

# **A Good Future Transport System: Urban Production and Consumption Perspectives**

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Production and consumption have long been central to our understanding of the evolution and management of transport systems. That can be seen in the heritage of research exposing the complex links between these aspects. The current paper argues that there are now some new elements in that understanding which deserve consideration and will shape a different future. It focuses upon two inter-dependent changes that could influence the way we consider the design of transport systems. These changes are the growth in logistic systems for the globalisation of production and consumption, and the related spatial and functional restructuring of large scale urban regions. The core ideas of the paper are that these two changes, associated with innovation and structural change in the economy, have produced concentration as well as dispersal of different types of production and consumption in very large urban regions. They create the need for some new responses in a transport planning. The governance of these responses, especially distributing different transport users over time and space, is now critical to effective transport planning. These approaches also need to be considered in the context of the ecological dimensions of transport, (in particular the problem of greenhouse gas

emissions and potential energy shortages), which is the subject of another substantial literature.

## **A. Background**

Modern production and consumption relies upon a functional and spatial fragmentation of activity (or what Scott (1986) labeled “vertical disintegration”) at the global or continental scale. This system has evolved rapidly and been refined through integration with information technology and is expressed in inter- and intra-firm linkages across nations, continents and the globe. One outcome has been the “global shift” Dicken (2003) has described, which uses an international division of labour to achieve product innovation, quality and output through geographic separation of specialists. These specialists cluster at places where local networks between firms (and the supply of particular types of labour) provide economic advantages. Hence the product design task is carried out in an area where high wage-knowledge workers are available while component assembly is found in another cluster in a region with lower-wage labour. The overall management of the task might be in another location. Regional outcomes of this process reflect in part the relational assets that Storper (1997) has stressed are embedded in local and regional social, political and cultural structures, but also depend upon transport connections for the movement of products, people and ideas.

This global dimension of production and consumption has re-shaped world trade. As Storper (2000) has shown, trade is no longer simply an outcome of comparative advantage with predictable movements between nations of different factor endowments. Rather, there is a considerable amount of trade between nations with similar products and similar cost structures. This is best seen in the auto industry where cars and components made in Europe are shipped to the US, while US cars and components are shipped to Europe. It is also apparent in the trade in services. O’Connor and Daniels (2001) have shown that service trade is greatest between nations with the best-developed service sectors. The scale of trade also reflects consumption preferences where individuals are willing to pay for products from many and different parts of the world. It is in this new context that we need to address transport planning in the regions that participate in this trade.

## **B. Global and Continental-Scale Logistics**

The mobility involved in the production system outlined above is facilitated by logistics services. These are significant actors in production as the mobility they facilitate can be seen as underpinning the innovative capacity of firms. Indeed, urban creativity, seen up to now as rooted in the socio-economic characteristics of resident populations (Florida 2005) could in fact also be dependent upon the diversity of sources of information, ideas, goods and components available at any production location. To explore that idea we need to understand the “link between corporate logistics behavior and regional or spatial development”, something (Thierstein and Schnell 2002:71-72) believe is “...very rarely evaluated”. In one study, Holl (2004: 537-550) illustrated how these dimensions have shaped transport demand in food processing in Spain where firms show a “locational sensitivity to the development of new road infrastructure” because “the logistics strategies being adopted in this sector as firms (tend) to operate over larger geographical areas.... and (move) towards time based strategies...”

Given the connections with corporate structure and organization, logistics (and the pressure it puts on transport systems) are often unique to particular industries and firms. However, a number of broad trends seem to be apparent. One is the reduction in the number of suppliers in supply chains, as major end-users seek greater quality control and cost reduction. Barnes et al (2000) have described such a system in electronics, where a small number of firms (who draw in components from a wide net) now manufacture many of the products of name-brand suppliers. This concentration of production is associated with a second trend, the renewed emphasis upon what has been labeled a “continental strategy” (Colography Group 2004:4-5) which will “spawn the development of intra-regional manufacturing facilities and warehouses”. This shortening of supply chains within what had been broader global strategies “...is playing itself out in the U.S. where today more than two thirds of all shipments travel 600 miles or less, and where the strongest shipping growth is concentrated in the regional less-than-truckload segment.” Some of these changes reflect the increased cost of fuel, while others are associated with issues of reliability. Either way they are re-focussing the network of

links between firms and in so doing will re-shape transport systems and need to be considered in any thinking on transport system design.

### **C. Logistics as an Influence upon the Modern Urban Context**

The organization of logistics has an effect upon the structure of urban areas. At a simple level, global and continental scale logistical systems are organized around airports, seaports, road and rail systems and storage facilities, which all tend to be space extensive. Studies of the catchment areas of major container terminals in Singapore (Rodrigue 1994) and New York (Rodrigue 2003) and Melbourne (Sinclair Knight Mertz 2003) show that these ports draw upon suppliers in extensive regional hinterlands, although they have very significant local area links as well. Some of those local links focus on the inter-modal terminals which in a number of cases are built on the edges of metropolitan areas. They have an effect on the location of related facilities like warehouses and Hesse (2004:1036) shows that ‘ a new distribution sector is emerging, no longer derived from retail or manufacturing, but increasingly following its own logic, unfolding its own power...’ In these ways modern production and consumption is embedded in inter-connected urban areas via its logistical connections.

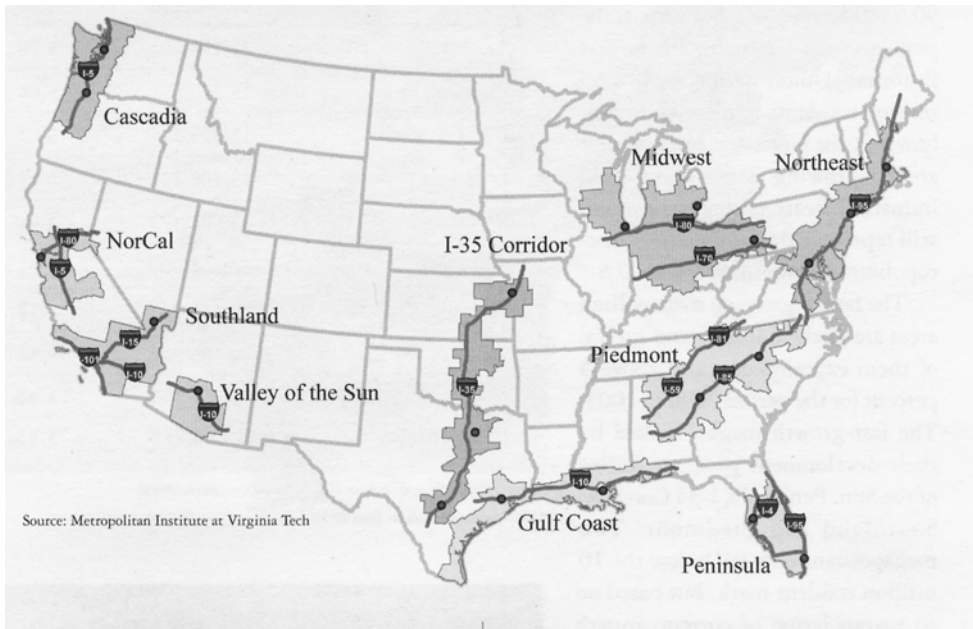
Recognizing this embeddedness requires a new way of looking at cities. In popular terminology what we are dealing with is the “*One Hundred Mile City*” suggested by Sudjic (1992), something akin to the idea of the “extended metropolitan region” (McGee 1994) or “global city region” (Scott 2001, Simmonds and Hack 2000). These dispersed urban patterns have been detected in the UK (Breheny 1999, Office of the Deputy Prime Minister 2006), US and Canada (Gordon and Lee 2003) and Australia (O’Connor et al 2001) and are implicated in the spread of urban regions around cities in Italy, (Dematteis and Governa 1999); Sweden (Warneryd 1999), Germany (Muller and Siedentop 2004) and France (Bretagnolle et. al. 2002).

Gordon et. al. (1998) suggest that these new patterns might reflect the fact that logistical systems have made agglomeration economies available in many parts of metropolis rather than simply at its core, where they were once concentrated. They believe the ubiquity of the transport system has freed up labour as well as component and other service delivery and that suburban sites are as good as downtown for many

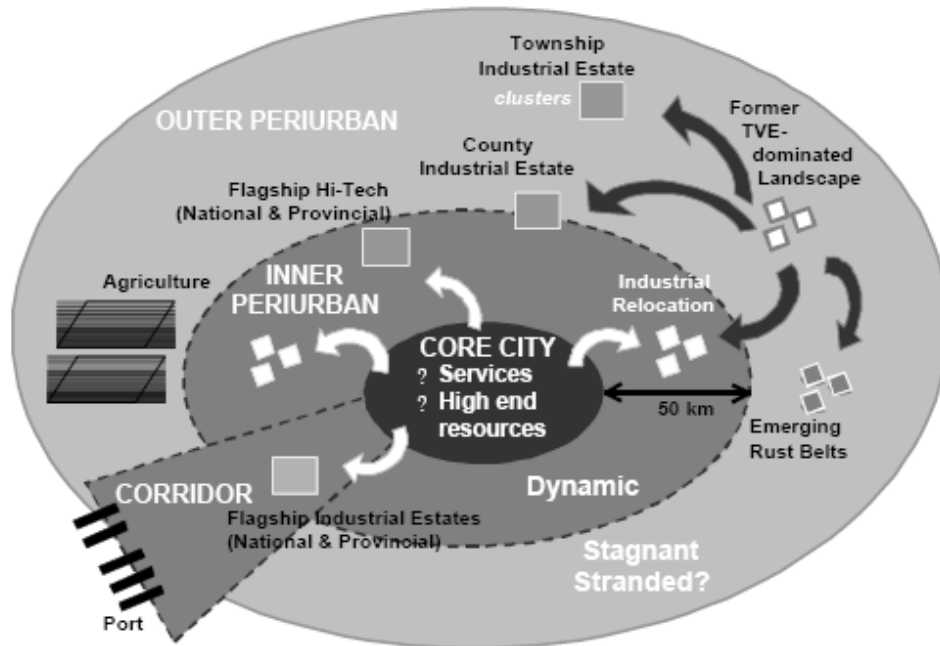
businesses. This is an observation confirmed by Guilano and Small's (1999) study of clusters of jobs in some local centres in Los Angeles.

Where the logistical connections between firms are organized over longer distances they are extending cities along corridors beyond functional regional borders. This effect can be seen in the ideas expressed in Figure 1 for the US (Lang and Dhavale 2005) and in Figure 2 for Asia (Webster and Muller 2002).

**Figure 1: Extended Metropolitan Areas of the US (Lang and Dhavale 2005)**



**Figure 2: Webster and Muller (2002) Model of an Extended Urban Region in China.**



These special features have been observed in Europe by Knapp and Schmidt (2003;15-16):

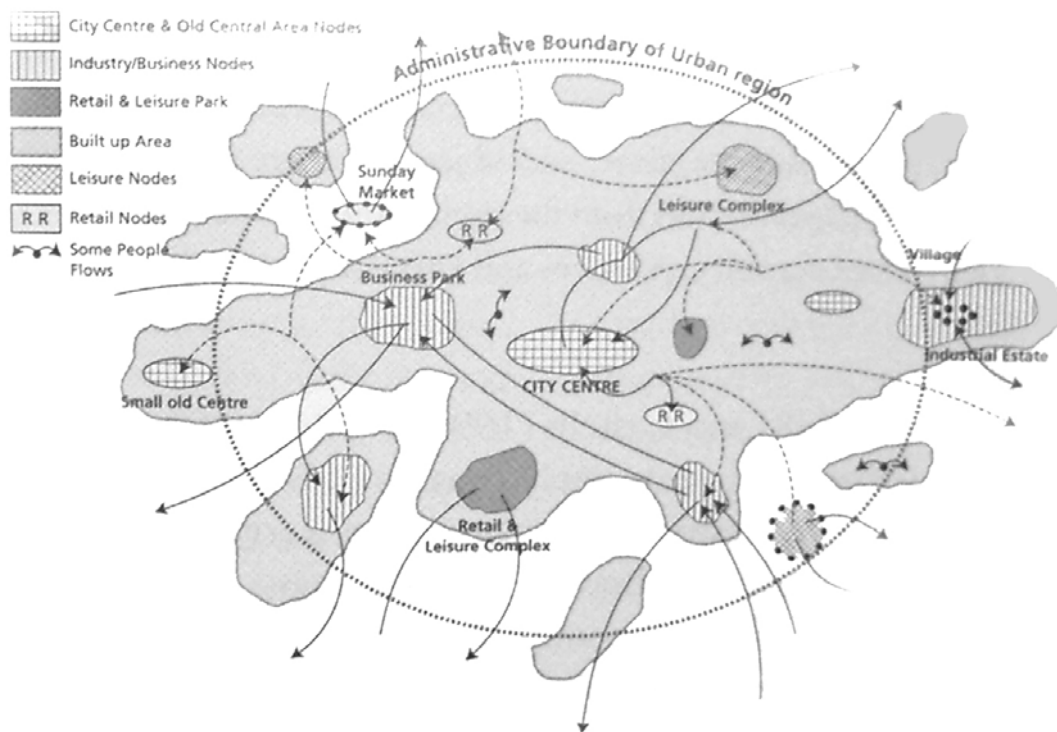
“current innovations in the urban region are not just taking place in inner cities but also at the periphery. There is increasing evidence that a new phase of development of the “urban periphery” is emerging which is no longer characterized predominantly by quantitative growth i.e a wider array of economic functions and qualified jobs. The new spaces-of-growth poles show a broad variety of spatial forms and functional specializations, forming in line with infrastructural networks “new intermediate zones” around suburbia with new centralities and peripheries” .

It is in this dispersed urban context that we need to think about the new character of a transport system.

#### **D. Spatial and Functional Restructuring in Extended Metropolitan Regions**

Frameworks have been developed to describe these new spatial outcomes. Hall (2001) has outlined one approach, showing that the global city region is now made up of the old inner core (with some renovated edges, for example Docklands in London) some middle zones (old renovated manufacturing areas as well as new edge city or business park locations, sometimes associated with the airport) and also more distant centres, some of which are based on originally free-standing towns and cities that have been connected to the global-city region in recent years. Healey (2001) has captured that thinking in a schematic diagram (figure 3) which adds an understanding of the multi-directional and cross-regional movement between these components.

**Figure 3: A Model of an Extended Metropolitan Region. (Healy (2001))**



These frameworks show there are several very different parts, and complex patterns of movement, within an extended metropolitan region. The following section explores

current activity and trends, as well as transport needs, in two of these parts. The challenge for a transport system is to meet these and other needs.

### *The CBD and the Inner City*

The most prominent part of an extended metropolitan region is the concentration of services that make up its CBD and surrounding inner city area. The buildings of the CBD and its fringe provided space for the advanced corporate services and the finance industry, the “producer services complex” (Sassen 2001), shown in London originally by Goddard (1975) and again recently by Cook et al (2004). The role of the area surrounding the CBD, usually labeled the Inner City, has been reinforced by activities other than finance and business services. Examples include advertising and media in Hamburg (Lapple 2004), design in Vancouver (Hutton 2000) and graphic design in Melbourne (Elliott 2006).

These clusters of services benefit from face-to-face contact (Storper and Venables 2004) and the diverse institutions and labour market available to them. Their size and competitive position depends upon connections to national and global networks as well as regular daily movement by people and packets of information (in the form of documents and reports) into and around a CBD. Telecommunications are obviously very important here, (Graham and Marvin 2001) but couriers (on foot, cycle and in delivery vans) are a big part of the total movement. That movement includes labour, some drawn from the inner area itself (as inner area employees move into inner area housing as O’Connor and Healy 2002 found), while the majority travels in from more dispersed residential areas. This diversity of movement means the challenge for a future transport system in these areas is substantial.

### *Suburban and Fringe Areas*

Though the inner area and the CBD remain significant and prominent, the models of extended metropolitan area development created by Hall and Healy draw particular attention to the suburban and outer parts of metropolitan regions. The significance of these areas is perhaps best captured in Lang’s (2003) research on office activity, which shows shares of new office building construction are greater in the suburbs than the

central city in all US metropolitan areas other than New York and Chicago. In a smaller national market, monitoring of office construction in Melbourne and Sydney over the past five years has shown that “the share of office space in the Melbourne and Sydney CBD's has dropped below 50% for the first time ever and continues to fall”.(Personal communication, CBRE Research Australia).

It is widely recognized that suburban development involves different activities compared to those in the inner parts of these big regions. Two very different studies, one by Boiteux-Oraim and Guillan (2004: 573) on Paris and the other by Searle on Sydney (1998) found an “...increased intra-metropolitan specialization depending on producer services reliance on face-to-face contacts for conducting their business”. These differences between the economy of the suburbs and the inner city will influence the transport needs of these suburban economies. One possibility is that the suburbs perform the back office functions for the CBD firms. Indeed Huriot (2004) has stressed that point for jobs in suburban Paris. These functional ties would create high levels of off-peak people and parcels movement between the inner city and the suburban areas and strong calls for centrally focused road systems.

However, Muller (1997) has suggested that some suburban activity is associated with global firms. In essence it is possible that suburban firms reach out to global and national markets in the same way as some of those in the producer services complex of the inner city. Research attention on one sub-sector (research and development) shows a strong emphasis on suburban operation by firms that usually have global networks. That outcome is well illustrated in case studies of innovative activities in European cities (Simmie 2001) and has long been part of the understanding of US high tech location (Saxenian 1994). On that theme Button and Stough (1998) have shown that the suburban airports of metropolitan areas are a magnet for high tech businesses. These approaches suggest that the production in suburban office and office-related functions might have some special transport needs.

Of course, manufacturing is still a key land use and so a major influence upon transport in the suburban (and fringe) parts of many extended metropolitan regions. In advanced countries its character is shifting and has a stronger role in producing capital goods with a much stronger connection with services. The impact of manufacturing and

its connection to transport systems is dramatic in some Asian extended metropolitan regions. There the first waves of foreign direct investment in parts of the Pearl River Delta, for example, created industrial estates and housing (Yeh et al 1989, Sit and Yang 1997). More recent experience in Bangkok (Webster 2004) and several cities in China (Webster 2002) shows how manufacturing estates have driven that development around the edge of a series of coastal cities (as shown in Figure 2 earlier).

So suburban (and fringe) manufacturing has an impact on transport needs that might parallel that of the suburban offices serving national and global markets. These will include regular delivery of components and finished products between factories within the region and via the sea port or airport to and from overseas customers. To this can be added the warehouse functions highlighted by Hesse (2004); these too could have national or even global linkages, as well as a responsibility to deliver across the metropolitan region itself.

Another activity whose spatial structure of production and consumption plays a prominent role in the character of the extended metropolitan region is retailing, especially when it is seen as a broad category of personal goods and services consumption encapsulating entertainment. This sector has produced large sub-regional concentrations around shopping malls in many countries as Ghosh and McLafferty (1991) showed, although its distribution has been tightly constrained in some countries. This sector usually relies upon car access from surrounding (and often extended) catchments, and goods delivery from suburban warehouses. There has been considerable attention paid to the possibility of the “fall of the mall” (Lucas 1996) in the face of changes in consumer taste and shifts toward inner city high density style living within cities. Recent analysis in the US has in fact detected a shift in the function and organization of malls to accommodate some of these changes, so that “malls targeted at upper-end clientele will continue to grow while mid-priced regional malls will become more centers of entertainment and service” (Barnes 2005:7).

Taking the current and likely future pattern of office, manufacturing and retail activity together, it is apparent that extended metropolitan regions have some special features that will call for particular transport services.

*The Movement of Labour within an Extended Metropolitan Region*

The patterns of employment opportunities created by business activity discussed above have a special effect in the movement of labour, a major element in transport demand. This movement is shaped not only by the location of jobs but also by the way that housing markets create opportunities for households in a variety of locations. Those opportunities emerge within a set of social (Hanson and Pratt (1988), economic (Randolph 1991) and institutional (Pratt 1996) concerns that shape residential choice. Filion et. al. (1999) have argued that dispersal of residential sites is still a strong influence in the modern city.

That outcome has diffused transport-land use connections (Guilano 1999) as links between suburban jobs and suburban and fringe residential areas become more prominent. That outcome that was apparent from the late 1980s in data on travel-to-work in the UK (Spence and Frost 1995), Australia (Gipps et. al.1996) and Pisarski (2002) in the US. This research has also shown that intra-suburban work travel has become the most prominent part of all work travel in most metropolitan regions.

These patterns suggest that the transport needs of labour in an extended metropolitan region are bi-modal: one group, (numerically the largest in most metropolitan areas) travel across sub-regions of the metropolitan area; a second group access the inner city from wherever they live, be it in the inner city itself, the middle suburbs or the longer distance outer or fringe areas. These needs will require provision of services with both a sub-regional focus and a region-wide capacity.

The ideas explored above expose reasons for the high level of mobility associated with the modern economy in an extended metropolitan area. It is important to acknowledge these outcomes reflect a set of technologies developed with low-cost liquid fuel and in most cases not paying the real cost as externalities they create. Looking to the future the challenge will be to maintain the flexibility and innovativeness of current production systems while reducing these negative environmental consequences. The latter could be achieved in part through a combination of infrastructure, regulation and technical change. These elements will be explored in the next section.

## **Part E. A New Agenda for a Transport System**

*The Transport Task in the Extended Metropolitan Area*

Designing and evaluating a “good” transport system involves effort to “coordinate employment, transport and housing in cities” (Pratt (1996:1357). In broad terms the transport system should be able to move goods and information and labour into, across and out of the extended metropolitan region in a way that provides many connections, predictability of time, and flexibility of delivery options. Approaches are being developed in what has been labeled “*City Logistics*” that can specify a set of connections to provide the level of connectivity implied in that arrangement (Taniguchi et.al. 2001). A simplified approach is outlined in table 1. It shows transport movements for a variety of reasons at a variety of spatial scales in an extended metropolitan region.

**Table 1: Production and Consumption Connections in an Extended Metropolitan Region**

<b>Spatial Links</b>	<b>Goods/Components</b>	<b>People and Information</b>	<b>Labour Casual and Fulltime</b>	<b>Consumers</b>
Global	To markets, and links with other firms	Business Travel		
National				
Extended Metropolitan Region	Warehouse to shop Linkages between firms	Business Travel	Commuting	To Major Centres
Local				To Local Centres

Table 2 explores the transport modes that could be used in this range of travel. It shows that a range of modes are suited to a range of tasks, and the choice will depend upon the cost and flexibility requirements of the user: road transport will probably be

favoured for goods and information delivery across the extended metropolitan region, while road will probably be favoured by suburban labour to reach suburban jobs and shopping centres. .

**Table 2: Transport Modes for Connections in an Extended Metropolitan Region**

Spatial Links	Likely Transport Mode				
	Airport	Seaport	Rail	Road	Walk
<b>To Global and National Markets, and Links with Other Firms</b>	Will use all modes, mix depending upon type of goods. Requires integration between terminals, national road and rail and regional/local road network				
<b>Warehouse to Shop, Linkages between Firms</b>					
<b>Business Travel</b>	Needs links to airport.		Will use all three modes, mix depending upon distance, possibility of alternative services requires point to point connections by rail, road		
<b>Commuting</b>					
<b>Consumer Travel</b>					

These two tables capture the expression of the logistics systems and the dispersal of urban population discussed earlier. They enable us to express a first criteria for a good future transport system.

*1. Provide all feasible modes for the movement of goods, information and labour into and across an extended metropolitan region.*

*Resolving Conflict in Use: Transport System Governance.*

The ideas expressed in tables 1 and 2 expose conflicts that are likely to exist in any transport system attempting to achieve such a diverse set of objectives. In the most obvious case the use of the road system for travel to work and the logistical connections between firms and markets lies at the heart of road congestion and its related problems. More subtle issues involve the capacity and operational restrictions on airports and seaports which due to global ties will want to operate 24 hours a day; it is possible that

adjacent land uses could create problems for that approach, and limit operations through bans on loading and curfews on operation.

Some potential conflicts associated with just road and rail are shown in Table 3.

**Table 3: Conflict in Transport Systems in Extended Metropolitan Regions**

	<b>Global/ National Goods Delivery</b>	<b>Business Travel</b>	<b>Cross- Regional Commuting</b>	<b>Local Commuting</b>
<b>Rail</b>	Rail freight Services	High speed Inter city	Longer distance high speed services	Short distance slower services
<b>Road</b>	Road freight services	Local road based personal trips	Longer distance commuters	Commuters

Conflict in use is significant in the rail system, which faces a range of demands requiring different speeds and times-of-day operation. The mix of freight and longer distance passenger transportation is one conflict; the mix of long distance express services with regional and local short-haul commuting is another. These same outcomes can be felt in the road network in the mix of local and regional commuter traffic with freight and inner city focused business traffic.

Conflicts of these kinds can be resolved in a number of ways. The most obvious and most expensive is separation of transport users. This approach lies behind the construction and extension of metro and light rail systems in a number of metropolitan regions. It can also involve dedicated infrastructure as in the Alameda Freight tunnel connecting the Port of Los Angeles-Long Beach with the trans-continental rail terminals in the heart of Los Angeles, and is also applied to the operation of high speed rail systems in France and Japan. Private use of private facilities, such as the use of US rail for freight, also illustrate this approach. The separation can be achieved via the market, too, by pricing the use of transport system to encourage some users and discourage others. The central area cordon in London and Singapore are examples of this approach. Pricing mechanisms could also have environmental values. Hence a further characteristic of a good transport system is that it will:

*2. Have mechanisms to separate users of the transport system either by investing in infrastructure for dedicated use and services and/or create charging systems for new and existing infrastructure to encourage separation of users.*

### *Coping with Local Travel Needs*

As noted earlier, one of the largest users of the transport system is the daily commuting flow and the daily delivery of products and information by truck and courier. These movements have some problematic elements: they are rarely large enough in any direction to justify dedicated infrastructure, yet at the same time both movements ( and especially commuting) can face congestion problems. Dealing with this issue as a transport problem is hampered by the fact that the commuting component of these trips is shaped by the way the local housing market is configured. A market with dispersed housing opportunities will have a different set of travel movements to one where housing opportunities are constrained either spatially or financially. There is an equity concern here as the capacity to act in the housing market is constrained by income so that lower wage workers can be located in transport poor communities if local and regional systems are inadequate.

The latter set of circumstances have been incorporated into metropolitan area planning in a number of cities through effort applied to control the location and density of population, and the mix of housing types, to shape travel patterns. Hence a good transport system will need collaboration between its operation (and infrastructure investment) and the regional supply of housing. This will only be effective where the transport system provides connection to jobs that home purchasers seek. Fine tuning the connections at that scale is beyond the powers of most planning systems; all that the planning system can hope to achieve is the provision of a wide range of job and housing opportunities in a range of locations which are accessible in a variety of ways by the transport system.

These objectives can be re-addressed once it is understood that the use of a transport system is shaped more by the quality and flexibility of its service than the spatial distribution of its surrounding population or workforce (Mees 2000). For the local trip this perspective involves some innovative thinking that can improve quality and

flexibility of services; here the focus of attention will be on buses and smaller scale local services provided to match local area needs such as clusters of jobs in commercial and industrial estates and along major local roads. Steps in this direction have been taken by some institutions in Melbourne such as schools and retirement centres; students and residents travel to and from facilities by specially provided buses at certain times of the day, not using regular time-tabled services. Some efforts to arrange car pooling and small van services in US cities, and in particular from airports, provide other examples. These approaches are likely to be more effective when they have some connections to the larger scale regional systems. Well organized and funded services for local commuting could provide more road space for the truck and courier delivery systems which have no real alternative. Using this approach a good transport system will be one that can

*3. Recognize equity and access concerns by providing local commuting services through smaller scale local systems that are flexible in time and routing, and connected to regional scale systems.*

### *Regional Scale Management*

A transport system that can meet the needs outlined earlier will need to be thought out at the scale of the extended metropolitan region, so that the integration of movement by type and at different times of the day can be achieved. In effect there is a need to create a spatial unit for transport planning that corresponds to the functional urban units described earlier, a need that has been well researched in urban spatial planning in recent years (Salet et al 2003). This work stresses the problems created by the tension between local and regional scale interests, which in most countries has usually constrained regional solutions; Fishman (2000) outlines the negative US experience on this issue.

However, regional approaches to transport have begun to be viewed in a more favourable light even in the US. (U.S. Advisory Commission on Intergovernmental Relations 1995). The challenge will be to get a region large enough to capture the extended metropolitan area effect that is central to the operation of production and consumption as outlined above. A possible problem is that these large scale regions not only involve many different local administrative units but they also involve transport

investment decisions and operations by national governments and private corporations, for example when national intercity rail systems, airport development projects or seaport terminals are based in a region. Decisions about these facilities might be shaped by corporate and national rather than regional priorities. Tripp (2005) outlines an approach to this issue at the scale of the Randstaat in Holland, but that is in effect a management system for a national network, with regional elements, rather than the regional scale system that is envisaged in the research outlined here. In this context a good transport system will be one that:

*4. Has a management system and arrangements that cover the surrounding extended metropolitan area, and is capable of negotiating outcomes with National Governments and private transport service suppliers.*

#### *Funding Mechanisms*

Any transport system that could be classified as “good” needs financial support that is adequate for the task of infrastructure supply as well as service delivery. This is made more significant when activity in the extended region involves the full range of national, regional and local services. The typical approach here is one of co-ordination of the funding approaches of a range of agencies, which can be effective, but is constrained by the uneven power relationships of providers.

Alternatively, it could be decided that a transport agency for an extended metropolitan region could be given greater responsibility for income collection and expenditure subject to national or regional Government overview. This could involve an approach that connected the pattern of economic activity to the cost of transport service provision through a transport levy on commercial and residential land uses. That approach would extend and develop the analysis used by Bowes and Ihanfeldt (2000) among others who have shown how land value is shaped by transport service. The structure of the transport levy could be determined by local political objectives perhaps with lower charges in locations where current services are poor and higher charges where they are well developed; at the same time the transport levy could be part of financial development contributions as new activity is added to an area, again scaled by the level

of transport service in place. Details of this approach need more work; for the current need the issue is that a good transport system will be one where:

*5. Income is generated from current and planned economic activity for the regional transport management authority.*

## **Part E: Discussion: Implications and Generic and Specific Dimensions**

The preceding ideas have been developed by taking account of some of the new functional and locational patterns in the operation of the economy within urban areas. A foundation for these ideas is that the systems now used for production influence innovation and creative activity in regions. That perspective creates space to extend thinking on transport planning beyond the compelling issues that surround commuting and congestion. Its final observations need to recognize that some of these outcomes may need to change in the face of oil scarcity and environmental impacts. Managing that outcome while maintaining a critical level of global, national and regional openness that mobility provides will be a significant challenge. The main insight here is that this challenge can be addressed through a set of policy values that can stimulate effective use of technology, infrastructure provision and pricing of use and a capacity to meet local needs.

Concerns associated with sustainability and environmental deterioration emerge in particular around the role of cars and trucks for city commuting, business networks and goods and information delivery. These concerns are etched more sharply in the context of more expensive (and declining supplies of) oil along with urban environmental pressures associated with greenhouse gas, noise and air pollution. As production and consumption systems described to date are energy-intensive and polluting, maintaining levels of mobility while reducing environmental impacts will reinforce the need for a carefully-shaped pricing policy, one that encourages the use of new fuel and engine technology. Some of these new directions are outlined below.

First, it is possible to consider a new emphasis in policy for goods and information movement, which currently relies mainly on roads. The scale of long distance freight movement by road could be reduced by a combination of infrastructure

improvements in the rail freight system (especially the inter-modal connections), a change in pricing of the long distance road network, greater use of information technology to co-ordinate collection and delivery and a shift toward natural gas-powered engines in trucks. Within the extended metropolitan area the truck (or van) is unlikely to be challenged in the movement of goods, and here the role of new engine technology and local road pricing that included different charges at different times of the day could improve operational efficiency and reduce emissions. In some cities it is proposed to use trains to distribute freight to “suburban freight centres” closer to the ultimate client. Currently that extra lift and sort is difficult to justify given its short range so the truck will probably remain the most common means of this type of movement until IT systems improve sorting and movement arrangements.

Second, other policy approaches could address the impact of the use of the car for the short-to-medium work and personal consumption trips within the extended metropolitan areas. Here policy action could include annual ownership fees and road speeds that are biased in favour of smaller vehicles that use emerging low-energy engine technology. At the same time additional infrastructure for local and intra-regional travel will be needed; this too will require better inter-modal connections, and once again information technology could improve the way service systems are managed to improve connectivity.

Hence it is possible that some of the mobility of goods and information that allow modern production and consumption systems to achieve their high levels of innovation and efficiency could be retained in a way that addresses environmental concerns associated with energy and air pollution. That will require new and carefully integrated approaches to the construction and management of the transport system. In those approaches a range of new technology, as discussed by the Office of Science and Technology (2005) and applied to design, movement and infrastructure management will play a significant role.

One of the longer term interests of the research of which this paper is a part is the discrimination between the generic and specific dimensions in planning a transport system. In the global and national production and consumption systems reviewed here this discrimination seems straightforward: the physical infrastructure is *generic*, and the management systems are *specific*. On the physical side perhaps one of the most

ubiquitous elements of a modern transport system is the 20 and 40 foot container and the cranes, rail carriages and trucks used in intermodal networks. To that can be added the optical scanning of box and consignment numbers and the co-ordination of their movement by logistic service providers. Rail systems for passenger movement can be seen as generic too, although higher standard systems have some local specificity. The car and bus too can now be seen as generic, as they are produced in similar forms in a wide array of countries. Hence creating the physical elements of a transport system is now a generic task, confirmed by the steady emergence of global transport companies that manage port, airport and road facilities in many different countries.

In contrast, the *specific* dimensions of a transport system are the set of decisions made on the scale and degree of separation of new infrastructure, efforts to ensure inter-modal operation, methods of financing, the setting of prices and the applications of new technologies. Here we need capacity to exert political will via governance structures to coordinate an array of transport services as well as a variety of levels of administration of urban development. Then we need capacity to innovate in areas of building, managing and charging for the use of transport infrastructure and deploying relevant new technologies. That means the achievement of a good transport system in any place will need assistance with local capacity, as well as knowledge of management and operation elsewhere in the world. The research agenda on the management of transport lies at the heart of progress in this regard.

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