DISTILLATE

PROJECT F

Appendix C

Land use: development densities & mix

April 2006

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Land use: development densities & mix

(Land use instruments group: policy instruments to influence where homes, workplaces, shops and other facilities are located)

1. Description

Definition

Encouraging less motorised personal travel through land use involves the planning of new land use development and the management of existing land use in such a way as to bring origins and destinations closer together in order to help reduce private transport trips. This is normally done by increasing development densities or by organising the mix of lad use types, or both. Land use policy can also encourage a modal shift to public transport.

How can land use planning encourage less personal motorised travel?

Land use patterns affect travel behaviour. A variety of land use factors affect travel patterns including density, land use mix, roadway connectivity and design, parking facility design, and building design. Certain types of land use patterns are accessible by multiple modes, which reduces per capita car use, while others are car- orientated, which increases private car use. There are several strategies which involve changing land use patterns to increase multi-modal accessibility and reduce car use. (VTPI, 2001).

The full range of ways in which land use planning can encourage less personal motorised travel is as follows (IHT, 1977, p58). The list includes all types of land use instruments: the first two are covered in this document.

1. increasing development densities - higher densities may encourage shorter journeys and, thus, the use of walking and cycling (and may help to make public transport more viable, see 3 below);

2. altering the development mix - a better mix of uses can improve accessibility and, hence, reduce the need to travel;

3. concentrating dense developments within transport corridors - where public transport can provide a viable alternative to the use of cars (see ‘Encouraging Public Transport Use Through Land Use Planning’);

4. reducing parking standards - this probably offers the single most direct impact on levels of car-use and can be used in trip-end restraint;

5. increasing developers' contributions for transport infrastructure, including public transport. Alternatively, the provision of public transport services can be required as part of the process of obtaining planning approval for new developments;

6. requiring commuted payments - these are a special type of developer contribution in which the normal requirements for private parking provision are waived in return

for payment to a local authority of a charge per space, so that the Local Authority can make provision in public car parks or promote park-and-ride schemes;

7. promoting travel-reduction ordinances/company transport plans - travel-reduction ordinances are used in the US and the Netherlands to require developers to produce a plan specifying ways in which they will reduce car-use to their development; this would require legislation in the UK. As an alternative, voluntary company travel plans could be developed.

How can land use density and mix encourage less personal motorised travel? (based on VTPI, 2001).

Density refers to the number of people or jobs in a given area. Mix refers to how land uses are arranged in relation to each other. If common destinations are located close together, this type of mix is sometimes known as 'clustering'.

Density and mix can have significant impacts on travel demand and travel patterns through the following mechanisms:

- Accessibility: The number of potential destinations located within a geographical area tends to increase with population and employment density, reducing travel distances and the need for private travel. For example, in low-density areas a school may serve hundreds of square miles, requiring most students to travel by motor vehicle. In higher density areas, schools may serve just a few square miles, reducing average travel distances and allowing more students to walk or cycle. Similarly, average travel distances for errands, commuting and business-to-business transactions can decline with density.

- Transport choice: Increased density tends to increase the number of transport options available in an area due to economies of scale. Higher density areas tend to have better pedestrian and bicycle facilities and better public transport service because increased demand makes them more cost-effective.

As a result of these factors, higher density and clustered land use mix together tend to reduce per capita car ownership and use, and increased use of alternative modes (Jack Faucett Associates and Sierra Research, 1999 in VTPI, 2001).

International studies indicate that increased urban density significantly reduces per capita vehicle travel, as illustrated in the figure below (Kenworthy and Laube, 1999 in VTPI, 2001). This occurs in both higher-income and lower-income regions.

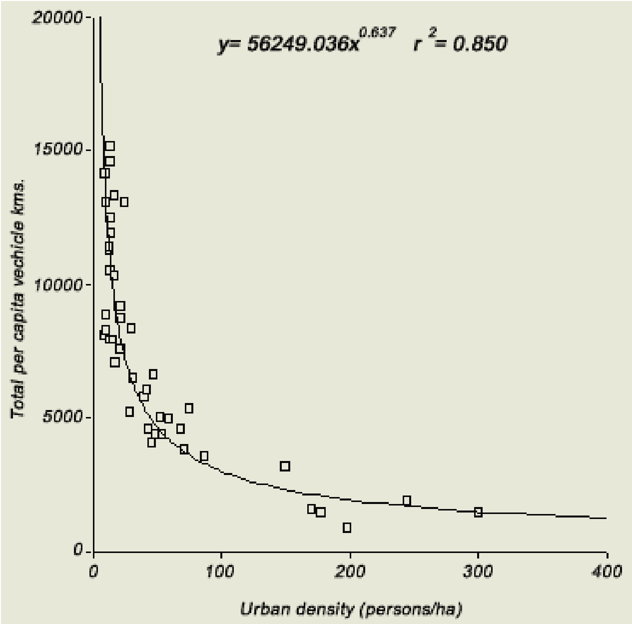

Figure: Urban Density and Motor Vehicle Travel (Kenworthy and Laube, 1999)

Each point marked on the graph represents a major international city. Per capita vehicle use tends to decrease with density.

It has also been found that average vehicle ownership, vehicle travel, and vehicle expenditure per household decline with increasing residential densities and proximity to public transport, holding constant other demographic factors such as household size and income.

One particular aspect of this instrument is where common destinations are located close together. This is known as ‘clustering’. An example of clustering is illustrated in the figure below:

A. This shows a conventional suburban development with buildings surrounded by parking and isolated from each other. There are often no paths connecting the buildings or sidewalks along the streets. Only car transport can effectively serve such destinations.

B. This shows the same buildings sited so they are clustered together and orientated toward the street, with main entrances that connect directly to the sidewalk rather than being located behind parking. This creates convenient pedestrian access between them, for example, making it easier for an employee in an office to visit an adjacent building, with a bank or shop for example (and for employees from two different buildings potentially to car share).

C. This shows eight buildings clustered around a park. As the cluster increases in size the efficiency of pedestrian improvements, car sharing and public transport services also increase, due to economies of scale.

D. This shows the eight-office building integrated into a park or campus, creating more convenient and attractive pedestrian connections between the buildings, further improving access and supporting transportation alternatives. It also creates a more enjoyable environment for employees and visitors compared with isolated buildings surrounded by parking.

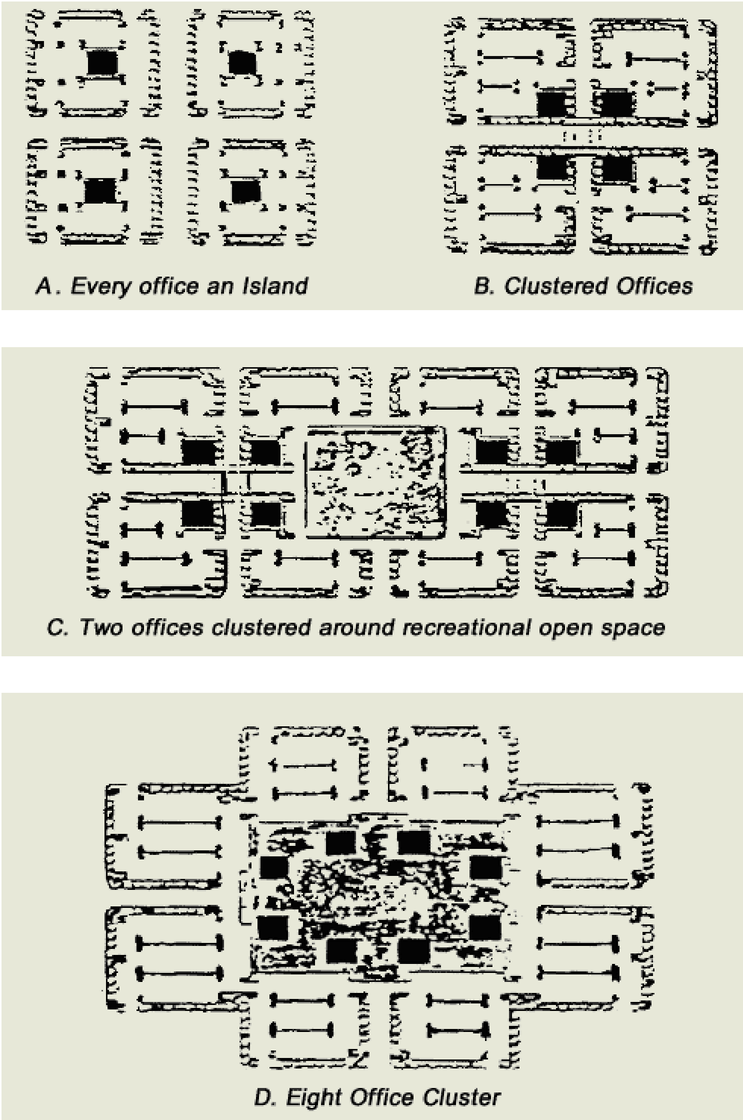

Figure: Clustering At the Local Scale (Source: VTPI, 2001)

2. *Assessment*

Why use land use planning to encourage less personal motorised travel?

The importance of the interactions between spatial (land use) planning and management, and the design, operation and use of transport systems, is fully recognised. Important aspects of this are (Cost Transport, 1998):

- the spatial organisation engendered by the evolution of the production process increases personal mobility requirements (and those for goods movements),

- low density development, particularly in the suburbs, has encouraged the growth of travel and of multi-car households;
- the growing polarisation of commercial structures has also led to an increase in personal travel, particularly by car.

The reversal or reduction of these land use development trends will tend to reduce the need to travel in general and travel by car in particular. Land use changes, however, take quite a long time, so this is not a short-term policy instrument.

The trends listed above may be illustrated by the cases shown in the following table:

Relationship between transport and location of property development	
Location/land use	**Effect**
Out-of-town business parks, UK	93% use car to travel to work
Gateshead MetroCentre, UK	80% travel by car compared to 27% to the city centre
Copenhagen insurance company moving from centre (near station) to suburbs	Car commuting up from 26% to 54%
Supermarket on free-standing outer London site	95% by car compared to 33% for inner London supermarket

Table: Relationship between transport and location of property development (Source: Lucas, Marsh and Jones, 2000, p.16).

The table below indicates how various land use design features are estimated to reduce per capita vehicle trip generation compared with conventional development that lacks these features (VTPI, 2001).

Design Feature	**Reduced Vehicle Travel**
Residential development around public transport nodes	10%
Commercial development around public transport nodes	15%
Residential development along public transport corridor.	5%
Commercial development along public transport corridor.	7%
Residential mixed-use development around public transport nodes	15%
Commercial mixed-use development around public transport nodes	20%
Residential mixed-use development along public transport corridors.	7%
Commercial mixed-use development along public transport corridors.	10%
Residential mixed-use development.	5%
Commercial mixed-use development.	7%

Table: Travel Impacts of Land Use Design Features (Source: VTPI, 2001)

Demand impacts

Increasing development densities and altering the development mix have an effect on demand in two ways:

- Reducing the need for motorised travel (especially private motorised travel) by ensuring origins and destinations are closer together (the topic of this document);
- Encouraging public transport use by improving conditions to enable public transport to operate more efficiently (dealt with separately under 'Encouraging Public Transport Use Through Land Use Planning' ;

It is the demand impact of the first of these which is the subject of this document.

The demand impacts of this instrument could be as follows:

- Change of destination: Higher densities and more mixed land uses bring more destinations of a particular type within easier reach;
- Reduction in the number of trips: Higher densities and more mixed land uses bring more destinations of a particular type within easier reach;
- Change in the mode of trips: Change of mode to public transport may occur where the change in land use makes the operation of public transport more viable, thus a better service;
- Selling the car: Where a sufficient range of destinations is available within a short distance, a car may become less necessary and so some may sell it.

Time scale for demand responses

Of all the instruments of transport policy, land use instruments are perhaps the ones which, potentially at least, can have the greatest impact on reducing the amount of motorised travel. However, they are also the ones which take the longest to implement and thus to bear fruit. The greatest opportunities for change are in the circumstances of entirely new development, when land use densities and mixes may be specified in advance. Even in these conditions however, results will take years to materialise

Level of response

The amount of reduction in motorised travel in response to land use instruments, will depend on:

- the scale of the land use changes;
- the design and type of the changes, in terms of density and mix;
- the speed with which the changes are effected.

In all cases, there will be no response in the short term and very little in the medium term, as indicated in the table above.

One study of travel patterns in a North American suburb found the elasticity of transit (public transport) mode split with respect to land use density to be +0.10 to +0.51, depending on type of land use. This means that each 1.0% increase in density increases public transport use by 0.1-0.51% (Cervero, 2002 in VTPI, 2001). The same study calculated the elasticity of per capita vehicle trips and vehicle travel with respect to various land use factors, as summarised in the table below. For example, this indicates that doubling neighbourhood density reduces per capita car travel by 5%. Similarly, doubling land use mix or improving land use design to support alternative modes also reduces per capita car travel by 5%. Although these factors may be small, they are cumulative. (VTPI, 2001)

Factor	**Description**	**Trips**	**VMT**
Local Density	Residents and employees divided by land area.	-0.05	-0.05
Local Diversity (Mix)	Jobs/residential population	-0.03	-0.05
Local Design	Sidewalk completeness/route directness and street network density.	-0.05	-0.03
Regional Accessibility	Distance to other activity centres in the region.	--	-0.20

Note: Trips = vehicle trips; VMT = vehicle miles travelled.

Table: Typical Elasticities of Travel With Respect to the Built Environment (Source: VTPI, 2001)

This suggests that neighbourhood design factors (density, mix and design) can reduce per capita vehicle travel on the order of 10-20%, while regional accessibility factors (i.e., where a neighbourhood is located with respect to the urban centre) can reduce car travel by 20-40%.

Supply impacts

The supply implications of this instrumetn are as follows:

- There will not be an increase in the supply of road space from land use instruments per se, though there might be additional local requirements, e.g. for access to new development, including by bus;
- If the land use policies are implemented on a regional scale, there could be a nett reduction in the need for road space (compared with doing nothing) in line with the decrease in the amount of travel;
- Higher density development could improve conditions for public transport and thus encourage greater public transport supply; (dealt with separately under 'Encouraging Public Transport Use Through Land Use Planning');
- Reduction in private motorised travel could encourage an increase in the supply of cycle and pedestrian facilities;
- Any reduction in car ownership would reduce the need for residential parking supply;
- Any reduction in 'motorised destinations' would reduce the need for non-residential parking supply.

Financing requirements

Though the costs of new development are considerable and land use solutions are, at their most extreme, the most expensive of the policy instruments contained in these pages, the cost usually falls in the main on the private sector (through investors, developers and occupiers). However, local authorities may have to bear some additional indirect costs (provision of extra traffic control, parking, public transport interchanges, etc).

Though it is difficult to cost this instrument, the range of possibilities being so large, some comments on cost can nevertheless be made.

Firstly, regarding individual developments, it has been estimated (Lucas, Marsh and Jones, p.19) that if development conforms to a standard to reflect sustainable development, construction costs will rise typically between 5 per cent and 20 per cent. Unfortunately the proportion of this extra cost related solely to attaining sustainable transport is not known but clearly there would be some additional cost if land use development had to conform to sustainable transport criteria.

There are ways of financing the extra costs of achieving a transport-friendly development policy, particularly where the extra cost would normally fall on the local authority. These ways include:

- Commuted payments
- Developer contributions

If development costs are looked at region-wide, an alternative picture on costs may occur, as illustrated in the following table (costs in Canadian dollars) (VTPI, 2001)

	Spread	**Nodal**	**Central**
Residents per Ha	66	98	152
Capital Costs (billion Canadian $ 1995)	54.8	45.1	39.1
Op & Maint Costs (billion C$ 1995)	14.3	11.8	10.1
Total Costs	69.1	56.9	49.2
Percent Savings over status quo option	0	17%	29%

Table: Estimated 25 Year Public Costs for Three Development Options

The table shows substantial public savings for higher density land use patterns associated with transport-friendly development.

Finally, one interesting issue regarding financing is the possibility of higher land and property values arising from improved accessibility, and how the local authority can get its hands on a slice of it.

3. Evidence on performance

Though there are many case studies of schemes intended to reduce travel by land use planning there are few, if any, case studies which have quantified the real travel-reduction effect. The main reason for this is the difficulty of comparing before and after conditions for an instrument that takes so long to implement and for effects to be felt.

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