Identifying Trends in Masterplanning: a Typological Classification System

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Abstract

ADAM Urbanism and researcher Claire Jamieson have collaborated to develop a new typological method for the analysis of masterplans. This quantitative method of analysis can be used to produce comparative data that will help in the comparison of urban design typologies and their development over time. This paper sets out the research to date, describing how the initial aims have developed from simple analysis to the creation of an analytical tool with wide applications. Comprising a detailed taxonomy of urban design features gathered from a wide database of recent and emerging masterplans, the system provides opportunities for further study such as trends, qualitative comparison against quantitative measurement, and comparison of aims and outcomes. This paper will describe the methodology and process of research, whilst elaborating on the potential of the tool.

Introduction

The study was initiated to see if it was possible to quantitatively analyse current international masterplanning trends. Although masterplans typically take 10 to 20 years to be fully realised, ideas and theories are changing more rapidly. There is often a sense that different schemes are described in similar terms – buzzwords such as ‘walkable’, ‘compact’, ‘permeable’ are commonplace. This study aims to create a baseline assessment of form-based characteristics eliminating descriptive elements that are not measurable. Additionally, the study provides a framework for the observation of trends across a shorter timescale than it takes for completion of a scheme. Stripping away qualitative descriptions and establishing

comparative criteria, would facilitate more focused studies into causation when judging the relative performance of masterplan types.

The objective is to establish a workable and flexible methodology that can be used for further research, taken on by others, expanded as appropriate and used to produce comparative analyses over a wide range of plans. In order to create a set of criteria with a quantitative base, the initial work was carried out without reference to anything but the representation of physical form. This paper will present that first phase, and the taxonomy of forms that resulted – as well as examples of applications to test and demonstrate its practicality and range.

Literature Review

There are numerous prominent theories, codes and systems of urban design. Part of the aim of this study was to fill a perceived gap in the study of urban design: a physical form-based taxonomic classification. An overview of the literature suggests that this approach is not typical.

Many of the most influential theories of urban design were written in the wake of the first formal course in the subject established at Harvard in 1960. In the proceeding decade Jane Jacobs (1961), Kevin Lynch (1960) and Gordon Cullen (1961) each produced texts that were decisive in shaping subsequent discourse. Often written as a reaction to modernist planning, these works in the main detailed the negative effects of modern city planning and promoted design methodologies more akin to the earlier work of Sitte (1889) and Unwin (1909). These texts aimed to establish guidelines for best practice, providing examples of formal types and

layouts that contribute to 'good' places. In *The Image of the City* Lynch (1960) identifies five aspects of "imageability" that make a city legible: "paths", "edges", "districts", "nodes" and "landmarks" (Lynch, 1960, p8). Similarly, Cullen (1961) describes the qualities and features of a city that contribute to "serial vision" (Cullen, 1961, p9), producing recommendations under a long list of categories ranging from the tangible: "the wall" (Cullen, 1961, p155), to the more ephemeral: "Immediacy" (Cullen, 1961, p188). Although focused on form, none of these early texts set out to establish a taxonomy of urban design features and tend to be polemical, particularly Jane Jacobs' *The Death and Life of Great American Cities* (1961).

Continuing the trend for polemical theory, in 1979 Rob Krier published *Urban Space,* again examining (what Krier considers to be) the "erosion of urban space in 20th century town planning" (Krier, 1979, p64). For Krier, all possible forms of urban space already exist and provide the vocabulary of urban design. Krier creates a classification system of urban spaces based on layers of categories. The resulting forms are not an exhaustive collection of all possible or existing urban spaces, but instead suggest the way that Krier believes urban space should be shaped in line with his own views. However, Krier does echo some of the aims of this study as he wished to strip away all meaning and aesthetic criteria from his analysis:

"…I have been able to observe from numerous discussions on this topic, visual and sensory habits, which vary from one individual to the next, are augmented by a vast number of social-political and cultural aptitudes, which are taken to represent aesthetic truths…However my observations indicate that they are almost always identified with the social structure prevailing at the time in question." (Krier, 1979, p15)

In the 1980s, *A Theory of Good City Form* by Lynch (1981) has a similar approach – setting out five key criteria and two "meta-criteria" toward a normative theory of city form (Lynch, 1981, p119). In addition, Lynch outlines: "A Catalog of Models of Settlement Form" in an appendix (Lynch 1981, p373). The list aims to cover models of the city in use at the time of writing, and is organised into groups which are not necessarily related to scale. One of the most relevant of these to this study is "General patterns", which identifies ten form based types of plan layout: "Star or asterisk", "Satellite cities", "Linear city", "Rectangular grid city", "Other grid forms", "Baroque axial network", "The lacework", "The inward city", "The nested city" and "Current imaginings" (Lynch 1981, p454). The description of each, which is historical and refers to literature, is accompanied by sketch diagrams rather than real examples. The catalogue is a postscript to the text, and is not developed fully to cover all scales of urban form.

The influential *Responsive Environments - A Manual for Designers* (Bentley et al, 1985) contributes to a similar discourse, showing architects and designers how to achieve a sense of "responsiveness" in urban spaces – the authors' key to successful places (Bentley et al, 1985, p9). In some areas, particularly those concerned with streets, some "types" are identified – but again these are recommended types rather than a taxonomy of all types. Later, *The New Urbanism: Towards an Architecture of Community* (Katz, 1993) establishes Katz's own theory of TOD (Transit Orientated Development) and TND (Traditional Neighbourhood Development). Although types and elements are established at a range of scales – they are strictly within a recommended ideological framework.

Literature based on establishing a theoretical approach to planning stretching back to Sitte (1965) continues in the more recent past with illustrated texts presenting real examples and

case studies of "good practice". *A Pattern Image – A Typological Tool for Quality in Urban Planning* by Bobic and Urhahn (1994) is a classic example. The authors establish eight types of environment for which they provide case studies of best practice and an analysis of urban form, density, use etc. In the UK, *The Urban Design Compendium 1 and 2* (Llewellyn Davies & English Partnerships, 2007) is one of the best examples and describes factors for consideration across a huge range of urban design characteristics. In the USA, Duany Plater-Zyberg & Co's: *The Lexicon of New Urbanism* (2001) continues in a similar tradition, centred on a specific theory of urban design.

Other literature synthesises previous theories of urban design into overarching principles; Cuthbert suggests four key such texts in his review of urban design in the last 50 years (2007): *Collage City* (Rowe and Koetter 1979), *Concepts of Urban Design* (Gosling and Maitland 1984), *Finding Lost Space – Theories of Urban Design* (Roger Trancik 1986) and *Emerging Concepts in Urban Space Design* (1990). All these texts offer a similar model – summarising modes and methods of urban design over time, but rather than surveying exhaustively what has been built or designed, the texts compile or synthesise theoretical approaches to urban design. Taking a different approach, both *The City Assembled* (Kostof, 1999) and *The City Shaped* (Kostof, 1991) try to understand urban form through social and cultural history – observing types and patterns as the product of historical periods.

There are examples of a more objective and analytical approach originating with the works of Conzen and Caniggia. In *Alnwick, Northumberland: A study in town-plan analysis* (1960), Conzen articulated the now classic division of the town plan, building fabric and land-use, and categorised the plan into streets, plots and buildings. The layering and combination of these elements enabled Conzen to analyse changing urban form over time and understand the

impact of building cycles and land values on physical form. Similarly, Caniggia (2001) created a spatial hierarchy consisting of elements, structures of elements, systems of structures and organisms of systems. Using this structure Caniggia analysed both individual buildings and urban form at the city scale. This paper has taken this taxonomic, evidence-based methodology as the basis for further research.

Growing from the morphological tradition, Hiller and Hanson's *The Social Logic of Space* (1984) strives to isolate structures and forms at their most basic urban level and attempts to represent them with a new two-dimensional vocabulary – explaining how elements could be combined to form more complex wholes. The theory focuses on the functionality of existing spaces, providing a descriptive tool for connectivity, the movement of people etc., rather than the full range of elements that form a masterplan and the way they change over time. Later in the 1980s, Christopher Alexander's *A New Theory of Urban Design* (1987) followed his seminal *The Pattern Language* (1977). Both volumes attempt to identify basic principles without any overarching masterplan or top-down influence.

Literature that comes closer to an objective taxonomy of forms can be found if the field is narrowed, in *Road Form and Townscape* (McCluskey, 1992) a detailed analysis of all types, forms, sizes and even materials of streets and roads is presented with accompanying diagrams. Instead of presenting only the types of road that he subjectively feels are 'good', McCluskey divides all types into four overarching categories: "the townscape alignment", "the flowing alignment", "the hillroad alignment" and "the countryside alignment" (McCluskey, 1992, p9). Each of these "alignments" represents a different context and condition, and therefore different characteristics of road or street

Stephen Marshall's *Streets and Patterns* (Marshall, 2005) contains some of the most rigorous formal analysis of urban forms, particularly networks, of the texts surveyed in this literature review. The aim of *Streets and Patterns* (Marshall, 2005) is to reconcile the tensions between the contemporary "urban design-led agenda" with the more modernist "roads-grounded theory" – with a view to establishing a unified approach towards creating "better urban places" (Marshall, 2005, pxii). The text is in two parts, with the first seeking to discover:

"…what forms of street pattern are desirable, and how they might be designed to create desirable functional urban layouts" (Marshall, 2005, p16)

The second part –of relevance to this study – is:

"…an in-depth investigation into the nature of structure, and how various structures may be described and analysed, and how such abstract structures underpin the urban and street patterns built out on the ground." (Marshall, 2005, p16)

In this part of the text Marshall presents a detailed analysis of types of street and patterns – and importantly, how they may be classified and represented. The culmination of which is a "single conceptual framework" and its application to practice (Marshall, 2005, p16). Of most significance to this study are the chapters on "Street type and Hierarchy" and "Pattern type" (Marshall, 2005, p16). The chapter on street type provides a review of the multitude and diversity of different street types, with an overview of the different terms in use, a full appendix of examples of street typologies from literature and a survey of "official classification systems" (Marshall, 2005, p57). This approach, based in literature and established descriptors, contrasts with the aims of this research study – which draws purely on observational, form based analysis. There is, nonetheless, some interesting commentary on

classification systems in general, describing how classification can be defined by theme – and primarily into four categories: "Form, Use, Relation and Designation" (Marshall, 2005, p55).

Marshall develops a "multi-tier hierarchical typology" which departs from the "conventional interpretations" described (Marshall, 2005, p68). This is more an exercise in terminology and the organisation of terms, than a description of formal characteristics.

The chapter on "Pattern type" follows a similar structure – surveying examples from literature of pattern typologies (Marshall, 2005, p73). In a similar way that street type classifications were divided by theme, pattern type classifications can be based on "the configuration of streets…the shape of interstices…the alignment of the routes" (Marshall, 2005, p77). Through a careful analysis of a select few classification systems (Brindle, Groth, Unwin, Keeble, Sitte, the Mosborough Master Plan, Haggett and Chorley), Marshall synthesizes his own system – with the specific aim to:

"…distinguish different kinds of pattern relating to *desired formations* of urban streets". [our emphasis] (Marshall, 2005, p84)

First, Marshall establishes four broad types – "Altstadt", "Bilateral", "Characteristic/Conjoint" and "Distributory", next he adds two further layers of classification: "Composition" and "Configuration" – describing arrangement and connective qualities and finally adds scale (Marshall, 2005, p85). The resulting "integrated taxonomy" reflects some of the overarching themes in Marshall's literature and represents the author's desired set of typologies (Marshall, 2005, p90). Although the text rigorously identifies and organises types, it is like most if not all of the literature reviewed in this study in that it seeks to present an underlying ideology. Most significantly, *Streets and Patterns* is limited to the

analysis of street networks and their structuring, and does not touch on the broader vocabulary of urban form: blocks, buildings etc.

There is a body of literature such as studies by W.C. Baer (1997), E.J Kaiser and D.R. Godschalk (1995), Lucie Laurian et al (2007), P. Berk and D.R. Godschalk (2009) that categorise plans or aspects of plan types in relation to the success of their outcomes. Indeed, this is the more usual form of analysis (see the professional response in Conclusions, below). These analyses are more or less comprehensive but make comparisons in accordance with quality standards, 'relevance', policy implementation (plan implementation evaluation – P.I.E.) or other qualitative criteria. While a review of this literature would be of some interest generally, there is neither the space nor sufficient direct comparison to benefit this report.

Although there is a wealth of material in the same broad area, no one study or text has the same aims, objectives and methodology as this research.

Methodology

The first part of the research created a comprehensive taxonomy of urban design characteristics, across all scales, adequate to describe any one of the masterplans selected. In order to establish an effective descriptive system and avoid the near-impossible task of sorting the first sample according to some measure of relevance, it was necessary to collect as broad a database of masterplans as possible within the chosen study range from 1990-2010. (see Fig. 1 and Fig. 2).

It was necessary to establish the difference between a masterplan and a large housing scheme. It was concluded that a masterplan must be mixed use with more than one developer or a staged development process. In addition, the sample was limited by size to ensure that there would be sufficient commonality, that the typology would be meaningful and to facilitate the task. After examining a selection from the initial 50 samples the minimum size was set at five hectares, reduced from 10 hectares after examining further samples.

The masterplans were compiled from journals, books and websites (typically the website of the architect/planner responsible for the masterplan), and through discussion with a knowledgeable, extended research team. In total, 350 recent masterplans were collected and then collated into a database, and assigned attributes for their date and location. The scope of the sample can be seen in the adjacent tables. The sample collected could not be typologically representative, but it was large enough to ensure any descriptive system based upon the sample would be likely to contain at least one representative example of all relevant features. A sample of 350 should establish a descriptive system suitable for a comparative analysis of any subsequently selected sample.

(Fig. 1- Location of examples)
(Fig. 2- Date of examples)

Each masterplan was given a set of attributes to describe its key characteristics. The attributes were not decided in advance, but generated through observation across the sample. In order to establish some sort of categorisation, each masterplan was empirically and provisionally assigned between five and fifteen attributes depending on its complexity. In the first run, a list of 48 descriptive attributes was generated. This provided a comprehensive descriptive

taxonomy appropriate for the entire sample group up to a level of detail applicable to the level of detail of the plans available. Initial consultation with selected urban design practitioners (Academy of Urbanism) confirmed the descriptive efficacy of this first list.

This list was initially grouped according to scale using an established accepted descriptive methodology: ‘Plan type’, ‘Network articulation’, ‘Block articulation’ and ‘Building articulation’. Looking more closely at and, in particular, looking beyond the plan, ‘Density’, ‘Permeability’ and ‘Context’ were added.

Although the list appeared to adequately describe the 350 masterplans, it became clear that the list could be refined and rationalised to a more concise set of attributes. This process of simplification was lengthy and involved, first an analysis of the attributes by our own research team, followed by a seminar session with invited professionals and academics in the field. The list was not only condensed in number but also improved and supplemented (see Table 1).

The initial list was narrowed down by subsuming attributes into each other, removing attributes with similar meanings and also creating new attributes that could account for a broader range of masterplans, for example, the rationalisation of ‘Plan types’ (see Table 1). There was some difficulty in setting parameters for particular attributes that were measurable, and it was decided that due to the scale of the descriptive system, our classifications could only function properly at a certain level – and so certain attributes (for example height) were categorised into a relatively small number of types.

Grids were rationalised from 7 to 5.

The ‘Regular Grid’ and the ‘Elongated Grid’ were subsumed into ‘Orthogonal Grid,’ as both were versions of an orthogonal layout; an ‘Elongated’ plan could be accounted for in the ‘Block Articulation’ and ‘Network Articulation’ attributes which can imply scale and proportion.

The ‘Parametric Grid’ was subsumed into the ‘Distorted Grid’ – which describes any grid that has been in some way modified from an orthogonal layout, according to a range of design or contextual factors which could include parametric design.

The ‘Barcelona Grid’ was renamed ‘Grid with Diagonals’ to encompass a broader range of the classic orthogonal grid with diagonal crossings. ‘Radial’ and ‘Clashing’ grids remained.

Three related plan types were ‘Townscape’, ‘Naturalistic’ and ‘Semi- Naturalistic’ – each described a version of the classic townscape layout, with varying degrees of curvilinearity. They were rationalised into ‘Townscape’ and ‘Townscape Organic’, recognising that the more naturalistic of these layouts are still townscape plans. This also avoided any subjectivity in classification: plan arrangement are either curvilinear or they are not.

The ‘Olmstedian’ plan layout was expanded into two attributes: ‘Olmstedian Urban’ and ‘Olmstedian Suburban’ after an extensive discussion about the difference between plan types with parkland features in urban locations, and those in the suburbs. It was felt that these two plans types were sufficiently distinct.

The ‘Formal’, ‘Eco-Town’ and ‘Urban Village’ classifications were removed on the grounds that they described ideological objectives rather than physical plan types.

The ‘Stem Pattern’ and the ‘Unbounded’ plan types remained as they had no related or similar plan type and no further additions or refinement were required to provide an adequate description.

Further rationalisation split the ‘Network Articulation’ category into two parts: ‘Network Articulation’ describes the proportion, scale and layout of streets and roads, and ‘Permeability’ was added to describe the degree to which the masterplan provides a choice of routes and pathways. ‘Permeability’ is measured by the attribute ‘Intensity of Intersections’ – a calculation based on the average number of intersections per hectare.

The same process was carried out for each of the other attribute groupings: ‘Block Articulation’, ‘Network Articulation’ and ‘Building Articulation’. ‘Use’ and ‘Context’ were also added to provide a fuller description. The former describes the mix of functions within the masterplan and the later describes the relationship between the masterplan and its surroundings.

At this stage a presentation of the research to date was made to a group of professionals and academics in a specially-convened seminar. A critical discussion of each attribute category and its constituent attributes led to the further refinement of a number of specific attributes, and importantly the addition of attributes and, significantly, an entirely new attribute category. One discussion focussed on ‘Permeability’, which featured just one attribute: ‘Intensity of Intersections’. It was felt that this was not adequate to describe the complexity of

permeability and an additional attribute, ‘Connectedness’, was suggested by transport planning professionals. ‘Connectedness’ measures the average number of intersections across a masterplan and their distribution. It is calculated by measuring the average distance between intersections, and in addition a maximum and minimum distance between intersections providing a range of ‘Connectedness’ categories from high to low in order to more easily relate masterplans to each other.

Participants also discussed the need to add an attribute category for density. Two different attributes were proposed: ‘Height’ and ‘Built Form per Hectare’. It was noted that in some cases height data was not easily available for particular masterplans, but this was an issue of sample selection not of attribute definition.

Following the seminar session a final list of categories with their constituent attributes was created (see Table 1). At this point it was necessary to go back through the database of masterplans to reassign, add and remove attributes to reflect the changes. From here, it was possible to generate a list of all attributes and their varying number of occurrences in the database. Now, it was possible to observe relationships between attributes, for example, we were able to calculate what percentage of grid plans featured perimeter blocks, or what proportion of suburban schemes featured detached dwellings and so on. As well as generating new and unanticipated findings, it was also possible to confirm the validity of the methodology by testing relationships that we knew should exist – for example that ‘Orthogonal Grids’ should always feature ‘Rectilinear Blocks’.

While the list of attributes seemed to us to be fully adequate to describe any masterplan from our sample, it must be possible that there has been an omission or that attributes could be

extended or altered to provide a more accurate range. This is an open-ended system – so additional attributes can be added or superfluous attributes omitted. This would not negate the work or invalidate the methodology.

Attribute Categorisation

There are 39 individual attributes totals 39, in 8 distinct categories: “Plan type”, “Permeability”, “Density”, “Network articulation”, “Block articulation”, “Building articulation”, “Use” and “Context” – fig. 3. These categories cover descriptors across a range of scales, from the city scale (Plan type), down to the building scale (Building articulation) – fig. 4.

Attribute Descriptions

Each can be described with common characteristics and typical features. Deciding whether an observed masterplan characteristic fits into an attribute description will always be a judgement but the attributes have been reduced to minimise choice while providing a range sufficient to make meaningful comparisons.

Plan Type

Describes the overarching layout of a masterplan –how blocks are arranged to create streets. The largest scale attribute category that can be determined with figure-ground plans.

Orthogonal Grid

Streets at right angles to one another and blocks either square or rectilinear in proportion. Streets are given a hierarchy which does not vary to respond to terrain. The primary streets provide the main grid pattern, whilst smaller streets and avenues may break up blocks in a

more irregular manner. Blocks can be removed to accommodate open squares, parks and public spaces. “Orthogonal Grids” can vary in rhythm across one plan, changing in block shape and dimension, width of road and orientation. Features such as roundabouts, central axes, parks, squares, special blocks and solitaire buildings can also disrupt the pattern.

Radial Grid

A variation on the orthogonal grid where streets radiate from a central point, or a theoretical central point. Other streets can cross radial streets. The street pattern could be curved or straight and the blocks irregular or orthogonal. Variation and hierarchy is achieved through different street widths and special features. A grid could be part radial and part orthogonal, either blending into each other or clashing.

Clashing Grid

A variation on the “Orthogonal Grid” - where more than one grid meets in one plan at different orientations. Blocks are necessarily irregular where they meet, whereas the other blocks conform to the same criteria as the “Orthogonal Grid” (or “Radial Grid” in the case of clashing radial grids). Any form of “Radial Grid” could clash with an “Orthogonal Grid”. “Clashing Grids” can vary across terrain, with grids of different grain meeting each other. There are limitations to the landscape distortion that clashing grids could accommodate.

Distorted Grid

The grid pattern distorted, relaxed or generated by a parametric formula. A grid pattern is still evident, but in a dramatically different form, most typically with curved blocks and streets. Block sizes have more variation than in an orthogonal grid and it is likely that no two blocks are the same. “Distorted Grids” may have varying street widths and blocks removed to make

way for squares, parks and feature buildings. A “Distorted Grid” can adapt its grain to the terrain.

Grid with Diagonals

A grid with diagonal or other off-grid avenues crossing an orthogonal grid. Diagonal streets could be boulevards, or create vistas towards particular buildings, parks and monuments. Triangular spaces created from the bisection of the diagonal street/s can accommodate squares, monuments, solitaire buildings, irregular blocks, superblocks or parks.

Townscape/Organic Townscape

Both “Townscape” types have no rigid pattern and respond naturally to variations in the terrain. There is a clear hierarchy of streets, with long through routes for traffic and a further complex pattern of streets and alleys. Many vistas are purposefully terminated and blocks shifted to prevent monotony. Blocks are most often irregular in shape and size and are often left out to make public squares or parks. The “Organic Townscape” has irregular and purposefully curvilinear streets, responding more directly to the terrain than the simple townscape model. “Townscape” also describes the urban village type – a small/medium-sized, self-contained, compact, medium-density formation with a “Townscape” or “Organic Townscape” plan layout - or a combination. Typically, these sorts of plans suit smaller buildings or detached dwellings. Public spaces such as squares or park, and civic buildings are usually located towards the centre.

(Figure 3 Attribute Categories)

(Figure 4 Attribute Categorisation Diagram)

Unbounded

The most radical difference from most traditional “Plan types”, with either blocks or buildings with no direct relationship to the street pattern. Buildings can be positioned within a street block so as not to address the street, or be shaped independently of the street pattern. Buildings within a block can also be positioned, orientated and shaped in such a way that there is no spatial relationship between them and they can be separated by public space. Blocks and buildings in “Unbounded” plan layouts can be of any shape and size.

Olmstedian Urban/Suburban

Named after Frederick Law Olmsted — famous for designing urban parks – a plan with parks or open green spaces as major features. Plans range from housing schemes featuring a communal park in the centre; housing situated on a rural hillside; urban villas in a park setting; or a masterplan whose main feature is an urban park. The suburban subset of the “Olmstedian Plan Type”, “Olmstedian Suburban”, covers plans located on the edges of cities or towns, typically in the more rural areas.

Stem Pattern

Typically one main arterial through route with smaller branching cul-de-sacs. These cul-de-sacs offer access to a building or number of detached dwellings. There are no vehicular ways through and every cul-desac is a dead-end. Stem patterns are typically organic in layout with curvilinear roads and a large part of a plan or neighbourhood can be made up of multiple adjoined stem patterns.

Multiple Plan Type

A plan where more than one of the previously described Plan Types occurs within one masterplan. The blending of Plan Types can be done in different ways. Different Plan Types can be blended together in a number of ways: by clashing (as the "Clashing Grid"); with the irregular spaces in between for public spaces, parks or "Solitaire" buildings; or by using a smaller block and the street grain to overcome irregularities.

Permeability

Permeability describes the degree to which a plan allows a choice of routes and paths, making the place accessible. Permeability is measured firstly by calculating the "Intensity of Intersections" and secondly by examining the plan's "Connectedness".

Intensity of Intersections

A measurement of the number of street/road crossings that occur on average per hectare. Plans can be categorised into three types:

- High permeability > 10 intersections/hectare
- Moderate permeability > 2 < 10 intersections/hectare
- Low permeability < 2 intersections/hectare

Connectedness

An indication of the number of intersections and their distribution, it is measured by calculating the average distance between intersections, and the maximum and minimum distance between intersections. Plans can be categorized into five types:

- Very Low Connectedness > 220 metres between intersections

- Low Connectedness > 150 metres between intersections
- Low to Moderate Connectedness > 80 metres < 150 metres between intersections
- Moderate to High Connectedness > 50 metres < 80 metres between intersections
- High Connectedness < 50 metres between intersections

Density

Measured in two ways which when read together provide a broad understanding of the density of built form.

Height

A categorisation into average height bands using the number of storeys across the masterplan.

- < 3 storeys
- > 3 < 5 storeys
- > 5 < 8 storeys
- > 8 storeys
- Mixed storey height - at least 3 different categories.

Built Form per Hectare

The average square metres of "Built Form per Hectare", to be read alongside the height attribute to give a broader picture of overall density

Network Articulation

Attributes that describe aspects of a masterplan in terms of streets.

Street Pattern

Describes the range of street and road widths present in a masterplan categorised into 5 types:

- < 3m width (lane)
- > 3 < 10m width (undifferentiated street)
- > 10m < 20m width (boulevard/avenue)
- > 20m (highway)
- Mix of 3 or more street types = Multiple street pattern.

Central Feature

Describes plans which employ the use of symmetry (or substantially equal halves), either in small areas or over larger parts of the plan, emphasising a particular route, street, square, building or other feature. This could be an ordering device, a viewing corridor, an important pedestrianised route, a special building, a public space or a park.

Boulevard

A wide, tree lined road, with a central reservation or carriageway for fast flowing, through traffic, with a further two minor lanes to service the buildings and street on each side. Typically, the "Boulevard" refers to straight or gently curved roads, not to roads that are dramatically curved or have multiple junctions or bends.

Avenue

A tree lined road, with wide pavements, in an urban area distinct from the "Boulevard" type in that it does not necessarily have a central carriageway or minor lanes.

Block Articulation

This condenses the vast range of different block forms into a usable number. Typically, a masterplan will feature more than one block type – accordingly, the attributes in this section can be applied singly or together. Three of the block types are also applicable to all other block type, they are: “Open Block”, “Partially Closed Block” and “Perimeter Block”.

Open Block

Any block form which is permeable with spaces between buildings. The spaces between the buildings can be private or public, pedestrian through-routes or public spaces.

Partially Closed Block

Blocks closed on the majority of sides, forming a perimeter block, but with an opening or a partially open side. This type is half way between a “Perimeter block” and an “Open Block”.

Perimeter Block

Blocks where the buildings form a continuous edge along frontages. Similar to the “Partially Closed Block”, the space inside the block can be private or public, used for parking, landscaped, divided or one space.

Irregular Block

A block type with almost unlimited possible forms – as by definition it has no fixed shape. It responds to terrain and is the constituent part of a “Townscape Plan Type”, but could appear in other Plan Types. Frontages of adjacent irregular blocks do not need to be parallel, and irregular blocks can have any number of sides – both curved or straight-edged.

Rectilinear Block

Plans with four-sided, regular-shaped blocks.

Curved Block

Blocks are curvilinear in form.

Super-Block

This could have the attributes of any other block type –irregular, square, elongated, curved elongated, circular, open and courtyard – but is distinguished by its oversized scale (between 500m^2-1 km^2). The block could have small pedestrian sub-routes or vehicular access through it but the block should be defined by its principal perimeter road.

Circular Block

A block form which is circular, elliptical or any distortion of a circle in plan.

Building Articulation

The smallest scale at which form is examined. When combined with block articulation, this category provides a more detailed account of the formal characteristics of a masterplan.

Row

An arrangement of individual buildings or a narrow strip of building, where all the entrances and access paths are orientated towards the street. They can be formed from detached, semi-detached or terraced units, and can have one or two sides with or without significant green space between them. Narrow apartment blocks can also be arranged in a “Row” formation,

provided their long edge is orientated towards the street. The “Row” can be straight or curved in form.

Detached Dwelling

Individual buildings on the scale of a single home. These can be arranged in any formation within the full range of block types, except the “Perimeter Block”.

Solitaire

Buildings that stands apart from other buildings in a block, or in some cases is the only building in a block, or stands between blocks. Special in form, use or materiality, it contrasts with surrounding buildings and is typically surrounded on all sides by open space.

Ribbon

Buildings rectilinear in form, and arranged with the short end orientated towards the street. “Ribbons” are often clustered in groups with the long edges facing each other, although they can be individual buildings. A “Ribbon” can occur within the full range of block types, except the “Perimeter Block”.

Use

The functional mix of the masterplan.

Residential

Masterplans which are predominantly (80%+) housing.

Mixed-Use

Masterplans which contain a variety of different building functions (more than 20% non-residential), integrated fully into each other, i.e. there is no separation of uses into different areas – for example, housing and retail could be positioned along the same street.

Zoned

Masterplans which clearly separate different building functions into defined areas. There may be a residential zone, retail and shopping zone, civic zone, or business zone etc.

Context

The relationship between the masterplan and its context.

Contained

Masterplans located within an existing settlement, with existing buildings meeting the new masterplan on all edges. Also describes masterplans where one edge is met by a waterfront i.e. a harbour masterplan in an existing settlement.

Extension

Masterplans added onto an existing settlement, with existing buildings only meeting the new masterplan on one/some edge/s.

Greenfield

Masterplans which are self-contained, with no physical relationship to an existing settlement. Built primarily on greenfield land, they can also be built on brownfield or specially constructed islands.

Infill

Masterplans made up of individual buildings or blocks within an existing settlement. In this respect there is little overarching "Plan Type" as design is at the scale of building and block articulation.

Size Relative to Whole

The size of a masterplan in relation to its context. The total area of the masterplan is measured, against the area of the entire settlement b which the masterplan is either contained, extends or infills. The ratio of is expressed as a percentage. If a masterplan were to be entirely new and unconnected ("Greenfield"), this would be 100%.

Applications

The categorisation system described above becomes an insightful tool for urban design analysis. Both measurable and immeasurable factors can be tested against form, including: time, geography, ideology, regulation, aspects of performance and use etc. Theoretically any factor can be tested to see if there is some relationship to form. In order to test the taxonometric system, we ran four such examples and examined their resulting analysis.

Time-based

Ten examples of UK masterplans from 1996 are compared with ten from 2006 (fig. 5) to see if significant differences can be detected. It is possible to identify certain regulations, texts and economic factors that could potentially have an effect on form. Although this is a relatively small sample, some notable differences emerge: there are considerably more "Orthogonal Grid" plan layouts in 2006, as well as more "Perimeter Blocks" and more plans with mixed street widths. It would take a more detailed analysis and reference back to

specific timed events to see if it is possible to detect reasons for these differences. There are also characteristics that remain unchanged: “Townscape” plans are common in both years, as are “Detached Dwellings”, “Mixed Use” and mixed height plans.

This was a test comparison with a small sample but this exercise could be conducted over any time span and could be made more complex by analysing trends for particular periods in order to track changes more closely.

(Figure 5 – Masterplans from 1996 and 2006 compared)

Geographical analysis

Comparing masterplanning trends in Europe and the USA, with 20 plans from each location between 1990 and 2010 (fig. 6) testing preconceptions about differences between European and American planning. The study confirmed these preconceptions. There are more “Orthogonal Grid” plan layouts, “Olmstedian” and “Olmstedian Suburban” plans in the USA. By contrast, more “Townscapes” are found in European masterplans. Interestingly, this analysis also show that the less traditional building and block types are found more often in European plans: such as the “Superblock”, the “Circular Block” and the “Solitaire” – suggesting that more experimental urbanism may occur in Europe than in the USA.

(Figure 6 – Masterplans from Europe and USA compared)

Ideological analysis

It is possible to investigate less tangible factors such as the relationship between stated objectives and outcome. Gathering a sample is more difficult than the measurable aspects of

time and place – and subjectivity is unavoidable. Analysing the effect of qualitative objectives on form is based on the principle that the sample is based on criteria chosen as a test and can only be judged in those terms.

'Starchitects'

20 built and un-built 'Starchitect' masterplans from across the world are compared (fig. 7). All the masterplans are designed by so-called 'starchitects': Norman Foster, David Chipperfield, OMA, Zaha Hadid, Frank Gehry, Jean Nouvel and Daniel Libeskind. The sample was chosen by selecting the first 20 results that appeared through a simple search of online resources using terms such as 'starchitect' and 'masterplan'. This is a basic form of randomised selection based on descriptive types.

There were mixed results with a range of contrasting characteristics. However, there are stronger trends for certain attributes such as taller buildings, wider streets and "Contained" masterplans. In the Plan Type category, the "Unbounded" layout is the most common, however the "Orthogonal Grid", "Townscape" and "Olmstedian" are also fairly prevalent. The dominance of the "Unbounded Plan Type" is an expected result, which confirms an expectation that the Plans Type likely to be used by 'starchitects' would be associated with the display of "Solitaire" building – a hallmark of 'starchitects'. The trend for "Contained" plans could reflect the more prestigious, inner city sites to which well-known architects are often linked. In terms of blocks the findings are less clear, with both "Irregular" and "Rectilinear" blocks common, as well as an equal weighting of "Open", "Partially Closed" and "Perimeter" blocks. This analysis shows that masterplans designed by this acknowledged (but not fully defined) group of architects do not fit comfortably into limited types, but that there are a number of strong trends.

(Figure 7 – Masterplans by ‘starchitects’ analysed)

New Urbanism

A comparison of the characteristics of a clearly defined ideology, New Urbanism, in its birthplace in the USA and in other global locations (fig. 8, fig. 9, fig. 10). There are a large number of masterplans that adhere to New Urbanist principles in North America, and indeed most self-confessed New Urbanists are American. It is therefore interesting to consider the extent to which the forms observed in New Urbanist schemes in the USA are similar to those found on other continents. For this study 20 examples of New Urbanism in the USA are compared with 20 on other continents.

For this study 20 examples of New Urbanism in North America are compared with 20 on other continents. As New Urbanism is an established ideology with self-defined adherents and is comprehensively documented by The Congress for New Urbanism, it is possible to assemble a reasonably representative sample. Differing scales were chosen from 13 US States and 2 Canadian provinces and from 13 other countries. As the major US exponents tend to be the major exporters of the type, 13 examples from firms such as DPZ, Calthorpe Associates and UDA were chosen in the USA and 16 from the same group in other countries, with the remainder from occasional or less prominent exponents such as Wood Rodgers in California, Gary White Associates in South Africa and the major international architects HOK.

The results show some clear similarities between the two samples. Both groups show a strong trend towards “Townscape” and “Townscape Organic” in the Plan Type category – with few other Plan Types observed in either group. There is also congruence between the two samples

in “Block Type” and “Building Articulation”, where the “Irregular” and “Rectilinear” blocks are very common, and there is a fairly equal weighting of “Open”, “Partially Closed” and “Perimeter” blocks within both groups. The “Row” and the “Detached dwelling” are the most common “Building articulations” across both groups, and most plans are also “Mixed use” and “Greenfield” developments. The “Intensity of Intersections” and “Connectedness” are also very similar across both groups – with a “moderate” level of permeability across each measure. These formal characteristics are all hallmarks of New Urbanism, and demonstrate the endurance of these principles even in radically different geographic and cultural contexts.

A slight difference can be observed in the “Street pattern” attribute. Here, there is a higher prevalence of “Mixed” types in global masterplans than in North America where a narrow street pattern is more common. This suggests some element of difference relating to context, and could imply more flexibility in plans outside North America or different highway regulations – however this is a limited conclusion as the similarity in the other attributes suggests little differentiation between contexts.

(Figure 8 – Masterplans defined as ‘New Urbanism’ in the USA analysed)
(Figure 9 – Masterplans defined as ‘New Urbanism’ in non-USA locations analysed)
(Figure 10 – Masterplans defined as ‘New Urbanism’ compared)

Conclusion

The literature review describes the typical discourse in urban design, urbanism and masterplanning. The categorisation system and methodology presented in this research attempts to break with that tradition, removing any reference to the designer’s qualitative description or ambitions for the plan and establishing an entirely form-based analytical

methodology. The research does not provide definitive results or findings, but a methodology that is applicable to other analytical objectives. This framework represents the output of the research – not the indicative findings.

When the research was presented to a group of professionals in the field, the participants had some difficulty in understanding the rationale. Many who work in this field are primarily concerned with the qualitative outcomes of design and stripping an analysis down to form may seem pointless. A form-based quantitative description can, however, establish a fixed comparative framework for in-depth qualitative analyses of outcomes. If two plans provide quite different qualitative outcomes but share several quantitative similarities, it is clear that the difference is not generated by those similarities. This would be an important and practical conclusion.

The set of quantitative criteria generated by this study can be evaluated by their ability to adequately describe any masterplan in terms of its formal characteristics. It is furthermore possible to refine or add to the set if it is found to be wanting or for the purposes of a particular analysis without disturbing the overall framework. We consider this to be one of the strengths of this methodology.

From the test comparisons in the range of external factors (time, geography and ideology), both correlation and marked differences in form are clearly observable. This suggests that the attributes have fulfilled the aim of establishing a baseline of formal analysis which can be used to detect similarities or differences in relation to external contextual changes. The test samples used for all but one (the New Urbanist) of the worked examples were limited in number and the selection was random. Nevertheless, the results still show valid conclusions.

To achieve more meaningful results, larger samples and/or a more rigorous selection would be required.

The framework for analysis of form presented in this study can provide the baseline for analytical research into a range of qualitative and quantitative external and contextual factors. The examples discussed in this report suggest that a wide range of analysis could benefit from the use of this methodology.

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