



LAND USE AND REGIONAL PLANNING

Achieving integration between
transport and land use

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Additional information on transport research programmes and related projects is available on the Transport Research Knowledge Centre website on the European Commission's Europa server:

<http://ec.europa.eu/transport/extra>

In addition, a public e-mail enquiry service is available at:
helpdesk@transport-research.info

Information on the wider transport activities of the European Union is available on the internet. It can be accessed through the Europa server:

http://ec.europa.eu/dgs/energy_transport/index_en.html

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FOREWORD

This Policy Brochure focuses on land use as it affects, and is affected by, transport policy. Its aim is to inform transport policy makers and to assist them in influencing those responsible for land use policy. Land use is defined broadly to include new development and the type and intensity of use of existing development.

The research issues on land use and transport can be grouped into three areas: the effects of land use on transport demand; the effects of transport on land use; and the resulting interaction between transport and land use. Research results related to these are drawn from the EC's fifth framework **City of Tomorrow** programme, an earlier European research review, **TRANSLAND**, and a series of national research projects.

The principal elements of a land use policy designed to support transport policy should

be a focus on higher density development, mixed development, development associated with public transport, and development with limited on-site parking provision. Adopted alone, these policies will have limited impact on transport problems, since people will continue to make longer trips to maximise the opportunities available to them. However, these policies are important in the long run as they provide the preconditions for less car-dependent lifestyles.

Further research is needed on a number of issues, including understanding the costs, and any benefits, of urban sprawl; investigating the economic impact of accessibility on location choice; designing and assessing land use pricing policies; exploring the impact of new transport modes on land use patterns; and understanding the micro-scale interactions between transport and land use.

1

DEFINITION OF THE SUBJECT

While land use policies lie outside the remit of **DG TREN** and most national transport ministries, they have a significant impact on the demand for transport. If new developments are at lower density, remote from public transport and provided with extensive parking, they will attract longer journeys, predominantly by car. Conversely, higher density mixed developments are more likely to facilitate shorter journeys, more of which will be made by public transport, walking and cycling.

Equally, transport policies can affect land use decisions. New roads are often built to stimulate economic development, but travel time savings from new road and rail capacity will typically encourage more travel over longer distances. When location choices are made, firms and residents will be influenced by the access that transport provides, but may well choose to move away from areas that are congested, noisy or polluted. Policies aiming to restrict the demand for travel in congested areas may also encourage firms to relocate. One of the most serious impacts of all of these reactions is the encouragement of urban sprawl, which consumes green space and agricultural land, and reduces the sustainability of development.

These complex interactions, as illustrated in Figure 1, can take place over a considerable time.

Some developments will anticipate the building of a new road or airport; others will only occur when changes in business opportunities or family life stage prompt a move. Some

decisions will be made by governments, such as the location of new schools and hospitals; others will be influenced by government policy on land use control; but the majority will be taken by individuals and firms within the context of current land use controls.

While land use policies may have a less immediate impact on the transport system than policies that impact directly on transport, they are very important in providing the context within which transport policies may succeed or fail.

This Policy Brochure focuses on land use as it affects, and is affected by, transport policy. Its aim is to inform transport policy makers and to assist them in influencing those responsible for land use policy. Land use is defined broadly to include new development and the type and intensity of use of existing development. New development covers the issue of what is built and where; it includes both greenfield development and redevelopment of brownfield sites. Land use type covers the way in which a given development is used; for example old industrial buildings may be converted to housing or leisure use, dramatically changing their demands for travel and their impact on the community; less obviously, the output of a shopping centre or business park may change over time as demands change. Land use intensity

covers the amount of activity in a given land use, including population density and retail and business turnover.

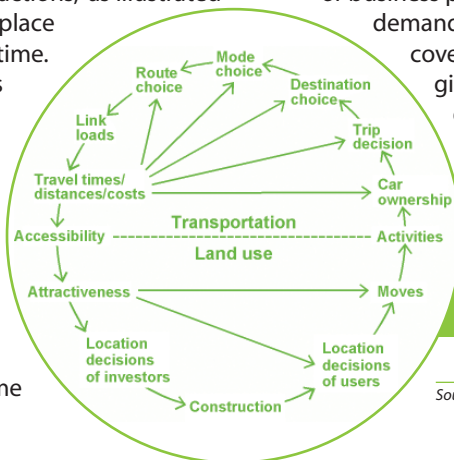


Figure 1:
The land use –
transport feedback cycle

Source: Wegener and Fürst (1999)

2

RESEARCH NEEDS

The research issues on land use and transport can be grouped into three areas:

1. the effects of land use on transport demand;
2. the effects of transport on land use; and
3. the resulting interaction between transport and land use.

The effects of land use on transport demand

A given development will affect transport demand in three ways, in terms of the number of person and freight journeys attracted, the origins or destinations of those journeys (and hence their length), and the modes of transport used. These impacts are relatively well understood. Most countries have databases that allow planners to estimate the number of person journeys that a given type of development will attract; some also cover freight activity. Journey length and mode will be affected to a greater extent by local conditions, but the general trends are well understood. These considerations suggest a number of land use policies that might help meet transport policy objectives. These include land use controls on the nature and density of development, controls on parking provision in new developments, controls on the way in which developments are used, and pricing of land use to reflect transport impacts and benefits. The last of these, in particular, has attracted relatively little research activity to date.

The effects of transport on land use

The impacts of transport on land use are generally less well understood, and have been the focus of significant recent research. Much

work has focused on the effects of improved accessibility, through faster, lower cost journeys, on relocation of activities and the stimulus of new development. This research includes understanding the process and impacts of urban sprawl. The converse effect of reduced accessibility and higher travel costs, which might arise through demand management and pricing policies, has attracted less attention. Transport policies can also affect land use by changing environmental conditions or, more subtly, by changing the image of an area. These impacts are less well understood than those of changes in accessibility.

The resulting interaction between transport and land use

A land use policy change will affect demand for travel, which may well in turn lead to pressure for new transport investment or demand management. At the same time, transport policies will influence land use, which will also lead to new patterns of travel and pressure for further changes in transport policy. These land use – transport interactions, which may take place over an extended timescale, have been the focus of a substantial recent research programme.



3

RESEARCH PROGRAMMES

The European Commission

Because land use policy falls outside the remit of **DGTREN**, and is seen predominantly as a local matter, there has been relatively little European Commission research into this area. The principal exception in Framework Five has been the **Land Use and Transport Research** cluster within DGRTD's **City of Tomorrow and Cultural Heritage** research programme. A total of 12 projects were commissioned, including ones which focused on the design of arterial streets (**ARTISTS**), sustainable freight policies (**CITYFREIGHT**), new prediction and appraisal tools (**ISHTAR**), integrated land use and transport strategies (**PROPOLIS**), guidance for decision-makers (**PROSPECTS**), and urban sprawl (**SCATTER**). A thematic network project, **PLUME**, brought together the results of these projects and provided an interface with end users through www.lutr.net. As a precursor to this programme, the **TRANSLAND** project, commissioned in the closing stages of Framework Four, provided an excellent review of past research (Wegener and Fürst, 1999).

In parallel **DGENV** has co-ordinated a series of working groups on aspects of the development of its Thematic Strategy for the Urban Environment. While no new research was conducted, these groups have provided useful summaries of what is known. The priority themes covered by the groups were: Sustainable Urban Transport, Sustainable Urban Management, Sustainable Urban Construction and Sustainable Urban Design. The objective of all four working groups was to identify the barriers to the implementation of the 'best practice' techniques in the European urban areas and to propose specific measures and actions that can be taken at the European level to overcome these barriers.

National programmes

Several national research projects have investigated the impacts of land use planning

policies on transport, the effects of transport on land use, and the integration of transport and land use. While there has been limited co-ordination of such research, there is an active Special Interest Group of the World Conference on Transport Research, which brings together the principal researchers in the subject area (WCTRS-SIG1). The following are examples of research projects supported by national research programmes across Europe:

- Interaction between land use and transport (Finland)
- Promoting traffic safety in land use planning (Finland)
- Mobility regulation and the evolution of car share, taking into account the diversity of land use and different spatial scales (France)
- Research to understand choices of commuters with regard to the location of their housing and activities (France)
- Regional impacts of transport infrastructure: ex-post impact assessment of implemented transport projects (Germany)
- Electric power systems and transport systems within land use planning for sustainable development (Italy)
- Sustainable land use planning, settlement structure and ways of living (Switzerland)
- The contribution of infrastructure and spatial developments to creating alternative arrangements for routing, transport mode and destination (the Netherlands)
- Integrating transport and land-use planning (UK)
- The impact of transport on residential location (UK)
- Design and Implementation of Support Tools for Integrated Local Land Use, Transport and the Environment (UK).

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RESEARCH RESULTS

The effects of land use policies on transport demand

The way in which land is developed (or redeveloped) will affect the demand for travel. This process has been the subject of extensive empirical research, as summarised in the Table on the next page, taken from **TRANSLAND** (Wegener and Fürst, 1999, p.40); (Paulley and Pedler, 2000, p. 11). There are three messages from this table:

1. while the scale of any new development will affect the number of journeys made, factors such as development density and location have no further effect on the number of journeys (“trip frequency” in the table)
2. development density, style and location will all affect journey length, and this can significantly influence the use of the transport system; higher density, mixed development and development closer to employment will all help to reduce journey lengths
3. as a result, these factors will also facilitate the use of public transport, walking and

cycling; in addition, development close to public transport facilities will help to promote its use.

Regulatory land use policies can also affect travel. Regulations to restrict the number of parking spaces in new developments have been shown to reduce car use in favour of other modes, provided that on-street parking is also controlled. Regulations to control the way in which new developments are used, and in particular to require business plans that limit demands on the transport system, can also reduce car and commercial vehicle use.

In principle, land use taxes that reflect demands on the use of the transport system could be expected to have an even more direct impact on travel demand. However, there has been little research to date into their design and possible impact. Current policies are limited to simple uniform charges throughout an area, such as the “versement”^[a] transport in France.

Recent results, as reported in **PLUME**, suggest that for a given level of development, land use policies have a smaller impact on transport policy objectives than do transport policies. However, they are important as a means of making transport policies more effective.

^[a] Versement transport is a tax levied by regional authorities on companies within their region. It is based on salaries paid and is aimed at generating funds to support public transport infrastructures.



Table 1: Impacts of land use in empirical studies

DIRECTION	FACTOR	IMPACT ON	OBSERVED IMPACTS
<p>LAND USE</p> <p>↓</p> <p>TRANSPORT</p>	Residential density	Trip length	Numerous studies support the hypothesis that higher density combined with mixed land-use leads to shorter trips. However, the impact is much weaker if travel cost differences are accounted for.
		Trip frequency	Little or no impact observed.
		Mode choice	The hypothesis that residential density is positively correlated with public transport use and negatively with car use is widely confirmed.
	Employment density	Trip length	In several studies the hypothesis was confirmed that a balance between workers and jobs results in shorter work trips, however this could not be confirmed in other studies. Mono-functional employment centres and dormitory suburbs, however, have demonstratively longer trips
		Trip frequency	No significant impact was found.
		Mode choice	Higher employment density is likely to induce more public transport use.
	Neighbourhood design	Trip length	American studies confirmed that 'traditional' neighbourhoods have shorter trips than car-oriented suburbs. Similar results are found in Europe.
		Trip frequency	No effects are reported.
		Mode choice	'Traditional' neighbourhoods have significantly higher shares of public transport, walking and cycling. However, design factors lose in importance once socio-economic characteristics of the population are accounted for.
	Location	Trip length	Distance to main employment centres is an important determinant of distance travelled.
		Trip frequency	No effect observed.
		Mode choice	Distance to public transport stops strongly influences public transport use.
	City size	Trip length	Mean travel distances are lowest in large urban areas and highest in rural settlements.
		Trip frequency	No effect observed.
		Mode choice	Public transport use is highest in large cities and smallest in rural settlements.

Source: Wegener and Fürst (1999); Pauley and Pedler (2000)

The effects of transport on land use

Transport policies can affect patterns of development and land use activity by making locations more, or less, accessible but also by changing the quality of the environment and the image of an area. Most empirical research has focused on the influence of accessibility, as summarised in the table from **TRANSLAND** (Wegener and Fürst, 1999, p.41); (Paulley and Pedler, 2000, p. 12). The table appears on the next page (page 8).

Accessibility will be increased where the cost of travel or the time spent travelling are reduced. Thus new higher speed roads and railways will encourage development close to junctions and stations, and lower fares will encourage longer distance travel, particularly to work. As noted in the table, provision of extensive parking space will also encourage development and longer distance travel. As the results from **PLUME** note, infrastructure investment can stimulate growth in journey length, and thus be a less cost-effective solution.

There has been less research into the effects of increases in travel time and cost on land use. The **PROPOLIS** study assessed the effects of pricing of car use, and found that it could encourage relocation outside the charged area, though the resulting improvements to public transport would mitigate this effect. It recommends the use of a graduated charging structure for road use to reduce congestion while retaining current patterns of activity. However, it also notes that reducing congestion will have the effect over time of encouraging longer distance travel unless charges are designed to control this impact.

PROPOLIS also found that the combination of public transport policies with car pricing policies helped to reduce or even avoid any negative impacts of the individual policies on land use. This is an important general result, but further work is needed to identify the most appropriate combinations of policy in different locations.



While there has been little research into the issue, there are several examples of improvements to the environment and image leading to increases in land use activity. This process is particularly noticeable through the effect of traffic calming measures in residential and commercial areas. Traffic calming in residential areas can make them more attractive places to live, and hence potentially change the mix of people living there. Traffic calming in city centres will make shopping and leisure activities more attractive, and can change the type of retail activity.

The **PLUME** project provides a useful summary of the role of a range of policy instruments in urban areas. A key message from several projects is that an integrated strategy will be more effective than one which focuses on a limited set of measures. Successful integrated strategies use combinations of policy instruments to achieve synergy and to reduce the barriers to their implementation. The five principal elements of a successful integrated strategy are enhancements to public transport, walking, cycling, pricing of car use, and

land-use policies designed to reinforce these measures.

Public transport services can be improved most effectively by increasing service levels, improving reliability and operating speeds, reducing and simplifying fares, and enhancing the quality of the vehicles, supporting infrastructure, interchange options and information systems.

Controlling the growth of car use is essential if sustainability is to be increased. While some success can be gained through regulatory measures, and controls on vehicle speeds, pricing is likely to be the most effective means of control. Ideally this should be through a form of road pricing, though parking charges imposed on all forms of parking can provide an effective alternative.


Road space needs to be managed more effectively, by allocating appropriate priority between general traffic, public transport, walking and cycling, frontage access and public space.

While most urban streets will be multi-functional, a balance should be determined for each street between its link status and its place status.

Walking and cycling are important modes in most European cities, and can provide for a significant proportion of journeys. They offer an effective alternative for many car journeys, provide access to public transport, and may also help relieve congestion on more heavily used public transport corridors. They need to be fully integrated into the overall strategy by providing for them effectively in land-use plans and in the reallocation of road space.

With this range of lower cost policy measures available, infrastructure investment, in roads or in public transport, will often prove to be a less cost-effective solution. Moreover, it can stimulate growth in journey lengths, which may jeopardise the pursuit of sustainability. Any such investment should be designed to be fully integrated into an overall strategy, so that it can focus on bottlenecks and gaps in the network, while avoiding the generation of additional travel.

Table 2: Impacts of transport in empirical studies

DIRECTION	FACTOR	IMPACT ON	OBSERVED IMPACTS
TRANSPORT  LAND USE	Accessibility	Residential location	More accessible locations are developed faster. If accessibility in the whole region grows, residential development will be more dispersed.
		Industrial location	There is little evidence of impacts of accessibility on location of manufacturing, but ample evidence of the importance of accessibility for high-tech and service firms.
		Office location	Office development occurs predominantly at highly accessible inner-city locations or in office parks or 'edge cities' at the urban periphery with good motorway access.
		Retail location	Retail development occurs either at highly accessible inner-city locations or on peripheral sites with ample parking and good road accessibility.

Source: Wegener and Fürst (1999); Pailley and Pedler (2000)

The resulting interaction between transport and land use

It is clear from the results reported above that there is a two-way interaction between transport and land use policies, with the potential for each to support or undermine the other. Moreover, these interactions can take place over an extended period. There is virtually no empirical evidence on these interactions, given the difficulty of finding cities that have introduced changes in both sets of policies together, and of isolating the impacts over time from changes in context. The only exception is the cross-sectional studies which have compared cities in different countries and with different approaches to transport and land use policy. The danger with these is that they suggest a causal process which may not be transferable to a different context.

Instead, most of the work in this area has relied on predictive **Land Use – Transport Interaction** (LUTI) models. The **TRANSLAND** study summarised earlier research in the field. Its principal findings are shown in the box opposite. It concluded that, while transport policies are much more direct and efficient in achieving sustainable urban transport, supportive land use policies are essential to the long-term creation of less car-dependent cities.

The **PROPOLIS** study explored a number of combinations of transport and land use policy, using a consistent modelling and appraisal framework in seven cities. Its specification for an effective strategy is shown in the box on the next page. It concluded that the most sustainable results were obtained from a combination of car pricing policies with simultaneous improvements of public transport through reduced fares and improved speed and service, and land use policies designed to encourage high density development focused on public transport corridors. Such policies were predicted to reduce CO₂ emissions by 15% to 20% and road accidents by 8% to 17%, and to generate social benefits of around €1,000 to €3,000 per inhabitant.

Effective land use and transport policies: TRANSLAND

- Land-use and transport policies are only successful in contributing to sustainable urban transport if they make car travel less attractive (i.e. more expensive or slower).
- Where land-use policies to increase urban density or mixed land-use are unaccompanied by measures to make car travel more expensive or slower the effects will be limited as people will continue to make long trips to maximise opportunities within their travel cost and travel time budgets.
- However, these policies are important in the long run as they provide the preconditions for a less car-dependent urban way of life in the future.
- Transport policies making car travel less attractive (more expensive or slower) are very effective in achieving the goals of reduction of travel distance and share of car travel. However, they depend on a spatial organisation that is not too dispersed. In addition, highly diversified labour markets and different work places of workers in multiple-worker households set limits to an optimum co-ordination of work places and residences.
- Large isolated retail and leisure facilities increase the distance travelled by car and the share of car travel. Land-use policies to prevent the development of such facilities ('push') are more effective than land-use policies aimed at promoting high-density, mixed-use development ('pull').
- Transport policies to improve the attractiveness of public transport have, in general, not led to a major reduction of car travel, have attracted only little development at public transport stations, but have contributed to further suburbanisation of population.

Source: Wegener and Füst (1999, pp.83-84)

Effective land use and transport policies: PROPOLIS

- Best results are achieved by using policy combinations, i.e. push and pull measures consisting of car pricing policies and simultaneous improvements of public transport through reduced fares and better speed and service. Better supply of public transport services is needed to satisfy the increased demand caused by car pricing policies and the mobility needs of people. Adopting land use and investment policies that satisfy the need for people to live along good public transport corridors and connections can further support this policy line in the long term.
- A good urban policy consists of co-ordinated elements working together to produce cumulative long-term effects that attain a balanced set of environmental, social and economic goals. These elements may include:
 - Combination of pricing policies directed at car users, with differentiation between peak and other hours as well as congested and non-congested areas, with an appropriate level of pricing of public transport fares
 - Investment programmes supporting the changes in demand caused by the above policies and especially responding to the increased demand for better public transport speed and service
 - A land use plan supporting the new need for people to live near central areas, in satellite cities or along well served public transport corridors as well as the people's increased need and opportunity to use public transport

Source: May et al (2005a)

A UK project on **Optimal Transport and Land Use Strategies** (May et al, 2005) obtained similar results, but took the analysis to a further stage of identifying optimal combinations of these policies. In the cities studied, the optimal strategy typically involved an increase in public transport frequencies, a reduction in public transport fares, the introduction of a charge for cars to enter the city centre, and low cost improvements in the capacity of the road network to accommodate the remaining traffic. Land use policies encouraging development at higher density along public transport corridors reinforced these policies but did not add greatly to their benefits, which were in the range € 4,000 to € 6,000 per inhabitant. While these optimal strategies would cost more than current plans, it proved possible to develop strategies that were financially neutral, with car use charge revenues paying for the other improvements, while retaining around 85% of the benefits.

Other national projects have added to these findings. An Irish project entitled '**Integrated Framework Plan for Land Use and Transportation**' looked into the integration of land use and transport at the local level. The project recognised the difficulty of realising the regional transport strategy for the Greater Dublin Area through the existing statutory planning instruments and addressed the gap between strategic transport planning and local area planning.

A Swiss research project entitled '**Interactions transport/land use**' elaborated on the interdependence between a sustainable transport system and sustainable regional land use planning. It reinforced the claim that regional planning can generally be defined as 'sustainable' if it offers short trips and benefits for public and non-motorised transport.

5

EUROPEAN POLICY IMPLICATIONS

As noted in the introduction, land use policies lie outside the responsibilities of **DG TREN**, yet they can have important impacts on transport demand and thus either support or frustrate transport policies. There is a strong case, therefore, for **DG TREN** to contribute to the determination of any future European Union policy on land use.

The interactions between transport and land use have been most fully studied and understood at an urban level. There has until recently been a view that such issues are the prerogative of national and local governments and that the Commission should not, following the subsidiarity principle, become involved. More recently it has been accepted that successful and sustainable urban areas are crucial to Europe's future, and that the Commission therefore has a locus.

The Commission should therefore adopt a policy on urban land use that reflects the policy implications below, and should encourage national governments and, through them, local governments to adopt that policy. At a national level, those countries with weaker land use controls should introduce regulations on what can be built and where.

The European Commission's Thematic Strategy on the Urban Environment has taken the first step to establishing such an approach. It outlines the following policy dimensions of land use planning:

- the interrelation between problems associated with poor quality of the built environment and socio-economic problems;
- the need for integrated approaches to managing the urban environment;
- land use planning as an integral part of transport planning;
- appropriate land-use planning as a means to reduce urban sprawl and the loss of natural habitats and biodiversity; and
- land use policy measures aimed at



avoiding urban sprawl through high density and mixed-use settlement patterns and hence contributing to reduced natural resource use per capita.

The related guidance on the development of sustainable urban transport plans provides clear advice on ways of developing, consulting on and implementing such strategies.

The principal elements of a land use policy designed to support transport policy should be: a focus on higher density development, mixed development, development associated with public transport, and development with limited on-site parking provision. Adopted alone, these policies will have limited impact on transport problems, since people will

continue to make longer trips to maximise the opportunities available to them. However, these policies are important in the long run as they provide the preconditions for less car-dependent lifestyles.

It is probable that taxation of land use, designed to reflect the cost of transport use, will further support transport policies. This is an area in which further policy-oriented research is urgently needed.

Conversely, land use policies that support large retail and leisure facilities remote from public transport are likely to increase the share of car travel and the distance travelled. They should be discouraged where possible.

While transport policies are the focus of other policy brochures, it is important to stress here that transport policies that reduce the cost of travel, either directly or through increased speed, are likely to stimulate longer journeys and urban sprawl. Care is therefore needed to ensure that new road and public transport infrastructure projects do not generate unwanted land use impacts.

Conversely, transport policies that increase the cost of travel by car, reduce the speed of travel and increase the service provided by public transport and walking and cycling are able to increase sustainability without limiting access. It is these policies that are most likely to be reinforced by the land use policies advocated above.

Overall, transport policies are more direct and efficient than land-use planning controls, in moving towards a sustainable urban transport system. However, land-use policies are essential as an accompanying strategy for creating less car-dependent cities in the long run.

These issues at the interface of transport and land use are best addressed when they are the responsibility of one department at either national or local level. Governments should encourage institutional structures that facilitate this. Where this is not possible each department should have a responsibility for ensuring that its policies are consistent with the others. The TIPP project made a number of recommendations on this, as shown in the box below.

Institutional recommendations for effective policy formulation

- National governments have a key role in providing effective institutional structures at national, regional and local levels, in facilitating an integrated approach to transport and land use policy; in providing an appropriate legislative and regulatory framework; in developing consistent approaches to financing, appraisal, monitoring and benchmarking; in encouraging innovation; and in supporting enhancement of skills, research and development
- Local authority boundaries are often inconsistent with travel to work areas. The adjustment of jurisdictions' boundaries and the establishment of special purpose entities can help to internalise spill-over effects. A single authority responsible for transport and land use planning in a conurbation and its travel to work area, with lower tier authorities responsible for detailed implementation, should be introduced in preference to distributing responsibility among potentially competing single tier authorities
- Concerns over subsidiarity should not be used to discourage EU involvement in regional and local transport policy. The European Union has an important role to play in encouraging consistent actions among member states and, through them, at a regional and local level. The EU is also able to disseminate good practice by comparing performance in different member states

6

FUTURE RESEARCH DEVELOPMENTS

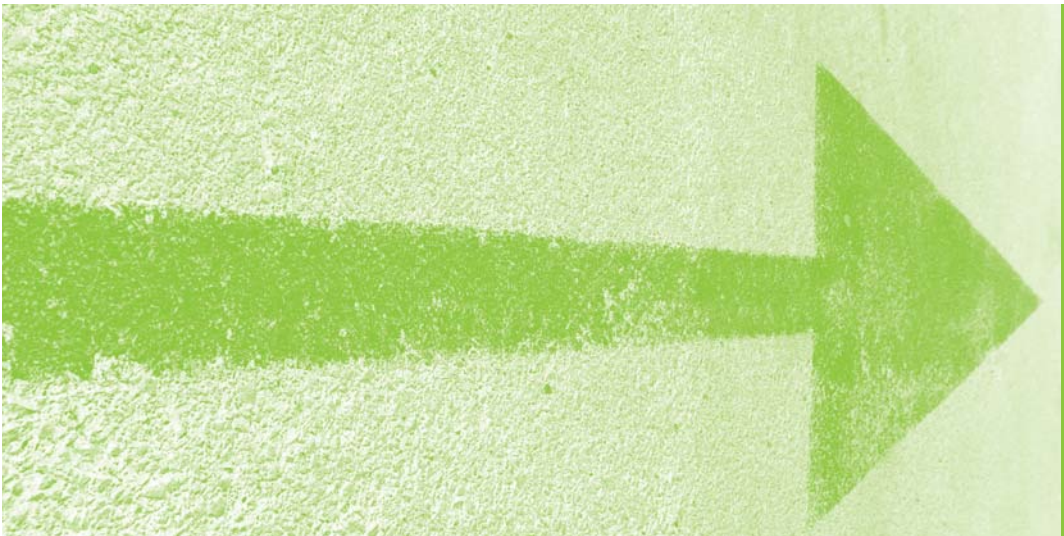
Unfortunately the decision was made not to continue the work of the **City of Tomorrow** research programme into the Sixth Framework of European research. This decision now appears to be at odds with the acceptance, in the Commission's Thematic Strategy for the Urban Environment, that these issues are important at a European level. It is to be hoped that the Seventh Framework will see the re-emergence of research into the interaction between transport and land use.

The **PLUME** project identified a number of research issues that required further consideration under the broad headings of human behaviour, technical performance, new trends, land use – transport relationships, research methods, political aspirations and professional applications. It argued that the land use – transport interactions were central to these research issues, and recommended further research on the following six issues:

Principal research needs: PLUME

1. understanding the costs, and any benefits, of urban sprawl;
2. investigating the economic impact of accessibility on location choice;
3. designing and assessing land use pricing policies;
4. exploring the impact of new transport modes on land use patterns;
5. understanding the micro-scale interactions between transport and land use, particularly as influenced by changes in environmental quality;
6. assessing the impact of infrastructure investment on travel generation and location choice.

Source: Clifford et al (2005)



The **PROPOLIS** project highlighted a similar set of research needs, and particularly the understanding of economic flows between transport and land use; investigation of the links between environmental quality and land use; and incorporating the principles of social justice into strategy development. Its main recommendations are shown in the box below.

Other studies have concentrated more on the institutional barriers to the integration of transport and land use. They demonstrate that further research is needed into the effectiveness of different institutional structures and on means of enhancing the processes of policy formulation, consultation and implementation.

Principal research needs: PROPOLIS

- Theoretical research is still needed to better understand the reciprocal economic flows between land use activities and transport systems.
- Similarly, more research is needed to better understand and model the interaction between environmental quality and land use
- More research is needed to define the optimum method and level of pricing policies, to carefully analyse the negative side effects of the pricing policies and, finally, to determine suitable countermeasures to mitigate these side effects.

Source: Lautso et al (2004, pp.274-276)



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GLOSSARY

CO₂	Carbon Dioxide
DG TREN	Directorate-General for Energy and Transport at the European Commission
DGRTD	Directorate-General for Research at the European Commission
DGENV	The Environment Directorate-General at the European Commission
EC	European Commission
EU	The European Union

