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TRANSPORT AND URBAN DEVELOPMENT: POLICIES AND PRACTICE

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ABSTRACT

Almost all cities in the developing economies are faced with the environmental and social impacts of urban transportation. Most of the recent publications, whether of the World Bank - "*Sustainable Transport*" or the United Nations Centre for Human Settlements - "*Comparative Modal Efficiencies in Urban Transport with Reference to Developing Countries*" attach major importance to this subject. In the developed economies as well, transportation is a major issue, particularly within the context of urban growth and environmental conservation, as outlined by Peter Hall in "*London 2001*" and VROM in "*Randstad en Groene Hart*". The inconvenient fact that other countries and other country's cities have done so much better in managing their traffic, and have done so on the basis of planning, is conveniently ignored. This paper attempts to bring together selected cases of Best Practice for comparative purposes in order to assess the current status of transportation management and sustainable development. This will hopefully pave the way for the successful replication of the major lessons to be learned from them.

This paper distils the lessons of eight cases of cities which have been successful in combating the growth of urban traffic. The focus here is to demonstrate the relationship between urban land use planning and transportation behaviour. The evidence suggests that the travel pattern and urban land use have a close relationship and, for one to be effective, the other must be adequately dealt with. Still, there is a wide diversity of problems and experience, and no simple solutions fit all countries.

The stress in this paper is, therefore, on macro planning principles and not on micro level improvements. This is also understandable as the paper argues the validity of the relationship between urban land use and transportation management as the main hypothesis. All the cases have been studied with this perspective in mind. The five cases of Amsterdam, Curitiba, Tokyo, Toronto, and Stockholm have been studied for the methods used to keep the city free from cars and, at the same time, promoting the use of public transport. The remaining two cases of London and Netherlands's Randstad have been studied in greater detail to bring out the physical planning linkage with transport planning clearly.

There are two objectives of this paper. The first is to look at the cities and observe the approaches taken to conquer the transport problems, and ask, "What was achieved and how?" The second objective is to map out the probable landscape and its linkages to transport patterns, and to suggest the solutions for other cities in general and The National Capital Region (NCR) of Delhi, India in particular.

A serious attempt has been made to incorporate all the experiences of the cases to establish a coherent yet broad-based framework for reforming urban mobility in NCR. Some comparative analysis is included, although the main intention is not to compare the relative merits or demerits of transportation strategies.

The maps used in this paper are reproduced from the documents mentioned in the references, particularly Hall (1989), Government (1983) and VROM (1996). Their use has been very significant in the study and contribute to this paper. Finally, whatever the success this paper may have in disseminating the important elements of transportation management, the shortcomings are all the author's.

RAJIV SHARMA
January 1998

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Back home, I would like to thank Dr. Kulwant Singh, and Dr. BN Singh for instrumentalising my field research. I specially remember Dr. BN Singh for helping me in formulating this study and bringing down my desires into concrete shape through a number of enlightening discussions, I had with him in Delhi.

The greatest debt is to my partner, Renu. Her great patience, encouragement and love allowed me to meet the deadlines. And, most important, little Ronak who inspires every chapter of this paper with his naughty smile.

RAJIV SHARMA

January 1998

ABBREVIATIONS

AC&DC	Alternate Current and Direct Current
AVG	Albtal Transport Company
BIS	Bureau of Indian Standards
BR	British Rail
CMAQ	Congestion Mitigation and Air Quality
DB	German Federal Railway
DMA	Delhi Metropolitan Area
DLR	Docklands Light Railway
DUA	Dwelling Units per Acre
GLC	Greater London Council
IPPUC	Curitiba Research and Urban Planning Institute
Kms.	Kilometres
LDDC	London Docklands Development Corporation
LRT	Light Rail Transit
MRT	Mass Rapid Transit
MRTS	Mass Rapid Transit System
NCR	National Capital Region
NCRPB	National Capital Region Planning Board
NCTD	National Capital Territory of Delhi
NMT	Non-motorised Transport
OMA	Outer Metropolitan Area
PT	Public Transport
RER	Reseau Express Regional
ROSE	Rest of South East
Sqm.	Square Metres
States	Provinces
TOZ	Transit Overlay Zones
TTC	Toronto Transit Commission
UK	United Kingdom
US/USA	United States of America

NOTES

1. *City centre* is used here as the high-density, multi-functional centre of the city often coinciding with the historic centre or 'old city'.
2. *Growth nodes* are the areas with potential for both economic and physical development.
3. *Inner city* is used here for the old ring of development around the city centre, with old houses dating from the late 19 or early 20 century, and without the provision of private vehicles.
4. *Mode* is the means of travel. For example walking, biking, bus, rail etc.
5. *Peri-urban areas* are sporadic and scattered developments at the periphery of the city.
6. *Primate Cities* or *Prime Cities* refer here to the major urban agglomerations of reasonably larger than average city size in the country. Examples are Amsterdam or Rotterdam in the Netherlands, Delhi or Mumbai in India.
7. *Secondary Cities* are smaller cities, both in function and size.
8. *States* are provinces in India.
9. *Transit* is used interchangeably with the term 'public transport'. Both are used to mean collective modes of transport, such as trains, ferries, buses, etc.{Type your acknowledgements here}

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1 INTRODUCTION

1.1 BACKGROUND

Urban transportation is one of the key problems for the exploding cities of the developing countries. Distances are increasing with the growth of cities, and so is the average trip length. The dissatisfaction with public transport and the consequent increase in a personalised mode of travel are leading to an increase in traffic density, a reduction in average speed and high levels of pollution.

Vehicular emissions are a major source of pollution in metropolitan cities in India. Vehicles in Delhi, Mumbai and Calcutta account for about 70 per cent of carbon monoxide, 50 per cent of hydrocarbons, 30-40 per cent of nitrogen oxides, 30 per cent of suspended particulate matter and 10 per cent of all sulphur dioxide pollution in these cities. The vehicles operated on 2-stroke engines account for 50 per cent of the country's gasoline consumption. They contribute 2 times more carbon monoxide and seven times more hydrocarbons as compared to 4-stroke engines. The measurements indicate that a significant proportion of vehicles does not meet the BIS[1] standards, and the heavy traffic junctions continue to be polluted (Mathur, 1992).

Transport has a major impact on the spatial and economic development of cities or regions. Land values are often dictated by the accessibility of the area, and this in turn depends upon the quality of transport infrastructure. Thus, transport planning remains effective only if a precise link is established between the activities associated with particular land uses and the type and volume of traffic these activities generate.

What could be the best transportation strategy is a challenge that planners and transport managers are confronted with in almost all cities of the developing world. But the answer is not simple. First, because transport cuts across many sectors, that is, actors and stakeholders are many, it requires a high degree of co-ordination and co-operation from all stakeholders. Second, solutions are not as simple as they appear to be in theory.

This introductory chapter tries first to conceptualise the key issues pertaining to transport and urban development, but also to present the structure of this paper to the reader, and to make him or her aware of the arguments and cases that are going to be discussed later.

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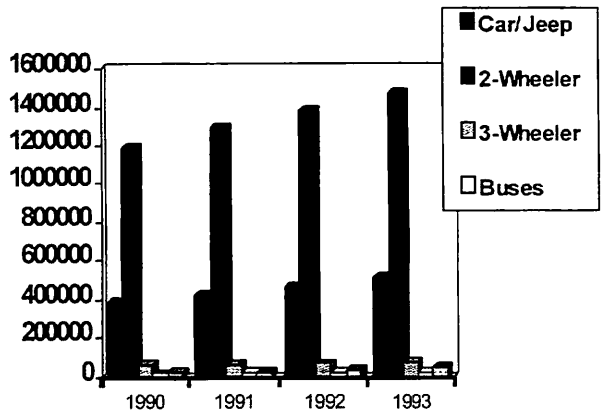
[1] Bureau of Indian Standards (BIS) sets the standards for India.

1.2 PROBLEM SETTING

Cities all around the world are booming with economic growth and are the major contributors to the GDP of any country, particularly in developing nations. In terms of urban development, this is seen as a conglomeration of activities in a small place. The road is seen as a major input in encouraging this development, and it is seen as an indicator of economic boom.

This has resulted in serious effects both on persons and nature. New roads bring with them more employment and also an increase in the functions of the town centre in terms of its commercial, industrial and science parks, as well as its leisure facilities and shopping, thus adding to migration. It can also be observed that when the growth in per capita income increases, the demand of per capita space results in a shift of high-income residential areas to green fields in the suburbs. The net result has been an increase in car traffic and longer journey lengths.

Figure 1. Growth of Vehicles in Delhi



The increase in the concentration of activities in Delhi and the consequent demand for travel has led to an increase in the volume of traffic over the years. It generated 9.27 million person trips per day in 1993, as compared to 5.34 million in 1985 and 3.89 million in 1981. Personal vehicle ownership has gone up at an annual rate of 10.6 per cent during a period of 8 years, 1985-1993. There has been a remarkable change in the modal split, and 2-wheelers and 3-wheelers, mostly two-stroke engine driven, played a significantly more important role in 1993 than in 1986 (Refer Fig. 1). The average trip length has gone up to 8.34 kms., the second longest in the country. The increasing congestion on roads has also brought down the average speed to 21-24 kms/hr. in the Central Business District and 8 kms/hr. in the walled city[2].

[2] Government of India (1996).

1.3 PROBLEM STATEMENT

The major issues pertaining to urban transport are diverse and multi-disciplinary. It is neither feasible nor practical to cover all of them, so this study narrows its focus by defining the problem and the consequent analysis in the following statement:

> *An isolated transportation management strategy results in an increase in personalised travel modes and travel time.*

The word 'isolated' is important here. Agencies responsible for transportation work in isolation from one another and in a fragmented way. They mainly restrict themselves to being providers of services. They do not often have a say in broader issues like city planning, selecting the locations of economic activities, adapting new technologies and the like. This paper looks at transportation management within the context of urban planning and land use policy development.

In India, one of the major constraints in the rational development of integrated urban transport systems is the lack of enabling legislation. Functions are dispersed over a large number of statutes, each dealing with components of urban transport as a peripheral area of interest. In the absence of any legal Urban Transportation Act, policy planning, management, financing, pricing and co-ordination is non-existent. The paper will highlight some of the major concerns in integrating urban land use policies with urban transportation.

1.4 TRANSPORT AND URBAN DEVELOPMENT - A VITAL LINK?

The most important link between transport and urban development is related to accessibility. Accessibility determines the value for different uses at different locations, and as accessibility changes, there is a consequent change in land use (and value). Transportation costs also have a bearing on land use. A change in transportation costs affects rental values, which are governed by market forces, and the land use pattern. Lower transportation costs allow the physical expansion of cities. They promote low-density development in the suburbs, a typical phenomenon of American cities. This concept is applicable to business locations as well. As transportation costs decline, firms become more competitive and tend to expand or relocate to accessible locations. Location theory argues that the consolidation of similar types or a specialised type of activities takes place in an area over time. The location of a few industries attracts similar industries, with forward and backward linkages, and together, they operate in a market of competitive advantage.

Box 1: Facts and Figures

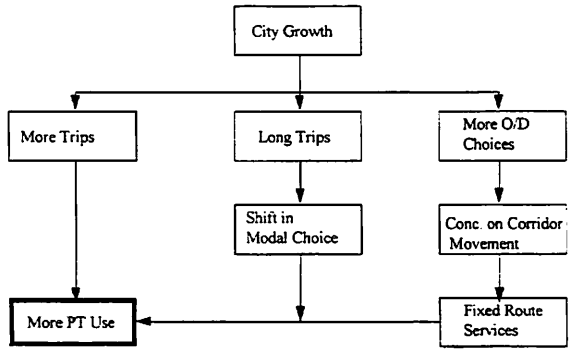
In the developing world:

- Each 1,000 increase in urban population generates 300-400 additional PT trips daily;
- Each unit increase in urban area (sq. kms.) results in 500 additional PT trips daily;
- Each $US increase in per capita income adds an additional 100 PT trips per annum;
- A changing population structure, i.e., more younger people, results in an increase in PT use, and
- A changing cultural attitude, accompanied by more working women, results in an increase in the number of trips and a consequent increase in PT use.

Source: Maunder (1997).

Another important aspect is that of the linkage between urban development, transport, and economic development. The impact of urban growth on transportation is illustrated in Box 1. In the various models developed on urban development and activity location, transport is seen as one of the most important variables. The gradual shift of transport modes becomes inevitable as a city grows. Economic development over time results in the relocation of specialised activities to specific zones. This brings into discussion another relevant aspect, that of time, which is important particularly when one talks of the consolidation of activities. The most simple model depicting the relationship of urban growth and the transport pattern illustrates the importance of public transport as a result of an increase in trip lengths with fixed origin and destination patterns (See Figure 2)

Figure 2:The Urban Growth Model



Source: Maunder(1997).

Within the context of sustainable development, the concept of a compact city - the containment of urban functions to prevent urban sprawl and to preserve surrounding activities - becomes important. Certain arguments favour this concept, saying that it drastically cuts down energy consumption, urban mobility and costs related to providing urban services. In many developing countries, the city centres have experienced tremendous concentration over the years due to the convergence of various transportation modes in these centres. This has resulted in increased harmony in economic development and, consequently, more demand to locate activities there. The model, therefore, shows that the lack of transportation facilities to access outer regions has also resulted in feasibility and acceptability of the city centres to become compact city forms. This then becomes an asset for transport network planning at a later stage. In India, however, experience has also shown that, for cities with high-density cores, the quality of life for those living in a compact city can be so poor that there is an inevitable shift to the periphery.

While the main objective of transport management remains improving accessibility, in many cases, other positive impacts, such as the generation of economic and employment activities, remain the motivation to take up certain projects. Investment in infrastructure has a substantial income multiplier effect, on a short-term basis, and locational advantages, on a long-term basis. The improvement of roads, for example, also promotes investment in other travel modes.

1.5 KEY CONCEPTS AND THEORIES

The concepts pertaining to settlement pattern and mobility theories are presented and discussed in this section of the paper. The basic discussion relates to 'urban form,' which is the physical arrangement of residences, workplaces, etc. Urban form describes the static physical setting of a city. The three components of urban form are:

a) *Spatial Organisation*: The configuration of the urban area in 2-dimensional space on a horizontal plan. Examples are core, satellite, linear layouts, etc.

b) *Activity Distribution*: The distribution pattern of land use activities within the spatial organisation in terms of both type and density of land use. Examples are concentrated, uniform, nucleated, etc.

c) *Transport Connectivity*: The transport network that provides the linkages between land uses and activities, and thereby services the spatial organisation in terms of travel mode, both type and capacity, and the extent to which it provides linkages between zonal pairs. Examples are radial, circumferential, grid, etc.

1.6 MAJOR ISSUES FOR POLICY FORMULATION

This section discusses certain issues which should be considered and weighed in transport policy formation. Measures taken have substantial, direct, as well as, indirect impacts. These are discussed below.

What is the impact of transport infrastructure on the local economy and development?

Investment on improving transport infrastructure increases the accessibility of an area, which in turn increases its popularity. This is evident from the increases in land prices and rental values of the area, as discussed in the previous section. It is, however, argued that the activities that move to this location may not be new to the region. It is very likely that there is a transfer of activity from one location to another, just as is desired by the urban developers, which may cause substantial disparities between the new and old locations.

This shift may result in longer travel distances, more frequent trips and an increase in car based movement. If these mobility trips replace walking and movement by public transport (typical of high density planning), the environmental and energy costs may be substantially high.

Can the benefits that accrue from improved accessibility justify infrastructure investment?

At regional level the accessibility benefits that accrue from improved infrastructure can be justified. Accessibility may increase attractiveness for new firms, lead to the cheaper distribution of goods and generate expansion of the labour market. However, the counter argument is that it may increase concentration of activities and thus localise the benefits to a smaller area.

Nodes of one or two modes are the locations with the highest potential due to better accessibility.

The meeting point of two or more transport nodes has been a popular place for development, especially for commercial development. Points with good regional and local rail service or an airport, in addition to road transport, have proved to be attractive locations for science parks, distribution centres, conference and hotel facilities and the like.

The developments may be very compact, including both residential and economic activities, or simply limited to the commercial activities alone. Spatial development is sometimes of the satellite type, characterised by decentralisation of some activities from the metropolitan centre itself.

The marginal costs of transport improvements are often high and are constrained by other factors such as the availability of land, labour, access to markets, government grants, etc.

Although it is a well-established fact that transport costs form a small part of total production costs, in developed economies the consolidation of expenditures on transport may not yield the same benefits as in the developing economies. The reason is that a dense network of transport infrastructure already exists, and so further investment in it may not be the sole deciding factor for a location decision. Other factors, such as the availability of land and labour, access to markets and government grants, may also play a significant role in this regard. Even if a location may become attractive due to low transport costs, this may be offset by higher wages, profits or rents, or by lower prices to the consumer as a compensation.

The funding of transport infrastructure has been traditionally a function of the public sector.

The total privatisation of the transportation sector is neither feasible nor appropriate for two reasons. Firstly, left to the private sector, these facilities would be produced at a sub-optimal social level, known in economic terminology as market failure. Since the marginal cost of serving a user is negligible, exclusion from using the facilities may be difficult. This will create problems if the 'user pays' principle is applied. Without its application, however, the private sector will not earn sufficient revenues to cover capital and management costs, and it will demand state subsidies ultimately resulting in the failure of the concept.

The second reason is that of economies of scale. When capacities are expanded, it is easier for the public sector to secure rights of way, assemble land and ensure that

various transport networks are properly connected. This may significantly exceed the capacities of those associated with facility construction. Another type of scale economy arises from the fact that improving or adding additional units to the existing system may induce more traffic or reduce the cost of present users more than proportionally. These two reasons combined with equity between both rural and urban areas, and between low and high income groups, make transport a low return investment project, thus making its operation by the private sector difficult. However, companies that derive substantial direct benefits from an improved transport network may be involved in cost sharing for the project.

Fiscal and taxation policies also influence transport and land development.

Some regions or even cities follow restrictive policies disallowing any development while others try to boost their local economies by allowing development. This may have serious consequences on travel needs and demand. A shift in economic development to peripheral locations may also result in a deteriorating city centre, now deprived of these activities.

The allocation of resources between different transportation modes cannot be easily resolved.

Since transport involves a large number of means and modes, integrating them is the only option for achieving the maximum benefit from the system. Each transport mode operates in its own sub-market, and the greatest overall benefit can only be achieved through competition in the overall market. However, the direct benefits to the supplier and consumer of transport services need to be balanced against broader social, developmental, environmental and other costs that are imposed by these modes. Thus, the evaluation of transport modes is rather complex as each mode has different impacts, not only on the land and natural environment, but also on the community and social environment. Integration would, therefore, reduce the dependence on public transport particularly for local or short trips. This is an important aspect and should be given due weight in the planning of urban transport infrastructure.

1.7 CONCLUSIONS

It has been proven world-wide that urban development and transportation policies have a direct link with each other. Developing a transportation strategy is a long process, as issues to be resolved need commitment from a wide cross-section of actors and institutions.

One important criterion, when implementing an integrated urban land use and transportation policy, is to account for the economic, financial and social costs of various transportation modes. A careful evaluation on economic grounds may prove that investments in a mass transit system are much more sensible than in private car use, particularly in a high-density environment with scarce road space. This has been reflected in the transportation strategies for Zurich, Paris, Stockholm and many Dutch cities.

When talking of urban space, it is important that adequate urban space is allocated to transport in land use planning. For example, in Delhi, the allocation of land for transport and communication purposes has shrunk from 21.96 per cent in 1961 to a mere 2.21 per cent in 1991 (TERI, 1995). To make mass transportation competitive with urban car use, there is a need to increase the interaction between transport options, urban structures, and a satisfactory level of service. The experiences of land use regulation, as a tool to combat urban traffic in eight selected cities, is the focus of discussion in the next chapter.

Thus, this study looks into this complex sector with a modest approach. The intention here is to work out a transportation strategy that is acceptable, sustainable and practical. A popular strategy would be one that relieves people from traffic hassles, relieves city from pollution and relieves the State from complaints of congestion and accidents. The replicability of *Best Practices*, pertaining to urban transport, is one of the thrust areas of this study.

The case of the National Capital Region (NCR) has been selected for the study. NCR represents a shift in perception from city planning to regional planning, more so as city dynamics cannot be contained within urban limits. NCR is a megacity region that covers over 30,000 sq. kms. It incorporates the whole of the National Capital Territory of Delhi (NCTD), about 60 per cent of the small state of Haryana, about 10 per cent of the large state of Uttar Pradesh and about half a district[3] of Rajasthan.

[3] One district is approx. 750 sq.kms.

2 SELECTED CITIES IN PERSPECTIVE

2.1 LITERATURE SURVEY[4]

Land use regulations that support investments pertaining to transit movements are not common world-wide. The selected cities, discussed below, have strengthened the view that land use regulations and transportation patterns are complementary. Efficient land use increases the effectiveness of transport investments leading to compatible land use and an effective movement pattern for communities and goods. The diversity in city size, location and culture further supports the universality of this concept. In each case, this fundamental relationship has been used as a basis to overcome pressing transportation problems. The cities discussed here are selected on the basis of their reputation for having attempted to reverse the negative impacts of motorization.

2.1.1 AMSTERDAM, NETHERLANDS

In Amsterdam, zoning regulations classify the businesses by their modal transportation needs. If the businesses need a high degree of accessibility for their growth, they are mandated to locate near the transit lines.

In Amsterdam, the city government has been the largest landowner since the end of the 15th century, when it bought land for expansion through public purchases. This helped in influencing the nature of development, especially since land values exploded in 1896. The government pursued urban development through the mechanism of leasing its land, which helped in regulating development (low-income housing), while generating revenues for infrastructure improvement. In the late nineteenth century, this restrictive policy shifted the pressure of growth from the city to the suburbs, where land was privately held. The result was increasing mobility problems between the city core and the suburbs. By the early 1920's, streetcars replaced almost every other mode of transport except the bicycle, which continued to dominate the core of the city.

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[4] The information presented in this chapter is collected from a large number of sources, including Cervero (1995), Harman (1993), Harrison (1979), Institution (1995), Langsved (1990), Lemmers (1993), Malmsten (1990), Pharoah (1992 and 1995), Ploeger (1995), PTRC (1995), Rabinovitch (1996), Stockholm Negotiation Group (1993), Stockholm (1990), VROM (1991), Wulkan (1996), Wyse (1990); and a large number of leaflets, paper cuttings and other publicity material.

During the 1960's, when the redevelopment and renewal of the city started, stress was placed on locating both housing and activities in the city, to lower the pressure on the suburbs and, at the same time, to bring liveliness back to the centre. The idea was furthered in 1978, when City Councils introduced the *"Compact City"* plan. Urban densities were increased, and urban functions were accommodated as much possible inside the city. This plan was not, however, successful in arresting the growth of suburbs, mainly because the suburbs did not have the property lease system prevailing within the city limits.

Because of a diverse activity pattern, congestion became an increasing problem. In 1965, approximately 65 per cent of Amsterdam's residents used private cars to move around on a daily basis, by 1993 this had risen to 85 per cent. Transit utilisation was accordingly reduced. In 1965, 35 per cent of the population used public transport on a daily basis, which declined to a mere 15 per cent by 1993. With the continuous increase in mobility, it has been estimated that, by the year 2010, the mobility requirements of Amsterdam's residents will rise by another 70 per cent, which is clearly beyond the existing and planned capacity of the roadway system.

Faced with this situation, the Dutch Government adopted a Regional Traffic and Mobility Plan in 1993. The overall goal of this plan was to create a balance between accessibility and the quality of life. The plan calls for a 3-pronged strategy:

1. The price of operating a private car was to be raised in order to reflect the true cost of driving it. This would result in a modal shift and also generate additional revenue for the government.

2. The price of parking in the city centre was to be increased, the available parking spaces in the core reduced, and all free parking converted into paid parking. In addition to this, other measures adopted included revamping the trolley system and operating it on the principle of dedicated right-of-way; installing priority signalling for the trolley system at selected traffic intersections; expanding the regional expressway for high occupancy vehicle lanes; integrating different public transportation modes with the regional railway system; upgrading the railway stations into multi-modal transport centres; converting downtown roadways into bicycle and pedestrian areas, raising the fines for illegal parking and increasing the cost of driving.

3. The change in transportation behaviour and travel pattern was to be pursued through zoning regulations and land use control. The 'ABC' land use code, in conjunction with transportation investments, resulted in business location decisions. The ABC code classified businesses according to their travel needs, as follows:

    A. a business that must be highly accessible to transit to succeed, e.g., commercial office space. This classification also states that private auto usage should be highly discouraged. Thus, the most parking spaces a business can have in this category is one private parking space per ten workers.

B. a business that needs to be highly accessible to both private car and transit to succeed, e.g., a retail shopping centre. The most private parking spaces a business in this category can have is one parking space per five workers.

C. a business that needs to be accessible by private car or truck if it is to be successful. There are no parking limits for a business in this category.

The ABC code is designed to promote the land use that will support the public investment. It redirects the existing growth of the city and attempts to place it at transit stations, in major suburban office centres, and at urban villages. Each of these areas must have a significant rail option for commuters, shoppers, and residents.

Although Amsterdam has backed away from its target of 50 per cent reduction in car traffic, achievements have still been very significant. Earlier trends of dispersal, which encouraged greater car use, have been reversed by the *compact city* model. Residential and commercial expansion is now predominantly planned for bicycle and public transport facilities. The new developments are taking place within the city rather than in the suburbs through the conversion of old harbour sites.

2.1.2 CURITIBA, BRAZIL

Curitiba is best known for its innovative, bus-based public transport system. It shows that the development of public transport system needs an integrated planning and administration framework, complemented by comprehensive initiatives in land use management.

Curitiba is the capital of Parana, an agricultural state in southern Brazil. This city has experienced rapid economic and demographic growth in the last few decades, which has transformed the city into a major industrial and commercial centre and a centre for transporting and processing agricultural goods. The population of Curitiba was 1.6 million in 1996 and spread over an area of 431 sq. kms. During the 1970's, three important elements influencing Curitiba's development were the rationalisation of an integrated transport system, the development of a road network system and land use legislation. As a result, despite having the second highest number of cars per capita in Brazil, Curitiba does not have a traffic problem.

The history of transport planning for Curitiba dates back to the 1960's, during the phase of rapid urbanisation in Brazil, when the city concentrated on a planning framework, which emphasised integration of all the elements within the urban system, and which centred on a transport system that gave primacy to mass movement rather than private movement. During the time when most Brazilian cities were being planned for cars and individual traffic, Curitiba planned, directed and controlled its growth process, avoiding large-scale projects and including small modest projects. The use of 'express buses', on exclusive busways was identified as a public transport option, since it was far cheaper than MRT or LRT, for developing economies in particular.

Curitiba is well known for its innovative public transport system based on buses. The buses are distinguished by service using colours. Thus, express buses (red), inter-district buses (green) and feeder buses (yellow) can easily be recognised. Inter-district buses run on circular bus routes to complement the express busways. There is full integration of express buses, inter-district buses and feeder buses to facilitate the easy transfer of passengers. Integration of ticketing has also been adopted, and bus terminals are equipped with newspaper stands, public telephones, post offices and small commercial facilities.

Another innovation was the introduction of a direct express bus system (grey), which has few stops and for which passengers pay before entering the specially raised-tubular shaped bus stops. These bus stops are at the same height as bus floor levels and therefore cut down the boarding and debarking time; a rapid bus system with these tubes can take twice as many passengers per hour. They run along one-way routes, which run on each side of the structural axis central roads. Automatic fare collection, articulated buses and traffic lights, which give priority to buses (operated by the vehicles themselves), allow optimisation of the system and lower its operating costs. This makes the system three times more efficient then a conventional bus system.

Curitiba's public transport system has developed over a period of 20 years. The key concept for the planning of Curitiba was to encourage its physical expansion along linear axes that had at their centre a road with exclusive-lane, express buses. This, together with a coherent zoning programme, resulted in a shift of new developments from the central area to land along the structural axes, mainly towards the north, southeast and west of Curitiba.

Curitiba's planned road network and public transport systems are probably the most influential elements accounting for the present shape of the city. The government also implemented complementary land use legislation to make its transport policies work. Over the years, urban growth has been encouraged along five main axes, with structural roads. Each axis is designed as a 'trinary' road system; that is, a central road has two exclusive bus lanes in the centre for express buses, and is flanked by two local roads. On each side of this central road, one block away, is a high capacity free-flowing one-way road, one for traffic flowing into the city and the other for traffic flowing out of the city. In the areas adjacent to each axis, land use legislation has encouraged high-density occupation together with services and commerce.

The success of public transport in Curitiba can be deduced from the fact that the system is being used by more than 1.3 million passengers per day and attracts nearly two-thirds of the population. 28 per cent of the direct-route bus users previously travelled in cars. This has ultimately resulted in about a 25 per cent increase in fuel savings and, consequently, lower levels of air pollution. Curitiba has one of the lowest air pollution rates in Brazil. Another important aspect of public transport is the savings to individual customers. At present, an average resident spends about 10 per cent of his or her income on transport, which is relatively low for Brazil.

One of the key lessons from the Curitiba experience is the importance of establishing a close relationship between the public transport system, land use regulations and the hierarchy of the urban road network. This provides an integrated framework that can be used for guidance and as a development tool. An urban growth plan should recognise where the city is growing and how different elements of urban development can be integrated. This calls for conscious technical, political and economic decisions in response to emerging trends. Curitiba has shown that even a city of over 1 million people does not necessarily need a MRT or LRT, but that surface solutions based on buses could be developed easily and at lower cost. Sustainable planning means less planning attention to car traffic and more to mass traffic, including arrangements for pedestrians and bicycles. Pedestrian areas and bicycle paths should be an integrated part of the road network and public transport system.

2.1.3 STOCKHOLM, SWEDEN

Stockholm demonstrates the difficulties encountered in securing a consensus on a long-term transport strategy for an entire city. The Dennis Agreement is remarkable as a piece of political engineering on a large scale, but this was achieved at the price of considerable compromise on traffic limitation issues.

The layout of Stockholm is fragmented by rivers, lakes and inlets that have always made communication difficult. The city was founded at the cross point of the 'teh' channel of water, which divides the north of the region from the south. The main road and rail routes have also converged at this point, thus creating a major transport bottleneck at the historic centre of the city. Successive plans were made to divert traffic away from the centre by building tangential and orbital routes further out, but only recently has specific action been agreed upon.

Until the 1940's, Stockholm was very densely built. But subsequent demand for housing in the 1940's was met by developing satellite communities connected to the city centre by suburban railways. This resulted in the decline of city population from 460,000 to 240,000 between 1940 and 1989. Employment, on the other hand, rose to about 260,000; a high proportion of which is located in the city centre with a land area of about 3 sq. kms. Route planning was co-ordinated with the new communities, which in turn were built with service centres and employment facilities focused around railway stations. The intention was to make each neighbourhood partly self-sufficient. Housing was planned with the highest densities near the station to maximise access for residents. Also, footways and cycle tracks linking the housing areas to the stations were largely segregated from motorised traffic. This integrated approach to transport and land use planning made Stockholm widely known among town and regional planners.

In spite of an efficient rail-based transport system, in the 1960's, Stockholm also planned a generous network of motorways to the city centre, as well as a ring around the inner city. This increased the volume of motorised traffic, along with noise and air pollution, accidents, hindrances to public transport and the dissection of urban and regional spaces for road building. The concern about remedying this

situation was first addressed in *Trafik Plan-1977*, which gave greater emphasis to NMT and PT. A notable feature of this plan was the identification of the parts of this city to be kept free from 'through' traffic, and this was achieved through extensive public participation.

Further restraints were imposed by raising parking charges and limiting parking spaces. The charges were higher (10 SEK) in the centre compared to the residential areas (7 SEK). In addition, standard requirements for parking provision were lowered in new developments[5]. However, the objective of 20 per cent reduction in car traffic could not be achieved for certain reasons such as, the decline in the real price of petrol after 1983 and higher per capita income leading to an increase in car ownership.

The subsequent *Trafik Plan-1989* aimed at reducing ecological damage and traffic accidents, at easing accessibility through public transport and improving conditions for essential business traffic. This was to be achieved by switching car travel to public transport and by reducing peak hour travel to the city centre by at least 30 per cent. This idea was supported by proposed investments in improving the railway system and in extending the existing line to serve new peripheral development in the town. The plan recommended that new urban areas should be built only at locations served by the rail system and that new employment centres should also be created at focal points of this network.

User charges for driving in the inner city and a general environmental tax for the whole of Land Stockholm were also discussed. Licensing, such as parking permits, was to be employed to reduce the traffic by 15% and the fuel tax by 5%. Although none of these measures were adopted, the discussion they generated prepared the ground for future actions.

Dennis Agreement

Despite the debates about traffic and development, no major decision was taken till 1990, when Bengt Dennis, head of the Bank of Sweden, was appointed to negotiate with all the various governments, municipalities and other bodies to agree on a plan of action. After discussions with the interested and affected parties, including local and regional councils, public transport operators, chamber of commerce, etc., Dennis put together a list of projects. However, rather than approaching the different institutions for an agreement on his proposals, he sought consensus among the political parties for a long-term agreement on specific projects.

Some political parties were opposed to any new road construction while others wanted charges for motorists. Of the three main parties, the Social Democrats preferred the outer western motorway to the inner ring motorway; the Liberals preferred the inner ring motorway to take the traffic out of the city centre, but with a toll system; and the Conservatives wanted both inner and outer motorways, but

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[5] For houses, the standard was 0.12 parking places per room (including kitchen); for office buildings 4-6 space per 1000 sqm. area or one parking place for 8 to 10 employees.

without any toll. Nevertheless, all the parties agreed on the need for major investment in the Stockholm Transport System, and pressure was successfully brought to divert a greater share of money to Sweden's metropolitan areas. Public transportation projects were generally less controversial than the road and toll issues.

The second agreement in 1992, after the unsuccessful first agreement in 1991, confirmed the road toll but determined that the returns from this toll would be used to finance road building projects, leaving the normal state and regional grants to be devoted entirely to public transport projects. The new legislation required for road tolls was facilitated by political support and the experience of a neighbouring country, Norway, which employed road tolls.

The Dennis Agreement has been described as monumental in many respects; i.e., in its goals, its means, its financial scope, its time frame, the scale of its constituent projects, its holistic character, its broad political support, its geographical purview, its inclusion of public transport as well as roads and car tolls, and the large number of interested parties it brings together. The projects include both inner and outer motorways, increased park and ride facilities and street improvements, extension and upgrading of regional rail lines, and construction of an orbital express tramway.

The outcomes of Dennis Plan were:

1. The diversion of traffic away from the city centre;
2. 35 per cent less traffic in the inner city and 10 per cent less traffic overall;
3. 35 per cent less pollution in the inner city and 15-20 per cent less overall;
4. Noise levels reduced by 45 per cent in the inner city, but higher levels on major roads, and
5. A favourable modal-split with PT covering 54 per cent and cars only 30 per cent in 1989.

The plan resulted in improved public transport, a concentration of suburban development along rail corridors, and extensive parking management. Other possible factors suppressing car use were the high costs of private motoring and strong environmental awareness in Sweden.

The measures were finally adopted in Stockholm as the outcome of much planning debate and tough political negotiation. The particular emphasis on public transport for the journey to work stands out in the strong radial structure of the rail system with lines converging on a traffic limited city centre, as well as the suburban communities planned around the railway stations. Tougher road pricing has been debated but not accepted. Agreement has been easier to achieve on investment to improve alternatives to the car, that is on pull rather than push measures.

Although the modal split in Stockholm is relatively favourable in terms of achieving environmental and accessibility objectives, it remains to be seen whether the outcome will, in future, be eroded by the new orbital roads, which could make

non-radial movement easier by road than by rail. It also remains to be seen whether the improvements to the public transport system, reduced city centre street capacity, and new toll roads will be sufficient to withstand the encouragement of car use created by the new road and parking facilities. The orbital motorways in the Dennis Plan, in particular, threaten to dilute the rail-based radial and satellite city structure, which, since the 1950s, has served so well to limit the spread of car use in the Stockholm region.

2.1.4 TOKYO, JAPAN

In Japan, and particularly in Tokyo, private commuter rail services have operated successfully for more than 100 years, and fairbox recovery ratios have regularly exceeded 150 per cent of both capital and operating costs. In 1995, Seibu International, a private company with over $US 12 billion worth of assets, was one of the largest private commuter rail operators in the world.

The travel modal split to rail transportation in Japan is as high as 85 per cent of all trip-making in some areas. Rail transportation is a lucrative business in Japan for two reasons: extremely high density and strict land use control. Since only 70 per cent of all Japanese land is inhabitable, it is a precious commodity. Therefore, unlike the United States, land is in the control of central authorities, which decide what gets built, what it looks like and where it goes. The government controls land use through the use of price controls and mandatory approval procedures. Land development is encouraged along the transportation corridors, and the urban centres are anchored by major rail stations.

Japan has paved the way for successfully involving the private sector through private commuter rail operators. The private rail operators in Japan are not solely commuter rail companies but large private real estate and commuter rail operators. The main reason for their success is that private companies have exclusive control over the land adjacent to their train stations, and the majority of their profits stem from land leases and commercial operations at these rail nodes. In Tokyo, Seibu has near monopolistic control over 70 per cent of land around its commuter rail transit stations and around 70 per cent of its annual profits come from the retail operations, including commercial and retail stores, golf resorts, etc.

The government acts as the regulatory body. In the name of public safety and reasonable fares, the government sets tariffs and appoints personnel in public-transport companies. In principle, profits should not exceed 7 per cent. Cars and aeroplanes provide competition to rail commuters, but the air fares and expressway tolls are fixed by the government to promote rail ridership. As a result, the fairbox recovery ratios regularly exceed 150 per cent of both capital and operating costs.

Almost all the private rail commuter companies in Japan have been in the business for over 100 years. They are operated by descendants of families with large land holdings, who, with the advent of rail in Japan, developed rail lines accordingly. For this reason, there has been virtually no start-up of other private rail companies in the last 30 years. Although the land reform of the 1950s in Japan broke up concentrated land holdings into smaller farms, the railroad holdings remained

untouched. This opened up opportunities for private rail commuter companies to purchase these small farms and convert them into housing, recreation and commercial centres. These new 'suburbs' were then connected by extended commuter lines, financed by low-interest loans from the government.

The experience of Tokyo indicates two things. First, public transport investment does not produce high returns to attract private investors, even in situations with very high trip making rates, as in Tokyo. In such situations, the government has to play a positive role as regulator if the operation is to succeed. Second, the close link between land use and the transport pattern has limited the opportunities for new companies to enter the market. The old companies have had monopolistic control over land, and this has helped them to remain solvent in the long run. Land development not only ensured their transit services would have riders, but it was also used, by the private companies, to make profits for their commuter rail line operations.

2.1.5 TORONTO-ONTARIO, CANADA

Toronto has been very aggressive in mandating that new developments be transit supportive. Strict land use regulations have been adopted since 197,7 and approximately half of the high-rise apartments and 90 per cent of office construction are within a 5-minute walk to a train station.

Originally started in 1892, Toronto operates a classic streetcar system. Operating at-grade in the city, it has 73 kms. of dedicated right of way, 284 street cars and carried approximately 334,000 passengers per day in 1988. Approximately 60 per cent of the central city residents use transit on a daily basis, while for the downtown area, the modal split to transit reaches 70 per cent. Most other people use bicycles or walk to their destinations; rarely do people use private cars as a means of transport in the central city.

In 1953, the Metropolitan Toronto Council (Metro Toronto) was established, consisting of the city of Toronto and the five cities around it. Greater Toronto, the area encompassing Metro Toronto and reaching 15 counties, is a higher level of regional aggregation. The population of the city of Toronto is about 660,000, while that of Metro Toronto and Greater Toronto are 2.5 million and 4.5 million respectively.

During the 1940's and 1950's, growth occurred mainly in Greater Toronto and the 4 cities adjacent to it. However, after 1960, the growth began in earnest in Greater Toronto and in the fifteen surrounding counties. Thus, typical of an American city, while the majority of employment remained in the Toronto Metropolitan Area, the majority of the population chose to live in the suburbs. This resulted in auto congestion and a consequent demand for roadway expansion. So, while the city government advocated transit expansion, the regional government advocated roadway expansion.

In 1971, the Toronto Transit Commission (TTC) decided to phase out the streetcar system, mainly because the operational costs were becoming high, as the system was old, and to provide a dedicated right of way for roadway expansion. Mass transit was proposed to use 'transit-only' lanes for diesel bus operation.

The turning point in the history of Toronto's street car came when two council members called a public meeting to discuss ways to stop street car derailment. A Streetcars Working Committee was formed to prepare a position paper on why the streetcars should be retained. The paper presented the streetcar system as an important social component of the city that greatly contributed to the city's image as one of the North America's most liveable cities of its size. On November 7, 1972, TTC announced it would keep the streetcar system even though TTC staff members had recommended that it be abandoned.

This decision resulted in an emphasis on planning an urban form that would support transit utilisation. Published in 1976, the "Metro Plan: Concepts and Objectives," explicitly called for the development of downtown Toronto as the employment, commercial, cultural and political centre of the region. The strategy adopted called for developing a hierarchical, multi-centred urban form together with adequate infrastructure investments in sub-centres and zoning incentives that encourage densification in high transit access areas. Along with density bonuses and the opening of an advanced light rail transit system, these public investments helped to create other private sector activities in the city centre. As a result, in 1989, the Toronto transit system carried 77.1 per cent of downtown bound commuters during the weekday rush hour.

Since 1977, strict land use regulations have been imposed to ensure enough ridership for the transit system. Following the opening of the *'Yonge Street'* heavy rail line, approximately half of the high-rise apartments and 90 per cent of office construction are within a 5-minute walk of a train station. This transit supportive land use trend is continuing with the modal split of rail transit hovering at 55 per cent in 1994.

Current transportation and land use planning in Toronto has shifted towards a more polycentric urban form supported by rapid transit at sub-grades. The planning and zoning regulations have been modified accordingly to allow high-density development in subway areas. The regulations are more restrictive for development in areas with no direct access to the subway. The majority of high-density development is in the form of retail, commercial, office and residential development, a sort of "mini city" approach. These mini-cities have increased employment opportunities, shortened commuting distances, improved access to retail stores and a variety of professional services, now all within walking distance.

2.2 CONCLUSION

The cases reviewed above, taken together, reflect the major developments in transport policy planning history in a chronological sequence of different innovations. A broad spectrum of measures was developed to influence the choice of transport modes. Measures range from planning for a strong public transport network, walking and cycling, and the integration of different modes; restricting car-use through pricing, parking controls and land use management; and finally the different forms of administrative, political, popular and private support, which are discussed in the following paragraphs.

In all the cases, there was a move to preserve the character of the historic town centre. This was achieved by planning mixed land use together with an improved public transport network. Thus, the cities re-imposed the historic high-density core by taking any available opportunity to rebuild the centre. These centres, however, saw a shift, as far as activities are concerned, from a predominantly residential to a predominantly commercial core. However, accessibility remained the major development tool for the region.

Consolidation of activities was pursued through a long-term vision and popular consensus. Amsterdam and Toronto used a referendum on transport and related issues to determine the long-term direction of policy. Popular support was envisaged as an important aspect of this approach in these cities. Toronto and Stockholm demonstrated the difficulties in securing a long-term transport strategy for the whole city instead of just the centre. Different models of participation and co-operation (e.g., public-public, public-limited private and private-limited public) were successfully applied in these cities. In every case, however, gathering the necessary popular support and maintaining it required considerable political tenacity; and the fundamental issues in the debate were nowhere fully and permanently resolved.

Finally, these case studies have also shown that well planned and modest investments in the quality and density of public transport may have far reaching benefits. The big-ticket road and rail projects in the cities, which have been studied, have had to be shelved due to their low returns and high environmental and social costs. Another interesting point in this regard is that greater operation and management subsidies are required by thin, low-quality service than by dense, high-quality service.

It has been proven that land use planning plays an important role in transport management. Land use regulations have been used as vital support mechanisms for transit investments. High-density development along transport corridors can be created to benefit from improved accessibility. This measure makes it possible to breach the trend in traffic growth, not only in the central area, but also over a wider urban region. Nonetheless, this requires a positive attitude that sees other urban improvements as inherently necessary along with better transportation management, both for ensuring effective utilisation of the service and for exploiting accessibility as a major tool to achieve an efficient urban form. The high quality environment that can be achieved in traffic limited areas gives a boost to

both economic and cultural activities, enabling these areas to compete with the car dependent areas in outer parts of the urban region.

However, in order to achieve traffic reduction, 'pull' measures are insufficient. Strong 'push' measures are also mandatory to achieve the desired success. This has been clearly demonstrated in Curitiba in particular. Accessibility of the regional service to the city centre; integrated timetables and fares for both city and regional services; high density, high speed and high comfort tram service; priority tram service in the centre; narrow roads, etc. helped in building up the acceptance of these improvements. All this helped in achieving the highest level of public service passenger usage in these cities and in stabilising car traffic.

The next chapter discusses, in detail, how land use and transportation investments have actively addressed the urban form and the urban transportation environment.

3 LONDON AND RANDSTAD- THE REGIONAL CONTEXT

3.1 LONDON[6]

One newspaper, recently seeking to reconstruct Phineous Fogg's epic, 80-day journey around the world by sea and land, ruefully commented that his first stage - from home to the station - would be no faster now than in 1873 (Hall, 1989).

London became the world's largest city, as the capital of the world's dominant empire, during the 19th and first half of the 20th century. Although it is no longer the largest city, it remains, in terms of its influence, economy and culture, one of the world's great cities. The main built up-area of the region, Greater London, has a population of almost 7 million, about the same as that of Switzerland. Greater London[7] includes three smaller units; namely the 2.75 sq. km. (677 acres) ancient *City of London*, the 25.9 sq. km. (10 square mile) *central area* embracing the City and, finally, the area of *inner London*, consisting of mainly older and denser housing.

Greater London is part of a much larger London Metropolitan Area. But growth has now rippled even outside this latter area, even, in fact, beyond the official south-east region, making it necessary to talk of a Greater South East. The Greater SouthEast comprises the entire southeast of England and the fringe of fast-growing counties, 16-32 kms.(10-20 miles) wide, around it. In 1986, this area had a population of 19.8 million, just under 40 per cent of the total for England and Wales.

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[6] The information presented in this chapter has been collected from a large number of sources, including Greater London Council (1984), Hall (1985 and 1989), Harman (1993), Hoyle (1973), London Research (1992), London Transport (1995), London Transport Task (1994), Mogridge (1987), Oldfield (1993), Pharoah (1992, 1994 and 1995), PTRC (1994), Richards (1990), TCPA (1987); interviews with DAC Maunder, Transport Research Laboratory, Berkshire; Peter Collins, London Transport Planning, London; BBC programme 'Mid-night Hour' of 18.11.97; informal talks with a large number of people in England; and publication material and paper clippings.

[7] Greater London Council was abolished in 1988.

3.1.1 MAIN PROBLEMS

The real problem, as *London 2001*[8] pointed out, was that even by 1963, Greater London was no longer great enough; it was declining in population, while the ring around - up to 70-80 kms. (45-50 miles) from the centre - was growing fastest, by nearly 1 million people, 29 per cent, in only 10 years. This was named the Outer Metropolitan Area (OMA). It went on growing, but at a diminishing rate: nearly 19 per cent in the 1960's, 8 per cent in the 1970's and between 2 and 3 per cent in the 1980's. The reason was not that population growth had ceased, but that growth was just spreading out farther. Whereas the belt of maximum growth was between 32-56 kms. (20-35 miles) from the centre in the 1950's, it was already 56-72 kms. (35-45 miles) distant in the 1960's, 97-112 kms. (60-70 miles) in the 1970's; and even beyond that in the 1980's, in the South East fringe counties between 129 and 177 kms. (80 and 110 miles) from London. It has now begun to break up into conglomerations corresponding to major urban groups: Reading-Basingstoke, Southampton-Portsmouth, Milton-Keynes and others.

As an attempt towards decongestion in central London, November 1964 saw a ban on new office buildings, which was followed by a comprehensive attempt to licence new office buildings through issuing office development permits. This proved to be a total fiasco; the city complained that invisible earnings were threatened and shortages forced up rents and brought a bonanza to the developers.

Since then, a strange set of paradoxes has transpired. Office space has increased from 98.6 million square feet in 1974, to 114.7 million in 1981 and to 117.9 million in 1983; while total employment has fallen from an estimated 1.4 million in 1961, to 1.1 million in 1971 and only 947,000 in 1981. The explanation for this dilemma is simple; because of the rising standards and rapid advances in information technology, the need for space is more than the need for employment. The de-industrialisation of the 1970's and early 1980's took away 255,000 manufacturing jobs and another 132,000 jobs in trade and transportation from inner London between 1971 and 1981 alone.

In 1962, approximately 1.238 million people were travelling to the centre; this declined to 1.075 million in 1975 and 998,000 in 1983. The figure, however, increased slightly to 1.103 million in 1986, mainly due to an increase in tourism. Tourism attracts 20 million visitors per year, more than half of whom (8.9 million in 1986), head for London, spending a total of 3.55 billion pounds. Total passenger miles on the London Underground increased much faster, by nearly 70 per cent in five years, from 2.3 billion in 1982 to 3.9 billion in 1986-87. The system is now so overloaded, with 50 per cent more journeys than the peak hours of the 1930's, that management is contemplating fare hikes to manage demand.

Total car miles went up by 16 per cent in inner London and 25 per cent in Greater London between 1972 and 1986; peak traffic increased by 22 per cent from 1975 to 1985. Despite sophisticated traffic control systems, peak period speeds are down to

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[8] Hall (1989).

19.3 kms. per hour[9], 11 per cent slower than in 1968. After the historic decision of the Greater London Council to axe the 800-mile road project, road construction has been limited to radial roadways. The 188.3 km. (117 mile) M-25 orbital motorway was constructed by the government in 1986, to provide ring movement along the edges of London. This ring roadway remains choked with vehicles now.

The broad management strategy developed in London addressed the transport problem at three levels: planning new job locations outside London; integrating regional mobility with city mobility, and exploiting the development potential of vacant land in inner London. These initiatives are discussed in the following sections.

3.1.2 THE PLANNING INITIATIVE

The idea of containing the growth of London and, consequently, mobility was first conceived and recognised in Abercrombie's Greater London Plan of 1944. The main ideology behind this plan was to contain the growth of London within its urban limits, while decentralising activities in the urban region in the form of a growth ring. Another important feature of this plan was the redevelopment of blitzed and blighted areas through the planned decentralisation of 1,033,000 people and their jobs away from the capital to new and expanded towns beyond it. A green belt, about 24 kms. (15 miles) from the city centre, was created to contain the urban spread of London and, at the same time, break the monotony of its urban sprawl.

Abercrombie's 1944 regional plan envisaged eight new towns, Mark I towns, (developed on the principle of the *garden city*[10] as conceptualised by Ebenzer Howard) to be developed in a ring of 48-65 kms. (30-40 miles) around London. Developed in 1960's, the new towns were able to achieve what they were meant to: they are now self contained towns for living and working; they have achieved a sound social balance; they have provided good homes with plenty of green space; their town centres are lively and bustling, and they have more than repaid the public investment made (Refer Figure 3.- Abercrombie Plan 1944).

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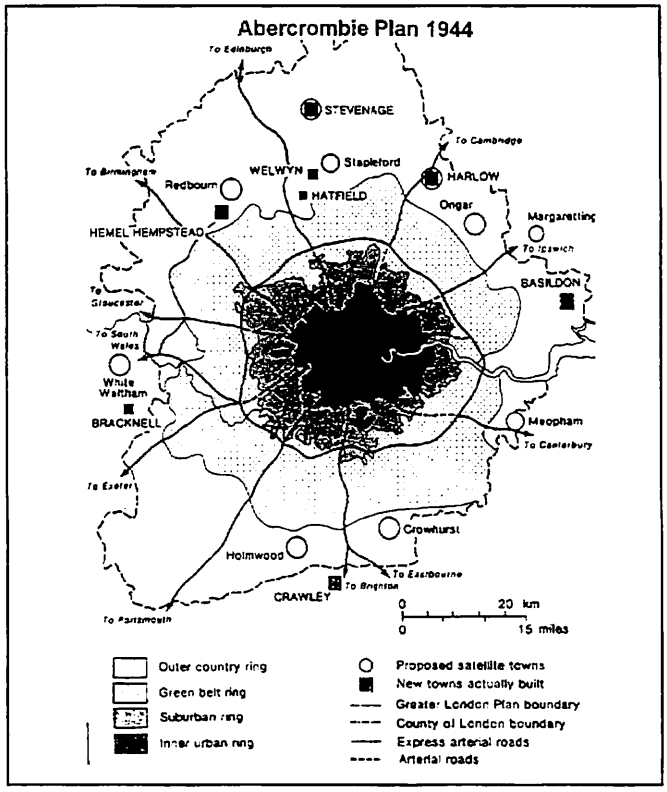
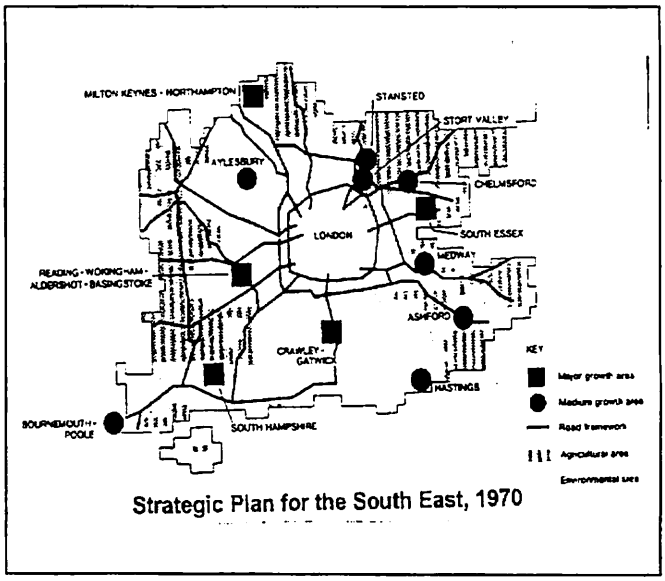
[9] 12 miles per hour.

[10]Garden cities are towns which combine the rural characteristics as greenery, large homes, small size and peace with the urban characteristics of employment, growth economy, quality infrastructure, etc.

Figure 3:Planning for London's Expansion





Another category of urban expansion, (Milton Keynes, Northampton and Peterborough) was developed further out, about 80 kms. (50 miles) from the centre. These cities were of a different character; they were much bigger, and two of them were built around existing towns outside the boundaries of SouthEast region.

For the most part, planning systems have tried to concentrate on suburban fringe developments around the major towns of the Outer Metropolitan Area (OMA). These include Reading, Aylesbury, Luton, Chelmsford, Southend, Rochester-Chatham-Gillingham, Maidstone, Horsham, Guildford and Aldershot-Farnborough-Fleet. Nearly all these towns lie about 16 kms. (10 miles) further from the eight Mark I towns.

The results are very simple to see. Reading, due to its good accessibility both by rail and road, has attracted a large number of industries. The gradually enlarging conglomeration of industry makes it the third largest office centre in South East England after the City and the West End of London. In 1970, the official strategy for the SouthEast designated it as the centre of one of the five major growth areas.

The Concept of Countermagnets

The main cause of worry among planners was the increasing catchment area of London. The continuous job growth in the city coupled with the increase in birth rates between 1955 and 1964 caused a sensation among planners and demographers. The first SouthEast study forecasted that, between 1961 and 1981, this region would gain an additional 3.5 million people, and, therefore, proposed new cities near or between big cities and expansions to accommodate the demand. This proposal met a mixed fate. Another effort (1967) of the South East Economic Planning Council - a new advisory body - suggested joining London to the major growth centres by discontinuous corridors of growth. But the major turning point came when a study, launched in 1970 in co-operation with local planning authorities, produced a Strategic Plan for the SouthEast. This plan was the most important regional planning document since the Abercrombie Plan of 1944, and it forecasted an increase in population from 17.0 to 21.6 million in the region. It also proposed that this increase should be accommodated by population growth of 3.1 million in the OMA and 2.4 million in the Outer SouthEast.

To achieve this, five major growth centres at distances of between 65 and 130 kms. (40 and 80 miles); one to the south-west, one in west, one to the north-west, one in east and one to the south, were planned to function as effective 'countermagnets' to London. Their eventual population would be between 0.5 and 1.5 million, large enough to receive decentralised industrial and commercial activities, and, at the same time, small enough to offer adequate social and entertainment facilities. These areas would, in fact, absorb the majority of the projected growth. Thus the character of SouthEast would profoundly change, from a unicentric region based in London, with a whole ring of relatively small satellites, to a polycentric city region rather like The Netherlands Randstad.

3.1.3 REGIONAL ACCESSIBILITY

From a transportation perspective, London is remarkable in two ways. Firstly, expansion was based entirely on rail transport, and, secondly, London's population peak of 8.2 million was reached in the 1930's, before the car made its appearance in any significant numbers. This was due to the highly efficient public transport system, 8,000 buses and trams running 360 million service kilometres each year, in addition to the underground and suburban railway systems with almost 1,000 route kilometres. In 1933, the number of public transport trips per person each year was about 500, not including suburban and main line railway journeys. Even today, when public transportation use is half what it was before the Second World War, the city could survive if all cars were to vanish over night. This is due to the fact that all major activities are located so that they are accessible by the extensive public transport network.

The railway network dictated the expansion of the city. This network was highly radial and efficient at channelling a large number of commuters into the central city. The centre of London had the highest accessibility of the large metropolitan area, and locations close to the centre experienced rapidly rising land values. One interesting location in this respect is not Oxford Circus, the centre of the one of the big office boom areas in the 1960's, but London Bridge. This is a convergence point of the regional railway from SouthEast and the metro line into the city. The unreliability of the metro line, due to breakdowns and cancellations, coupled with the deregulation of the financial services sector in October 1986, led to a big office boom in this area.

As a result of improved accessibility, commerce eventually displaced residences as the price of land increased. In 1801, over 129,000 people lived in the central city; this declined to a mere 5,000 in 1961, while the number of people working increased to over 500,000. As a consequence, the roadway network became more and more congested with vehicular traffic. The city designed for walking, biking and carriages saw a boom in vehicular traffic that literally choked the narrow winding streets of the city.

The movement now is in the form of a chain as the subdominant cities and towns are linked to each other. The mobility has not declined in real terms, but is localised in the SouthEast region. The interdependency of the cities becomes more and more complex every day.

3.1.4 REGENERATION OF DERELICT AND VACANT LAND

The green town concept was mostly resisted by the rural population. Their argument was logical enough. They enjoyed a rural way of life, and did not want it disturbed. In 1987, building society reports spoke of the vast and growing divergence in housing prices between South and North London. This was serious, not only for the people, but also for actual or potential employers, who were faced with the need to pay an escalating premium to attract staff.

This led to the argument that the population should flow back to London. While the Home counties were being covered with cement and bricks, there were large pieces of urban wasteland in the heart of London. Redevelopment of vacant land became the thrust, and in the late 1970's, the Labour government, in the White Paper of 1977 and the Inner Urban Area Act of 1978, effectively switched money from the New Towns Programme to inner-city revitalisation in areas such as the Docklands. The slow growth rate of major growth zones further confirmed this action, and this resulted in the launch of London Docklands project.

London Docklands is a story of urban form and its relation to transit. It is a story of accessibility and its relation to making a location attractive for investment. The project has also had a chequered history. In the initial phases, the London Docklands Development Corporation (LDDC), charged with the regeneration of the Docklands, took a private sector approach in its redevelopment activities. Public sector investment of approximately one billion pounds, including the new automated light railway, encouraged over ten billion pounds of private investment. The promise of significant government investment in transport infrastructure enabled the LDDC to leverage private investment against public.

Instead of a strict land use planning regime, such as the Japanese model, the London Docklands developed a flexible approach, allowing for the involvement of the private sector. For the Docklands Light Railway (DLR), LDDC acquired the land and provided infrastructure while private developers constructed the structures. The LDDC's success in implementation was due to the fact that it was able to work with private firms to prepare the plans for development. The approach was neither policy determined nor wholly market-led, but the organisation had a considerable role of its own in creating and raising market demand. The result is that the land prices increased fivefold in less than 18 months.

The projected population of the Isle of Dogs (a part of the Docklands) was expected to grow from 40,000 in 1990 to 130,000 in 1999. This created excessive demand on the DLR, constrained accessibility, making the location less attractive for investment. Only when the proposal to approve the existing underground came through, was the location again seen as attractive. The underground will share the increased load of 100,000 passengers per day with the DLR. The Docklands have been transformed from 9 square miles of wilderness and derelict land into the third major economic node in the capital.

3.1.5 CONCLUSIONS

The development of London can be characterised by a series of successes and failures. These are further analysed below. Experiences studied leave the impression that London failed to set a clear vision and that measures taken were rather ad hoc and uncoordinated, at least since the demise of the Greater London Council (GLC) in 1988. The GLC was created in 1965 specifically as an authority to produce integrated strategic plans for transport and land use. An overwhelmingly reason for abolishing GLC was not that there was no need for such a strategic function, but that the organisation was unable to fulfil these functions. This

becomes relevant when London is viewed within the context of other cities discussed in this paper, which are able to do what London could not.

In spite of remarkable planning interventions, there are still substantial gaps in the transportation systems. The highway system offers unequal access to different parts of London and the SouthEast. Outer London is much better served than inner London; north London, especially NorthEast London, has better accessibility than south London, since there is no South circular.

There is apparently no attempt to integrate the different elements of the system. Most strikingly, there is no plan for linking highway and rail investments through the development of 'park and ride' stations at points well located for both highways and train access to the centre. Consequently, there is very little incentive for the car riders to shift to public transport in outer London once they are in their cars. They either drive all the way or transfer at inadequate sites in the middle ring, causing needless rush-hour congestion and environmental nuisance at no real gain to themselves; everyone loses.

To solve the problem of regional inaccessibility, London would need to learn from Paris and build an RER. This would be the biggest change in the London rail network and its extension to the countryside. London RER would not require any large-scale new construction as most of the network is already there; all that would be necessary would be to link it up, via short stretches of new or reconstructed tunnel, under the centre.

Finally, a proper balance could be achieved by pricing, by regulation, or by a combination of the two. London has attempted a combination of the two, though less enthusiastically and less effectively than in many other cities. The major interventions have been metering of the large central and inner area, pedestrianisation of selected streets in central London, traffic management to keep extraneous traffic out of residential areas, and priority lanes for buses and taxis with an exemption from other traffic regulations.

Of course, London has reason to be proud of its achievements as well. The Docklands has been a unique planned inner-city regeneration. This promises the development of new communities not recognised either in Abercrombie's plan of 1944 or the strategic plan of 1970. It is, therefore, confirmed here that the concept of regional planning remains as powerful now as it was a few decades ago. However, it needs a strict follow-through on the ground.

3.2 THE RANDSTAD[11]

The concern of the national government to preserve the ecology of the *Green Heart,* together with providing access to it's four strategically important cities has resulted in an impressive urban form, known as the Randstad. The main objective of the Randstad model is to improve the accessibility of the important nodes, thus promoting urban growth in the western region of The Netherlands, together with preserving the *Green Heart,* an ecological area of national importance. Important activity centres in the chain of urban growth are Schiphol airport and Rotterdam harbour, both having a diverse catchment pattern, and both needing a high degree of transportation links to their hinterlands for success.

Over half of the more than 15 million inhabitants of The Netherlands live in the Randstad. The Randstad is located in the western part of The Netherlands and comprises 3 provinces. The horseshoe-shaped urban area stretches from Dordrecht in the south, through Rotterdam and The Hague to Haarlem and Amsterdam in the north and Utrecht in the east. The four major cities, guiding urban growth in the region, are Amsterdam, Utrecht, The Hague and Rotterdam, all of which are important growth centres of the country. Amsterdam has about 720,000 inhabitants and is part of a conurbation of 1.2 million. It is a popular tourist destination, besides being an administrative centre and capital of The Netherlands. Utrecht's population is about a quarter million, the city is a commercial centre and the preferred location for many high-tech offices and businesses. The Hague, with about 0.4 million inhabitants, is the location of most of the central government's administrative functions, while Rotterdam, with 600,000 inhabitants and a conurbation of 1 million inhabitants, is a port city (Jong, 1995).

3.2.1 PLANNING AND GROWTH MODEL

The main challenge for planners has been to keep development within the ring, which circumscribes the *Green Heart,* the prime ecological and green area of the country. The view is that economic potential should be exploited, but not at the cost of the environment. The harmony between the two should be maintained. This thinking has led to a planning model that is unique in many senses.

The basic approach of development came into existence in the 1950's, and was given a stronger focus in the 1960's. The core idea is that the cities should not spread in an unplanned and uncoordinated way, but should rather follow a particular pattern, the nodal corridors in this case, which would be supported by major investments in transit movements. Such developments are dictated by the major growth centres, which remain the prime locations both for infrastructure and

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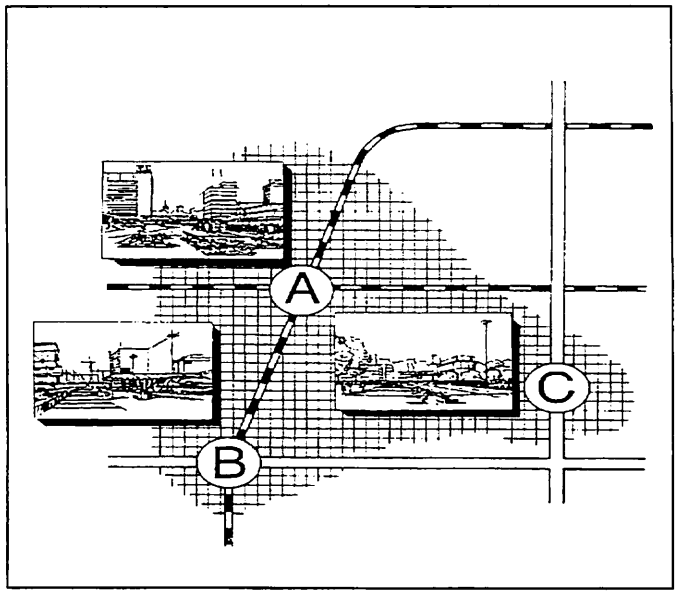
[11] The information presented in this chapter has been collected from a large number of sources, including Briginshaw(1997), Harman (1993), Hoyle (1973), Jong (1995), Kreukels (1993), Laconte (1995), Pharoah (1992, 1994 and 1995), Ploeger (1995), PTRC (1994), Venemans (1996), VROM (1991 and 1996); interview with JTM Bloemberg, VROM, Hague; informal talks with a large number of people in the Netherlands; publication material and paper clippings.

transit developments. These growth centres are surrounded by other communities. which are smaller both in function and size. This generally helps in estimating the inter-nodal and intra-nodal trips and, accordingly, to plan a suitable transport network. The concept of the Randstad has resulted in the formation of a horseshoe type of ring along the highly developed transit corridor, with the secondary cities having access to this corridor only at planned locations.

The ecological balance in the rapidly urbanising region was maintained by the policies of *Green Heart* preservation and the maintenance of buffer zones between the cities of the Randstad. *Green Heart* preservation is necessary to maintain the ecological balance and, at the same time, enable city dwellers to benefit from nature. The buffer zones serve two functions; first, they break the continuous monotony of the urbanised area, and second, they establish the links between the cities and the ecological and natural processes of wetlands, regional parks the *Green Heart* and other ecological areas.

Figure 4: ABC Zoning Policy



The spatial planning, and, particularly, the location of new urban settlements, is regulated by the Vinex Plan[12] of 1988 (revised in 1990). Stress is given to regional connectivity and the environmental impacts of these developments in the region. ABC zoning principles[13] were applied to determine the location of an activity, while connectivity between regional and local services is considered as the prime factor in considering an area's potential for development. Major investments in the

[12] Plan for spatial development in the region known as Fourth Report on Physical Planning Extra.

[13] See 'Amsterdam' in Chapter 3 for details.

extension of a ring line (tangential metro system) in Amsterdam, the metro in Rotterdam and a regional tangential bus line between Haarlem and Schiphol are used by the government to leverage urban growth in and around these centres for reasons of improved accessibility. This is an example of guided urban development in which transport investments dictate the shape of spatial development and also help in organising the urban growth pattern. Productivity is another factor that plays an important role in location decisions. For example, the catchment area of Schiphol airport is much larger than Rotterdam port, and this results in higher productivity per unit area occupied. This then becomes a location incentive and hence a challenging planning tool for the region.

Vinex-1990 is closely linked with the Second Transport Structure Plan. Vinex promotes the idea of developing new residential areas in or very close to existing towns, since a restrictive policy prevails in the countryside. These locations are designed to provide short-term solutions to answer the fast growing demand for new housing in relation to the baby boom of the 1950's. To implement Vinex, especially for siting new urban areas and the corresponding public transport, the national government makes agreements with provincial governments and the municipal councils of the four major cities by means of covenants and implementation contracts lasting ten years. The Ministry of Transport also signs these covenants so as to ensure the best possible link with the transport network. These contracts include commitments of billions of public guilders of investment in housing, the environment and infrastructure in the specified locations.

There are, however, strict national laws that prohibit development in the *Green Heart* and buffer zones, since they are recognised as open spaces of national importance and, therefore, as important planning tools. These national policies and directives are translated into the development process through regional plans, which are prepared by each province and provide the guiding framework for municipal plans. Municipalities prepare local structure plans, which indicate their future strategy, primarily for the main urban areas. The local plan is a precise zoning plan for development and is accompanied by detailed regulations on construction and use. Now, emphasis is being given to the preparation of joint plans for the four cities in the Randstad.

3.2.2 POLICY OUTLINE

Within the national context, the Vinex plan proposes reducing urban mobility, particularly through land use planning and public transport development. The present policy requires the siting of housing, businesses and public buildings close to public transport intersections. It also discourages labour-intensive businesses and leisure facilities that attract visitors from areas less accessible by public transport. The main policy guidelines and the lines of thinking could be summarised under the following points:

- There is a compact city approach and restrictive policy for *Green Heart* development;
- The prime responsibility for implementation lies with the municipality, which resolves dilemmas of priorities and integration in the early planning stages;
- The integration of environmental concerns and spatial development as well as the optimal use of policy instruments to maintain existing environmental regulations;
- Since the two objectives of development and environment cannot be easily met, it is acceptable to be flexible with norms. However, the loss in environmental quality, if any, should be compensated for by creating additional environmental assets;
- Space should be developed for economic activities; but not without linking the environment and sustainable development with economic development;
- Clean technologies, the efficient use of public space and infrastructure, and environmentally friendly transport should be promoted;
- Institutional partnerships should be built and rest on the principles of horizontal (inter-departmental) and vertical (inter-governmental) co-operation among all actors to integrate different policy areas; and
- The central focus should be the quality of life in the Randstad with linkages between city and outer areas, densely populated city life and sparsely populated rural life.

3.2.3 ACCESSIBILITY

Accessibility is the potential for interaction; both social and economic. It is determined by the spatial distribution of activities and the ease of reaching them. Travel time and travel costs are two important variables in defining accessibility. Thus, prioritisation of the traffic flows and, at the same time, improvements to ensure reliability are the main characteristics of accessibility in the Randstad. Improving accessibility to important potential destinations such as Schiphol airport, the Rotterdam port/Rijnmond area and their hinterlands and towns is one of the important aspects of transportation strategy for the Randstad.

Enhancing accessibility in the Randstad region has not been an easy task since traffic congestion in the region is much higher than the national average, while road capacity is quite limited. The planners have, therefore, focused on localising urban mobility needs by changing the land use pattern. To reduce car traffic, both push measures - restricting parking - and pull measures - improving the quality of public transport service - are being pursued. The four main cities have witnessed huge investments to develop high-quality, public transport systems that could compete with the car. Ongoing rail improvements and the construction of high-speed tracks have also been taken up in the region, together with the following measures:

- Increasing the capacity of intermediate stations;
- Doubling rail lines and the construction of flyovers;
- Giving priority to investment in the Randstad, and
- Exploiting the possibilities of alternative modes of transport such as canal, rail, tube and sea, as a measure to decongest the roads.

Another important development in this context is that of *transferiums*. *Transferiums* are basically transfer stations provided to ease the change from one service mode to another, for example, from regional train service to city tram service. They are weather-protected and are provided with commercial and shopping places to make the interchange attractive and lively. A park and ride facility is also provided at '*transferiums*' to make the city centre accessible for car users. In some cases, cars are even stopped at the outskirts, and other services (e.g., mini-buses) are provided to bring the riders to the nearest public transport facility.

The investment plan involves outlays of DFL 2 billion for the development of infrastructure in the Randstad, including the conservation of green areas. The *Green Heart* conservation and development programme receives an allocation of DFL 30 million/year. The new investment plan has kept a reserve of DFL 60 billion for new projects, of which DFL 2 million are reserved for the Green Heart locations. This clearly shows the priority area, which, in this case, is the conservation of ecological areas. Thus, under the plan, any new development should consider its environmental impacts both directly, in terms of the development of open land, and indirectly, in-terms of mobility, pollution, etc.

3.2.4 CONCLUSIONS

The Randstad demonstrates the challenge of linking urban mobility and prosperity with the ecological preservation of the *Green Heart*. The Randstad forms the main focus of Dutch economic activity and population. Theoretically, it is the country's metropolitan region, but with the metropolitan city functions distributed across four major cities and their immediate catchment areas.

This model also demonstrates certain weaknesses. With the overwhelming concentration and consolidation of the activities in the proximity of urban growth areas, urbanisation is taking place in almost every single vacant piece of land. This has led to two serious consequences. The first is that the cities are gradually losing their specialised character. The result is, obviously, a tremendous increase in work-related and freight trips. Since the second order settlements are not so well connected, travel between two second order settlements is often very cumbersome, time and energy consuming. Secondly, the environmental consequences of over-concentration of activities and inhabitants are rather serious, since they exceed the assimilative capacity of the natural environment in the region. This is evident from the fact that the solid waste from this region has to be sent over long distances before it can be safely disposed.

The success of this model lies in the fact that Vinex-90 has been developed on the fundamental element of transport arteries and the local movements in the cities. Vinex has been innovatively integrated with the Second Transport Structure Plan, which again confirms the integral relationship between land use and transport planning. The main idea is to contain urban mobility and to otherwise localise it. The residential locations are, therefore, developed around excellent bicycle paths and high quality public transport, and are located as close to the city centre as possible. The transport plan encourages the use of bicycles and public transport and discourages the use of car. Consolidation of similar activities is also seen as one of the effective measures of localising transport needs.

The protection of the environment, especially the *Green Heart,* has been the prime focus in assigning the growth functions to the Randstad cities. The prime importance assigned to the green core and radial buffer zones has not only led to containing the urban sprawl but also in predicting the most efficient urban form for the growth of the area. The integration of the Environmental Plan, the Transport Plan and the Physical Plan has been able to meet the growing needs of the region without compromising the environment. This makes the Randstad a unique case.

3.3 Main Lines of Thinking

The two case studies of London and the Randstad further strengthen the argument that integration of transport policy and physical planning is important in developing an efficient and environmentally friendly transport pattern. The 1960's saw urban development with residential areas spreading into suburbs while jobs remained in the centre. This resulted in heavy commuter traffic. Comparing the ring of Randstad and the geographical spread of Greater London is a difficult task. Both have been the planning landmarks of their own countries, which certainly leaves an impression of how complex the whole process is.

However, some of the broader issues that emerge from these two case studies are discussed in the following paragraphs. These issues are identified as lessons that can be taken from this comparison, and this discussion is ultimately aimed at providing a framework for developing an effective transportation management strategy for the NCR.

Which form of development-corridor or radial would be more effective in reducing urban mobility?

The two regional developments discussed above can safely be classified as the corridor type, for the Randstad, and the radial type, for Greater London. This becomes clearer if one looks into the geographical spread of the two. The Randstad, has clear boundaries to its urban spread with high-order development linking the major nodes along the main corridor, while all other second-order activities are accessible only through these prominent nodes. Greater London, on the other hand, has been systematically exploiting the potential of the development of towns and cities along two categories of rings, one for satellite towns and other for countermagnet towns, connected to central London through a radial road and rail network.

The corridor type of growth model envisages locating cities with different functions but the same hierarchical status, along the main corridor. This has been the case in the Randstad. The advantages of this model are that the flow along the corridor is large enough to support the development of a highly efficient mass transit system. The lateral connections can be easily developed at the cross-points or major nodes, and these need not be served by high-speed and high-investment transportation networks. The promotion of 'park and ride' facilities or non-motorised traffic, integrated with feeder service to the main nodes is a viable option to meet the mobility needs of the second-order activities. Settlement theory confirms that the corridor model is a very efficient form of development, since it is highly susceptible to regulatory mechanisms. Simple decisions, like changes in commuting costs or improvements in transport infrastructure, may have significant impacts on residential and workplace locations and, therefore, on the land use along the corridor.

The criticism of this model emerges from the fact that it may result in long travel along the main corridors, since the nodes can not be bypassed. Even if direct connection is available, the transport network on the secondary corridors may not be as efficient as on the main one. This concept is, therefore, based on a combination of mass transportation scale, including nodal transit point transfers, and pedestrian scale.

Within the context of Greater London, land use changes have occurred, both in terms of the internal structure of the city, as well as of the rural hinterlands. The result has been that London has become the dominant destination for all purposes and that city boundaries have expanded because of both internal and external pressures. The satellite towns around London were developed in the form of a ring to protect the growth of London from external pressures and, at the same time, to cope with its internal pressures by decentralising activities.

The criticism of this model is that there is only one functional centre. Although decentralisation to the countermagnets and satellite towns has been achieved, they are still unable to achieve full self-sufficiency and thus still depend on London for a variety of functions. Still, the seven cities planned around a ring of 7-10 kms. from London are beginning to become major strategic shopping centres due to their potential access by public transport and the high quality road system.

The mobility pattern in the London model assigns equal priority to mass movement along all corridors, thus making the network very complex and expensive. Establishing a hierarchy or identifying the main and secondary transport corridors for mass movement would be a very difficult choice in this model. The increasing congestion on M-25 indicates that radial movement and circumferential movement may become equally important over time in this growth model. Finally, this model may break the organic structure of the communities through its series of highways and arterial roads.

Will the concept of specialised cities help in reducing urban mobility?

The concept of specialised cities is debatable in itself. The Randstad initially had this characteristic, but it is gradually fading away. The general belief is that specialised cities tend to minimise work-related trips. As similar activities are located in cities, each tends to develop a linkage with its resident population for jobs. This also avoids a multiplicity of trips as many functions can be performed in one go. The criticism of this approach is that the dependency for other services is so heavy that the savings in fewer trips may outweigh the additional trips that may be generated in the process.

Greater London planning did not necessarily stress this point, but over time, consolidation of similar activities is taking place at particular locations. Reading is one such example. It has attracted a large number of industrial and commercial establishments so that it has become, as was noted previously, the third largest office centre in SouthEast England.

Can environment and development go hand in hand?

This is one issue every planning authority is faced with. But preserving the *Green Heart* and buffer zones in the Randstad has successfully demonstrated this integration. As has been demonstrated in this model, corridor development has made it easier to draw a line between development and environment. The urban spread of the corridor model is limited by accessibility, which promotes development only at nodes. Thus, it is easy to guide growth in a controlled way, which means a better environmental record is created.

In the Greater London case, although concepts of green belt and garden cities have been repeatedly mentioned, they are used more as a planning concept rather than as a demonstration of environmental concern. The green belt was proposed to contain the growth of London, but it failed to achieve its objective, and growth leaped forward. The green belt has been partly eaten away by the M-25 and its large intersections. As one minister said long ago, "the green belt is not very beautiful and may not be very green, but without it, the city will never end"[14]. Thus, the function of the green area in London has been merely a 'stopper' rather than an ecologically functional region.

3.4 CONCLUSIONS

The intention of comparing six cities and two city-regions has been more to identify them as '*best strategies*', that is, to explore options for strategy development, rather than to find out which city has achieved the most. Initiatives are related to local circumstances, and in order to replicate them in other cities, the peculiarities of the problems and the emerging solutions must be understood.

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[14] Hall (1989).

To make these practices successful in another context, one needs to study the variety of circumstances in which these solutions have emerged. Examples include: the influence of topography in Stockholm and Tokyo; the greater ease of keeping car use low in the centre of cities like London and Amsterdam; the preservation of the national green space in the Randstad; the involvement of residents in planning and decision-making in Curitiba and Toronto. These are all special circumstances and must be considered along with understanding the value of having a clear national framework to encourage and support actions by individual cities.

Thus, the success of these policies relates to the historical, geographical and administrative circumstances of the cities, and successful outcomes can be achieved in a wide variety of circumstances and in a wide variety of ways.

Traffic limitation policies, as observed previously, are not very successful in tackling the wider problem of traffic growth. Regional development trends everywhere are encouraging patterns of mobility that are localised and manageable. Motorization is an inevitable force and, therefore, solutions have to be sought from a long-term perspective, i.e., that of the creation of a transport system which offers a high quality of life and minimum dependence on the car. The cases that have been discussed have this one single and determinant lesson in common. Private car use is inevitable, but through appropriate measures, its negative environmental effects and resulting congestion can be mitigated, to a large extent, by the development of adequate land use and transportation policies. This is the solution.

4 NCR - ITS PLANNING CONCEPT AND TRANSPORT LINKAGES

4.1 WHAT IS NCR?

Delhi has always been one of the most vibrant cities of the old and modern India. Today's Delhi is a conglomeration of 209 villages, 29 census towns and 3 municipal bodies. The planning and development challenge of Delhi has been as daunting as the growth of the city itself, but not so much until the planners began talking of the regional context. To contain Delhi in an orderly urban form, the National Capital Region Plan was inspired by the outstanding planning models of the world.

The need for a regional plan arose from the need to contain the unprecedented growth of Delhi, both in terms of its population and its size. Delhi has had an average annual growth rate of more than 5 per cent since 1951, higher than Calcutta, Chennai and Mumbai. The 1991 census records a population of 9.4 million,[15] and demographers predict that, at the present rate, Delhi will have 13.2 million inhabitants by 2001. This extraordinary growth is causing a serious drain on natural resources and alarming levels of noise, air and water pollution. The Delhi Urban Arts Commission, however, insists that urban Delhi will not be able to environmentally sustain 11 million people and their related activities by 2001. This has inspired the planners to look for a regional planning approach as a remedy to this situation.

The need for a regional plan for Delhi was realised as early as 1959, when the first Master Plan for Delhi was being prepared. Together with the publication of this master plan in 1962, a shadow Planning Board was constituted and the National Capital Region delineated, comprising urban and rural areas around Delhi. This Board prepared a regional plan in 1973 under the auspices of the Central Town and Country Planning Organisation. The National Capital Region Planning Board (NCRPB), set-up in 1962, was reconstituted in 1985 after the enactment of NCR Planning Board Act of 1985, together with the consent of the legislatures of the states of Haryana, Rajasthan and Uttar Pradesh. The Board is now empowered to co-ordinate and monitor the implementation of the regional plan and to develop a harmonised policy for the control of land use and the development of infrastructure in the NCR.

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[15] Government of NCTD, 1995.

The NCR extends over an area of 30,242 sq. km. and covers three states. The population distribution policy of NCR promoted the idea of regional distribution of employment, commerce and, consequently, population. The total population of the region is estimated to be 32.5 million, of which the urban component is 23.4 million, with 11.2 million accommodated in the Delhi Urban Area.

The major policy prescriptions in the NCR Plan 2001 are to achieve:

1. Reduced growth in NCT, so as to contain its population at the level of 11.2 million rather than the projected 13.2 million;
2. Moderate growth in the Delhi Metropolitan Region (DMA) to accommodate a population of 3.8 million in 6 DMA towns;
3. Provision of an opportunity for accelerated growth of eight towns/urban complexes identified as priority towns. These priority towns are likely to accommodate the population of 2.0 million deflected from Delhi. They have been assigned a population of 4.9 million by 2001; and
4. Accelerated growth of five countermagnet towns to arrest the migration and avoid further consolidation of activities in Delhi.

4.1.1 THE PLANNING CONCEPT OF NCR

To meet the objectives of achieving balanced growth in the region, the NCR plan recognises the need for a spatially and functionally articulated settlement system (Refer Fig 5). The three-tier hierarchical system of settlements, as envisaged in the plan, is discussed in the following paragraphs.

i) DMA Towns

Six towns within Delhi Metropolitan Area (DMA) limits are identified as DMA or ring towns in the NCR plan. DMA towns are to be developed as self-contained entities in matters of workplaces and housing, but with strong economic, social and cultural ties with the 'mother city' of Delhi. The DMA towns are expected to absorb the subsequent population increase in the region, together with the spillover population of Delhi. These towns will more strongly orient their growth towards service and processing industries, since Delhi will be decentralising these functions.

ii) Priority Towns

There are eight towns developed in the region outside DMA which are to accommodate a population of 5 million by 2001. These towns are earmarked for accelerated growth through intensified development efforts with respect to infrastructure facilities and amenities. It is expected that these priority towns, once developed, will be able to expand rapidly by absorbing, future migratory streams, otherwise destined for Delhi.

A new strategy advocates promoting the growth of new townships in the vicinity of

the priority towns and DMA towns. These towns will be centred around core economic activities, to be dispersed from Delhi. This makes good economic sense, and will also be socially more just and equitable. The new growth centres will act as catalysts to consolidate the specialisation and resources available in the area, so that the bond between town and country can be strengthened, and the benefits trickle down to the deprived. Needless to say, this development must be supported by adequate transportation and communication linkages with the existing core to facilitate decentralisation.

iii) Countermagnet Towns

The concept of developing countermagnets has been germane to the policy of decentralisation. While emphasis is on the development of ring towns around Delhi, and selected growth centres in the region (London model), it has become imperative to enlarge the scope of this concept to transcend the NCR boundaries, in order to make it more effective and meaningful in the total context of a dynamically growing metropolis and its region.

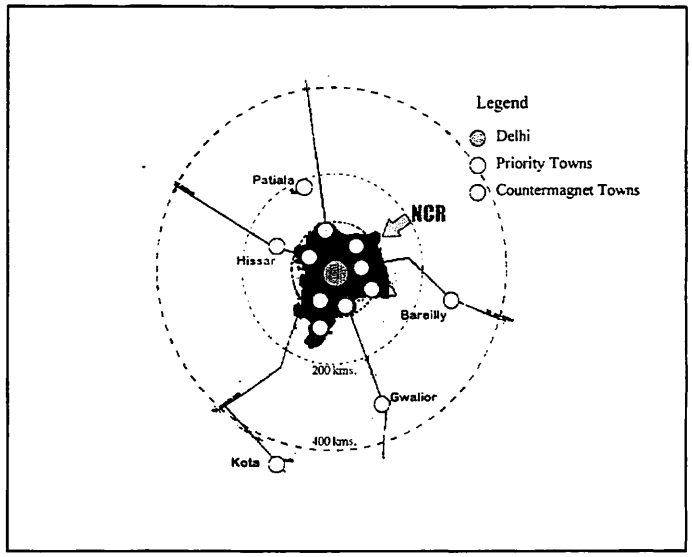
The countermagnets will play complementary roles within the context of NCR:

1. First, as future shock absorbers and interceptors of migratory flows, since increased investment in the region is bound to provide further impetus to migration from less developed districts of adjoining states, and will have to be controlled and channelled to alternate centres of growth; and

2. Second, as regional growth centres in the regions of their setting, a situation which can be exploited by concerned State Governments to achieve a more balanced pattern of urbanisation.

NCR has identified five countermagnet towns, on the basis of identified criteria

Figure 5:The Spatial Context for Regional Development in NCR



pertaining to: the volume of migrants from each to Delhi; the distance of each from Delhi - since this should be at least 25-30 kms away from the NCR boundary and at least 60 kms. from each other; the location of each on transport corridors, making both commuter and goods movement easy; and the developmental potential of each in terms of size, economic base, type of activities, etc.

In the analysis that was undertaken, the five towns identified as potential countermagnets are Hissar (Haryana) to the northwest, Patiala (Punjab) to the north, Kota (Rajasthan) to the southwest, Gwalior (Madhya Pradesh) to the southeast and Bareilly (Uttar Pradesh) to the east of Delhi. The countermagnets will thus thrive, to a substantial degree and in the initial stages, on the deflected growth foreseen in the overall decentralisation strategy of the metropolitan regional plan. Each will eventually develop its own hinterland and influence area as a dynamically growing urban centre.

The main question faced by the planners and demographers now is where does one go from here? What kind of growth potential should be assigned to these towns so that commuting in the region is minimised? It is now a well established fact that urban growth and urban mobility are complementary to each other. Thus, as a measure to reduce mobility in the region, one would need to develop a functional growth pattern, which support transportation investment and contributes to efficient communities. The next section, then, briefly discusses functional growth and travel demand within the context of NCR.

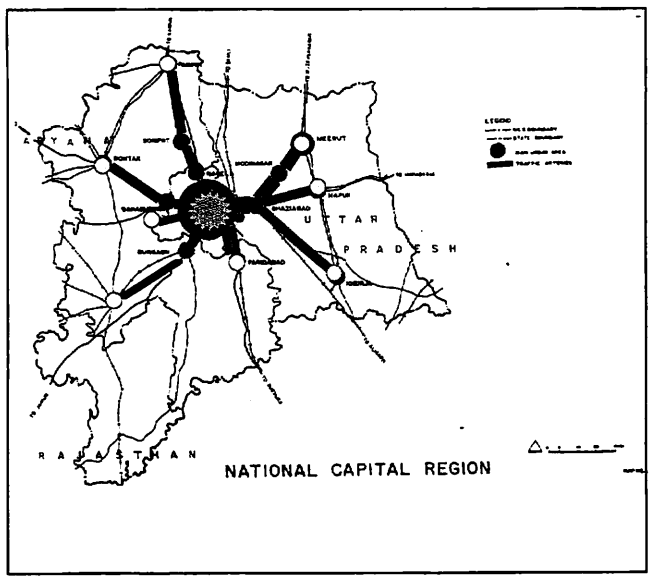
4.2 Alternate Growth Models of NCR: In Search of an Ideal Transport System

NCRPB has worked out different growth scenarios for the region based on the financial, social, technical and institutional implications of development. Different functions and, accordingly, populations have been assigned to the DMA and priority towns to achieve the objective of a harmonious and balanced growth of the region. This paper, reiterating the functional relationship between activity and travel pattern, analyses the mobility under different growth conditions of the priority towns. It analyses five possible scenarios to establish which amongst them would be the most appropriate one in minimising commuting in the region. These scenarios are discussed, one by one, in the following paragraphs.

4.2.1 SATELLITE TOWNS

This pattern of growth envisages the priority towns being developed as satellites of Delhi. This means that these towns will be self-contained to a limited extent in the matters of employment, housing and basic infrastructure, but will be dependent on the nuclear-city, Delhi, for activities such as services, major economic and commercial activities, wholesale markets, major shopping, specialised social and educational facilities and the like (Refer Fig 6). Although satellite towns may be separated physically from Delhi and from each other by green belts, functionally, they will continue to depend on the facilities the mother city is likely to offer. The advantage of this model is greater rural-urban integration, less overcrowding and a low cost of living, once good social and economic facilities are developed in these towns. However, the disadvantages would be greater, the increase in mobility between Delhi and priority towns being one of them, as is evident from the case of the Greater London Plan.

Figure 6.Satellite Towns

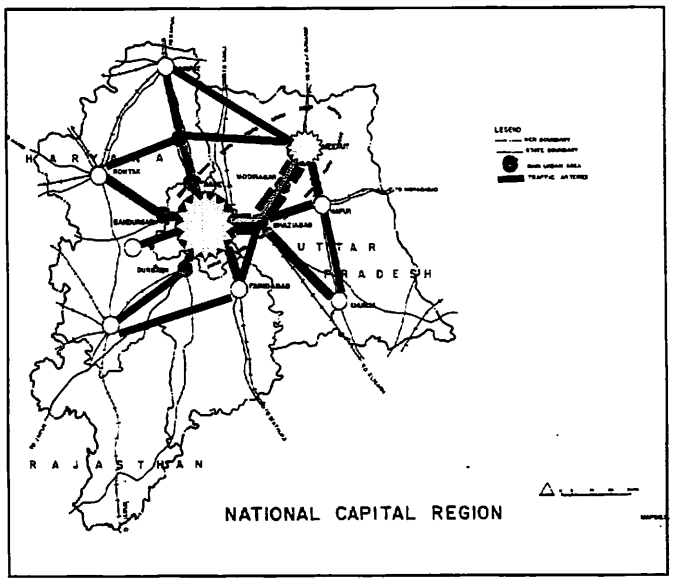


Also, with the passage of time, there would be a strong tendency for gradual filling in of the in-between open-space or *green belts,* making them *brown-belts.* Ultimately, this will result in a big conurbation, making mass movements very expensive and difficult The pattern has no built-in mechanism to reduce commuting to Delhi and to reduce the pressure on the services located there. Rather, it will encourage the dependency of the surrounding population on Delhi and result in breakdown in service efficiency in the capital. The net result will be higher mobility on the corridors connecting Delhi and these towns. The model is therefore not very desirable.

4.2.2 ADDITIONAL METROPOLITAN CENTRE

The central idea of this growth model is to create a strong additional metropolitan centre in one of the selected priority towns, with the objective of siphoning off the growth of Delhi (Refer fig 7). The town identified would need a major developmental effort, while other towns could still maintain the same function as satellite towns but now with two nuclei. The agricultural or green belt would act as a separator for the cities.

Figure 7. Additional Metropolitan Centre



It can be said that sustained growth of one town will perhaps trigger self-generating growth. Once it attains a population of 1 million, it would be capable of restraining effectively the growth of Delhi. Applying the simple principle of economies of scale, the cost of providing services would be much more economical for a city of this size[16]. This points to an argument for developing large growth centres in contrast to small ones; the latter are economically not very attractive to large investors. This metropolitan city would have the additional advantage of attracting migrants otherwise destined for Delhi in search of marginal employment.

The disadvantage of this model would be high travel demand on corridors connecting the two metropolitan cities and the remaining priority towns in the hinterland. There would also be a gradual filling-up of the green space between the cities, resulting in a continuous ribbon form of development. The traffic, at a later stage, might become too difficult to manage both from the environmental and road safety points of view.

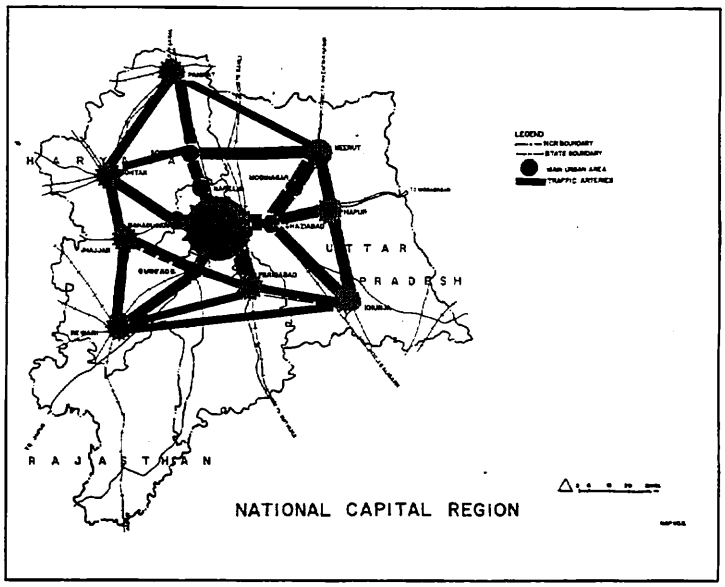
[16] For further discussion, please refer to: Government of India-1983.

4.2.3 MULTI-TOWN PATTERN

Each priority town in the region has got its own character and speciality. This model would exploit these potentials of the towns in stimulating the development of the region, as seen in the Randstad, for instance. The result would be a series of specialised towns in the NCR, each having interaction, not only with Delhi, but also with the other priority towns (Refer fig 8). This is essentially the pattern advocated in the satellite town model; but this model suggests specialisation, in terms of activities and services, so that it can hold a bigger population than feasible in satellite towns.

The specialised town form has an advantage over other forms. Consolidation of the activities over time would exert a magnetic-pull for continuous consolidation of similar activities from Delhi to these new locations, not because of any regulatory persuasion, but in response to market forces. Such a concentration may lead to agglomeration of economies at these centres and may generate substantial employment opportunities.

Figure 8:Multi-town Pattern



The main weakness of this model, within the context of NCR, is that it would be difficult to predict the dependency of one specialised town on another or on Delhi. Even the provision of a mass transit system between Delhi and these towns may not be able to address the travel demand as the mobility pattern between various centres and Delhi, for the effective use of specialised functions, would be rather complex and unpredictable. The lack of diversity in the economy may limit and, in fact, result in a wide disparity in the development of social and economic activity in these towns. A major recession in a particular town may lead to failure of the

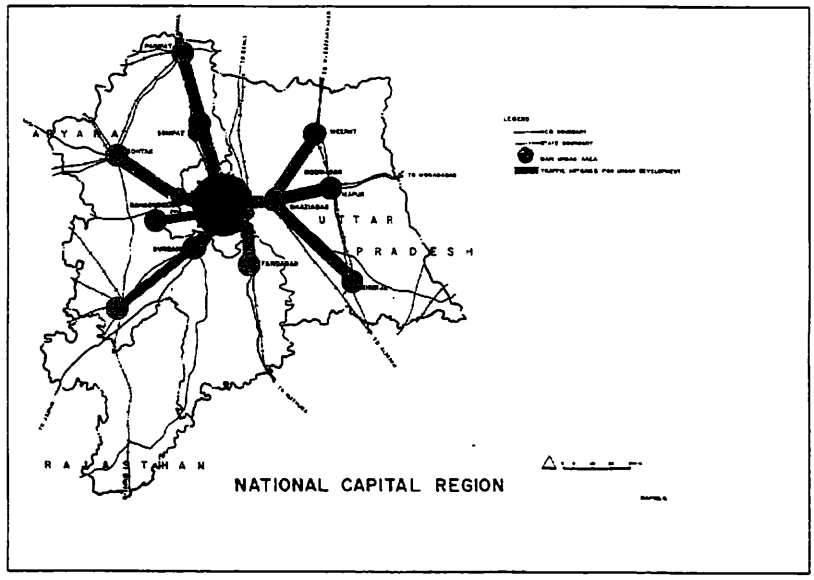
whole economic net and damage interrelated growth links. Other disadvantages are the same as for the satellite town model.

4.2.4 FINGER PLAN

This growth model recognises the linear urban growth along the prominent traffic corridors (Randstad model), the prime objective being to satisfy the need for speedy movement from home to work and for the maximum utilisation of the existing transport infrastructure (Refer fig 9).

The main highways could be used to disperse the excess population outside Delhi. Thus, excluding the main traffic arteries, the plan anticipates retaining green and agricultural areas along and between the transport corridors. The advantage of this model is that the corridors could be indefinitely extended without upsetting the growth of the region. The guiding principle of the growth would be travel time and not distance. The people living and working along these corridors could avail of the facilities of Delhi and at the same time enjoy the advantages of the countryside.

Figure 9:Finger Plan



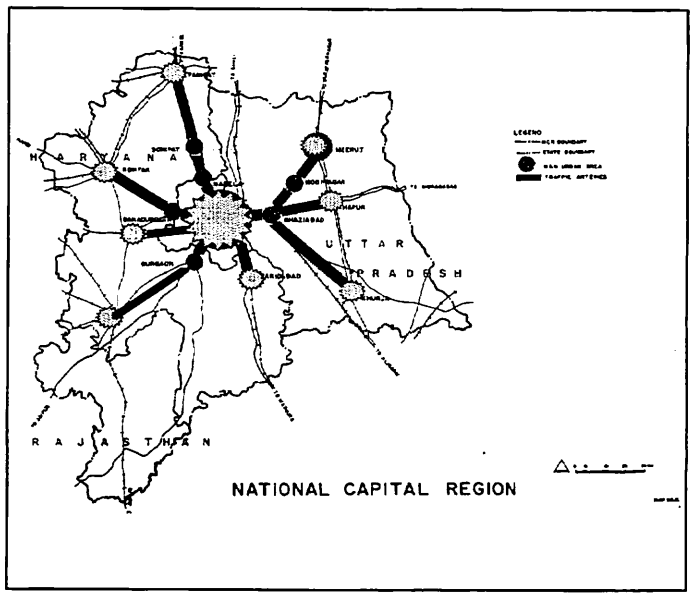
The model requires heavy investment, both for the main transport corridors and for construction of laterals to transfer commuters from the region to the corridor. In addition, the radial connection between the corridors cannot be overlooked. Otherwise, the mobility would not be really reduced as in the case of Greater London and the Randstad. High-density development along the city transit system has been demonstrated in all the cases studied in this paper. However, high-density growth along the regional transport corridor sounds very ambitious and may result in the growth of incompatible land uses, difficult to service. This development would also lack social cohesion and civic administration, and may result in unsatisfactory living conditions.

4.2.5 RADIAL CORRIDOR PATTERN

This growth model combines the advantages of all the earlier possibilities. It takes into account the present urban growth along the main traffic corridors radiating from Delhi, as well as its relationship with the multifaceted metropolitan economy of Delhi (Refer fig 10). It superimposes the finger development model on the satellite model, with the modification that these centres, instead of being a continuous sprawl, would be separated by agricultural green belts. The major effort would be on corridor development and selected town development.

The advantage of this model is that it builds primarily on the local economic bases of these towns. While assimilating the theories of 'specialised multi-town pattern' and 'finger pattern,' it tries to bring into the mix the element of self-sufficiency in planning, not totally ignoring the importance of Delhi for the specialised services it may still have to offer. Regional accessibility is the most important component of this model, and inadequacy in addressing it may lead to failure, such as that experienced by London. This model combines the 'high accessibility' concept of the Randstad with the 'decentralised growth-centre' concept of London.

Figure 10: Radial Corridor Pattern



This growth model promises maximum chances of achieving social goals. It identifies the existing growth potential of the towns, consolidating it over and over again to make specialised cities. It also promotes the rural-urban interface, as was anticipated in the *garden city* concept of Greater London. This growth model will necessitate minimum interaction between different towns, unlike the other forms of development, while still maintaining the key position of Delhi as nuclear city. This would, therefore, be the recommended form of development in NCR.

4.3 CONCLUSIONS

There is a universal acceptance in Delhi and India of the need for devising policies and programmes for metropolitan decentralisation through developing new urban nodes around and away from primate growth centres. This is necessary not only for the survival of the metropolitan economy and its social and physical environment, but also for balanced regional development through an equitable distribution of population and employment opportunities, which at the same time preserves green and agricultural areas. The objective is the spatial reorganisation of the urban economy by establishing a functional settlement system around the prime growth node. In this context, the decentralisation approach has taken many spatial forms namely, ring towns, new towns or priority towns; the ring or radial corridor concept; the counter-magnet concept, as well as their combinations.

Any programme for metropolitan decentralisation has two basic complementary components: containment of metropolitan growth through restrictive policies, and accelerated development of new urban nodes through promotion policies. Restrictive policies for metropolitan growth have not worked very well in the Asian context due to the lack of promotional policies, which spell out accelerated growth in the new urban nodes. Obviously, promotional policies require a multi-pronged strategy for infrastructure development in these identified urban nodes. In addition, there is a need to rationalise basic issues pertaining to institutional, fiscal and development mechanisms for regional development that streamline the existing processes of development management. Energising the role of the private sector in the development process is another basic issue, so also is the "packagibility" and prioritisation of programmes, and a unified management mechanism for functional and sectoral co-ordination.

While pursuing long-term policy initiatives, the measures and areas of policy intervention, which would have immediate effects in the meantime, are summarised as follows:

1. *Depopularising the job market:* Taxing employers in NCTD may result in more rapid job outflows than would otherwise occur. Also zoning and environmental controls may make the job outflows inevitable.
2. *Housing:* Developing suburbs and residential complexes outside the main activity centre of NCTD will promote outward growth. This will, however, need a new kind of public development agency, which would understand the concept of this transformation.
3. *Transport*: Charging for road use will help in generating revenues for road management (as has been the case in Stockholm). This will encourage people to show that they are willing to pay for a better level of service. Since public transport will continue to carry the vast majority of commuters, a direct budgetary allocation will help to improve its service.
4. *Redevelopment*: Re-densification along the major traffic corridors and the development of vacant areas will need to be taken up for the inner city. This will need local and innovative mechanisms for more effective and comprehensive development.

5. *Administration*: It remains to be seen what the domain of NCRPB will be in the developmental activities of the region. As a statutory organisation, it will have to manage the process for there to be effective results.

This indicates that the preparation of an urban transport policy is a complex exercise, as it has not only to foresee spatial planning, land use, and economic growth, but also to account for the political mood, limitations on finance and technology and, above all, to consider the existing infrastructure deficiencies.

Developing the radial corridor model appears to ease the consolidation pressure on Delhi, and it may promote balanced growth in the region. However, there are many inherent challenges that need to be addressed for achieving the successful decentralisation of Delhi. The most obvious ones are discussed in the next chapter, and they are discussed within the context of what has been learnt from the review of the selected *Best Practices* in this paper.

5 EPILOGUE

5.1 ELEMENTS OF URBAN TRANSPORT POLICY

For many years, it has been assumed that there is a vital link between transportation and development, and that this link is a positive and causal one. This report does confirm that cities with better transportation networks have a competitive advantage over those which do not. Transportation development, therefore, becomes relevant both for national and regional economic development. The main elements of transport policy could be broadly categorised under the following five major headings:

5.1.1 ACCESSIBILITY

Improving accessibility has been one of the major objectives for transportation improvement. But the debate here is if accessibility has regional impacts or mostly local impacts. The cases studied here have shown that the impacts of improved accessibility are highly localised, and any new investments for improving accessibility cannot be counted on for long-term relief. New investments are unlikely to be of sufficient scale to attract major new employment to the city. If accessibility by private vehicle is equally high as for high-occupancy public vehicles, environmental, congestion and economic costs are likely to be very high. This is so in all historic town centres.

Another important factor here is the scale of investment required in improving accessibility. If accessibility is improved by increasing the frequency of PT or by providing a LRT system, its impact will not be as significant as making an inaccessible area accessible. This is happening in developing countries, where investment in new infrastructure is resulting in changes in accessibility, and, consequently, the impact on local and regional development is also significant. One of the potential areas for development has been the interchange points of the modes, particularly if land is available for development. London experienced this with the development of the London Bridge area, where the regional network of transport brought people from outside to transfer to the unreliable local metro system.

Banister and Hall (Banister, 1995) argue that this debate about accessibility is related to the complementarity found within the networks. Accessibility tends to be viewed as the impact of one link on the network as a whole. However, many investments are strongly complementary, and they do not need to be consumed in

fixed proportions since they form systems. Competition is really taking place between the systems and not between individual products. Consequently, accessibility should not only be viewed as the changes in one particular system but as the new competitive position of that system in relation to other systems.

5.1.2 The Importance of Transport in the Development Process

Much of the debate in this study is about linkages between transportation and urban development. Developed economies with dense networks of rail and road have used land use regulations to promote mass transit movement and thus manage urban traffic. On the other hand, investment in urban transport has also promoted urban development and growth, as in the case of the Docklands in London.

Historical and age old settlements along rivers and seas strengthen the view that transportation has been an important guiding factor for urban growth. Airports are the new generation growth nodes, as is experienced in the Randstad of the Netherlands and in SouthEast England, for their large catchment areas. The extreme polarisation of activities in these regions have played havoc to the immediate surroundings. These regions, over the years, have become so powerful that even government has not been effective in lobbying the case of other regions and second-order cities.

However, accessibility also negatively affects certain categories of activities such as manufacturing industries. Improved accessibility has resulted in a shift from manufacturing to advanced service industries, and, accordingly, the employment structure has also shifted, as in Central London. Banister and Hall (Banister, op. cit.) also argue that needs for service industries vary significantly. Some need to be located near their market, while others can be located at a remote distance. Growth will only take place where conditions are already evident, and transport investment may promote consolidation, but this will happen only in areas with vibrant local economies.

Cities have adopted cosmetic measures to reduce mobility by limiting development to selected growth nodes, and along transport corridors. This has certainly achieved the objective of increased ridership for transit systems and additional finance for its operation and maintenance. But in the conceptual framework, it is really difficult to quantify what is actually being measured, either in terms of change in development, or in the performance of the transport system. This seems to point to a rich area of theoretical, methodological and empirical analysis waiting to be explored.

5.1.3 Integration at Different Levels

Transportation is a multi-dimensional and multi-sectoral subject, and this makes the issue of integration important. Integration has been the main challenge for the cities, whether it is horizontal or vertical integration of organisations, or integration

of modes or integration of fares. The case studies discussed in this report are classified as *Best Practices,* since they have integrated transport with other important issues, which most other cities could not. Transport planning policies call for the integration with broader urban objectives, environmental pollution, the rights of all transport modes, fares and ticketing, and private operators, to mention a few.

However, issues that are more important are: what should be integrated? At what level? To what extent? Inadequate or improper integration would be as inefficient as no integration. The common link in the case studies of this research has been the integrated approach to transportation and land use management. As a result, there has been a tremendous market flux in all the cities in terms of increases in the property values, because of improved accessibility of certain areas, and consequent changes in the social structures of the city. This has resulted in a move of the target groups to other deprived areas, not adequately served by the transport infrastructure. Integration of functions and agencies has also resulted in unexpectedly long delays in project implementation and inadequate enforcement of regulations.

However, looking at the positive side, integration of transport and environmental policies has successfully resulted in containing the car fleet. Air pollution targets have been more effective politically in achieving the same objective of reduced urban traffic. The integration of institutions dealing with transportation, environment and land use planning has been lauded for commendable achievements in many European cities. Similarly, horizontal and vertical integration of governments in The Netherlands has resulted in an efficient urban form, effectively contained in urban transit limits.

The integration of public and non-motorised transport modes has resulted in uncrowded and environmentally friendly cities. Integration also provides an opportunity to plan transport efficiently for a region and to work out uniform tariff and regulation policies. This is particularly important within the context of this report, as regional planning suggests the dispersion of employment and service activities to a wider area. These elements are not original, but they need reinforcement and reassertion for each successive case.

5.1.4 Financing of Infrastructure

The funding of infrastructure has historically been a public function. However, faced with a situation of constraints on public funding, new sources of finance are being explored, particularly from the private sector. However, ensuring equity is an important criterion for the government, and this is not always met by the private sector. Moreover, combined mechanisms tend to dilute the monopolistic power of the government, and this is often a major area of concern, especially in developing countries.

Another important issue, regarding private sector participation, is the sharing of risk. Investors want a guarantee for the front-end risk in handling political opposition, protracted public enquiries, expensive mitigation measures and project

delays. This is particularly important for developing economies, where the ground rule changes are very frequent. Government guarantees ensuring adequate returns on investment is the most popular method of overcoming this difficulty. Private rail operators in Japan were assured of a 7 per cent return on their investment by the government. Another method of mobilising resources is through investment sharing with those who benefit from the service - not users, but the community and businesses, according to the benefits they enjoy.

The transport and urban development nexus is now difficult to replicate as this calls for relocation and re-densification of activities. In London and Tokyo, the privatisation of railways was successful because of the enormous amount of land available to the private sector, which they used for development purposes, as a revenue sharing mechanism. Curitiba, Stockholm and Toronto re-densified their transit corridors to capture either the capital investment or running expenditure of their project. Other governments are doing the same, but cautiously and carefully, as they are not sure of the implications of their actions.

In the free market, rivalry has been created between a highly subsidised public investment based transport infrastructure and a recovery based private sector one. This gives immediate rise to paradoxes. New investment could be coupled with tolls, but only when superior facilities are provided. If existing facilities are tolled as well, this may give rise to both technical problems and political acceptance. This may not solve the problem of free riders, which may use the old system paying only a minor penalty in terms of time, but imposing severe environmental externalities on third parties that live along the old roads. This issue makes the private sector sceptical in investing in transport infrastructure.

Finally, public transport systems remain subsidised, even under strict economic surveillance. This is simply for reasons of political feasibility and economic viability. Increases in fares lead to more car traffic, reducing the number of public transport commuters. This also indicates that the 'social costs' of 'user charges' in public transport are so high, that you dare not touch them. This makes transport tariff setting a highly fragile issue from the economic point of view.

5.1.5 Forecasting Travel Behaviour

It is extremely difficult to assess the direct or indirect impacts of new investments in transport on development. One reason often cited is that the returns from transport investments are long-term, while both politicians and private investors tend to look to short-term results. Construction of new roads is said to increase, rather than decrease, traffic. A new road may take diverted traffic from the old congested road and at the same time may promote new development, again increasing the net flow of traffic.

Looking at the organic form of the city-region is helpful in evaluating where time benefits lie, then reflecting these in locational advantages. There is the problem of simultaneously evaluating externalities such as congestion and environmental impacts, which may breach the growth propensity of a location. The broad

structural difference between London and the Randstad brings up this issue once again, when organic linkages between London and the new towns were so strong that it resulted in a totally unpredicted orbital travel pattern. This did not happen for the Randstad, although accessibility among the prime nodes is high. The reason was that secondary nodes were designed on an inter-modal travel pattern.

Having a developed understanding of travel behaviour would make regulatory mechanisms easier to design and implement. The approach generally followed in planning is the 'provide and predict' type, forcing people to use the infrastructure in place. The objective, therefore, remains of reconciling private investment and generating private profit from urban development. This obvious conflict appears in most of the cases.

Thus, for forecasting travel behaviour, impacts should be evaluated as an integrated part of the justification of the project or as part of the assessment of wider social and economic factors. What is required is the continuous process of monitoring, analysis and updating to understand the dynamics of change and the impact of the project. Only then will the cause and effect factors be understood and isolated, together with the possibility of a clear assessment of the impact of the transport investment on urban development.

5.2 CONCLUSIONS

Much of this paper is concerned with presenting the linkage between transport and spatial development as an effective method for solving transportation problems in the developing world, but no clear blue-print solution has emerged, even at the end. This shows the complexity of the problem and the difficulty in making any assumptions or forecasting.

The report itself discusses extensively the impact of land use planning decisions on transport systems/models adopted for city expansion. The cases endorse the fact that new and existing land uses have played an important role in influencing the travel pattern and transportation behaviour of the cities. Recognising this important fact, cities have made significant investments in transportation infrastructure to contain the travel pattern in an orderly form. As a consequence, improved accessibility has also paved the way for dispersion of activities in the region.

Translating the main lessons learnt from the cases for improving the situation in NCR has not been an easy task. However, the validity of the relationship between urban land use and transportation gives significant leverage in extrapolating this to other contexts. The theoretical models on the linkages between transport and certain types of locations, gives an insight into how transportation demand may vary with the dispersion of population or jobs or both. Further arguments can be developed to recognise the linkages between commuting costs and the location of residences and workplaces based on simple economic principles. Simple interventions such as changes in transport tariffs or improving transport quality have significant effects on residential density and work centre locations. This is the framework within which the transportation management of NCR would need to be

tackled for effective results.

With the advent of a new generation of technologies, new patterns of working and leisure, and a wide range of new technologies in telecommunications, the identification of cause and effect in transport and urban development is likely to become even more complex. The data on changing living conditions and on the transition of economies are often not available to justify this further. This leaves a major challenge for planners, who are required to update the validity of their planning models. The continuous monitoring of change over time is one key to our understanding of the dynamics of the processes at work, but it is also necessary to have simple methods which can at least give some indication of the scale of the expected impacts of transport on urban development. In addition to understanding the process of change and the scale of that change, it is also necessary to be aware of the range of changes that can now result from transport investment. Many of these are small in scale and may not all work in the same direction. The links between transport and urban development have interested researchers and policy makers for some time, and yet the explanations have never quite matched the expectations. The challenges outlined in this report will perhaps give a new impetus to the study of this subject.

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