

LOCAL DESIGN FOR SOCIAL SUSTAINABILITY

The four papers which we present as the Local Design element of the SOLUTIONS project broadly represent principals, first steps, creative exploration and hard facts. This paper sets the scene in terms of orientation and methodology, with a focus on social inclusion and local designarchetypes. The second paper illustrates aspects of the research by reference to the London case study and the first London local study area in Hillingdon. The third paper examines the three study areas in and around Cambridge. Work is still in progress but some results are reported. The third paper explores the research literature on local travel behaviour and access to local facilities, explains the research method and presents the results of a pilot survey carried out in Bristol.

CONTEXT AND PURPOSE

The SOLUTIONS *Local Design* research starts from the recognition that the prevailing pattern of suburban and exurban development compromises the principle of sustainable development. While outer city areas vary hugely in social and physical character, there are certain traits that are endemic, shared across many cities in Europe, Australasia, America and Asia. Some of the characteristics that particularly contradict sustainable development are listed below -

Less than sustainable characteristics of suburbs and exurbs

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|---------------|---|
| ECONOMIC | <ul style="list-style-type: none">▪ Economic dependence on external employment and commercial areas, with some suburbs and most commuter settlements lacking their own economic base or adequate service levels.▪ Low levels of investment in some older suburbs, conversely very high levels of investment elsewhere, normally in the form of car-oriented use-segregated site-by-site development |
| SOCIAL | <ul style="list-style-type: none">▪ Social polarisation, with large estates in outer suburbs being associated with a particular social class, limited household variety and mix.▪ In some areas. Poor social cohesion, reflecting the lack of a clear sense of identity and low levels of social and cultural vitality.▪ Social exclusion, affecting certain groups in relation to job search areas, accessible local facilities, transport choice and quality environments.▪ Unhealthy lifestyles, with the decline of daily walking and cycling, outside play and recreational activity.▪ Increased mental illness, related to social isolation and the decline of local social networks. |
| ENVIRONMENTAL | <ul style="list-style-type: none">▪ Excessive use of land, because of low densities for housing and, particularly, commerce.▪ High consumption of energy, water and construction materials.▪ Unsustainable levels of greenhouse emissions due to high |

- vehicle use and building energy use.
- Congestion traffic danger, “sprawl” lack of continuity of the urban-fabric, lack of distinctiveness and character.

Sources: Gwilliam et al 1998, Barton et al 2000, Urbed 2004.

The central objective of the SOLUTIONS Local Design research programme is “to develop and test alternative neighbourhood designs”, that might be applied to outer city areas over the next thirty years. These designs should be “inspired by local urban form theory/practice” and “enable comparisons to be made between different design philosophies”. The research will “evaluate the options for their likely feasibility, robustness and sustainability”. (quotes taken from the SOLUTIONS consortium bid to EPSRC in Oct 2003). The social aspect of sustainability is a particular theme, i.e. the degree to which different designs are socially inclusive, promote social cohesion, health and well-being. This theme will be examined later in the paper, when we look at the evaluation criteria.

The Local Design research relates closely to other elements of the SOLUTIONS programme and other parts of EPSRCs Sustainable Urban Environment (SUE) programme. It is intended to complement the Strategic Design work undertaken by Cambridge University, with outcomes from Local Design feeding into the strategic modelling, and vice versa. It learns from Pattern Specification (UCL) and provides evidence for Integrative Appraisal (University of Leeds). The empirical research on Neighbourhood Accessibility and Social Inclusion (which is the subject of the third paper in this set, and undertaken at UWE, Bristol) will enable us to refine our assessment of local accessibility for facilities. It will provide evidence about how much residents use local facilities, how they get to them, and what spatial variables influence them, helping to fill a critical gap in the underpinning research. This work is tied into another SUE Transport project: Accessibility and User Needs in Transport for Sustainable Urban Environments – a project more conveniently known as AUNT SUE. The aim of AUNT SUE is to improve understanding of the behaviour, perceptions and motivations of people who experience transport-related exclusion. Our Neighbourhood Accessibility project will enable AUNT SUE to, as it were, calibrate her analysis of the needs of certain user groups (youth, elderly, disabled) against our observations of actual behaviour and what is possible in terms of neighbourhood design. Equivalently we will be able to increase the sophistication of our design evaluating in relation to those user groups, and hence make better recommendations to practice.

A further layer of analytical ability could be provided by the SOLUTIONS Micro-simulation research. The micro-simulation model can be calibrated against the empirical data provided by Neighbourhood Accessibility and then be used to predict the possible local travel behaviour of each design on test.

SCOPE AND METHOD

The Local Design research team are studying the sustainability of different forms of future neighbourhood development. Future scenarios have been designed based on recognisable underlying urban design forms that guide development patterns. Different urban forms result from the complex interplay of local built and natural infrastructures, market forces and trends and spatial planning policy and drivers. In any locality, over the medium and long term, the resolution of these forces and factors can give rise to different urban forms. The result is the variety and mix of urban forms generally found in our existing settlements.

The Local Design research does not focus on why these different urban forms arise, in this there is already an established discourse (ref via Christine Lambert). This research is breaking new ground in asking the question - which urban forms are likely to give rise to better sustainability. The SOLUTIONS project definition of sustainability is development that is socially inclusive, environmentally sustainable and economically efficient. In light of the UK Government's commitment to sustainable development (ref. needed) and current house building ambitions (ref. needed) this line of enquiry is very timely.

The research approach is innovative in adopting as its central tool an enquiry by design process. The application of the urban design archetypes to the case study areas and the evaluation of the resulting spatial development scenarios is a reflexive process.

The approach allows for adaptation to local conditions through site visits and participative elements whilst also being steered by the expertise in sustainable urban settlement design of the professional design team. The approach displays both deductive reasoning, in applying and testing received theory by observation, and also inductive reasoning in its ambition to generate new hypotheses from observation of designs in progress.

The core urban design process is exploratory and iterative. The standard 'drawing board' based urban design work is being supported by use of a Geographic Information System (GIS). The analysis and metrics that this can provide, combined with the participatory elements, provide validation and evaluation tools that both have qualitative and quantitative elements.

Two participatory stakeholder workshops ensure a reciprocal exchange of information and ideas between the researchers and local knowledge. The first workshop in each study area is held with a small group of selected key decision makers. The second workshop is held with a wider group of public and private interests is used to test the feasibility of the draft scenarios.

In order to evaluate the strategic and local design scenarios in terms of sustainable development, an appraisal framework has been developed for the Solutions project. The appraisal is based on a series of evaluation criteria that best capture economic, social, environmental and resource impacts. The full set of evaluation criteria have been developed to integrate the strategic and local design work, some criteria from the full set are only applicable at one of these levels. At the local design level there are four screening criteria and ten assessment criteria. Some of these are discussed in a later section.

ASSESSMENT CRITERIA

Local screening criteria

These represent natural or cultural features that would prohibit or proscribe development in certain areas.

1. Valued built heritage – conservation areas and listed buildings
2. Valued landscape features – woodland, green space, rivers and wetland
3. Biodiversity – recognised wildlife sites
4. Flood risk –

Local assessment criteria

1. Productive (previously undeveloped) land lost to development
2. Trip distance (proxy for transport emissions and energy use)
3. Accessibility to (a) local shops; (b) local schools
4. Accessibility to public transport
5. Accessibility to major green-space
6. Trips by walk or cycle (proxy for physical activity)
7. Vitality of retail services
8. Public and political acceptability
9. Market and Institutional feasibility
10. Physical practicality and robustness

A careful analytic process has selected these criteria as being the most appropriate in responding to the different urban form scenarios at the neighbourhood and township design scale. The assessment criteria capture a range of parameters critical in assessing the sustainability of the local design scenarios. Measurement procedures are explained below:-

1. Productive (previously undeveloped) land lost to development. The total greenfield, brownfield and other land that needs to be built on for each scenario has been measured. Efficiency of land use can be assessed by comparing these measures with total number of people housed – specifically greenfield hectares per thousand population.
2. Trip distance (proxy for transport emissions and energy use). A figure has been arrived at that represents the average distance of travel from all dwellings in a case study area to the main district centre.
3. Accessibility to schools and local shops. A network analysis provided data that has been used to calculate the percentage of people within easy access of these facilities in each case study area. Distances used are within 600m (7/8 minutes walk) of a primary school, 1500m (20 minutes walk) of a secondary school and 800m (10 minutes walk) of a local centre or supermarket.
4. Access to local public transport. Existing public transport information was analysed and plotted onto the case study maps. New services or alterations to current services have been proposed through assessment of published plan and analysis of potential service demands. Public transport services have been graded as 'Excellent' for 12 or more services an hour, 'Good' for services 5-11 services an hour, 'Mediocre' for 2-4 an hour and 'Poor' for services below 2 per hour. A 'pedshed' of 400m has been used for most services but an enlarged pedshed of 600m for a direct and 'Good' service that is also very reliable such as an off-road or dedicated service.
5. Access to major green space. The exact way that this criteria will be assessed is still under evaluation. It attempts to capture information about access to amenity open space. However with such open access to green space afforded by the locations of the three Cambridge case studies the exact metric to assess will need further consideration and may involve additional rights of way and land use data being collected.

6. Trips by foot or cycle will be assessed following the results from another work package – work package 12 on Neighbourhood Accessibility. This is based on an empirical study of local modes of travel. See discussion later.
7. Vitality of retail services. This can be assessed in three ways. The number of people within a 5 minute (400m) and 10 minute (800m) walk has been calculated. We have assessed location for attractiveness in terms of factors such as passing trade. Stakeholders have also commented on this criterion.
8. Public and political acceptability. This is assessed for each scenario through a stakeholder workshop in each case study area. A qualitative appraisal methodology based on sustainability threshold analysis (STA) has been used to steer discussion, surface opinion and collate the findings.
9. Market and institutional feasibility. As with criterion 8, this is assessed through the stakeholder workshop, supplemented on occasion by questions to our local authority partners.
10. Physical practicality and robustness, The exploratory process of devising and refining scenarios provides the designer with an understanding of these factors. See later discussion.

Geodatabase

Evaluation of criteria one to seven was undertaken using a geodatabase to analyse the designed scenarios. Baseline maps consisted of layers of GIS data provided by the participating local stakeholders. Each urban design form, having been generated through in-house design workshops and stakeholder comment is committee to the geodatabase and further refined. Tools such as a network analyst have been used to provide exact measurements of journeys along existing and designed networks.

Other criteria

In addition the following criteria have been considered for inclusion in the analysis:

- Surface impermeability (diffuse pollution and flood risk proxy)
- Energy use in buildings
- Water consumption
- Materials used in construction
- Biodiversity and landscape ecology

These criteria, although very important at the local level, are subject to an overwhelming influence from design choices made at the plot layout and building and landscape construction scales. Decisions at these scales are mediated by developer aspiration, planning constraints, development control and building regulations. Urban design will only have a weak influence on these criteria, performance of a scheme against these four criteria is not strongly affected by the deployment of the different archetypes *per se*. However, *biodiversity* is discussed later, and may yet be included.

INTEGRATED ASSESSMENT: STA

The overall integrated assessment method for SOLUTIONS, being co-ordinated by Leeds University, is Multi Criteria Analysis (MCA). This involves scaling and weighting different criteria and assessing the sensitivity of results to variations in the weighting scheme. In order to feed into this process without pre-judging the issue of

the value put on different criteria, the Local design study will use an evaluation tool that avoids weighting, but does give a good indication of the *seriousness* of any particular impact. This tool is Sustainability Threshold Analysis (STA), which was presented in a paper last year (Barton 2004). STA is a five-layered grading system incorporating positive and negative impacts as follows:-

- BLUE: an *excellent* sustainability level:- the sustainability criterion is fully satisfied. For example, in relation to *water* you might expect autonomy of supply and treatment, with insitu drainage and flood risk effectively managed.
- GREEN: a *good* sustainability level:- the criteria is generally well satisfied, at least to the level we would currently consider best practice. For example, in relation to water there would be demand management, rain water and/or recycled grey water for low grade uses, sustainable drainage systems and effective flood risk management, but not full water autonomy.
- YELLOW: a *negotiable* level: There are significant areas of unsustainable or questionable practice which could (or at least in theory) be overcome by practicable means. In the water example it might be the absence of any strategy for sustainable drainage – which could be achieved straightforwardly.
- ORANGE: a highly *problematic* level:- the criterion is not likely to be satisfactorily fulfilled without major reassessment, a change in the basis development assumptions, or action in a related (but independent) decision area. In the case of water the assessment might be *orange* if development was proposed in an area of water shortage without appropriate demand management, rain-water collection and grey water recycling – unconventional and expensive measures.
- RED: an *unacceptable* level – the criteria cannot be satisfied. This might apply, for example, where development is proposed in a major flood plain

An advantage of STA is that it can usefully summarise measurements and judgements on diverse criteria, for example substantive criteria such as public transport accessibility and process criteria such as market feasibility. It identifies the key problems (i.e. grades orange and red) which will need to be confronted if a proposal is to have any chance of success.

ASSESSING SOCIAL SUSTAINABILITY

The local design research is not primarily predictive. It assesses spatial outcomes (of alternative design scenarios) that are known to affect social and environmental sustainability in this context is through levels of accessibility: can all user groups gain access, by means of travel that are open to them, to local and city-wide facilities. The central agenda here is that of social inclusion (Social Exclusion Unit 2000). Non-car-users need access to a good range of facilities (and, for some, job opportunities) by means of walking, cycling and public transport. Particular groups in this respect are children, teenagers, parents with very young children, poor households the elderly, and mentally/physically informed/disabled. An inclusive society (or an inclusive town) created options for these groups, which amount to about half of the population. In so doing it also provides choices for the population at large, increasing the freedom to choose, for example, local or distant facilities, walking or car use.

The assessment of local accessibility in SOLUTIONS concentrated on four facilities: local retail centres, schools, major greenspace and public transport services. GIS analysis calculated the proportion of the population that are within a set distance of these facilities along the pedestrian network, and maps the “pedsheds” of those facilities. The distances are derived from the practice guide ‘Shaping

Neighbourhoods' (Barton et al 2003) which was subject to extensive consultation and reference group evaluation:-

- primary schools – 600m (7.5 minutes walk)
- secondary school – 1500m (20 minute walk)
- local centre – 800m (10 minute walk)
- bus stops – 400 m (5 minutes walk)
- major open space – still to be decided, but likely to vary between case study cities: e.g. 800m for Cambridge, 1500m for London.

Local accessibility also benefits health. Distance is a key determinant of the propensity to walk, other things being equal, and regular, incidental, physical exercise is a key determinant to health (Handy 2005). The level of incidental walking is also likely to affect mental well-being, both through direct physiological and psychological effects and through social contact. However, the evidence is fragmented in relation to this. The SOLUTIONS ESRC-funded research student at UWE (who starts in the new year) will be looking at the relationship between local pedestrian activity, social capital and mental well-being.

Whether local accessibility also benefits the global environment – in terms of a reduction in transport-related greenhouse emissions – is uncertain.

We will also be attempting to predict the number and length of trips on foot and bike. The starting point for this will be the prediction from the strategic model. However, that will be only a very general guide and not discriminate between spatial scenarios. The existing research on local facilities and walking/cycling is insufficiently robust to give reliable answers. We hope that the empirical project reported in the paper on “Neighbourhood Accessibility and Social Inclusion” will eventually provide consistent data that can be used together with the output of the micro-simulator work package to produce a clear picture.

Biodiversity and Landscape Ecology

We would like to include a criterion about biodiversity, or more broadly, landscape ecology. This is an important factor with considerable public interest and concern. It is clearly significant at strategic and local level, and a measure of open space fragmentation has been suggested at both levels as an indicator of biodiversity. However, any measure of fragmentation at the strategic level is – given the very broad nature of land use distribution identified in the models – likely to be largely arbitrary and a very poor proxy for biodiversity. At the local design level continuity or fragmentation of greenspace is identifiable from the scenarios. Even at this level it had to be recognised that *actual* impacts cannot be assessed – it is more about an *enabling* open space framework, where if other development and land management policies were suitably pursued then increased biodiversity would occur. (Kirby 2005). A landscape ecology assessment would take a deeper view than just continuity/fragmentation. It would also include an assessment of existing/potential wildlife reservoirs and distinctive habitats – relying on maps, aerial photographs and stakeholder comments to identify woods, water-course, mature hedgerows. The criterion then could be a composite one, incorporating the potential for ecological landscape and resource management as well as biodiversity. The practicality of this still has to be trialled.

THE LOCAL URBAN FORM ARCHETYPES

The study progresses through the analysis of the application of contrasting development archetypes to shed light on what would be the best approach. Four archetypes, representing contrasting urban design neighbourhood and district forms have been selected from study of current and traditional practice in the UK. In order to clarify their distinct characteristics, the archetypes are described in this paper in their pure (or extreme) versions. This is distinct from the archetypes in application. In the research process, as in reality, these archetypes are applied to local areas through an urban design approach. They are moulded to local conditions through a design response to natural and built local infrastructure and features. Through this process the pure archetype is modified. For example, significant woodland, flood plain, prevailing wind and topography will all affect application of the archetypes, as will major public transport routes or proposals, existing settlement patterns and neighbouring land use. Therefore in the case studies, as in existing towns and cities, these archetypes tend to be encountered in applied forms that may not display all their attributes *in extremis*.

It is worth reflecting on the origins of the SOLUTIONS local archetypes, and the way they have evolved. Previous studies have drawn distinctions by age, density or tenure, or a combination of these. The Rowntree's study on suburban areas, for example, distinguishes historic suburbs, planned suburbs and car suburb (Gwilliam et al 1998). See also the URBED report on suburban revival in the South East (URBED 2004), which reviews many of the classifications used by different commentators. The focus in SOLUTIONS is on *form*. We have drawn heavily on specific sources: the British new towns, the Urban Task Force report (1999), the "new urbanists" in the USA and Australia, and work on sustainable community and neighbourhoods at UWE, Bristol (Barton 2000, Barton, Grant and Guise 2003). Our studies of existing suburban areas suggest that five distinctive local urban forms are sufficient to describe most of the existing suburban and exurban localities and that the characteristics across many different contexts are reasonably consistent. These five are

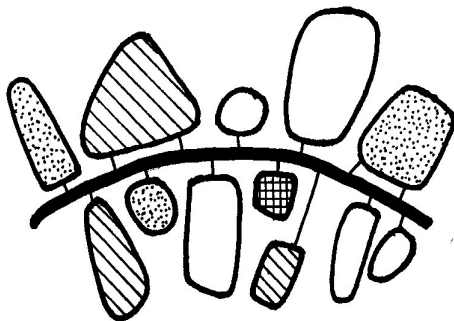
- use-segregated car-oriented "pods" of development
- neighbourhood cells, (or units) closed off to surrounding areas ("off-line")
- neighbourhood cells, where the local centre is on a through road ("on-line"), but the cell is still separate from its neighbours
- nucleated clusters of linked neighbourhoods, where permeability between them and within is high
- linear urban continuum with permeable neighbourhoods along public transport oriented high streets.

The first of these is exemplified by much edge of town development over the last part of the twentieth century. The neighbourhood cells are often examples of planned suburbs and settlements, but also describe many villages (see the Cambridge report: Northstowe). Much new urbanist design is for such neighbourhood cells, often in loose (not nucleated) clusters or as "beads on a string" along major transport routes (Calthorpe 1993) The Cluster of neighbourhoods, grouped around a district centre and built at high densities to maximise accessibility, has been powerfully advocated by the Urban Task Force; also, in a less concentrated form, by Australian designers (e.g. Morris and Kanforman 1997). The linear pattern reflects much early twentieth century development out along main tram routes (see the Hillingdon analysis below) but also designed new towns, and is increasingly evident in literature and practice (e.g. Tjallingii 1995), Barton 2000, and Current proposals for Northstowe – see the Cambridge paper).

	1. Use-segregated "pods"	2. Closed cells	3. Open cells	4. Interlinked clusters	5. Linear township
Land use	Single use	Residential + local services	Residential and local services	Mixed use and residential	Mixed use and residential
Street pattern	Tributary	Varied	Varied	Web or grid	Grid
On/off line	Off-line	Off-line	On-line	On-line	Township on-line
Density	Low	Medium	Medium	High	Graded
Location	Fringe	Varied	Varied	Inner urban or new extension	Urban radial or new extension

Figure x.x. shows some of the essential characteristics of the local archetypes, drawing on analysis for SOLUTIONS by UCL. In the final analysis we decided to reduce the number of alternatives in the interests of manageability, eliding "closed" and "open" cells into one class

Pod development



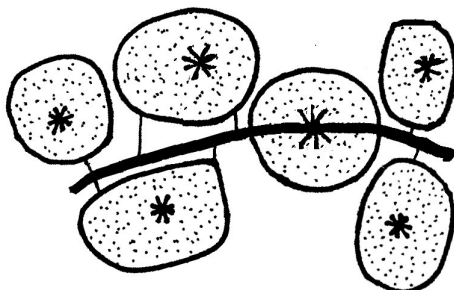
This development is typified by single use sites, with no interconnection, accessed by one or occasionally two roads coming off a main distributor. The pod is never on a main distributor, we have termed this 'off-line' development. Uses can be entirely residential, business, education, leisure or retail. Retail and leisure can sometimes be found together in a single site. Edge of town land availability, market forces and planning policy led to a lot of this kind of development in the later quarter of last

century and it is still a dominant urban form for current new build.

This form is the most versatile, in that it can be found in the widest range of scales and sizes. Single pods can be anything from 1ha, say a small residential development of 20 houses, to 500ha, a large business park campus. Since the pods are designed as independent developments, they can be found as one-offs, e.g. infill development, or spread over a wide areas often as district-wide edge of town development.

Market forces play a very strong role in determining the pod. Attributes such as size, density, access, building type, land use are market led. Socially driven agendas such as provision of public open space, community facilities, quality of the public realm are only addressed where regulation dictates or local planning places constraints. Similarly environmental performance issues tend to be driven by regulation.

Cell development



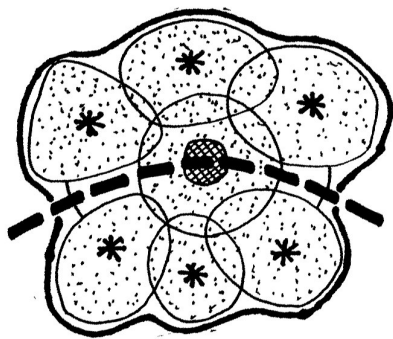
With cell development the hand of the urban designer is very evident. The underlying concept is to provide identifiable

'neighbourhoods'. Each neighbourhood is provided with a central focus usually some local shops, maybe a pub and often a social element such as a church, community centre or other local public or health facilities. These cells are designed to be independent and the boundary does not allow much movement in or out. The term 'closed' neighbourhood described this condition. Access is usually via two or three access roads from main distributors. In some instances, the cell and its central facilities lie on the main distributors, i.e. 'on-line' development. This increases the viability of its central shops and service and such an 'on-line' cell may act as a district centre.

As the cell has to function as a neighbourhood there is less size variety that found with pods. In order for the central functions to be viable the minimum population is taken as 4,000. The upper end of population is determined by accessibility. For viability the local centre needs to be within approximately 5 minutes walking distance of most of catchment 'customers'. This equates to 400m across flat unobstructed land. In a road network, where direct routes are constrained, a 400m walking distance can generally only be achieved by trips arising within a 300m radius. This places an upper size limit on a functioning cell. Allowing for a proportion of longer walking journeys, the upper limit is about 10,000 people.

In urban areas, this form of development was popular in the 1950s and had a renaissance in the some of the new town development built in the 1970s and 1980s. These developments were often low density though better accessibility and environmental sustainability can be achieved when density is graded with higher densities towards the local centres. The higher densities at the centre will also contain elements of mixed use.

Clustered development



This urban form is described in the Urban Task Force (1999: p53) as clear urban districts and distinct neighbourhoods, it has also been referred to as the new urbanist model. In this form the planning and urban design intention is to develop a series of inter-related neighbourhoods around a district centre, the goal being to maximise the number of people within walking distance of the district centre. The district centre must be 'on-line' for viability. Each neighbourhood has its own local facilities a level that will be

viable in each case.

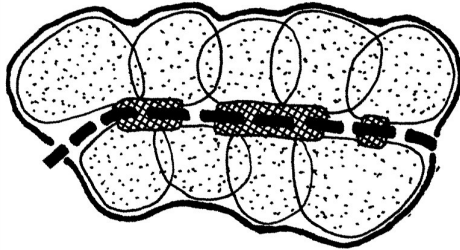
A high degree of mixed use is found in the district centre with some also but to a lesser extent in the local centres. There are normally six slightly overlapping cell neighbourhoods. These can be termed 'open' neighbourhoods in that although each has an identifiable core there may be no identifiable boundary, i.e. fuzzy boundaries.

The idealised pattern of 6 cells and a hub would make seven cells of 4000 totalling 28,000. To keep the centre accessible, the maximum direct distance from centre to edge is about 900m direct.

Density is graded with higher densities towards the centre of each open cell. The district cell has the highest densities, matching those of the local centres at its periphery but grading even higher towards the district centre. In the interstices

between the cells, lowest density uses such as education and small-scale green space are sited.

Linear development



This form is determined by the goal of maximising public transport viability. Density is graded with increasing densities towards a central public transport corridor and around transport interchange nodes. Mixed use is found in these higher densities. Facilities are located on the central road corridor with some freedom of position.

As an urban continuum the form could contain populations of between 20,000 – 40,000, covering some 1 - 3 km in length. The linear form is not continuously even but displays the characteristics of display a series of fuzzy neighbourhoods, the boundaries of which are dynamic in time. The diagram shows a 'single strand' of development but the form can also be developed as 'double strand' along two parallel transport routes. There are high levels of permeability (particularly for non-motorised movement) between neighbourhoods.

Linear accessible open space should run alongside the development. This open land could also contain a parallel non-congested road bypassing the main central road but giving intermediate access to it. The central road will have the local traffic slowed down by the good access to shops and facilities.

Application of the Archetypes

The use of the archetypes in the research is first to analyse the existing spatial structure of the study areas, and then to shape future spatial options or scenarios. The analysis of the existing forms in Cambridge, Bristol and Hillingdon has demonstrated that the four types more-or-less encompass British suburban reality and do help understanding of the current situation. The archetypes are sometimes strongly evident, sometimes only half-formed –more "virtual" than actual. The Hillingdon analysis (later in this paper) illustrates this well, where the form is dominated by historic linear townships and development well away from those historic routes resembles neighbourhood cells that never fully matured, lacking strong local centres. This gives pointers to future policy priorities.

The creative process of devising scenarios for 2016 and/or 2031 is much more difficult. There are a series of factors which have to be recognised and worked with:-

- *consistency*: all the variables that go to make up the scenarios must be treated consistently across the varied study areas. Our earlier exploratory attempts have now settled, and the templates for each archetype are clear
- *level playing field*: each of the archetypes, must, in its own character be designed as well as possible, avoiding designer bias and ensuring that the results reflect innate differences rather than good/bad design. Finding good solutions in an exploratory process.

- *relationship to strategic design*: in some study area (though not all) the local design scenarios are in the context of specific broad strategies and need to be applied in that context
- *density assumptions*: the range of densities appropriate varies between archetypes and between study area locations (e.g. suburban vs new town). However, in the interests of permitting sustainable detailed design for *all* scenarios a distinction has been drawn between net and gross residential densities. This allows for small parks, playgrounds, primary schools, SUDS and ecological landscapes in every scenario
- *intensification*: where “compact city” strategies apply, the potential for progressive densification of existing developed areas should be explored. The cluster and linear archetypes both assume densification, and so to a lesser extent does the cells option, but the pods archetype does not
- *networks*: local accessibility is determined in part by the street networks available for pedestrians. Pods are assumed to have tributary street systems with limited permeability, so they are bound to perform badly on accessibility criteria. The other three all have similar grid-based networks, so holding constant that element of design and allowing the broader aspects of neighbourhood form to determine performance
- *public transport services*: public transport accessibility is a key criterion. In the two analysis so far undertaken we have adopted different strategies. In Cambridge Northstowe public transport services are kept the same for each scenario (though the exact route varies). In Cambridge Southern Fringe the different forms lead to different systems
- *robustness*: in all such situations, where design or policy assumptions effect outcomes, sensitivity testing is essential. The GIS analysis process can encompass this.

LEARNING FROM THE PILOT STUDY

Cambridge Southern Fringe was the pilot study area for the Local Design element of SOLUTIONS. The innovative and unconventional nature of the methodology meant that the pilot was not the straightforward application of tried and tested ideas, but an exploratory and incremental process. This process involved a number of stages:

- orientation and base-line studies, including meetings with local authority partners and prospective developers
- the production of draft long-term scenarios and consultation on these with local authority partners
- The production of draft shorter-term scenarios and a stakeholder workshop on these in December 2004. The stakeholders included representatives from public, private and community sectors as well as most members of the SOLUTIONS team and Steering Group
- The revision of shorter and longer-term scenarios, and the use of GIS systems to evaluate them.

The process has helped to provide insight into a number of critical questions in relation to research methodology. The first of these is about the relationship between the duty of the researchers to the research *per se* and the duty to the local authority partners who are themselves contributing resources to the research to the process. This tension – hopefully a creative one – is built into the way EPSRC has constructed the SUE research programme. In the case of the Cambridge Southern Fringe, the *actual* decision-making process had been progressing at the same time as the SOLUTIONS study. The fact of the issues being “live” gives reality and point to the research exercise. But it also means that partners and stakeholders are very sensitive about the public, political and even commercial implications of the design scenarios that are proposed. They may fear the re-opening of basic policy questions that have (for the moment at least) been settled. This was the situation here. The draft long-term scenarios were considered by our local authority partners to be too radical for sharing with stakeholders. So only shorter-term scenarios, limited in their scope to land already identified for development, were presented to the stakeholder workshop. The workshop did produce some useful analysis of those scenarios. But it was also limited in that the archetypes were not fully articulated by the scenarios, so the stakeholder evaluation did not extend to the more contentious issues which the research intends to examine. The conclusion is that longer term scenarios should be developed and evaluated, and partners need to be made aware and accept the implications early in the process.

The second issue is about the function and operation of the stakeholder workshops. Two formats have been tried and both were productive, but also suffered from inadequate preparation of material by the team. The main lesson is that the scenarios need full development and initial GIS evaluation in advance of the workshop.

The third issue concerns the archetypes on test. Theoretical studies have identified many variants. Practicality suggests a maximum of four. The Cambridge Southern Fringe study has permitted us to progressively home in on the four that best articulate the range of theoretical approaches. Each is now more clearly distinguished from the others in name and character, with precise design criteria. Through experimentation and testing in Cambridge, Bristol and now Hillingdon, we have established the applicability and robustness of the chosen forms.

The fourth issue concerns the relationship of *local design* research into *strategic design*. In the original research concept it was anticipated that the different local archetypes would be tested by using the strategic model – i.e. the alternative levels of key variables (e.g. dwelling numbers, average pedestrian trip lengths) would be input into different runs of the model. It has since become apparent that there will not be sufficient runs of the models to permit this. On the contrary, the model will only be able to handle *one* set of inputs per strategic archetype on test. Since the local archetype by their nature produce varied estimates, and the assessment of that variation is central to the local design research, there is an apparent conflict. Eventually it may be that the micro-simulation modelling will provide an answer. Meanwhile, for the key variable of dwelling numbers at least, we will adjust figures proportionately to achieve a match with modelling inputs. This effectively means that the design date of each scenario can be moved forward or back according to the scenario's land use efficiency.

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