10.3.7 Standard Street with Cycle Lane	With carriageway for general vehicular traffic with cycle lane and footway alongside
10.3.8 Shared Surface Street or Area	With a carriageway designed as a shared surface for use by general vehicular traffic, pedestrians and cyclists
10.3.9 Busway	With provision for buses only
10.3.10 Bus Street	With provision for buses with footway alongside or around
10.3.11 Standard Street with Bus Lane	With carriageway for general vehicular traffic with bus lane and footway alongside
10.3.12 Standard Street with Bus and Cycle Lane	With carriageway for general vehicular traffic with bus lane, cycle land and footway alongside

11. Other Urban Uses and Users

In the context of a classification exercise oriented towards existing classifications of streets, which are primarily basically classifications of urban roads, it has perhaps been permissible to put all kinds of users of the street, other than transport users, into a single 'other' category. This reflects the existing (lack of) emphasis on these other 'non transport' users of the street such as residents and shoppers[17].

In the classification exercise, it was found that these 'other urban users' are referred to only to a very limited extent – in only three countries explicitly – in connection with the definition of streets at the low end of the hierarchy.

Nevertheless, in reality almost any type of street that is worthy of the name (ie, excluding motorways, etc) is likely to accommodate these other users. This will include Arterial Streets and, assuredly, Sustainable Urban Streets.

11. Other Urban Uses and Users		
Case	TYPE	Explanation
11.1 Belgium	LOCAL STREET	Provides access for local residents
11.2 UK	ACCESS ROAD	Use of highway by frontagers. Delivery of goods and servicing of premises.
	PEDESTRIAN STREET	Walking, meeting, trading
11.3 Portugal	PEDESTRIAN STREETS	For social, meeting and shopping

Since non-transport use of streets is one of the themes deserving particular attention for Sustainable Arterial Streets, this is returned to in Part C.

12. Environment

A street type may be defined by the kind of 'environment' it serves or passes through. In the case of Hungary, 'environment' is one of the criteria used consistently to rank all (all-purpose) street types. However, in that case, 'environment' refers to a combination of built-up area and sensitivity of environment, and the latter only has two states (sensitive and non-sensitive) which do not themselves differentiate types within the spectrum. The only other explicit reference to the environment is in the case of Copenhagen, where the aim of the LOCAL STREET is to 'minimise the car traffic and the speed for the sake of the environment in the residential areas'.

Since environment is one of the areas deserving significantly greater attention in the case of Sustainable Arterial Streets, this is returned to in Part C.

[17] Incidentally, it may be pointed out that these other urban users (strictly, those using the street space and not the occupiers of property) are actually likely to be mobile, and so the classification of a person as a 'shopper' in itself the result of an implicit prioritisation of their urban function (shopping) over their mobility function (eg, pedestrian).

13. Built Frontage

A street type may be defined according to whether or not it has built frontages (in effect, whether it might qualify as a street or not). The intended use here applies where a street type is defined with explicit reference to buildings or built frontages, not simply that it is called a 'street'.

In fact, the only explicit reference to built frontages (as opposed to frontagers, who are classed 'users' as in 11 above), is in the case of Germany, where the presence of frontages is used as one part of a composite theme that defines street types across the spectrum. Basically, there is a single point of distinction which rates all streets either as non frontage streets (A or B type streets) or as frontage streets (C, D or E type streets).

Since the presence of frontages is important to the recognition of streets, as opposed to roads, it is considered one of the categories deserving significantly greater attention in the case of Sustainable Arterial Streets, and is elaborated in Part C.

14. Road Width

Roads and streets may be defined according to their physical form or road standard, such as road width[18]. Although a common way of describing roads in general terms, it appears to be little used in the specific context of street classification – at least in the cases encountered so far. Clearly, in slightly different contexts with different emphases – especially new roads and inter-urban roads – distinctions between single carriageway and dual carriageway, etc. will have greater importance. Road standard in a sense falls outside the term 'functional classification', since it relates to supply of infrastructure.

In the Classification Review, road standard (excluding access control) is hardly referred to at all. In Portugal, the two upper categories refer to high capacity, and in Spain the highest category (Autopista) is described as having two or more lanes.

Road width itself is inherently a property that is liable to continuous variation, that is not necessarily directly related to a street's function. This may explain why it is not used consistently as a criterion for classifying streets in official classifications. Yet it is clearly an obvious and intuitive descriptive handle, and features in several non-official classifications, or illustrations of types, or design guidance.

The overall physical form and character of streets, including their width, is considered one of the categories deserving significantly greater attention in the case of Sustainable Arterial Streets, and is returned to in Part C.

[18] 'Road width' is here preferred to 'road standard', since road standard could be taken to include a package of attributes including access control, intersection control and vehicular exclusions.

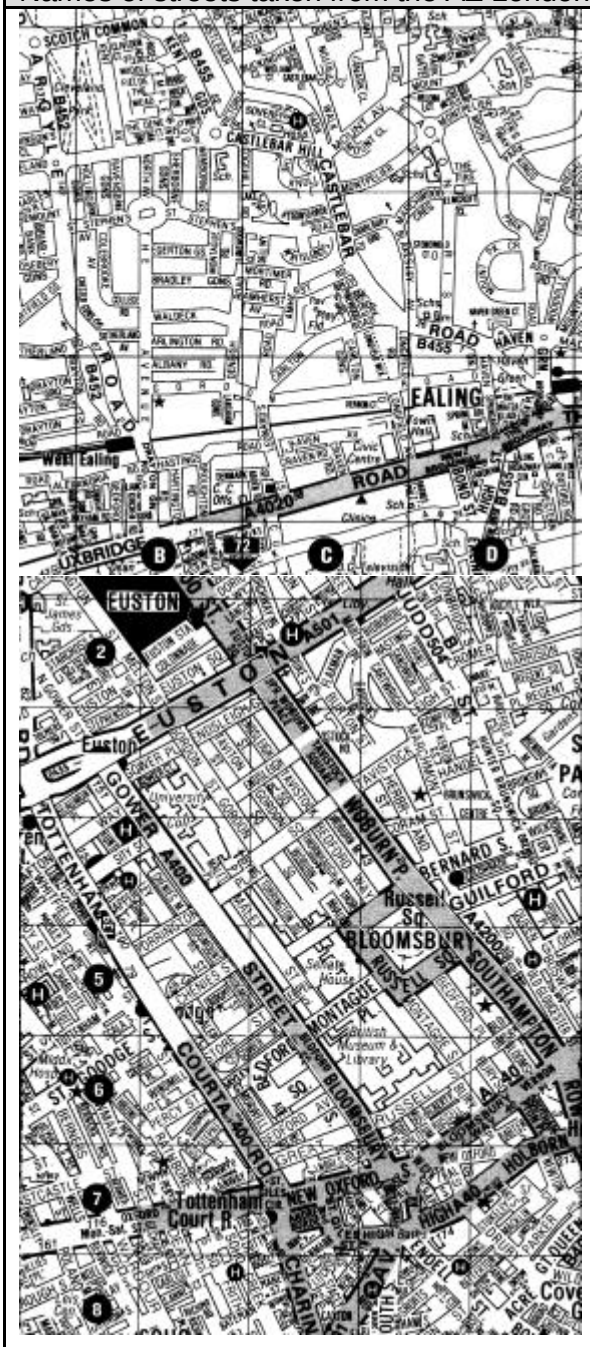
Part C.

15. Street Name

The name attached to a street may often give an indication of possible classification themes. Below is a list of street names taken from the AZ London Street Atlas (Geographers', 1993). Each might be regarded as a 'type' in itself, or could be grouped into a number of classes (see over).

15. Street Name

Names of streets taken from the AZ London street atlas.



ALLEY
APPROACH
ARCADE
AVENUE
BOULEVARD
BRIDGE
BROADWAY
BUILDINGS
CIRCLE
CIRCUS
CLOSE
COTTAGES
COURT
CRESCENT
DRIVE
EMBANKMENT
END
GARDENS
GATE
GREEN
GROVE
HILL
LANE
MANOR
MANSIONS
MARKET
MEWS
PARADE
PARK
PASSAGE
PATH
PLACE
RISE
ROAD
ROW
SQUARE
STREET
TERRACE
VALE
VIADUCT
VIEW
VILLAS
WALK
WAY
YARD

15. Street Names, classified by theme	
Theme	TYPE
15.1 General route	DRIVE ROAD WAY
15.2 Infrastructure	BRIDGE EMBANKMENT QUAY STEPS VIADUCT
15.3 Relation to Topography	HILL RISE VALE VIEW
15.4 Planting	AVENUE BOULEVARD GARDENS GREEN GROVE PARK
15.5 Threshold function	APPROACH END GATE TOLL
15.6 Shape	CIRCLE CIRCUS CRESCENT OVAL SQUARE
15.7 Other Place	BROADWAY MALL PLACE PRECINCT
15.8 Relation to Form of Buildings or Enclosure	ARCADE BUILDINGS COTTAGES CLOSE COURT MANOR MANSIONS MEWS PARADE ROW TERRACE VILLAS YARD
15.9 Scale of Route	ALLEY LANE PASSAGE PATH WALK
15.10 Commercial Function	MARKET

16. Street in Cross-Section

Street in Cross-section is really a composite category that may combine road width/standard, presence of building frontages, and possibly the different transport modes accommodated.

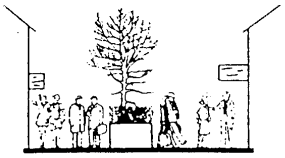
For example, in the case of the UK, different road widths are implied in illustrations of standard road types, but those widths or other physical features are not part of the definitions of those types.

16.1 Street in Cross-section		
Case	Type	Criterion
16.1.1 Act for the Rebuilding of the City of London (1667)[19] The street types were defined along with implied building types.	1. High and principal streets	40ft
	2. Streets and lanes of note	35ft
	3. By-lanes	14ft
	4. Narrower alleys	9ft
16.1.2 Spain Machón et al. (2000)	14.1.1 Narrow streets	With equal or lower width than 6-8m.
	14.1.2 Medium size streets	Between 6-8 and 15-20 m
	14.1.3 Wide streets	More than 20 m

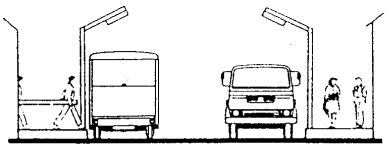
[19] On the 1st of September 1666, The Great Fire of London destroyed 80% of the walled city of London, and with it 89 churches, 13200 houses and 400 streets. King Charles II's 1667 act was established "to upgrade the quality of buildings and streets, to prevent fire, and to ensure 'the better regulation, uniformity and gracefulness' of new building". "It established a strict typology of streets, with buildings to match" (Hebbert, 1998).

16.2 Street in Cross-Section

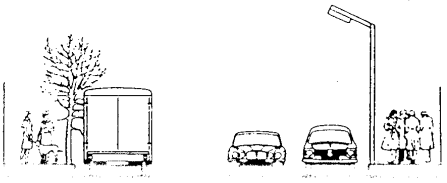
This is an illustration of typical cross-sections, but it must be stressed that these are not used to *define* the street types concerned. Source: Roads and Traffic in Urban Areas, UK (IHT and DoT, 1987).



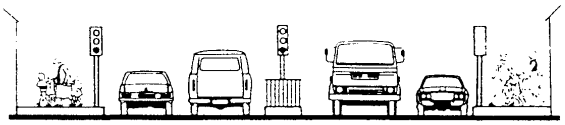
(a) Pedestrianised Streets



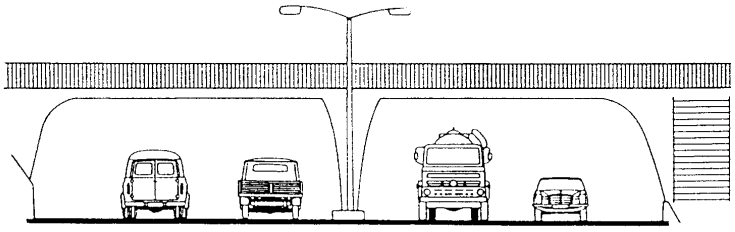
(b) Access Roads



(c) Local Distributors



(d) District Distributors

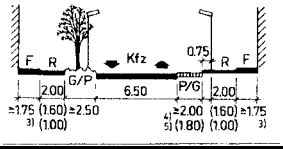
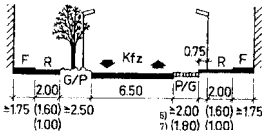
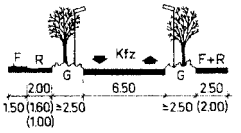
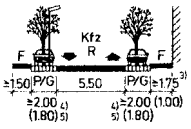
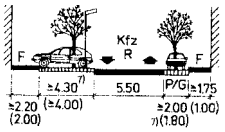
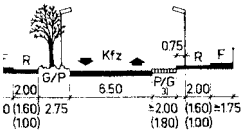
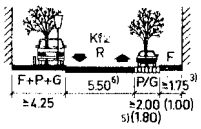
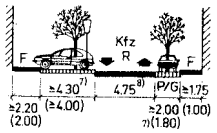
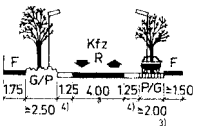
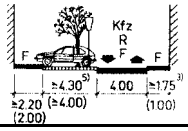
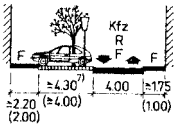
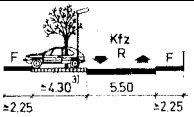
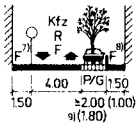
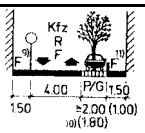
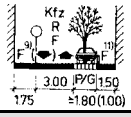


(e) Primary Distributors

Source: IHT & DOT (1987), Roads and Traffic in Urban Area

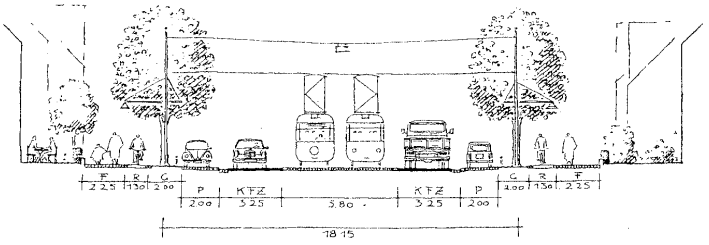
16.3 Street Cross-section in Design Guidance

Source: EAE 85/95 (German guidelines). Note: also relation to decisive function (circulation, access or stay), and several other factors (not shown here). Supplied by Univ. of Kaiserslautern.

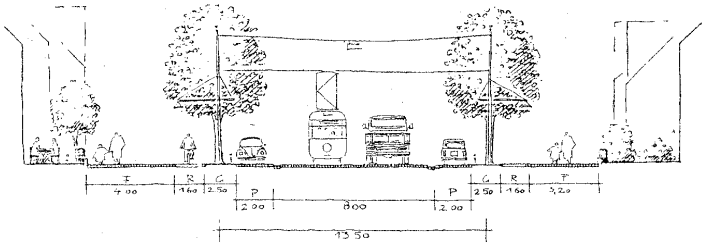
Design elements in city centres.	Design elements in old built-up areas near city centres.	Table 17.
		
		
		
		
		
		

16.4 Street Cross-sections with pedestrians, traffic and trams

Source: EAHV 93



Geplante Querschnittsgestaltung



Alternative Querschnittsgestaltung

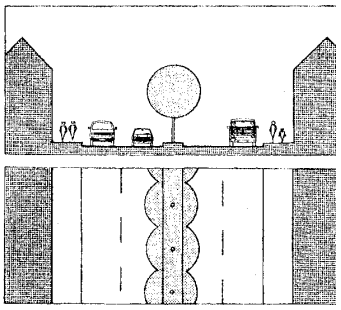
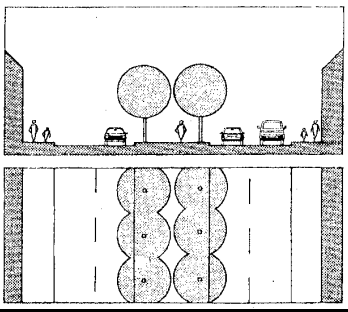
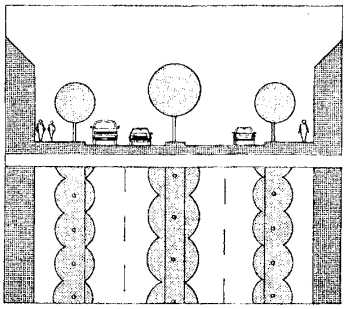
17. Frontage Form

A street could be defined by the physical presence of frontages.

17. Frontage Form	
Category	Explanation
Continuous	Continuous frontage buildings (eg, tenements, terraces or shopping parade)
Intermittent	Individual buildings typically set back from the road.
No frontages	No buildings adjoining/accessing the roads. This would apply in the case of inter-urban roads, roads through parks, over bridges, and urban roads where frontage access was specifically banned.

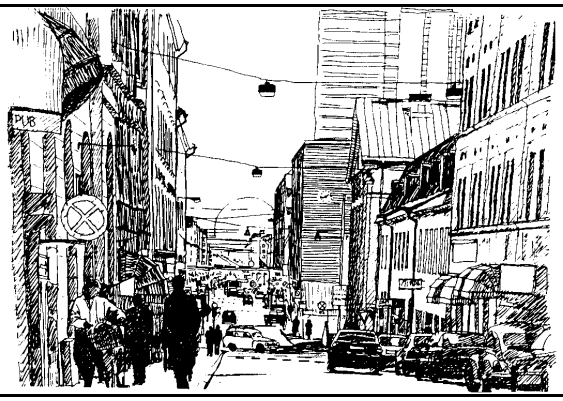
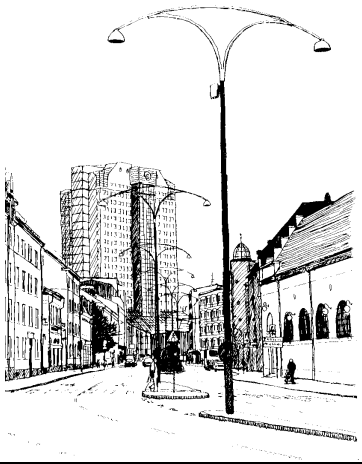
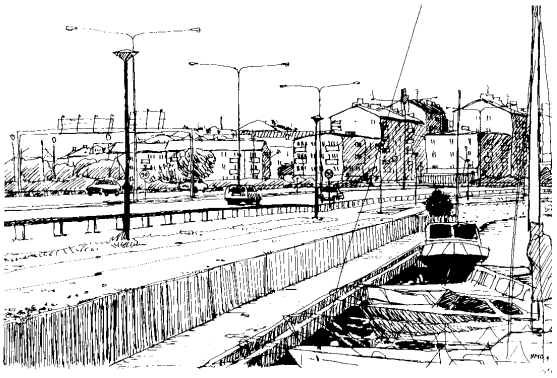
18. Planting

A street could be defined in terms of the type of planting along it. Three street types are shown here, identical in road layout, but distinguished by the number of rows of trees.

18. Planting Boulevard sections from EAHV 93. Supplied by University of Kaiserslautern.	
	18.1 Boulevard with one line of trees
	18.2 Boulevard with two lines of trees
	18.3 Boulevard with three lines of trees

19. Street Character

This is suggested as a possible categorisation that would range from 'street-like' character at one end to 'road-like' at the other. The examples show three cases which could all be arterial streets (even different sections of the same route). They might have the same traffic role - but have quite different *character*.

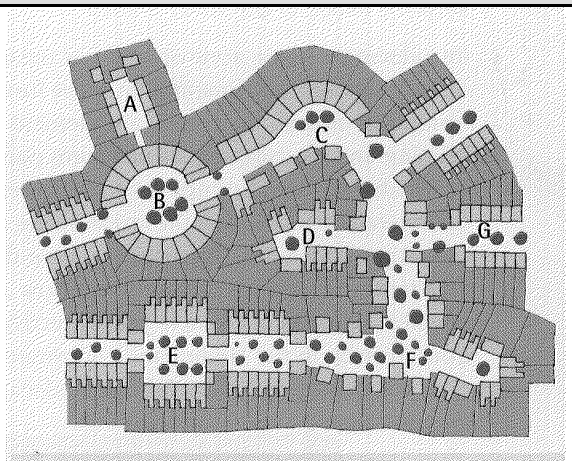
19. Street Character Sketches taken from the booklet "Calm Streets!" produced by the Swedish Association of Local Authorities (supplied by Malmö municipality).	
	**19.1 'Street' character** This shows a route that might be an arterial street. Certainly, one would say it has the typical character of an urban street.
	**19.2 Intermediate character** This "depicts a four-lane street in the city centre that derives its character from being considered as part of the city architecture. This means that kerbstones, stone retaining walls and simply-designed lampposts are used. The intersections are sometimes controlled by traffic signals and have cycle paths and walkways or pavements. Room-like space is created by the buildings and vegetation." (p87) However, the dual carriageway nature of the street could make it feel like an intermediate case between above and below.
	**19.3 'Road' character** This is coined to hint that, although an urban road, the term road itself also connotes non-urban character. The text accompanying states (p86): "It is important to adapt the traffic environment to the surroundings so that we build *streets* in the city and *roads* in the country. The sketch on the left is of a four-lane street close to the city centre that bears the character of a country road. The road has verges, embankments, metal crash barriers, fabricated steel lampposts and bridges or tunnels with ramps, even for moderately large traffic volumes."

20. Urban Character

This is similar to street character, but implies more the wider urban context. Where street character could perhaps be captured in a single view or perspective, as above, urban character implies more about where the street is and its role in the urban area.

20. Urban Character		
Case	Category	Explanation
Spain This is a classification 'according to the urban scenery in which the street is located'. This mixes: ?? road standard and layout ?? position in settlement and ?? age of development in addition to ?? urban character Machón et al. (2000).	Streets in historic centres	Narrow streets in general, with irregular layout and with an architectonic and urban scene with high historic ambient value.
	Streets in traditional centres	with analogue morphological characteristics, but located in little rural villages or in urban outlying centres
	Streets of nineteenth-century enlargement	corresponding to the urban extensions of past century and of the beginning of the current one; its conception takes already some needs of vehicular traffic: perpendicular line, middle widths, segregation, etc.
	Streets of "modern" enlargements or new areas of cities	It also considers the traffic but, in general, in the frame of urban views of open building or extensive single-familiar house.
	Other types	Park roads, ring roads or peripheric roads, promenades, boulevards, fluvial walkways, etc. (generally related to great openings of streets and demolition of medieval fences and walls of European historical centres, or to lands won from the sea, or to road openings of "large roads" above previous historical weaves, as "Gran Via" or baroque axis.)
USA Lynch (1981)	CHAOTIC COMMERCIAL STRIP BARREN ARTERIAL ARID INDUSTRIAL ROUTE	Lynch uses these as examples of the lack of ideas for types of street between the major traffic routes such as freeways and intimate pedestrian spaces.

21. Spatial Shape or Character



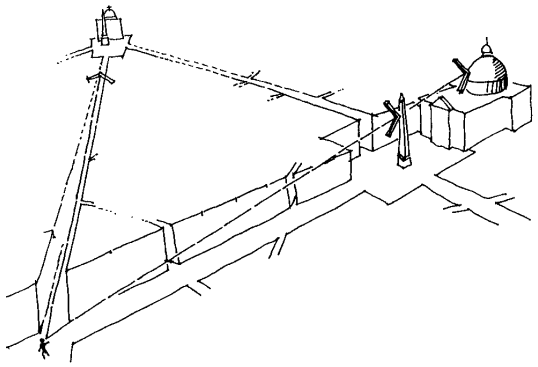
A; Mews; B: Circus; C: Crescent; D: Close; E: Square; F: Arcadia; G: Street

Illustration of different residential street space types. From guidelines for Home zones - the UK concept closest to the Dutch *woonerf* (Biddulph, 2001).

p51. "Different street spaces to create distinctive places".

A. Mews
B. Circus
C. Crescent
D. Close
E. Square
F. Arcadia
G. Street

22. Visual Axis



22.1 Vista Street

Here the streets acts as part of an architectural composition. Its role is as a vista - in fact a void, focusing attention on landmark buildings.

Original caption: Features of the 'Grand Manner' design method (Erickson, 2001: 26)

23. Civic Role

23.1 'Armature'

The concept of the 'armature' is based around the idea that the street is a (or *the*) central component of the urban fabric, containing the main public spaces and buildings, as well as the main flows of movement. The arterial street is likely to correspond with the concept of the armature.

Bill Erickson describes the 'armature' as "an urban structure that is experienced through movement. It is composed of spaces (streets and squares) and of objects (buildings and monuments)" (Erickson, 2001:24)

A street could be defined as an ARMATURE.

24. Spatial ‘Integration’

Space syntax is a method of spatial analysis which has been applied to the structure of space in buildings and the structure of urban space.

Space syntax is a quantitative analysis based on the configuration of 'axial lines of sight'. Space syntax makes considerable use of the property of spatial ‘integration', which provides an indication of where the most central, connective routes in a network lie, and has been used to predict the intensity of pedestrian use of space, and has also been correlated with traffic volume. High spatial integration is often associated with intense pedestrian activity, often coinciding with places of high social interaction or commercial activity.

Typically, arterial streets forming part of the main structure of a city’s road network would have high values of spatial integration. In maps colour-coded with the gradient from high spatial integration (red) through medium (yellow) to low spatial integration (green and blue), arterial routes often stand out clearly in red.

24. Spatial ‘Integration’	
Spatial Integration (Hillier and Hanson, 1984; Hillier, 1996).	In theory it would be possible to allocate every street (or rather each street space defined by axial line of sight) a value of the property of spatial integration, and generate a spectrum of types based on this, ranging from high spatial integration to low integration.

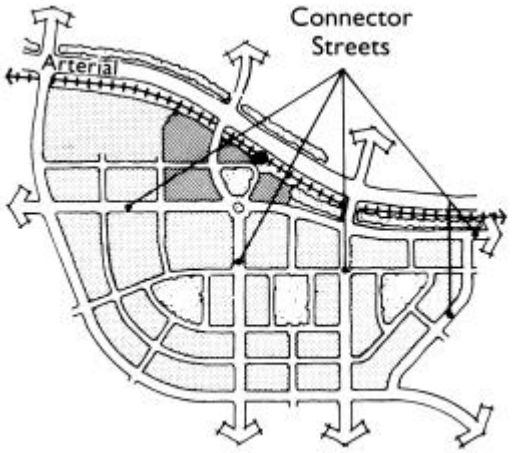
25. Urban Morphology (Formation)

Various schools of urban morphology describe different types of street defined by their manner of formation. This can help explain the existence – and to some extent the role – of a street in the urban network, though it is not strictly a functional classification.

25. Urban Morphology (Formation)	
Urban morphological terms (selection of street types defined by how they came into existence) From a glossary of urban form terms: Larkham and Jones (1991)	BREAK-THROUGH STREET BYE-LAW STREET CONSEQUENT STREET OCCUPATION ROAD

26. Structural Role

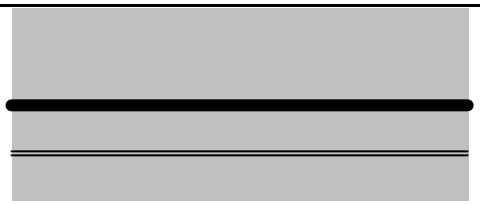
In general it is possible to use descriptive terms to indicate the structural or configurational role of a street in the network. This is similar to network role but has more specific connotations relating to the configuration on one route relative to another within the network.

26. Structural Role	
26.1 General descriptive Terms that simply describe routes in terms of their structural role.	AXIAL STREET BY-PASS ROAD CONNECTOR STREET COLLECTOR-DISTRIBUTOR ROAD CUL-DE-SAC GRID ROAD LOOP ROAD RADIAL ROAD SPINE ROAD THROUGH ROAD
	**26.2 Graphically defined** A particular type of street defined by its structural role in (neo) traditional street grids is the CONNECTOR STREET, advocated by some New Urbanists. According to Calthorpe (1993), the CONNECTOR STREET would connect to minor side streets, other CONNECTOR STREETS, and ARTERIALS. In a sense this type may be defined graphically, as depicted here.
26.2 Route Structure Analysis This method identifies networks as being composed of discrete routes which may be continuous through junctions. The way that the different routes are connected together generates properties of continuity, connectivity and depth. The combination of such properties can explicitly identify different route types defined by their structural role.	It is possible to define quantitatively routes defined by their structural role such as: THROUGH ROAD SPINE ROAD COLLECTOR ROAD CONNECTOR STREET CROSS-CONNECTOR CANTILEVER These are effectively defined based on their relative position in the network and their continuity relative the to number of junctions and side roads, etc. (Marshall, 2001 and forthcoming)

27. Corridor Role

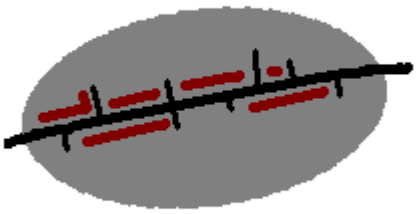
An arterial street may be classified according to its role along a particular *corridor*, and the extent to which it has *closely associated parallel routes* which bear some of the corridor's capacity. Four categories were suggested in the Initial Scoping Paper and are defined in the table. The Arterial Street and Sustainable Arterial Street could fit any of the four categories.

Clearly, some discretion is required in defining corridors, regarding whether a particular alternative route is 'closely associated' or not. In some cases, the alternative route may be literally in parallel, overhead or underneath (eg, elevated motorway, sub-surface metro); or share a start and end point; but in other cases some judgement would be required, and possibly further criteria developed.

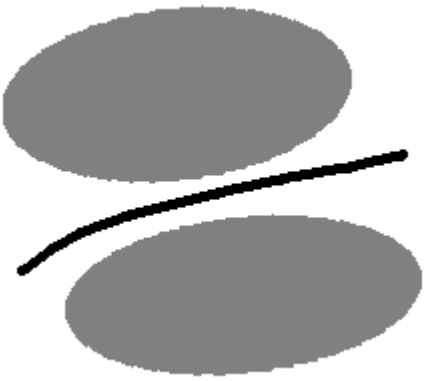
27. Corridor Role Suggested as part of the ARTISTS project (IP).	
	**27.1 'Sole conduit' for all modes** – where the street is the only route in a corridor, bearing the full capacity for the corridor across all modes.
	**27.2 Paired with complementary PT route** – where the street has a closely associated parallel public transport route – for example, a railway line adjoining (or directly underneath). The total public transport capacity of the corridor is therefore shared between the arterial street and the complementary PT route.
	**27.3 Paired with complementary traffic route** - where the street has a closely associated parallel traffic route – for example, a relief road or elevated motorway (could be directly above). The total traffic capacity of the corridor is therefore shared between the arterial street and the complementary traffic route.
	**27.4 Complementary PT and traffic routes** – where the street is paired with both a parallel PT route and parallel traffic route.

28. District Role

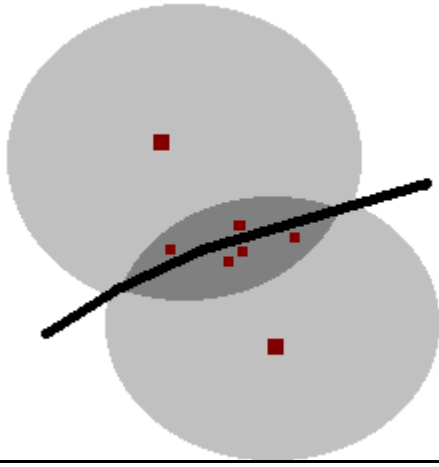
Suggested as part of the ARTISTS project (SM).



28.1 'Spine' of a district.
Here a street is clearly the activity focus for, and central public space of, a particular *district*. Wherever districts are identifiable, it is often possible to identify a district spine route. In London, an example could be Upper Street in Islington, where this is the main shopping street and activity spine for the area; the identifiable district of Islington lies on either side of it; the district's central functions lie along it.



28.2 'Separator' (barrier) between districts. Here a route acts as a barrier separating districts. This severance would typically apply with a heavily trafficked suburban route, with few urban facilities along it. It would particularly apply in routes built or upgraded in the second half of the 20th century, where the traffic capacity of such routes was maximised, and access and frontage functions discouraged, and local activities planned as separate 'clusters' or 'centres' away from the main road. The ultimate extreme of a barrier would be a route completely barring public/pedestrian access – though this would no longer qualify as an arterial street.



28.3 'Seam' between districts.
A street functioning as a 'seam' is taken to be one that lies alongside two different areas or districts, but acts to join them together, in possessing some activities or facilities used by both adjoining districts (including the role as a public transport route). An example in London could be Pentonville Road, where there is Islington to the north and the Clerkenwell/Finsbury area to the south. Pentonville Road is hardly a 'local high street' (like Upper Street), but performs a linking function.

29. Land Use or Frontage Function

Street types defined by the land use zones they pass through or frontage uses alongside.

29. Land Use of Frontage Function		
Case	Type	Explanation
29.1 Land Use Function Machón et al. (2000)	RESIDENTIAL STREET	-
	INDUSTRIAL STREET	-
	COMMERCIAL OR OFFICE STREET	-
	OTHER PREDOMINANT USE	Park roads, urban motorways, streets of non-residential activities, etc.
29.2 Urban function Moughtin, Oc & Tiesdell (1995)	1. CIVIC STREET 2. COMMERCIAL STREET 3. RESIDENTIAL STREET 4. MULTI-FUNCTION STREET	
29.3 Frontage Function Suggested as part of ARTISTS project.	RESIDENTIAL STREET	Mainly houses, apartments and other residential buildings.
	COMMERCIAL STREET	Mainly shops and/or offices.
	MIXED STREET	Mixture of other categories.
	OTHER STREET	A great variety of other categories could be recognised, such as industrial, civic, community, etc., or further subdivisions of commercial or residential.

30. Commercial Role

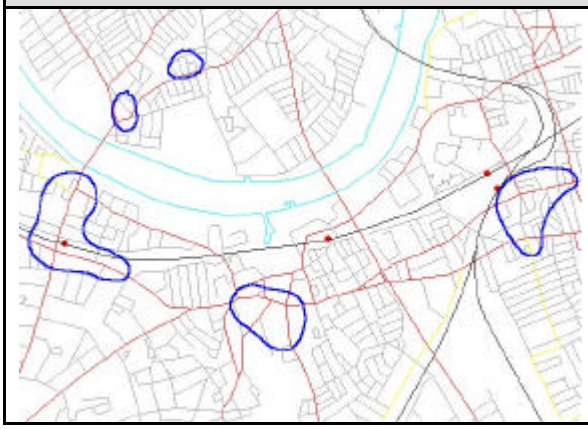
A street may be defined by its commercial role as a shopping street, through a variety of indicators.

30. Commercial Role	
30.1 Shopping Street	Shopping Street Non shopping Street
30.2 Retail Turnover	High (Euro/month or year) Medium (Euro/month or year) Low (Euro/month or year)
30.3 Retail Rental	High (Euro/m^2 floorspace) Medium (Euro/m^2 floorspace) Low (Euro/m^2 floorspace)

31. 'Towncentredness'

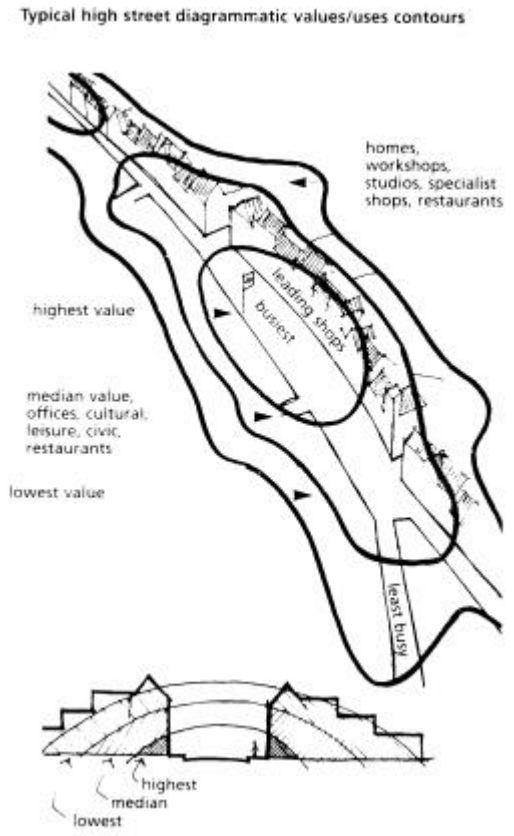
The Centre for Advanced Spatial Analysis (CASA) at University College London has developed an index of 'towncentredness', with the purpose of defining town centres for statistical purposes. It is based on a mix of commercial and other land use indicators of central function.

It is potentially of interest to ARTISTS is that it can thereby identify areas definable as "town centres" and we can see to what extent the contours of 'town-centredness' correlate with arterial streets, and how arterial streets are the focus of, or otherwise pass in and out of, such areas.

31. 'Towncentredness'	
	**'Towncentredness'** This diagram only shows a single 'key contour'. The full suite differentiates a surface or spectrum of towncentredness, which in places traces linear bands along arterial streets. Source: CASA (2002)

32. Intensity of Use

A street could be defined according to the intensity of uses along it.

32. Intensity of Use	
	This graphically depicts three levels of intensity which could contribute to the classification of street type. 32.1. High intensity 32.2. Medium intensity 32.3. Low intensity Source: Barton, Davies and Guise (1995)

33. Urban Uses and Users

Presented here is simply a list of users. No actual street types are given at this stage. Street types could be constructed from these, according to which users or combinations of users were to be catered for or prioritised.

33. Urban Uses and Users of Streets Suggested as part of ARTISTS project (SM).			
Users	Uses of street space	Attributes of Vehicular Activities	?? Through movement ?? Loading/servicing/picking up/setting down ?? Parked, etc.
		More Mobile Pedestrian Activities	?? Parading ?? Jogging ?? Walking
		Intermediate Pedestrian Activities	?? Demonstrating ?? Exercising ?? Loitering ?? Playing ?? Shopping ?? Sightseeing ?? Soliciting ?? Windowshopping ?? Working (eg, cleaning, building)
		More static pedestrian activities	?? Eating/drinking ?? Selling/business ?? Sitting ?? Sleeping
	Intermediate	Any of above activities performed just inside or outside buildings, that are in partial contact with people on the street, eg sitting on balcony, playing on steps, etc.	
	Users of adjoining buildings	Users primarily local residents Users primarily local business owners/employees Users primarily visitors/shoppers Use of adjoining buildings negligible	

34. Living Space

A street or part of street space may be defined to the extent that it corresponds with 'living space' rather than being a part of the traffic network.

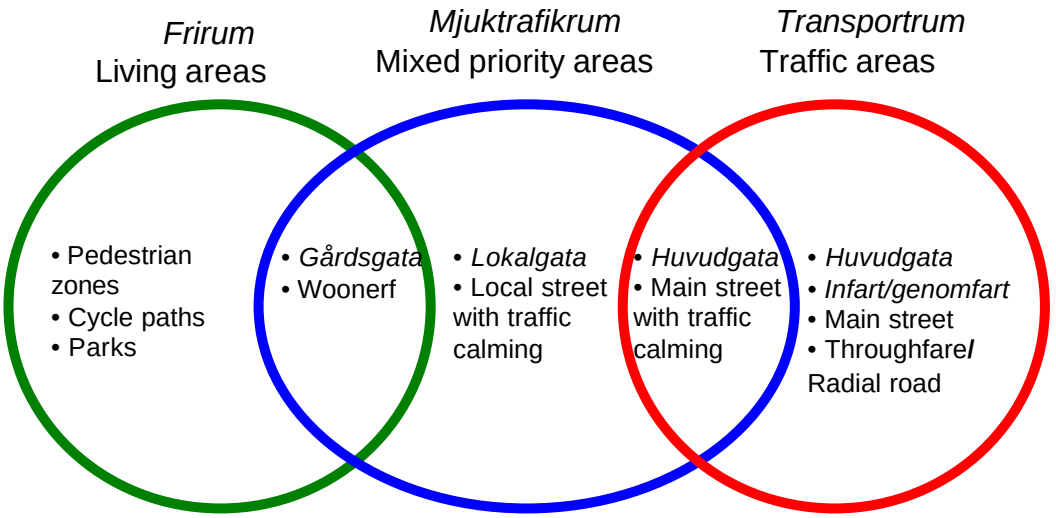
"In the late 80's, a new model was introduced, *Livsrumsmodellen* (the Living Space Model) formulated by Prof. Olof Gunnarsson at Chalmers Institute of Technology. This model contains three different urban spaces. The Living areas (*Frirum)* is totally free from motor vehicles, the mixed priority areas (*Mjuktrafikrum)* where the priority is shared between different users groups and which includes most parts of the city street network. The traffic areas (*Transportrum)* prioritise the motor traffic." Text from Stefan Krii and Elin Engqvist, Malmö Stad.

Living space is also associated with traffic speed (see part A, 1).

34. Living Space

Different street types classified according to the area they are associated with. Diagram supplied by Malmö Stad.

The living space model



35. Neighbourliness

This could have be defined as part of a larger class such as ‘community role’ but is here described as ‘neighbourliness’ to emphasise the fine spatial scale intended. The labels are deliberately framed in quantitative terms here to demonstrate that even ‘soft’ or ‘subjective’ criteria such as neighbourliness may be expressed in quantitative terms, should the circumstances demand.

<table>
<tr><th colspan="2">35. Neighbourliness

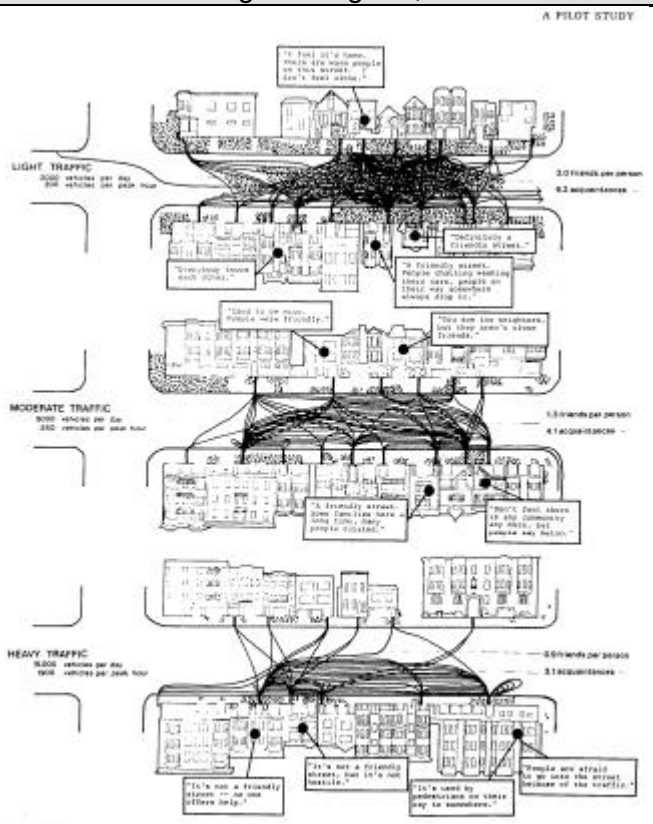
From Appleyard (1981).
Note that on the original diagram, the streets also are labelled by traffic flow.</th></tr>
<tr><td rowspan="3"> 

FIGURE 3.
San Francisco. Neighboring and visiting on three streets: lines show where people said they had friends or acquaintances. Dots show where people are said to gather</td><td>3.0 friends-per-person street</td></tr>
<tr><td>1.3 friends-per-person street</td></tr>
<tr><td>0.9 friends-per-person street</td></tr>
</table>

36. Pedestrian Use of Streets

In the traffic engineering context we may in circumstances equate pedestrians with the ‘movement’ function (slightly lower in the great scheme of things as the cyclist, one might say), while at other times, pedestrian spaces may be equated with the so-called access function, or non-transport uses. Indeed, the pedestrian use of streets can be divided simply into ‘circulation’ or ‘occupation’ functions, as suggested here.

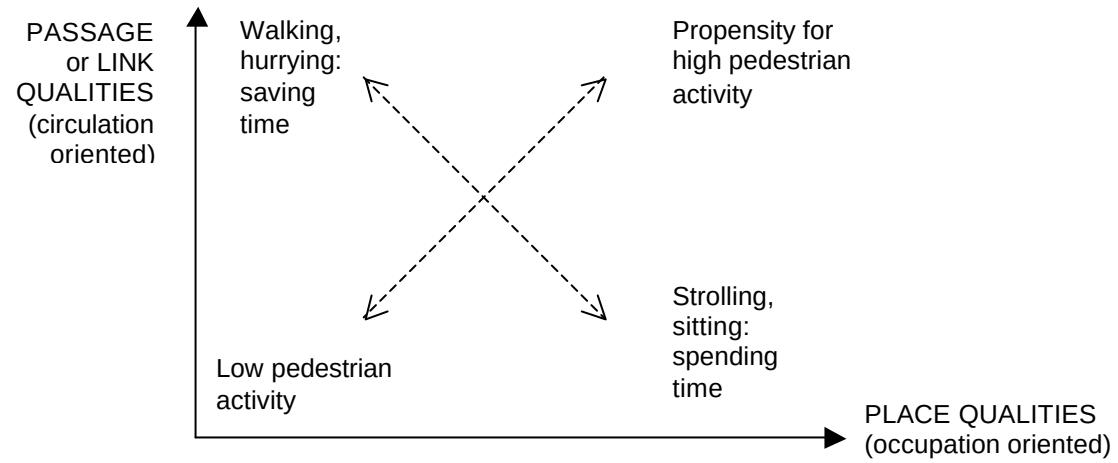
Here four categories of pedestrian use (hence possible categorisations of street space) are defined in relation to the pedestrian function of streets. The four categories can alternatively be seen as a two-dimensional spectrum, as shown. Although this division in some respects echoes the Circulation v Access spectrum (no. 7) for traffic, here there is allowance for street spaces that combine high values of both or low values of both.

36. Pedestrian Use of Streets

Suggested as part of ARTISTS project (SM).

Circulation-oriented (Passage oriented)	The street space is mainly used by people in transit, walking, scurrying, strolling, running. The **passage qualities** of the street as a **pedestrian route** are important, including width, flow, capacity – akin to criteria for vehicular flow. In the extreme case, circulation may predominate almost exclusively, as in the case of an underground station passageway, where the link/flow qualities are paramount and place qualities minimal.
Occupation-oriented (Place oriented)	The street space is mainly used for occupation by people – they may be occupied standing, sitting, talking, loitering, engaged in conversation (whether in motion or not). The **place qualities** of the street as **pedestrian space** are important, including aesthetics, visual interest, shelter, surface texture, presence of shops, street furniture, etc. Occupation-oriented spaces include not only streets but squares, parks, etc.
Circulation and occupation oriented	The street space is significantly oriented towards both circulation and occupation (there is a 'balance', at a high level). The Boulevard may be a classic example.
Not pedestrian oriented	The street space is not oriented toward pedestrian circulation or occupation (there is a 'balance' at a low or zero level). The pedestrian may be not provided for, or prohibited. The motorway would be the ultimate case.

Suggested relationship between pedestrian circulation and occupation (Marshall, 1998).[20]



A street space with poor passage qualities (eg, poor surface, narrow, cul-de-sac) will deter pedestrian use at least for through movement. A street space with poor place qualities (eg, noisy, exposed, blank walls, etc.), will deter pedestrian use at least for lingering, occupying space. The design of street space may prioritise circulation or occupation. If both are required, non-pedestrian uses may have to be sacrificed.

[20] The terms 'link qualities' and 'place qualities' are from Caliandro (1978).

37. ‘Diverse’ Vehicular Classification

This is devised to express ‘soft’ functions of streets (living, shopping, people, children) in vehicular terms. It deliberately relegates motor traffic to a single ‘other’ category. In theory, it could be used as a statistical description of streets – provided a fine enough data set could be obtained – and hence used to classify street according to priority users, or typical combinations of use.

Although not likely to be destined for actual application, this classification is used to illustrate a few points about the nature of classification systems:

- Street design will tend to prioritise those classes of traffic/uses that are officially recognised and coded in data sets. If a particular mode of movement is not recognised, it is unlikely to be catered for; it may be marginalized or even discriminated against.
- There is often no comfortable accommodation provided for rollerskates, rollerblades, skateboards and so on. They share the some characteristics of pedestrian motion and manoeuverability but at higher speed. They do not comfortably fit on either the footway or carriageway. They may even be discriminated against by regulation.
- Categories can be made as coarse or fine as desired. Lumping all motor traffic together in a single category is in some respects no more crude than lumping all non motor traffic together.
- With sufficiently sensitive data capture, a ‘serious’ and ‘objective’ looking mapping exercise could be based on these vehicle use categories, to define street space type.

37. ‘Diverse’ Vehicular Classification Suggested as part of ARTISTS project (SM).		
Vehicular use	Possible unit	Indicates
Unicycle	Flows of >0 per year	Street space with periodic recreational use
Baby buggies and prams	Flows per day	Vulnerable user needs, recreation or transit
Child’s pedal car	Observations	Vulnerable user needs, recreational use
Child’s scooter	Observations	Vulnerable user needs, recreational use
Shopping trolley	Flows, or number parked per m^2	Shopping function
Shopping rickshaw	Flows per day	Shopping function/ local sustainable goods delivery
Skate boards	Observations	Street space for recreational use
Roller skates	Flows per day	Street space for recreational use or through travel
Roller blades	Flows per day	Street space for recreational use or ‘sustainable’ transit
Bicycle	Flows per hour, day	Evidence of ‘sustainable’ transit or recreational use
Motor vehicles	Flows per hour, day	Evidence of mainly through transit use

38. Public Transport

As with many other criteria, the presence of public transport can be used to highlight a single type of street, or be used in a grading to differentiate a whole spectrum of types. Two examples are given here.

<table>
<tr><th colspan="3">38. Public Transport</th></tr>
<tr><td rowspan="2">Portland Arterial Street Classification Policy Portland, Oregon, United States (Dotterer, 1987:171)

Streets are simultanesouly graded in traffic and in transit terms.</td><td>Auto Traffic:</td><td>Transit:</td></tr>
<tr><td>Regional Trafficway
Major Traffic Street
District Collector
Neighbh'd Collector
Local Service Street</td><td>Regional Transitway
Major Transit Street
Minor Transit Street
Local Service Transit</td></tr>
<tr><td>Bristol City Council (2000).

Proposed redefinition of some radial routes – previously though traffic ‘arterial’ routes – as Public Transport Corridors.</td><td colspan="2">The Road Hierarchy Review proposes the following route categories:
1. NATIONAL PRIMARY ROUTES (determined with DETR),
2. CITY PRIMARY ROUTES (formerly, County Primary Routes),
3. LOCAL DISTRIBUTOR ROADS,
4. ROADS WITHIN ‘ENVIRONMENTAL CELLS’,
5 ‘TRANSPORT GREENWAYS’ (for non motorised modes)

City Primary Routes are also to be divided into (i) LINKS TO NATIONAL PRIMARY ROUTES and (ii) PRINCIPAL PUBLIC TRANSPORT CORRIDORS.</td></tr>
</table>

39. Sustainability

No indicators directly or explicitly to do with sustainability itself were picked up as part of this Classification Review. Of course, sustainability-related issues cut across many of the preceding categories. The use of prioritisation of ‘green’ modes is a familiar theme linking to environmental sustainability. The use of public space by pedestrians is also important to socio-economic activity which might be considered in relation to social and economic dimensions of sustainability.

The specific consideration of sustainability concepts and indicators is being carried out elsewhere within ARTISTS (Deliverable D1.2).

Appendix 3. Common Reference Classification

This Appendix is a more or less direct analysis of the set of street types featuring in existing classification systems (ie, Appendix 1). The set analysed here comprises 55 street types in 10 classification systems (hierarchies) in 9 countries. The ten classification systems are one from each of the 9 ARTISTS countries except for Denmark which has two: one national (DK) and one from the City of Copenhagen (K).

Common Reference Classification System

In order to compare cases across countries, it was found convenient to place each street type into a common framework – in effect, a new Common Reference Classification system devised to accommodate the cases in all the others.

This is not exactly presented as an 'ideal' or 'universal' classification system, for two reasons. Firstly, bearing in mind the comments made in section 2 of this report, the idea of any single optimum classification system is warned against, since different systems will be used for different purposes. Secondly, this classification system adopted here is no more than (although no less than) an attempt to reflect all the existing classification systems included in the Classification Review. This means that it will share the emphases (and biases) of the existing classification systems.

The purpose of creating this Common Reference classification is to provide a common frame of reference for including all street types in the present Classification Review, that may be used to recognise and compare similar types with different purposes, labels, etc. in different countries.

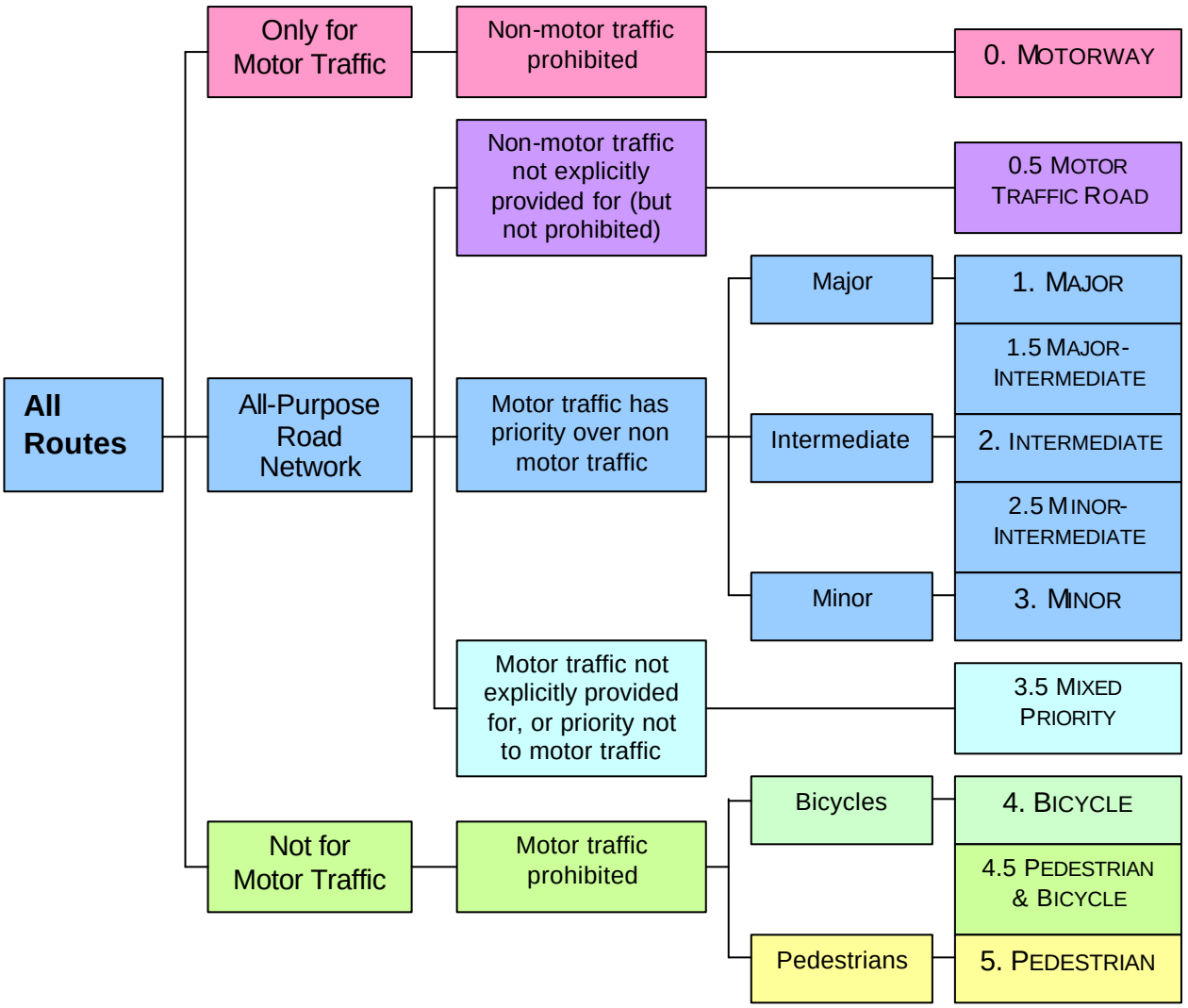
In the first instance this is presented in terms of transport related criteria, but it may also be seen in urban terms – the other side of the same coin – that is, the inverse relationship of increasing allowance for frontage access and urban (non transport) use of streets.

The relatively fine 'grain' of the classification (11 categories) reflects the desire to capture and distinguish as many types as featuring in the existing classification systems. At the same time, these are numbered not 1 to 11 but 0 to 5 (with 0.5 steps) to allow a cruder listing (in steps of 1) to be abstracted as necessary. In practice, the intention is that where possible the integer values are the main categories used, with the in-between cases employed for more specific fine-tuning. This system is felt to suit the present needs for *this* (common reference) classification exercise.

The basic rationale is shown in the Figure overleaf. This is shown in terms of transport criteria which can perhaps be more explicitly categorised (ie, vehicles defined in legal terms) than urban criteria. Note that public transport does not explicitly feature – this is a function of the fact that it does not really feature as a critical element of those hierarchies represented here.

This common reference classification is then shown in tabulated form (overleaf) and the categories further explained in text form.

The Rationale for the Common Reference Classification system



Common Reference Classification attributes

	Suggested Name	Defining feature (rule of thumb)	Traffic	Bicycle	Ped.
0	MOTORWAY	Non-motor traffic prohibited	✍✍	X	X
0.5	MOTOR TRAFFIC	Non-motor traffic not provided for (but not prohibited)	✍	✍	✍
1	MAJOR	The all-purpose road with the highest traffic function	✍	✍	✍
1.5	MAJOR-INTERMEDIATE	Intermediate sub-divisions based on traffic function	✍	✍	✍
2	INTERMEDIATE		✍	✍	✍
2.5	MINOR-INTERMEDIATE		✍	✍	✍
3	MINOR	The all-purpose road with normal priority with lowest traffic function	✍	✍	✍
3.5	MIXED PRIORITY	The road tolerating traffic with lowest traffic function *and/or* road with pedestrian priority	✍/✍ ✍	✍	✍/ ✍✍
4	BICYCLE	Bicycles only	X	✍✍	✍
4.5	PEDESTRIAN & BICYCLE	Pedestrians and bicycles	X	✍✍	✍
5	PEDESTRIAN	Pedestrians only	X	X✍	✍✍

Key: ✍✍✍ Prioritised; ✍ promoted; ✍ provided for; ✍ not provided for; X prohibited.

0. The **MOTORWAY** (the English-language term used in UK) is intended for motor traffic only. Pedestrians, low capacity mopeds, bicycles and animal traffic are all explicitly prohibited by law.

0.5 The **MOTOR TRAFFIC ROAD** is intended for motor traffic, and while not providing for non-motor traffic, does not prohibit it. An example would be an expressway or dual carriageway within an urban area, having no footway or cycle lane. Pedestrians could have access to the verge but are supposed to use alternative routes, and cross by means of overbridges or underpasses.

1. The **MAJOR ROAD OR STREET** is the 'highest' all-purpose type catering explicitly for pedestrians, ie, with footways alongside.

2. The **INTERMEDIATE ROAD OR STREET** type is, by definition, intermediate between Major and Minor types, and may have further distinctions, 1.5 MAJOR-INTERMEDIATE and 2.5, MINOR-INTERMEDIATE, perhaps based on traffic function.

3. The **MINOR ROAD OR STREET** is the 'lowest' all-purpose type to have the 'normal' priority of motor vehicles over pedestrians.

3.5 The **MIXED PRIORITY ROAD, STREET OR AREA** either has motor traffic not explicitly provided for, or priority is shared or to non-motor traffic. This is the 'lowest' category of all-purpose road (ie, to which motor vehicles are permitted).

4. The **BICYCLE ROUTE, STREET OR PATH** caters for bicycles only and in principle is not intended for pedestrians (though in practice may be used by them).

4.5 The **PEDESTRIAN & BICYCLE ROUTE, STREET OR PATH** caters for both pedestrians and bicycles.

5 The **PEDESTRIAN ROUTE, STREET OR PATH** caters for pedestrians only and in principle is not intended for bicycles (though in practice may be used by them).

The Case Study Street Types fitted to the Common Reference Classification

The 55 street types form the 10 hierarchies are now shown tabulated with respect to the Common Reference Classification.

Positions of 55 street types in the Common Reference Classification

Type in Meta-Classifcation		Street types featuring in country or city case									
		B	DK	K	D	G	H	P	E	S	UK
0	MOTORWAY	✍	*	✍	*	✍	✍	✍	✍		*
0.5	MAJOR TRAFFIC ROAD	✍	*		✍			✍		✍	✍
1	MAJOR	✍	✍	✍	✍	✍	✍	✍	✍	✍	✍
1.5	MAJOR-INTERMEDIATE		✍		✍						
2	INTERMEDIATE	✍	✍	✍	✍	✍	*		✍	✍	✍
2.5	MINOR-INTERMEDIATE		✍								
3	MINOR	✍	✍	✍	✍	✍	✍	✍	✍	✍	✍
3.5	WOONERF		✍	✍	✍	✍				✍	
4	BICYCLE		*				✍				✍
4.5	PEDESTRIAN-BICYCLE	✍	*							*	
5	PEDESTRIAN		*			✍	✍	✍		✍	✍

✍ = 55 street types as interpreted in Classification Review.
* = street type not directly evaluated but known explicitly to exist (or to be an alternative interpretation) from other parts of the Classification Review.
Other categories (especially at lower end) are no doubt existing though not recorded here.

This tabulation replicates types as featuring in the Classification Review. Of course, some categories that really exist (in some hierarchy) will be missing. For example, in the UK, motorways really exist, but do not explicitly feature in the particular urban road oriented hierarchy given (in which an urban motorway in practice would be allocated to the primary distributor category). Some cases may have deliberately excluded motorways and pedestrian streets (or the hierarchy they use may do so), since the ultimate focus of the exercise is Sustainable Arterial Streets.

The relatively large range of the Common Reference classification (11 types) allows the possible accommodation of additional types, perhaps not originally featuring. For example, in the UK, *Traffic in Towns* (MoT, 1963) only included types 0.5, 1, 2 and 3; *Roads and Traffic in Urban Areas* (IHT/DoT,1987) had added type 5, and *Transport in the Urban Environment* (IHT, 1997) added type 4.

In general there is a problem with matching hierarchies to reality, because in many cases the classification types are so far from reality, that one does not know how to interpret. For example, in the UK, an actual arterial shopping radial street is far from being either a primary distributor (which its traffic function demands) or an access road (which in strict interpretation, its frontage access function demands).

Catalogue of Types

The full listing of types is given as a Catalogue of Types in the following pages. This shows all 55 types with their relative 'degree of provision, prioritisation or prohibition' and ordered according to the types in the Common Reference Classification.

Common Reference Classification: Catalogue of Street Types and Functional Attributes

Street Type Ref. (App. 1)	CRC Grade	Name of street type (Appendix 1)	Transport modes						Parking & Servicing		Access		Urban Role		
			General traffic	Heavy goods (excluding servicing)	Public transport	Cycling	Pedestrians - along	Pedestrians - across	Servicing	Parking	Access to minor side streets	Access to building frontages	Commercial street/ market place	Public social space/ civic functions	Living area/activities
B1	0	MOTORWAY	✍✍	✍	✍	X	X	X	X	X	X	X	X	X	X
K1	0	MOTORWAYS	✍✍	✍✍	✍	X	X	X	X	X	X	X	X	X	X
H1	0	HIGH SPEED ROAD	✍✍	✍	✍	X	X	X	X	X	X	X	X	X	X
P1	0	COLLECTOR ROAD	✍✍	✍✍	✍✍	X✍	X	X	X	X	X	X	X	X	X
E1	0	MOTORWAY	✍✍	✍	✍	X	X	X	X	X	X	X	X	X	X
G1	0	FREEWAY	✍✍	✍	✍	✍	X	X	X	X	X	X	X	X	X
B2	0.5	METROPOLITAN ROAD	✍	✍	✍	✍	✍	X	X	X	X	X	X	X	X
P2	0.5	MAIN DISTRIBUTOR.	✍	✍	✍	✍	✍	✍	✍	✍	✍	✍	✍	✍	✍
UK1	0.5	PRIMARY DISTRIBUTOR	✍	✍	✍	✍	X	X	X	X	X	X	X	X	X
S1	0.5	THROUGHFARE-RADIAL ROAD	✍	✍	✍	✍	✍	X	X	X	✍	X	X	X	X
D1	0.5	B III / IV NON FRONTAGE ARTERIA L STR.	✍✍	✍	✍	✍	✍	✍	✍	X	✍	X	X	✍	X
B3	1	TRUNK ROAD	✍	✍	✍	✍	✍	✍	✍	✍	✍	✍	✍	✍	✍
DK1	1	TRAFFIC ROAD, HIGH SPEED	✍	✍	✍	✍	✍	✍	X	X	✍	X	X	X	X
K2	1	REGIONAL ROADS	✍	✍	✍	✍	✍	✍	✍	✍	✍	✍	✍	0.5	✍
H2	1	MAIN ROAD	✍	✍	✍	✍	✍	✍	✍	X	✍	✍	X	X	X
P3	1	MAIN LOCAL DISTRIBUTOR ROAD	✍✍	✍✍	✍✍	✍✍	✍	✍	✍	✍	✍	✍	✍	✍	✍
E2	1	ARTERIAL	✍	✍	✍	✍	✍	✍	✍	✍	✍	✍	✍	✍	✍
UK2	1	DISTRICT DISTRIBUTOR	✍✍	✍✍	✍✍	✍✍	✍	✍	✍	✍	✍	✍	✍	✍	✍

S2	1	MAIN STREET-ARTERIAL STREET	✍	✍	✍	✍	✍	✍	✍	✍	✍	✍	✍	✍	✍	✍
G2	1	ARTERIAL STREET	✍✍	✍	✍	✍	X	✍	✍	X	✍	✍	✍	✍	✍	✍
D2	1	C IV, MAIN COLLECTOR STREET	✍	✍	✍	✍	✍	✍	✍	✍	✍	✍	✍	✍	✍	✍
DK2	1.5	TRAFFIC ROAD, MEDIUM SPEED	✍	✍	✍	✍	✍	✍	✍	✍	✍	✍	✍	✍	✍	✍
D3	1.5	D IV, COLLECTOR STREET	✍	✍	✍	✍	✍	✍	✍	✍	✍	✍	✍	✍	✍	✍
B4	2	INTER-DISTRICT ROAD	✍	✍	✍	✍	✍	✍	✍	✍	✍✍	✍	✍	✍	✍	✍
DK3	2	TRAFFIC ROAD, LOW SPEED	✍	✍	✍	✍	✍	✍	✍	✍	✍	✍	✍	✍✍	✍✍	✍
K3	2	PRIMARY ROADS	✍	✍	✍✍	✍✍	✍	✍	✍	✍	✍	✍	✍	✍	✍	✍
H3	2	SIDE ROAD	✍	✍	✍	✍	✍	✍	✍	✍	X	✍	✍	✍	✍	✍
E3	2	DISTRIBUTOR	✍	✍	✍	✍	✍	✍	✍	✍	✍	✍	✍	✍	✍	✍
UK3	2	LOCAL DISTRIBUTOR	✍✍	✍✍	✍✍	✍✍	✍	✍	✍	✍	✍✍	✍✍	✍	✍	✍	✍
S3	2	COLLECTOR STREET	✍	X	✍	✍	✍	✍	✍	✍	✍✍	✍	✍	✍	✍	✍
G3	2	COLLECTOR	✍✍	X	✍	✍	X	✍	✍	✍	✍	✍	✍	✍	✍	✍
D4	2	D V, ACCESS STREET	✍	✍	✍	✍	✍	✍	✍	✍	✍	✍	✍	✍	✍	✍
DK4	2.5	LOCAL ROAD, MEDIUM SPEED	✍	✍	✍	✍	✍	✍	✍	✍	✍	✍	✍	✍	✍	✍
B5	3	THROUGH STREET	✍	✍	✍	✍	✍	✍	✍	✍	✍	✍✍	✍	✍	✍	✍
DK5	3	LOCAL ROAD, LOW SPEED	✍	✍	✍	✍	✍	✍	✍	✍	✍	✍✍	✍	✍	✍✍	✍
K4	3	DISTRIBUTOR STREETS	✍	✍	✍	✍	✍	✍	✍	✍	✍✍	✍✍	✍	✍✍	✍	✍
P4	3	ACCESS ROAD	✍	✍	✍	✍	✍	✍	✍	✍	✍✍	✍✍	✍	✍	✍	✍
E4	3	LOCAL STREET	✍	✍	✍	✍	✍	✍	✍	✍	✍✍	✍✍	✍	✍	✍	✍
UK4	3	ACCESS ROAD	✍	✍	✍	✍	✍	✍	✍	✍	✍✍	✍✍	✍	✍	✍	✍
S4	3	LOCAL STREET	✍	X	✍	✍	✍	✍	✍	✍	✍✍	✍	✍	✍	✍	✍
G4	3	LOCAL (GENERAL)	✍	X	X	✍	X	✍✍	✍	✍	✍	✍	✍	✍	✍	✍
D5	3	E V, ACCESS STREET	✍	✍	✍	✍	✍	✍	✍	✍	✍	✍	✍	✍	✍	✍
DK6	3.5	LOCAL ROAD, VERY LOW SPEED	✍	✍	✍	✍	✍✍	✍✍	✍	✍		✍✍	✍	✍✍	✍✍	
K5	3.5	LOCAL STREETS	✍	✍	✍	✍	✍✍	✍✍	✍	✍	✍	✍✍	✍✍	✍✍	✍✍	
S5	3.5	WOONERF	✍	X	✍	✍	✍✍	✍✍	✍✍	✍	✍✍	✍✍	✍✍	✍✍	✍✍	
G5	3.5	TRAFFIC CALMED STREET	✍	X	X	✍	✍✍	✍✍	✍	✍	✍✍	✍✍	✍	✍	✍	
D6	3.5	E IV, ACCESS WAY	✍	✍	✍	✍	✍	✍	✍	✍	✍	✍	✍	✍	✍	
H4	4	BICYCLE ROAD	X	X	X	✍✍	✍	✍	X	X	✍	✍	X	X	✍	
UK5	4	CYCLE ROUTE	X✍	X✍	X✍	✍✍	✍✍	✍✍	X✍	X✍	✍✍	✍✍	✍✍	✍✍	✍✍	
B6	4.5	LOCAL STREET	X	X	✍	✍	✍	✍	✍	✍	✍	✍✍	✍✍	✍✍	✍✍	

H5	5	FOOTPATH	X	X	X	X	✍✍	✍	X	X	✍	✍	✍	✍	✍
P5	5	PEDESTRIAN STREET	X	X	✍	✍	✍✍	✍✍	✍	✍	✍	✍	✍✍	✍✍	✍✍
UK6	5	PEDESTRIANISED STREET	X	X	✍	✍	✍✍	✍✍	✍	✍	✍	✍	✍✍	✍✍	✍
S5	5	PEDESTRIAN STREET	X	X	X	X(✍)	✍✍	✍✍	✍	X	✍	✍	✍✍	✍✍	✍
G6	5	PEDESTRIANISED STREET	X	X	X	✍	✍✍	✍✍	X	X	X	X	✍	✍	✍

Appendix 4. Classification and 'Hierarchical Contiguity'

Not only are conventional classifications typically arranged in a 'linear' structure, but there is a specific kind of spatial organisation implied. Put briefly, in this form of spatial organisation - which may be termed *hierarchical contiguity* - the roads in the highest tier of the hierarchy all form a single contiguous network, and progressively down the hierarchy the sum of all tiers down to a given level form a single continuous network[21].

For example, on the British mainland, all "A" roads form a single network, and the network of all (A + B) roads forms a single contiguous network. However, all B roads do not form a single contiguous network.

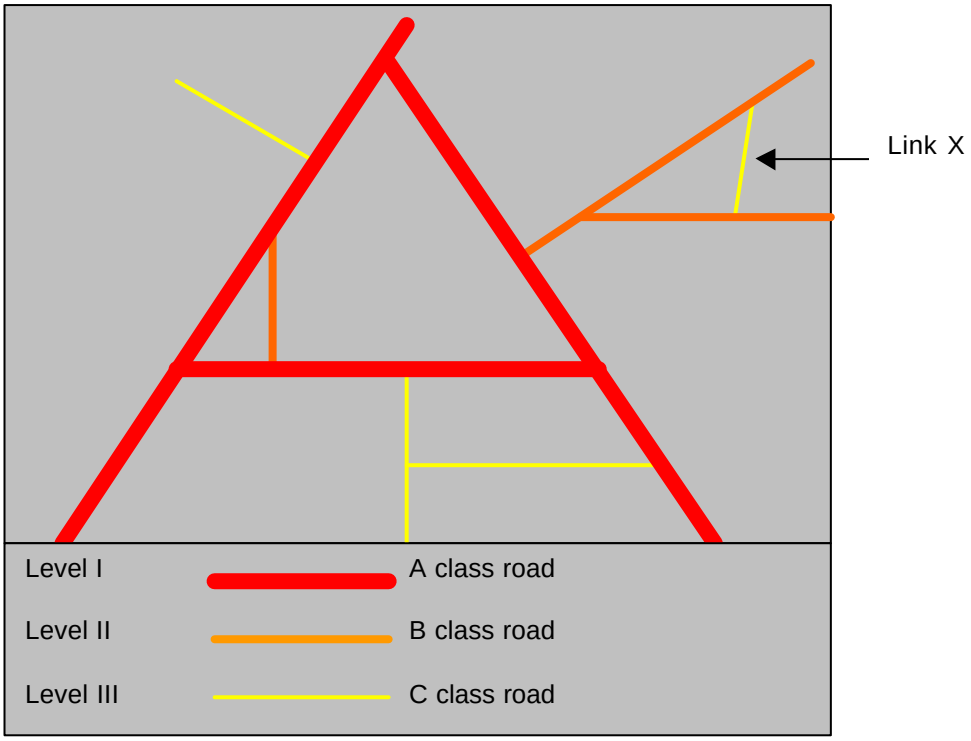
The significance of this is that to some extent roads are classified (at least in terms of route number, and possibly administrative status) in such a way that this 'hierarchically contiguous' spatial structure is maintained. There is no case (at least in the UK) of an isolated section of road upgraded to "A" status because of either its *form* or *function*.

This finding is in accord with the observation that classification systems tend not to be based on locally variable criteria (such as traffic volume) but on criteria that allow the construction of a network on the principle of hierarchical contiguity (criteria such as Strategic Role, or perhaps as a proxy, Trip Length OD). This may be regarded as an important underlying rationale which is not necessarily obvious from studying the apparent rationale for classification. Yet this "invisible" structural property appears to be present in all classification systems.

A consequence of this property of hierarchical contiguity is that the so-called 'linear' hierarchy (Figure 3.1) actually has a hidden *asymmetry*. The hierarchy does not read from bottom to top in the way that it reads from top to bottom. Put another way, we could not simply 'invert' the hierarchy by placing PEDESTRIAN ROUTE at the top and MOTORWAY at the bottom. At least, we could invert the labels but without also changing the implied spatial structure, the apparent priority that road hierarchy gives to vehicular traffic routes would not be challenged.

[21] Exceptions are (1) motorways, which could be regarded as forming a separate network (they are not all-purpose roads) rather than the highest tier in "the" road network; in any case, these were not part of the original road classification system, but bolted on afterwards, and finally, they are in a sense defined by form (road standard) or administration (a special legal category of road) rather than route function; (2) roads on separate islands.

Demonstration of Hierarchical Contiguity



The above network has a specific structural property, that may be referred to as *hierarchical contiguity*[22]. This means that the set of all roads *down* to any given level in the hierarchy form a single contiguous network. That is:

- the highest tier in the hierarchy (A class roads) forms a single contiguous network;
- the set of all (A + B) roads forms a single contiguous network
- the set of all (A + B + C) roads forms a single contiguous network

(However, the set of all B roads, or the set of all C roads *do not* necessarily form a single contiguous network)

This means that, for example, we would not find Link X as an A road, since it is isolated from the A road network. However, link X could be a B road as well as a C road, and the network would still be hierarchically contiguous.

Networks based on hierarchical route classifications and structured by hierarchical contiguity are typically classified using themes such as Strategic Role, Network Role, Circulation v Access, Trip Length (OD).

[22] This property is described as 'arteriality' by Morrison (1966) and has been developed with respect to road hierarchy and the structure of street networks (Marshall, 2001). However, in the present project context, the terms 'arterial' and 'arterial street' are fostered in a specific manner. While they may be associated to some extent with 'arteriality', the use of such close terms might imply a deliberate emphasis or requisite relationship - which is not necessarily intended as such. Therefore, the more neutral term 'hierarchical contiguity' is preferred here.

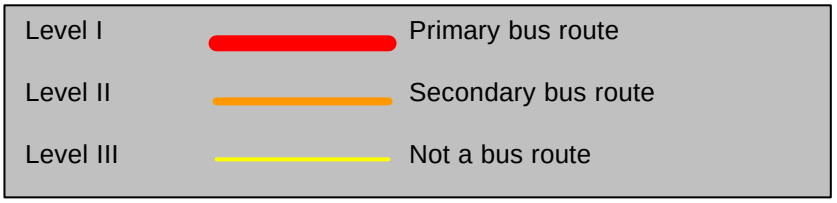
The significance of hierarchical contiguity

The significance it is that it is a potentially useful spatial logic by which to arrange a network. It is potentially a most efficient way of organising a network, since the highest speed/capacity sections of the network are all connected up, and can take advantage of each other. (In contrast, having isolated sections of high speed/capacity route may be inefficient - for example, a boulevard having a grade-separated junction at one end but with traffic signals along its length).

Hierarchical contiguity seems to be important to networks made up of linear elements, where consistency along those linear elements (ie, streets) is desirable. Hence it is appropriate for consideration of streets in terms of their arterial function. Hierarchical contiguity is less important for - indeed may be inappropriate for - other urban functions or (non-network-related) forms. For example, there is no particular reason that all areas of high pedestrian amenity or a given building type should necessarily be advantageously formed into a single contiguous area.

It is arguable that, while hierarchical contiguity is useful for general road networks, it may be even more crucial for public transport networks. This is because public transport can be considered more vulnerable to 'weak links' in networks, and to 'interchange penalties' in changing levels up and down in the 'hierarchy' of public transport modes[23]. Therefore it seems appropriate that the classification system devised here should accommodate (or implicitly promote) the idea of hierarchical contiguity for public transport networks.

Indeed, the spatial logic of the previous diagram can be applied to public transport simply by changing the labels in the legend:



Or:

[23] For example, two high speed train lines linked across a city by a bus is more of an inconvenience, relatively speaking, than two motorways linked across a city by a surface street, because although the middle weak link implies time penalties and a possible bottleneck effect in both cases, the public transport discontinuity will additionally have an intermodal interchange penalty and possible inter-operator (information and ticketing) penalties.

Appendix 5. A User-Based Classification System

A suggested structure

Here is developed a possible way of structuring a classification system based on users.

The aims are:

1. That there is a *range* of detail or resolution, so that for any particular purpose or circumstance, we may choose to use a more 'basic' (ie low resolution) classification or a more 'refined' (ie high resolution) classification. This form of classification system can be seen as sort of *bridge* between the low-resolution typology of existing roads classification and the high-resolution breakdown of detailed descriptors (as in Deliverable D1.2).

2. The classification structure can be based on attributes that may either be *quantitatively* measured (eg, flow in veh/hr) or *qualitatively* allocated (eg, 'high flow') - and where the exact indicators used would be determined according in the light of the outcome of the investigation of indicators.

3. The classification may be represented *graphically*, in the sense of demonstrating the relative position of a given street relative to other streets, and/or the relative significance of different attributes in the make-up of a street.

A suggested *graphical device* is shown in the following diagram. It is a combination of a table, a dendrogram and a pie chart. This shows progressively different subdivisions of users. The structure of the cells in the diagram reflects the subdivisions, while the size of the cells represents relative weighting. Therefore it is possible to observe at a glance the relative importance of different attributes to a given street.

<table>
<tr><td rowspan="4">1. All Functions</td><td rowspan="2">1.1 Movement Function</td><td>1.1.1 Vehicular</td></tr>
<tr><td>1.1.2 Pedestrian</td></tr>
<tr><td rowspan="2">1.2 Urban Function</td><td>1.2.1 Frontage-related</td></tr>
<tr><td>1.2.2 Public space-related</td></tr>
</table>

This diagram is a combination of a table, a (horizontal) dendrogram and a (rectangular) pie chart. It shows the relative significance of different functions (where the height of each cell indicates the relative significance). It shows a street with high vehicular function and low pedestrian/public space function.

Illustration - Classification of Users

Here, users are divided into a series of categories. By careful definition, these can be made mutually exclusive, which fits the structure here, though they could clearly be assembled in overlapping categories for other purposes.

<table>
<tr><td rowspan="14">All Users of the Street</td><td rowspan="12">Local Users</td><td rowspan="6">Users of buildings (who may also use street space and have non-local origin/ destination)</td><td rowspan="2">Residential Users</td><td>Residents</td></tr>
<tr><td>Visitors to residences</td></tr>
<tr><td rowspan="3">Shop users</td><td>Shop owners</td></tr>
<tr><td>Shop employees</td></tr>
<tr><td>Shoppers</td></tr>
<tr><td>Office users</td><td>Office users</td></tr>
<tr><td rowspan="6">Users of street space (who do not access buildings, and who may have non-local origin/ destination)</td><td rowspan="5">Users of street space</td><td>Social activities</td></tr>
<tr><td>Other activities, sightseeing, etc.</td></tr>
<tr><td>Play</td></tr>
<tr><td>Pedestrians (passing but engaged with other street activity)</td></tr>
<tr><td>Users of kerbside</td><td>People engaged in interchange</td></tr>
<tr><td rowspan="3">Users passing through only</td><td rowspan="3">Users of carriageway and footway only for through movement (both origin a and destination outside street segment)</td><td>Users of footway</td><td>Pedestrians (disengaged from other street activity)</td></tr>
<tr><td rowspan="2">Users of carriageway</td><td>Car drivers and passengers</td></tr>
<tr><td>Bus passengers, etc.</td></tr>
</table>

The 14 categories are an illustration, of a possible first theoretical approach. The structure and categories are primarily illustrative and do not preclude different groupings and clusterings to give different emphases.

Where a subdivision at any level is a bifurcation, this bifurcation may be represented as a two dimensional table or matrix of types.

The types may be based on
- presence/absence (or significant/not significant)
- relative ranking (high/medium/low)
- absolute numbers or proportions

User classification (bifurcation) expressed as a plot/table:

All Users		Locale Users (X)		
		Low use	Medium use	High use
Through Users (Y)	High use		?? Marylebone Road	
	Medium use			
	Low use			

Demonstration of subsequent tabulations based on successive bifurcations:

X. Locale Users		X2. Users of/accessing buildings		
		Low significance	Medium significance	High significance
X1. Users of street space	High significance			
	Medium significance		?? Marylebone Road	
	Low significance			

X1. Users of street space		X1.2 Pedestrians using street space		
		Low significance	Medium significance	High significance
X1.1 Kerbside (servicing)	High significance			
	Medium significance			
	Low significance		?? Marylebone Road	

X2. Users of/accessing buildings		X2.2 Residential “Private”		
		Low significance	Medium significance	High significance
X2.1 Civic & commercial (including shopping) “Public”	High significance			
	Medium significance		?? Marylebone Road	
	Low significance			

Y. Through Users		Y2. Users of footways		
		Low use	Medium use	High use
Y.1 Users of Carriageway	High use		?? Marylebone Road	
	Medium use			
	Low use			

As noted earlier, we could represent the relative significance of the subdivisions graphically using this tabular format. Indeed, we could choose to subdivide or ignore some of the finer subdivisions according to their significance (ie, cell height reduces to zero).

1. A basic set of subdivisions where each of 14 categories of user (at the finest level of division) is given an equal weighting (this implies a relative weighting in upper divisions, eg Locale Users 11: 3 passing through).

All Users of the Street (14)	Locale Users (11)	Users of buildings (6)	Residential (2)	1. Residents
				2. Visitors
			Shop users (3)	3. Shop owners
				4. Shop emp.
				5. Shoppers
			Office users (1)	6. Office users
		Users of street space (5)	Users of street space (4)	7. Social act.
				8. Other act.
				9. Play
				10. Walkers
			Kerbside (1)	11. Interchangers
	Users passing through only (3)	Users of carriageway and footway (3)	Footway users (1)	12. On foot
			Carriageway users (2)	13. In car
				14. In bus

2. Example of weighted diagram for, say, Marylebone Road, London

All Users of the Street (23)	Locale Users (8)	Users of buildings (4)	Residential (1)	1. Res.
			Shop users (1)	3. Shop users
			Office users (2)	6. Office users (score 2)
		Users of street space (4)	Users of street space (3)	7. Social act.
				8. Other act.
				10. Walkers
			Kerbside (1)	11. Interchangers
	Users passing through only (15)	Users of carriageway and footway (15)	Footway (1)	12. On foot
			Carriageway users (14)	13. In car and commercial vehicles (score 8)
				14. In bus (score 6)

Here some categories disappear as negligible. Others have a multiple weighting (eg, office users are, say, twice as numerous as shop users).

This kind of diagram allows two types of street to be compared at a glance:

(a) classification of a hypothetical suburban residential arterial

<table>
<tr><td rowspan="8">All Users of the Street
(20)</td><td rowspan="4">Locale Users
(5) 25%</td><td rowspan="3">Users of buildings
(3) 60%</td><td>Residential (2)</td><td>1. Res.</td></tr>
<tr><td>Shop & off. (1)</td><td>3. Shop users</td></tr>
<tr><td rowspan="2">Users of str. sp.
(2) 40%</td><td>Users… (1)</td><td>7. Pedestrian</td></tr>
<tr><td>Kerbside (1)</td><td>11. Interchangers</td></tr>
<tr><td rowspan="4">Users passing through only
(15) 75%</td><td rowspan="4">Users of carriageway and footway
(15)</td><td>Footway (1)</td><td>12. On foot</td></tr>
<tr><td rowspan="3">Carriageway users
(14)</td><td>13. In car and commercial vehicles (score 10)</td></tr>
<tr><td colspan="2"></td></tr>
<tr><td>14. In bus
(score 4)</td></tr>
</table>

(b) a hypothetical local shopping street

<table>
<tr><td rowspan="10">All Users of the Street
(25)</td><td rowspan="6">Locale Users
(15) 60%</td><td rowspan="3">Users of buildings
(7)</td><td>Residential (1)</td><td>1. Res.</td></tr>
<tr><td>Shop users (4)</td><td>2. Shop users</td></tr>
<tr><td>Office users (2)</td><td>6. Office users (score 2)</td></tr>
<tr><td rowspan="3">Users of street space
(8)</td><td rowspan="3">Users of street space (6)</td><td>7. Social act. (2)</td></tr>
<tr><td>8. Other act. (2)</td></tr>
<tr><td>10. Walkers (2)</td></tr>
<tr><td colspan="2">Kerbside (2)</td><td>11. Interchangers (2)</td></tr>
<tr><td rowspan="4">Users passing through only
(10) 40%</td><td rowspan="4">Users of carriageway and footway
(10)</td><td>Footway (1)</td><td>12. On foot</td></tr>
<tr><td rowspan="3">Carriageway users
(9)</td><td>13. In car and commercial vehicles (score 5)</td></tr>
<tr><td colspan="2"></td></tr>
<tr><td>14. In bus
(score 4)</td></tr>
</table>