ID 1315 | A MODEL FOR THE PURSUIT OF ROBUST URBAN FORM

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1 INTRODUCTION

The starting point of the argument to be presented here is that the physical structure of urban areas lasts from many decades to several centuries. Without rebuilding, it can constrain, or even prohibit, specific urban activities that are thought desirable and being planned for. In contrast, economic and social forces will change markedly over the same time period and it is desirable that the physical structure should be designed to cope with these changes.

Growth of settlements is the norm rather than the exception and, at the very least, there is no basis for assuming that a city will never expand beyond its existing limits. As urban areas expand, it becomes necessary to retrofit them by inserting new, and adapting existing, buildings and by renewing and extending the infrastructure. Increases in residential density will result and will require similar retrofitting. If, therefore, a city is to be planned it must be robust: it should be designed to accommodate change, particularly the expansion of infrastructure, on a continual basis.

Although, at first sight, very long-term physical planning of robust form may seem like a tall order, it will be argued that it is feasible. A theoretical and normative model of robust urban form can be derived, or deduced, from two sets of planning goals - pursuit of quality of life and pursuit of sustainability (Hall, 2015) - and it will be shown that it has some remarkable properties.

2 DERIVATION OF THE PED-SHED

A sustainable goal of minimising use of energy leads to the planning criterion that activities should be located such as to minimise the need to travel. This then leads on to a sequence of further locational criteria, arranged in order of priority. A first priority would be no travel. In practice, this would imply no more movement than would be expected within a building or between adjacent buildings. In other words, mixed land uses would be immediately adjacent to each other in two dimensions or overlay each other in three dimensions.

Obviously, not all activities could, or should, be located so close together. Parks and playing fields would not fit and an attempt to combine retail, commercial and residential activities within an excessive extension of three-dimensional megastructures would militate against a high degree of quality of life. As a second priority, therefore, urban form should permit uses to be located within walking distance of each other. A walking distance can vary between 300 and 700 metres in length, and a typical length is 400m. However, we will wish to talk about an absolute maximum for the extent of development, and to explore its consequences for urban form in general, and so we need a robust figure that would not normally be exceed. Urban design guidelines commonly suggest an average of 400 metres and maximum of 800 metres radius (Llewelyn Davies et al, 2000).

The resulting form is not a new idea and is referred to in the technical literature as a ped-shed. (Unfortunately, there appears to be no suitable alternative that is problem free.) The structure of a typical 800m radius ped-shed is illustrated diagrammatically by Figure 1. There is some, but not complete, equivalence here with the work of Calthorpe (1993) and many other proponents of the neighbourhood principle (Walters, 2007).

Because of the of both the desire to minimise the need to travel and likely economic pressures on the supply and value of land, the residential density can be expected to decrease with distance from the centre. The absolute density levels within each ped-shed would be determined by the distance of the pedshed as a whole from other urban centres and the socio-economic pressures resulting from this. Nonresidential uses permitted in the settlement would be expected to be concentrated in the mixed-use core.

3 LINKING UP PED-SHEDS

There are clearly limits to what facilities could be contained within one 800m-radius settlement. Adoption of a maximum distance implies that, once such a settlement has been constructed, further development would require additional ped-sheds. The pursuit of sustainable travel now requires, as the third level of priority, that walking gives way to travel between the ped-sheds not dependent on the private motor vehicle. They should be linked by a high-grade public transport corridor, ideally a frequent-service fixed-track facility, each stop at the centre of the mixed-use core. This creates what is often known as a beads-on-string form. If a facility is not within walking distance, then it ca be reached by walking combined with public transport. Although travel in total is not minimised, the form adopted means that it can still take place in the most energy efficient manner. The form does not necessarily compel the use of walking and public transport but that it does ensure that anyone without private motor transport is not disadvantaged.

Open land would surround each ped-shed and would thus be within the walking distance of all dwellings. This would not only minimise travel to outdoor recreation but also make it available to those without access to a car, especially children. The green areas between the strings could be substantial and would not only allow ample room for recreation. Such land could also have a significant role to play in urban agriculture and the management of storm drainage.

As with the ped-shed, the beads-on-string idea is not in itself new. Similar ideas have been set out by Peter Hall (Hall and Ward, 1998), Hildebrand Frey (1999) and the Urban Task Force (1999), amongst others. However, the following proposals previously set out by this author (Hall, 2015), have not been commonly advocated elsewhere.

3.1 THE DESIGN OF ROAD PROVISION

Within the ped-sheds, motor vehicle access would be permitted but a low speed environment would favour safe and pleasant movement by foot and bicycle. All the roads, therefore, should have frontage access and speed limited to a maximum of 50 kph or, in some neighbourhoods, 30 kph. Local buses within 50 kph roads could supplement the public transport provision. Higher-speed roads, with no frontage access, would be located outside the ped-sheds and would permit vehicle speeds up to, or even in excess of, 100 kph. They would link the ped-sheds and could carry higher-speed long-distance buses in addition to private cars.

Some may be motorways but others may just be two-lane roads. The point is the access restriction. This implies a two-level road hierarchy for motor vehicles:

- urban streets with low speeds, limitations on heavy vehicles, active frontages and enclosure of space;
- motor roads with higher speeds, surfaces supporting heavy vehicles, no necessary building frontage and restricted access.

3.2 NON-RESIDENTIAL PED-SHEDS

Park-and-ride facilities around public transport stops pose a particular problem. The space taken up by the parking of cars is in conflict with the principle of bringing other uses closer together with pedestrian access. The solution is to locate park-and-ride facilities around dedicated public transport stops away from residential ped-sheds. This would have the further advantage of allowing direct access by the higher-speed roads.

Warehouse and distribution centres and park-and-ride facilities should be located outside of residential ped-sheds. The same would go for all other space-hungry, low-intensity commercial and manufacturing uses, such as very large hospital and educational complexes. They, like park-and-ride facilities, should have their own stop on the quality public transport network. This leads to a non-residential ped-shed containing a combination of such uses, as illustrated diagrammatically by Figure 2. It would also be possible to have a ped-shed that was, say, half non-residential and half residential, or similar proportions.

3.3 DEALING WITH RESIDENTIAL DENSITY

What will be the number of people living in a residential ped-shed? The threshold of population needed to support specific facilities is a perennially difficult one because it is subject to change over time. For example, variations in the economics of retailing affect the support for different types of shops. The catchment areas of schools may be affected by changing educational theories and economics. Moreover, there can be different threshold populations for different types of facility.

The robust solution is that it is the area that is fixed and the density that should vary according to the number of people required to support the facility provided. This contrasts with the more usual approach of density being regarded as fixed and uniform and the number of people required for the catchment area generating the area of the settlement. Different densities in different beads (i.e. ped-sheds) would support a different mixture of facilities. The variation would not just be between ped-sheds but could change over time through the process of redevelopment. Services not found within one ped-shed could be reached by easy travel to another nearby or to a city centre.

4 A THEORETICAL CITY MODEL

Supposing we were to base an entire city on the beads-on-string form, what would the result be? Such a whole-city model would be an idealised form, not an actual city plan, but it would create a theoretical model whose properties could be examined (Hall, 2015). For our model, a radial structure will be adopted, with arms or fingers radiating out from a central point. This is not, in itself, novel and similar suggestions have been made by other authors and for particular cities. The innovation proposed, and pursued, here will be to insert additional radial "arms" between others where space allows, with these arms being served by branches from the public transport lines, as shown in Figure 3.

It is possible to explore different spacing of station stops and separation of the radial arms. The author has examined these (Hall, 2015) but space precludes a full discussion here. The optimum solution was found to be a line of 800m radius ped-sheds with a minimum separation of at least 200m between them and at least 200m between the radial forms. This produces the city shown by Figure 3, extending to a maximum radius of approximately 10 km. Note the emergence of circular or orbital public transport routes at 3.6 km and 9 km radii from the city centre.

There is green space within walking distance of all residents. Outside of the city centre, substantial non-built-up areas between the beads-on-string are created. As the extent of the city grows so these areas become largely enclosed on all sides with only narrow connecting strips between them. As such, they are not really green wedges in conventional planning parlance, as these normally remain open-ended as the city grows.

The term that will be used here for the non-built-up areas will be green enclaves. Starting 4 km out from the centre, each one is approximately 5.5 km long and varies in width from 0.5 km to over 2 km, with a total area of approximately 560 ha. These are areas that can accommodate a wide range of uses (other than continuous built-up areas). This has the great advantage of accommodating roads for motor traffic and railway lines for high-speed passenger and heavy freight movements, in addition to the recreational facilities and urban agriculture.

At first glance, the diagram may appear very uniform, as though all the ped-sheds would be the same, but this would not necessarily be the case. What is being presented is a long-term physical structure. Residential density would vary over the city in both space and time, as could the quantity and scale of nonresidential uses. Many of the ped-sheds could be at a much higher residential density than adjacent ones and could incorporate local centres with significant shopping, commercial and social facilities. Furthermore, a number of the ped-sheds would not be predominantly residential but might have all, or a major part of, their area devoted to manufacturing or distribution activities, or to large-scale health or educational provision or to park-and-ride facilities. These spatial variations would be subject to change over long time periods. What of the city centre in Figure 3? It is not a continuous built-up area, as in most cities.

However, the central ped-shed could reach very high densities and contain a very wide range of uses, as could the ped-sheds adjacent to it. The central ped-sheds could be brought closer together than the outer ones but, whether they are or not, the prospect is of a larger central area composed of higher-density urban neighbourhoods, or quarters, separated by parkland while still constituting an integrated whole. Note also that an intercity railway line passing through the city could be accommodated within the green enclaves, with a main station within the central ped-shed.

Figure 3 also shows the roads for motor vehicles where they are outside the ped-sheds. There would be the two-level road hierarchy already proposed: slow speed with active frontage within ped-sheds and higher speed with restricted frontage outside. The separation of 200m between the ped-sheds offers major advantages. Major roads can pass between the ped-sheds permitting circular routes around and throughout the city. We are immediately presented with a most remarkable result. It is possible to drive over the entire city at a reasonable speed on roads designed for the motor vehicle even though the city has been laid out to facilitate walking and use of public transport. A possible objection that readers may now raise, though, is that these roads are severing the green enclaves and creating barriers to the movement of their users. One response is that this is certainly going to be no worse that the situation in existing cities.

However, there is the more important point that, although these roads may be subject to access restrictions, not all of them will be the same. Some may, indeed, be motorways with several lanes in each direction. On the other hand, and at the other extreme, many may have just one lane in each direction carrying mainly local traffic. This will, as with the population density, vary both within the city and over time. In large parts of the city, especially at the extremities, the severance will be very minor. Moreover, the large size of the green enclaves must be taken into account. They are not types of local park but areas up to 2 km wide.

Another important property of the theoretical model is that it is extendable while retaining access to public transport and green space. There is no fixed outer boundary. The land that cannot be built on is within the city rather than around it. Figure 4 shows the city expanded to a radius of approximately 20 km.

We now have another set of green enclaves. These larger enclaves, starting 9 km out from the centre, are approximately 10 km long and also vary in width from 0.5 km to over 2 km, each having a total area of approximately 1800 ha. What can now be seen is how the inner ring of green enclaves can now accommodate express rail lines providing faster services from the city centre from the outer areas and retrofitted as the city expands. There is now another orbital public transport route at a radius of 18 km from the centre.

5 CITY EXPANSION AND NETWORKS OF CITIES

Although the theoretical city model appears to be able to expand indefinitely while retaining its sustainable characteristics, allowing for retrofitting of infrastructure as it expands, this is, of course, a theoretical concept. In reality, the city would encounter other settlements as it expands and would eventually meet other large cities. Cities could be strung along the transport corridor to create a higher level of beads on string form. Notwithstanding the ability of each theoretical city model to expand sustainably in a radial direction, would indefinite expansion be a good idea in reality? Figure 5 shows two 20 km radius cities with their centres approximately 40 km apart. As they merge into each other a higher concentration of ped-sheds results such that another city could be said to emerge, but in an unplanned way. In particular, there would be no new radial public transport routes to a new centre unless retrofitted on a massive scale. This is not in line with the intention of designing the planned robust city.

Figure 6 shows 20 km radius cities with a gap of approximately 10 km between them. Additional ped-sheds are allowed along the line of the inter-city route but not otherwise. Radial expansion is restricted in favour of the building or expansion of other cities. The Figure shows how the cities could possibly be arranged on a regular lattice that could be extended. What is happening here is the use of the theoretical model to explore the properties and consequences of a developing megalopolis i.e. an arrangement of a considerable number closely packed and interacting cities. Merged cities already exist in North-western Europe and North-eastern America. In rapidly developing countries, such as China on the Yangtse and Pearl River estuaries, at the time of writing, ever more extensive megalopolises are emerging. A method for making this process of agglomeration a planned one could have considerable practical potential.

6 IMPLICATIONS FOR PLANNING PRACTICE

Implementation of the proposals made in here does not necessarily require the construction of complete cities, and complexes of cities, on the lines of the theoretical model. There are much more prosaic applications of the ideas that could be readily absorbed into day-to-day planning practice. Urban extensions can be designed using the beads-on-string form proposed and, indeed, it can lead to a useful step-by-step method is available leading down from the strategic to local design criteria (Hall, 2015).

There are significant implications for the preparation of development plans in that the emphasis on physical form does not necessarily require the preparation of detailed master plans a long time in advance of development. Detailed two-dimensional maps and three-dimensional perspectives are essential for short-term planning but they are not required for the long term. Long term plans could be based on a formula, or criteria-based approach, as used in our theoretical model, for both for the location of development and the expression of design qualities, with physical detail shown only where and when required. These criteria could then be carried over from one plan period to another to achieve the long-term physical consistency.

The same locational principles could also be used to manage and plan for expansion “upwards” or, more properly, urban intensification. Levels of residential density could be related to walking distance from public transport nodes (Hall, 2015). The idea of high-density development around major stations is, of course, nothing new and is a policy that is widely implemented. What would be different here is to have a policy for the location of low and intermediate densities, and identification of areas where there would be no increase. This is not to say that these lower levels would not change over time but that the change would be put on a rational basis. Increases in density would be related to improvements in accessibility.~

7 CONCLUSIONS

Taking stock of the theoretical city model, it can be seen to have some remarkable, and to a certain extent counter-intuitive, properties.

- The robust city does not require limits to growth placed around its periphery. It could, in theory, continue to expand without limit while still successfully pursuing quality of life and sustainability.
- This does not mean, however, that there are no limits on the extent of urban areas - far from it. What it means is that non-built up areas or green enclaves would lie between the radial routes rather than being in the shape of green belts around the city. They would be similar to green wedges but would not necessarily be spatially open ended, as a green wedge concept would normally be. What is important is that the shape and size of the green enclaves would not be arbitrary but a necessary and systematic consequence of the locational principles of development.
- The green enclaves would provide the space for the retrofitting of infrastructure.
- Although the locational principles are based completely, and explicitly, on facilitating walking and the use of public transport, the resulting city form would also permit, rather unexpectedly, almost unrestricted access by motor vehicles across the city. Their speed would be limited within predominantly residential ped-sheds but this would not be the case when travelling between them through the green enclaves. They would be able to access park and ride facilities and commercial warehousing, distribution and manufacturing centres with little restriction.
- The same principles guiding the expanding structure of the city could also be applied to growing complexes of adjoining cities. They would be linked by transport corridors but separated by extensive green areas.

The planned robust city appears to work perfectly. Why then do we not find it in practice? Even where a planning regime is very interventionist and has proper regard to the design of physical form in the long term, the argument of this book presents two significant challenges at the local political level.

- The protection of the green enclaves.
- The cost of providing quality public transport corridors contemporaneous with new development.

Overcoming these obstacles is, in effect, a necessary consequence of having a city that is genuinely planned. The choice before us is between a city with a planning system and processes but which is not actually planned in any strategic sense and the planned and robust city as argued here. What is remarkable about the model is the advantageous implications of restricting development to within walking distance of public transport nodes. It results in quality movement about the city for motor vehicles as well, although such vehicles would have to accept significant speed restrictions within built-up areas. It permits the city to expand in a planned manner with room for the retrofitting of infrastructure within the existing boundary as the city grows. In more common parlance it allows the city "live and breathe" as it grows.

8 PICTURES

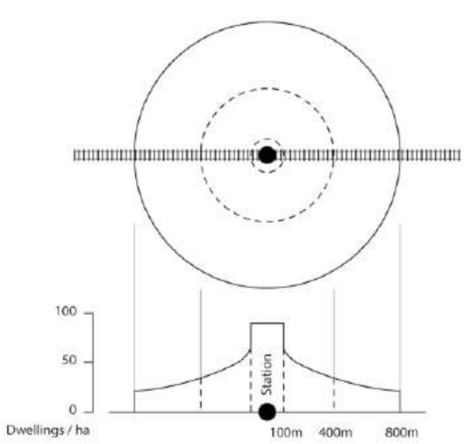

Figure 1 The 800m ped-shed showing a possible gradient of residential density from a mixed-use core around a centrally-located station.

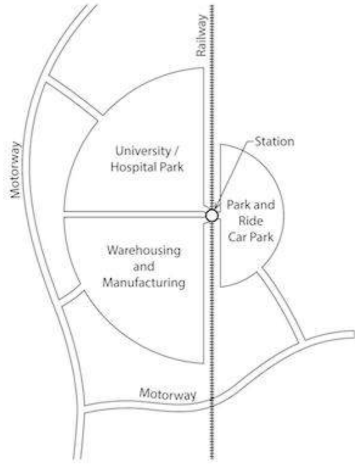

Figure 2 A diagrammatic representation of a ped-shed devoted to non-residential uses with a high level of use of, and access for, motor vehicles. In practice, all of three of the land-uses shown would not necessarily be present together and there may be other possible uses that are not shown.

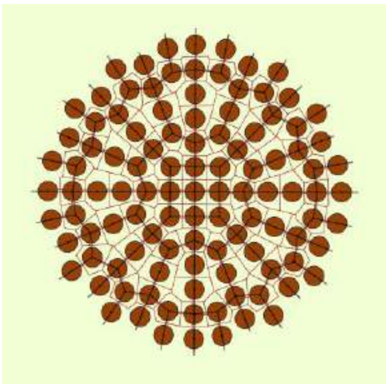

Figure 3 A city model with 800m radius ped-sheds and 200m separation, station stops every 1800m. City radius is approximately 10 km. The network of restricted-frontage motor roads is shown.

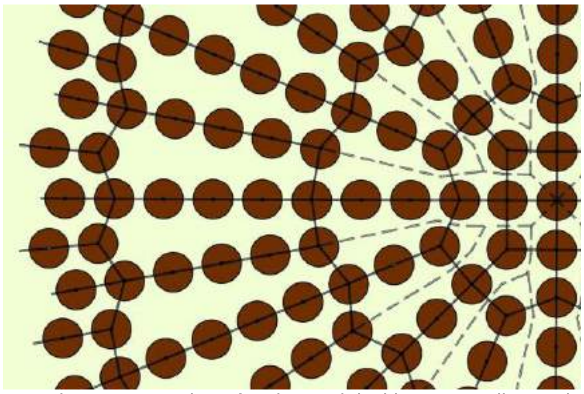

Figure 4 A section of a city model with 800m radius ped-sheds and 200m separation, station stops every 1800m. The city radius is approximately 20 km. The provision of express rail links is shown. (The road network is omitted for clarity.)

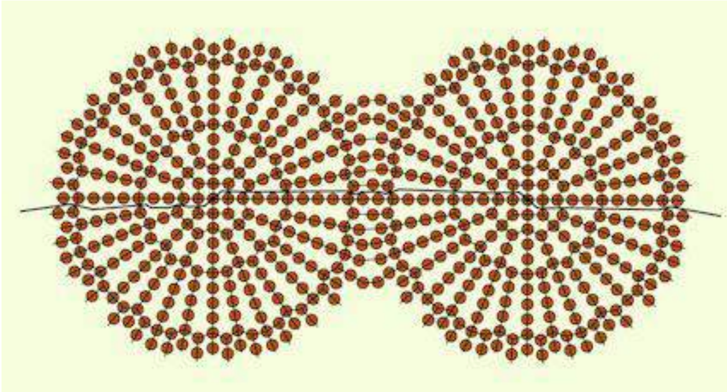

Figure 5 The effect of merging two 20 km radius cities

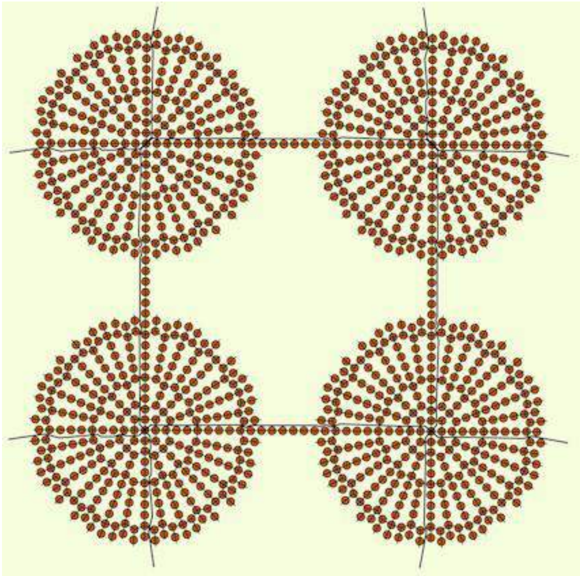

Figure 6 A lattice of 20 km radius cities separated by 10 km.

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