

2. Literature study

2.1 Introduction

This chapter presents a review of the relevant literature in the field of study in order to clarify a number of key concepts used in the current research. The chapter comprises of four sections, namely transportation and spatial development integration; public transportation and its orientated development; nodal-corridor development; and environmental and development relationship. The chapter concludes with a short discussion of the findings of the review.

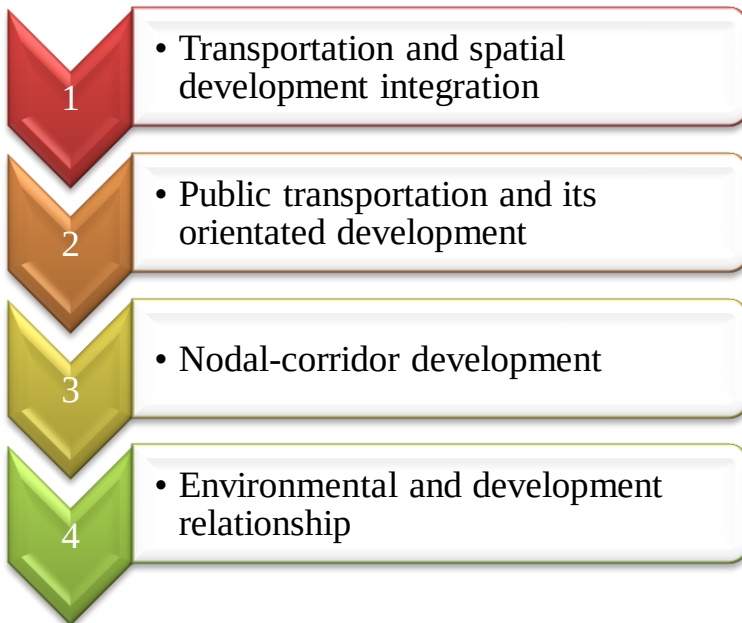


Figure 4: Literature review outline

Source: Own construction, 2011

2.2 Transportation and spatial development integration

In this section, the need for integration between transportation and development planning is explored, with reference to the manner in which this topic has been approached in the relevant literature.

The purpose of transportation is moving people, goods and services from one place to another. However, transportation systems also affect the community's character, the natural and human environment, as well as economic development patterns. For example, a transportation system can improve the economy, shape development patterns, and influence quality of life and the natural environment.

Land use and transportation are in a symbiotic relationship, because development density and location influence regional travel patterns, and, in turn, the degree of access provided by the transportation system can influence land use and development trends. It should also be noted that urban or community design can facilitate alternative travel modes. For example, a connected system of streets with higher residential densities and a mix of land uses can facilitate travel by foot, bicycle, and public transportation in addition to automobile use. Conversely, dispersed land development patterns may facilitate vehicular travel and reduce the viability of other travel modes (U.S. Department of Transportation, 2007:29).

Of importance in this regard is that:

“Land transportation functions must be integrated with related functions such as land use and economic planning and development through, among others, development of corridors, and densification and infilling, and transportation planning must guide land use and development planning” (Hanyane, 2009:173).

By considering the symbiotic nature of the relationship between transportation and land use, the integration of spatial development and transportation plans can work toward a more sustainable future.

Integration is only realised when it is applied to policies, planning methodologies and the organisation of processes or structures. Also, integration is a multidimensional task. Not only do different policies need to be integrated, but the supporting tools and the supporting organisational structures of town planning and transportation engineering also need to be integrated. Often, the strongest integration is found at the policy level. For example, most cities in Europe attempt to initiate integrated policies for areas such as public transportation-orientated development. However, the integration of supporting models, monitoring indicators and institutional structures is much less fully developed in Europe (Consortium Transplus, 2003:10).

The environmental, economic, and social pressures exerted by population and economic growth in major urban areas worldwide have driven policy-makers to promote sustainable transportation and urban forms as a means of achieving greenhouse gas reductions, to reduce land consumption, improve air quality and public health, and also in order to enhance the overall welfare and quality of life of urban populations. In most metropolitan areas of the developed world, various policies promoting sustainable transportation and “smart growth” principles have been developed to accommodate growing urban populations. A common denominator among the proposed policies is their multi-sectoral nature which entails that their impacts extend beyond the transportation sector itself to other sectors such as environment, health, and education. This situation has put enormous pressure on decision-makers to facilitate coordinated action among the range of actors involved in transportation policy appraisal, funding, implementation, and monitoring (Hatzopoulou & Miller, 2008:149).

In a study conducted by WS Atkins (2001) on ‘European best practices in the delivery of integrated transportation’, the presence of regional authorities bridging the gap between national policy formulation and the implementation of local transportation is regarded as a crucial ingredient for success, provided these authorities have their own budgets (from national government allocations as well as a portion of local revenues). In the case studies examined, Atkins (2001) found that regional authorities have helped to increase the accountability of decision-making and to focus investment on achieving integrated planning across the region rather than merely on local priorities. Regions have also managed to improve the co-ordination of transportation and land-use planning and to reduce competition between neighbouring authorities (Hatzopoulou & Miller, 2008:150).

Equity (also called *justice* and *fairness*) refers to the distribution of impacts (benefits and costs) and whether or not that distribution is considered appropriate. Transport planning decisions have significant and diverse equity impacts:

- The quality of transportation available affects people’s opportunities and quality of life.
- Transport planning decisions affect the location and type of development that occurs in an area, and therefore accessibility, land values and developer profits.
- Transport facilities, activities and services imply various indirect and external costs, such as congestion delay and accident risk imposed on other road users, infrastructure costs not funded through user fees, pollution, and undesirable land use impacts.
- Transport expenditures represent a major share of most household, business and government expenditures. Price structures can significantly affect financial burdens
- Transport facilities require significant amounts of land that is generally exempt from rent and taxes, representing an additional but hidden subsidy of transport activity.

- Transport planning decisions can stimulate employment and economic development which have distributional impacts.

(Litman, 2010:2).

2.2.1 International examples

2.2.1.1 North and South America

In the United States, metropolitan planning organisations (MPOs) have been established to serve as co-operative transportation decision-making bodies with decision-making representatives from cities, counties, the state and federal authorities. MPOs focus on transportation functions and the relationships with other functional departments or institutions dealing with social, economic, energy, environmental and land use matters, and their impact on transportation. MPOs are therefore multifunctional, and they operate as planning and decision-making bodies for roads, public transportation, safety, traffic congestion and inter-modal transportation matters.

The Canadian Transportation Authorities (TAs) are similar, and serve as multi-functional institutions where the functions of roads and public transportation are combined in a single institution governing transportation. In Curitiba, Brazil, the transportation function is not managed as a separate function or as a special institution independent from the government dispensation at local or regional level, but rather as a special project managed by an operating agency. This agency is a business venture between the authorities and the private sector, reporting to a management board on which the authorities are also represented.

- The Greater Toronto Area (GTA) and the rest of Ontario

In the GTA, because of their mandate, regional municipalities should have a direct role in helping the local municipalities in shaping their strategic plans. According to participants in regional municipalities, they occasionally sit on the technical advisory committees of other regional municipalities particularly when cross-boundary road projects are in effect or in the development of transportation master plans, but only for information purposes rather than real participation (Hatzopoulou & Miller, 2008: 157). Both lower-tier and regional municipalities complain of a lack of involvement from the provincial level (“we have good co-ordination with other area municipalities but with the province, there is a huge gap. We can’t get any kind of long-range Transportation vision or even a 10-year capital program to know what they are planning to do within the next 10 years. We understand that all these highway programs are meant to reduce congestion but we feel that there should be more money into transit”, according to Hatzopoulou & Miller, 2008:157). In addition, municipal participants state that cooperation between the federal level and municipalities in the GTA is minimal; in fact, most surveyed municipalities complain about the lack of interest of federal agencies in the challenges currently facing most municipalities such as the need for additional funding for public transit and alternative modes of transportation (Hatzopoulou & Miller, 2008:157).

In most Canadian urban areas, it is frequently the case that each department is responsible for part of the problem, but no department attempts to take a holistic outlook on an entire issue. As a result, integrating decisions become a matter of overcoming defined responsibilities, while at the same time respecting departmental portfolios. Indeed, when asked whether they thought agency mandates were an obstacle to integrated policy appraisal and decision making, most participants found mandates to be a hindrance to integrated policy appraisal but felt that these cannot be avoided since agencies need to have a defined set of functions (Hatzopoulou & Miller, 2008:159). These functions have to be different for different agencies. Some participants disagree that mandates constitute an obstacle and mention that it is possible to achieve better integration with the existing mechanisms. In spite of the necessity for better integration, participants expressed some reservations mainly due to the time and resources it entails (“Integrated appraisal means more time to the decision process and if different agencies are looking at different things, we need to have a way to bridge these perspectives whereby we don’t end-up having endless discussions until a consensus is built” (Hatzopoulou & Miller, 2008:159, 160).

The pressures of population and economic growth in most Canadian urban areas have confronted planners and policy-makers with new challenges for managing this growth ‘‘responsibly’’. As a result, the past ten years have seen the emergence of strategic transportation and land-use plans aiming at promoting growth patterns that respect the general goals of economic, social, and environmental sustainability. The complexity and interdependency of sustainable development objectives call for greater policy integration across government departments. Yet, institutional structures in Canadian cities seem to be struggling between attempts to centralise decision-making under the umbrella of regional organisations and trends towards fragmentation and decentralisation of decisions. There seems to be low levels of institutional integration among the three levels of government and weakened regional visions within most urban areas. Most municipalities complain about the lack of involvement of the federal government in urban issues. They also suffer from clashes between municipal and provincial visions. Because of their mandate, provincial governments are likely to be interested in provincial highways while municipalities are currently at a turning point whereby the provision of alternative transportation is crucial. Such a vertical government structure has indeed hindered coordinated and focused action (Hatzopoulou & Miller, 2008: 161).

2.2.1.2 Europe and the United Kingdom

Policy principles such as privatisation, deregulation and the devolution of responsibilities to lower spheres of government have been the main driving forces behind the establishment of transportation authorities, not only in South Africa but also in Europe. Through treaties amongst member countries of the European Economic Community (EEC), an attempt was made to standardise these policy issues and to explore how these related to transportation governing structures, the management of the function generally and the provision of transportation services and systems throughout Europe.

Nevertheless, although the underlying principles of privatisation, deregulation and devolution are generally accepted throughout the EEC, there are differences between the various dispensations for transportation authorities that have been designed for each country’s own practical circumstances and internal political environment. These differences emphasise the autonomy of each member country with regards to transportation issues. The differences in opinion among EEC members regarding privatisation, economic regulation and deregulation also indicate that in Europe these policy issues are fairly controversial matters.

(Groenewald, 2003: 2)

- United Kingdom

Planning transportation authorities in the United Kingdom operate as separate institutions, reporting to a political transportation committee, which is an internal local authority structure. There are differences in approach between metropolitan authorities such as London, and rural or ‘county’ areas. The East and West Sussex Counties are examples where the respective county councils are similar to the regional or district councils in South Africa with regional functions of which transportation is one. In contrast, the transportation authority in London is more specialised, and separated to suit the requirements of a metropolitan area where extensive multimodal integrated transportation systems are under control of a dedicated management structure (Groenewald, 2003: 2)

- Norway

The sustainability agenda has to a large extent penetrated the urban planning discourse in Norway, although the concept is not always mentioned explicitly. The issue of sustainable development has been addressed in all the investigated land use plans and in the Governmental White Paper on better urban environment, but hardly in the transportation packages (Naess, Naess, & Strand, 2010:128).

The most commonly cited definition of sustainability in transportation usage and management relates to sustainable development conceived by the Brundtland Commission in 1983. The Commission defined sustainable development as:

Development which meets the needs of the present without compromising the ability of future generations to meet their own needs (...and aspirations) (Hanyane, 2009:170).

During the decades that have passed since the Brundtland Commission's report was published, the dominating interpretation of the concept of sustainability has in some countries been redefined in such a way that the social dimension is interpreted as a concern not to offend powerful interest groups, the economic dimension as promoting traditional economic growth and the environmental dimension as providing a clean and aesthetically attractive local environment, with little concern for global-scale impacts of local consumption levels and emissions, illustrating a situation where the hegemonic discourse somehow "eats up" the new alternative discourse. This does, however, not seem to have taken place to any high degree in the Norwegian planning discourse (Naess, Naess & Strand, 2010:128).

Sustainable development has gained the status as some sort of overarching goal among land use planners and in land use plans in Oslo metropolitan area, but has not achieved the same status in transportation planning. In land use plans in this city, sustainability goals are expressed increasingly prominently in the most recent plans. Environmental sustainability is considered to be beneficial to growth. In the transportation plans, the concept is hardly referred to. Environmental problems resulting from growing car traffic, notably greenhouse gas emissions, are the sustainability challenge most commonly mentioned in investigated plans and policy documents, articles and among interviewees. Saving nature and urban green structure comes next, whereas there is comparatively less emphasis on energy in buildings, waste, "closed loops", heritage built environment, city attractiveness and social cohesion. The issue of sustainable mobility thus had (and currently has) a prominent position in the Norwegian discourse on sustainable urban development (Naess, Naess & Strand, 2010:128).

A strong focus on coordinated land use and transportation planning with a view to reduce energy use and emissions from transportation is an important part of the explanation of Oslo's farewell to urban sprawl. Whereas land use development has to a large degree been in line with principles of sustainable urban development, the development of transportation infrastructure has been more ambiguous, judged against sustainability goals (Naess, Naess & Strand, 2010:136). Transportation authorities and planners involved in transportation infrastructure development in the Oslo region have generally considered road development as a measure to combat congestion; the transportation planners have, however, at the same time often argued that better roads must be combined with road pricing in order to avoid traffic increase leading to new congestion.

Yet, the decoupling between growth and negative environmental impacts is relative, not absolute. The city is still moving away from important goals of sustainable mobility, albeit at a considerably lower pace than earlier (Naess, Naess, & Strand, 2010:136)

Sustainable development denotes a concern for future generations and for the long term health and integrity of the environment. It embraces concerns for the quality of life, for equity between people in the present generation, for intergenerational equity, and for the social and ethical dimensions of human welfare.

There is a fundamental necessity to create an appropriate institutional framework towards achieving sustainable development. This involves integrations of traditional separate policy areas, including economic services, development and land use planning, transportation, environmental protection and natural resource management, as well as extending beyond government to include business and community interest groups (Chi-on, 1999:10, 27).

In conclusion, the importance of the avoidance of negative environmental impacts points to the need for sustainable development concerning future generations for the long term health and integrity of the environment, quality of life

and intergenerational equity. These international examples can further be used to promote future sustainable integration between transportation and spatial development within the South African context.

2.2.2 Sustainability factors

There is no universally accepted definitions of sustainability, sustainable development or sustainable transport (Beatley, 1995). Definitions include:

Sustainable development “meets the needs of the present without compromising the ability of future generations to meet their own needs” (Brundtland Commission, 1987).

... sustainability is not about threat analysis; sustainability is about systems analysis. Specifically, it is about how environmental, economic, and social systems interact to their mutual advantage or disadvantage at various space-based scales of operation” (Transportation Research Board, 1997).

Sustainability is

the capacity for continuance into the long term future”. Anything that can go on being done on an indefinite basis is sustainable. Anything that cannot go on being done indefinitely is unsustainable (Centre for Sustainability, 2004)

(All quotes above from Litman & Burwell 2006: 332, 333).

Two major approaches towards defining and implementing the notion of integrated land use and transportation strategies can be identified:

- Land use policies aimed at reducing the need to travel – these are mainly “forward” policies (or “city of tomorrow” policies) which create new centres or regenerate brown-field sites, changing the urban fabric and limiting the sprawl of dwellings, workplaces and the like;
- Transportation policies aimed at improving accessibility with a wider range of transportation alternatives – these are mainly “backward” policies (or “city of today” policies) taking the existing urban fabric as a datum, and changing the transportation system in order to improve accessibility by alternative transportation modes (public transportation, walking and cycling, flexible transportation services, car sharing and the like) and stimulating the revitalisation of high-density and mixed-use neighbourhoods within the city.

Both approaches are needed in order to develop comprehensive strategies based on urban and regional structural plans and aiming to achieve the sustainability goals, as those included in some key European Union policy documents (Consortium Transplus, 2003:9).

The first sustainability indicators for mobility suggested is the “average travel distance”. By this indicator, the total distance travelled by passengers to work should be reduced in order to attain sustainability.

Since the effect of land use, transportation and environment integrate with each other, one can suggest that good planning can foster sustainable transportation which, in turn, will result in a better environment (Chi-on, 1999:82, 83).

Concern about sustainability can be considered as a reaction to the tendency in decision-making to focus on easy-to-measure goals and impacts, while ignoring those that are more difficult to measure. Sustainable decision-making can therefore be described as *planning that considers goals and impacts regardless of how difficult they are to measure*.

Sustainability also tends to reflect a *conservation ethic*, which means that production and consumption patterns are structured in such a way as to minimise resource consumption and waste. This requires changing current economic policies that encourage inefficient production and consumption (Litman & Burwell 2006: 333).

2.2.2.1 Underlying factors to sustainability

❖ Transportation decision-making

Sustainable transport planning requires a *paradigm shift*: a fundamental change in the way people think about and solve problems (Litman, 1999a). This involves more comprehensive analysis of impacts (including consideration of indirect and cumulative impacts) (Berger *et al.*, 1998) and the consideration of a broader range of solutions than what usually occurs as well as a more effective public involvement in transport planning.

❖ Transportation equity

Equity has several potential implications for transport policy, but there are few guidelines that one can use in evaluating these various types of transportation equity. Below are some equity issues that could be considered in sustainable transportation planning:

- Horizontal equity implies that externalities of transportation should be reduced except where they are specifically justified. This includes reducing pollution emissions and accident risk from motor vehicle use, or compensating those who bear such external costs. Horizontal equity also implies that users should “get what they pay for and pay for what they get”, which could involve more road and parking fees, more accurate insurance pricing, and other pricing reforms.
- Vertical equity implies that access options should improve for people who are economically, socially and physically disadvantaged. This can include improved transit, ridesharing, cycling and walking conditions, and discounted prices for disadvantaged people (Litman & Burwell 2006: 339, 341).

Transportation, as an infrastructure, has an important role to play in promoting sustainability in urban development. The advent and demands of global integration and sustainable living have created a need to re-examine the scope, dynamics and developments of urban transportation systems with specific reference to public transportation in South Africa.

Wadhwa (2000:281) takes a different view at what sustains a city in the twenty-first century; his opinion, in effect, complements the various viewpoints put forward in this research. He argues that, in order to promote sustainability in urban areas, one has to examine the transportation system in a given urban centre. This approach results in the conceptualisation of what is termed *sustainable transportation*. The latter refers to a transportation system that is capable of delivering the required capacity and performance, uses an inexhaustible energy source, is compatible with the desired lifestyle, and is clean and affordable.

For example, the Transportation Association of Canada has identified a sustainable transportation system as a system that:

- meets the access needs of the current generation;
- allows future generations to meet their own access needs (which are likely to grow as a result of economic growth and an increasing population);
- is powered by renewable (inexhaustible energy resources);
- does not pollute air, land and water;
- is technologically feasible;
- is economically and financially affordable and supports a desired quality of life;
- is clean and affordable; and
- supports local, national and global sustainable development goals

(Hanyane, 2009:169, 171, 172).

Transportation equity analysis is usually performed as part of other evaluation activities, rather than as a stand-alone project or process. Equity considerations can be incorporated into the analysis of transportation planning and funding, land use planning, road and facility design transportation pricing and subsidies, the provision of transportation services, and just about any other transportation decision-making. Below are some general guidelines that can be used when applying equity analysis in transport planning:

- Consider a variety of perspectives and impacts when evaluating equity.
- Allocate transportation resources approximately equally per capita, based on user payments or some combination of the two; unless a subsidy is specifically justified.
- Ensure that basic mobility and access needs are met. If necessary, prioritise facilities and services to favour basic transport.
- Take into account the needs of disadvantaged people to insure that they have an adequate level of service. Special discounts and exemptions can be provided to disadvantaged groups. Consider disadvantaged people's needs when planning all facilities and services.
- Involve stakeholders in planning to help identify development and transportation equity concerns and priorities in transportation and development.

More comprehensive equity analysis allows planners to better anticipate problems, incorporate equity objectives in planning and it can help optimise planning decisions to maximise equity objectives.

Improved equity analysis in transport planning can reduce conflicts and delays, and better reflect a community's needs and values (Litman, 2010:40).

With the increasing drive towards taking the broader impacts of transportation into consideration (such as issues of equity, quality of life, and social inclusion), institutional integration will even need to extend its reach beyond transportation or land-use planning and embrace to education, health, housing, and the like, depending on the potential spill-overs of different plans. As a result, institutional integration will not only have to occur on the vertical and regional levels, but also on an inter-sectoral level - which entails that various government departments (such as. environment, health, housing, municipal affairs, and the like) are invited to participate in the policy appraisal process.

In order to achieve such integration, the literature has illustrated the importance of regional municipalities, the establishment of cross-departmental working groups or strategic transportation authorities. New independent organisations or task forces may be established with the responsibility of appraising land-use and transportation plans, providing funding for municipalities in the implementation of their master plans, and integrating decisions across government departments (Hatzopoulou & Miller, 2008:161).

- Sustainable transportation

There are two basic perspectives on problem-solving in terms of sustainability. A “reductionist” approach considers sustainability as a narrow set of *individual* problems that can be addressed using existing transportation planning in which experts rank problems and solutions. This view assumes that growing travel volumes can continue, provided that the most critical sustainability objectives are addressed in vehicle design.

On the other hand, a “comprehensive” approach assumes that sustainability is a broad set of *integrated* problems that cannot be solved using existing transportation decision-making practices, which allow solutions to one problem that exacerbate others. This perspective suggests that sustainability requires a reduction in total travel volumes (Litman & Burwell, 2006:345).

The following recommendations synthesise the main findings on how to improve the implementation process of LUT (land use transportation) policies:

- Be aware of the barrier “problems”, for example public cooperation and funding, and take the initiative to find solutions;
- Adopt a broad strategic concept for the city;
- Strengthen co-operation and co-ordination; and
- Promote the involvement of stakeholders and inhabitants.

Integrated LUT planning is considered as one of the instruments that should be used in order to promote a more rational use of private cars and sustainable land use and transportation in cities and regions. While scholars often separate the transportation and land use fields of research, practitioners have to deal with the many interdependencies between them.

Public transportation oriented development includes several mechanisms to intensify the density of housing and other activities. The most common measures include:

- Improving public transportation accessibility in existing settlements: this includes the revitalisation or extension of light rail lines and tramways - or the continuous development of bus systems in smaller cities.
- New public transportation-orientated settlements: concentrating urban growth and sub-centre development around public transportation (PT) nodes and corridors is a practical way to apply the “decentralised concentration” concept (Consortium Transplus, 2003:14, 17, 37).

Increasing the recognition of the importance of integrating land use and transportation has led to the development of new approaches in planning. Two of the many possibilities include context-sensitive solutions (CSS) and transit-orientated development (TOD).

Transit-orientated development (TOD) is defined as compact, mixed-use development near transit facilities and high-quality walking environments, typically leveraging transit infrastructure to promote economic development. By enhancing the attractiveness of transportation alternatives, TOD boosts transit ridership and reduces traffic congestion, while creating a sense of community and place (U.S. Department of Transportation, 2007:30).

2.3 Public transportation and its orientated development

Public transportation is the main focus of this section. Below follows a consideration of published research regarding public transportation in the literature. The discussion is furnished with examples.

Transportation systems are developed primarily with a view to expand the reach of both individuals and industry. One measure of transportation infrastructure services is *accessibility*. Accessibility is both the primary product of transportation infrastructure and the link between transportation infrastructure and land use. Its change is a measure of the spatial impact of newly built transportation infrastructure and shows the change in the attractiveness of a region's location over time. The transportation planning process has been illustrated in Figure 5 below.

The development of the world's population in space and time is characterised by a continuous dispersion over the past five decades. Strongly connected with this development is a significant growth in land consumption, an increase in the distances covered, spatial dispersion of traffic and thus an increase in individual motor traffic.

During the first decades of the twentieth century, and in the immediate post-war period, motorway network planning was not seen as an instrument of regional policy. However, first attempts in this direction were made during the planning phase as considerations about the principal functions of the road network were formulated: “The Swiss road network has not only to connect but also to access regions”. However, this definition was revised for the construction of the motorways (Tschopp & Axhausen, 2008:84, 87, 94).



Figure 5: Transportation planning process

Source: Litman 2009:2

Modern transportation allows for urban sprawl to occur, but planning controls can be used to limit what is essentially not a transportation problem (Knowles, 2006: 420). Transportation planning in many cities has focused primarily on the facilitation of automobile transportation to the detriment of other modes of transportation. The result has often been a decline in public transportation systems and degradation of the pedestrian environment to the point that non-motorised means of transportation are no longer feasible (Frieslaar, Marks, & September 2007:24).

The arguments for public transportation improvements as a measure to enhance sustainable mobility implicitly assume that better public transportation reduces the growth in car traffic. This assumption is thus a premise in all the investigated plans and policy documents. Transportation planners have argued that better roads must be combined with road pricing in order to avoid traffic increase leading to new congestion, but this argument has usually been based on assumptions of a general rise in mobility and not by induced travel created by the road improvements themselves.

To a higher extent than what is found with relationships between urban structure and travel, the acceptance of knowledge claims about the traffic-inducing influences of road capacity increases in congested areas seems to have been influenced by power relations (Naess, Naess & Strand, 2010:131)

The word ‘liveable’ denotes a desirable quality of life, economic soundness, social health and environmental viability. Liveable cities are human-orientated, environmentally friendly, economically viable, efficient and socially sound. Fundamental to the generation of such a liveable environment is the integration of transportation and land use planning to ensure the production of development scaled to human needs, with excellent access to public transportation and non-motorised transportation facilities, while allowing an appropriate level of car access. Government’s policies should aim to encourage public transportation, walking and cycling over the use of the private car.

Land use and transportation systems are inextricably linked – if one were to change, the other must respond. Indeed, land use planning decisions have a significant impact on transportation needs, car ownership and public transportation viability. Transportation technology and planning has a similar impact on land use, influencing the locational demands of businesses and households.

2.3.1 Strategies of “no-regret growth” and “smart shrinking”

Compact urban form based on the “no-regret growth” or “smart shrinking” philosophy is believed not only to support environmental conservation, but also to enhance the quality of life (QoL). As a method used to promote compact urban form, transit-orientated development (TOD) or transportation development area (TDA) has attracted a great deal of attention in many countries. It is based on the notion of “location efficiency” which emphasises how accessible opportunities are, rather than how mobile one must be to find them. The TOD aims to achieve better accessibility with a view to satisfy our needs of social interaction without increasing the negative effects of mobility, which are marked in the suburbanised cities.

The integration of land use and transportation planning, such as the TOD, at the local and regional level can contribute significantly towards achieving the goals of reducing urban sprawl, thus promoting a modal shift to public and non-motorised forms of transportation. Furthermore, consideration of the interaction between land use and transportation can enhance accessibility in urban and rural areas. Key elements of the policy framework within integrated land use and transportation planning solutions include:

- Consistency with the principles of sustainable development;
- Promotion of mixed-use development;
- Urban regeneration, including the reuse of previously developed land;
- Promotion of good quality design;
- Securing reductions in the need to travel and use private cars while promoting alternative, more environmentally friendly forms of transportation; and
- Integration within and between the different types of transportation

(Doi & Hayashi, 2005:7).

In many respects, land use planning and transportation planning have failed to provide positive urban environments. Increasingly, many cities are faced with serious traffic congestion, declining public Transportation networks and residential and business environments that are mono functional and sterile.

As the understanding of the environment has developed, it has become apparent that the reliance on the car, with its internal combustion engine, is not sustainable. This unsustainability has two elements: (1) the production of greenhouse gases that are a by-product of the combustion of either petrol or diesel, and (2) the finite nature of these fuel reserves and the increasing demands being placed on these reserves as more fuel is demanded by growing economies (Frieslaar, Marks & September, 2007:24).

Whilst many people are moving closer together in time/space, others are moving farther apart. Social exclusion limits the access of individuals to transportation modes and services and, consequently, to activity sites. Although non-car ownership or availability in developed countries often restricts the personal mobility and physical

accessibility of a substantial minority of the population, supersonic air travel has enhanced time–space convergence for a tiny minority of super-rich and powerful people on a few intercontinental routes.

Transportation infrastructure strongly shapes the layout of towns and cities and influences the location of activity sites for employment, retailing, recreation, schools and colleges and hospitals. These geographical patterns have changed and decentralised initially with electric trams and suburban railways, but much more extensively with the personal motorised urban mobility of the majority in the age of the car (Knowles, 2006:420).

The need to accommodate cars in large numbers exacerbates the problem of low density, as more land is required for road reserve and parking. Low densities reduce the population in an area, in turn impacting on the viability of public transportation and commercial and retail activity. The result is the development of “big box” retail centres to which people have to drive and the decline of public transportation networks as high frequency services are not economically viable with low population thresholds. This means that people are forced to drive more often and further, thereby exacerbating traffic congestion and fuel consumption with its attendant problems. Apparent from the foregoing is the need for better transportation systems that offer a range of transportation options without maximising any one.

To complement these views on transportation networks, one should also note that there is a need for better human environments that minimise the distances that people are required to travel in order to access the goods and services, social networks and recreational opportunities that are necessary for everyday life. In addition, these new environments should facilitate the development of all modes of transportation, particularly non-motorised modes of transportation that have a limited environmental impact.

In order to achieve these ends, there is a need for integrated planning that considers both transportation and land use together in order to develop urban environments which support a range of transportation options and at the same time meet the needs of the people who use them. Such planning is necessary if truly sustainable cities are to be developed.

Transportation planning needs to consider solutions to transportation problems in an integrated and systemic manner. The basis for this need to be the integration of different modes of transportation and the acceptance that there is not one form of transportation that should be dominant, but rather a range of options should be considered. Of particular importance is the need to ensure that automobile dominance in transportation planning no longer prevails and, instead, means are found to make public transportation more efficient and convenient and non-motorised forms of transportation are planned for and the use of such forms is encouraged.

For public transportation facilitation measures to work and for non-motorised means of transportation to be used, the pedestrian environment has to be such that people are prepared to walk. If the pedestrian environment discourages walking, people will not use public transportation as all public transportation trips have an element of walking. Therefore, regardless of how closely goods and services are located to places of work or residence, people will still drive if the pedestrian environment is not properly planned and user-friendly (Frieslaar & Marks, 2007:25, 26).

- The public route of transportation and its transportation and spatial impacts

Achieving sustainable transportation is a major challenge faced by countries around the world, in particular, Asian countries which have to cope with transportation-related environmental problems stemming from rapid economic growth. Some Asian countries have developed diverse and unique transportation systems to cope with increasing travel demands for over a century. However, the rapid growth rate in motorised road transportation has partly offset the advantages of these transportation systems. This rapid motorisation, together with poor land-use planning, condenses urban space and accelerates suburbanisation – thus leading to the development of an inefficient urban structure. A vicious circle of motorisation and suburbanisation has caused serious transportation-related

environmental problems, including traffic congestion, inefficient energy use, as well as, air, water and noise pollution.

Many growing Asian cities have experienced rapid economic development and urbanisation since the latter half of the previous century. These developments have resulted in a significant increase in the mobility of people and goods that are highly automobile-dependent. Due to the increase in car ownership and poor road supply, the present carrying capacity of the road network cannot cope with a further increase in traffic demand. This trend has caused a deterioration of road network conditions, which in turn has brought about an increase in the average travel time along major corridors within big cities.

Figure 6 below illustrates how the increase of car ownership causes a vicious circle that gives rise to many negative impacts, including traffic accidents and congestion.

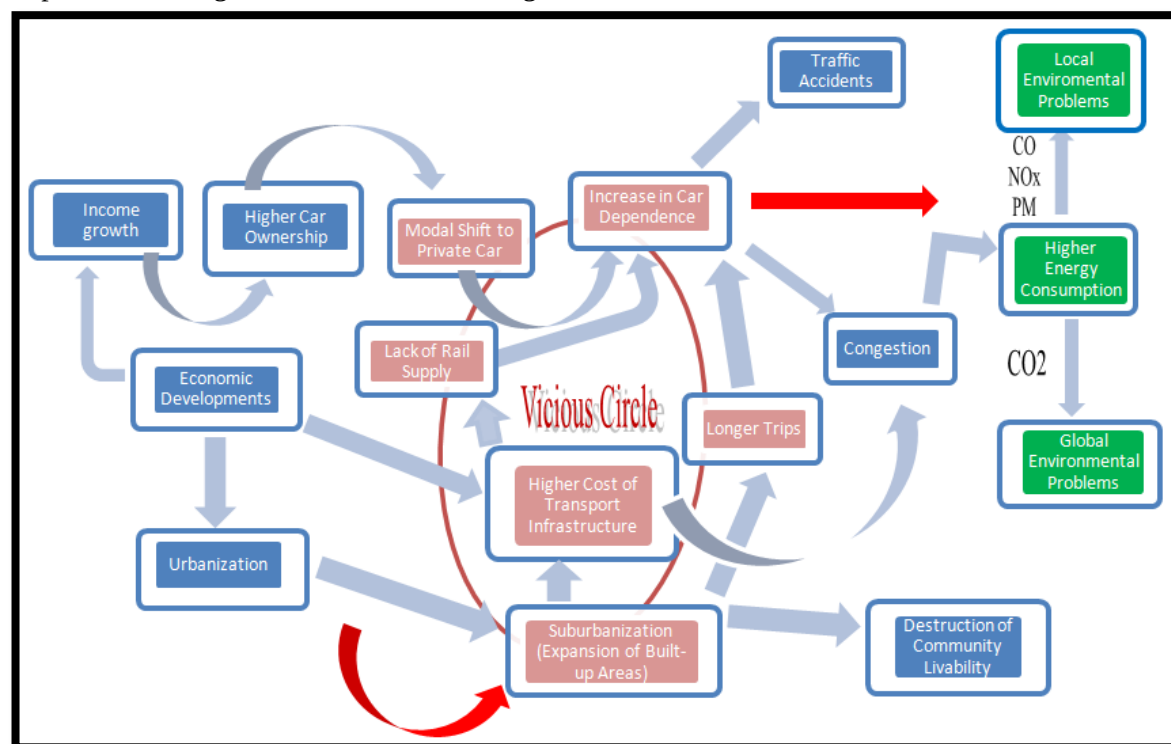


Figure 6: Casualties of detonation in transportation-related environment

Source: Doi & Hayashi, 2005:2.

- Cause and repercussions of transportation-related environment:

Public transportation services in Asian cities are road-bound in the sense that they tend to depend on buses and intermediate public transportation modes rather than on rail transit. Intermediate public transportation (IPT) represents the full spectrum of transportation modes, both motorised and non-motorised, that falls between the private car and the conventional bus. This can be regarded as the first characteristic of transportation in Asia.

Most Asian cities lacking rail infrastructures are forced to accept scattered and sprawling developments, resulting in higher dependence on private cars and intermediate public transportation systems. This is a different approach to the one found in most European cities where well-developed railways have contributed towards achieving sustainable transportation systems through the transit-orientated development (Doi & Hayashi, 2005:2, 8, 9).

A number of unsuccessful transportation systems and related problems have been highlighted above. Below are examples of a number of successful transportation systems in cities in order to provide a measure of perspective on possible solutions that can be implemented to resolve transport problems in Asia.

2.3.2 Examples of highly successful interventions and developments in other cities

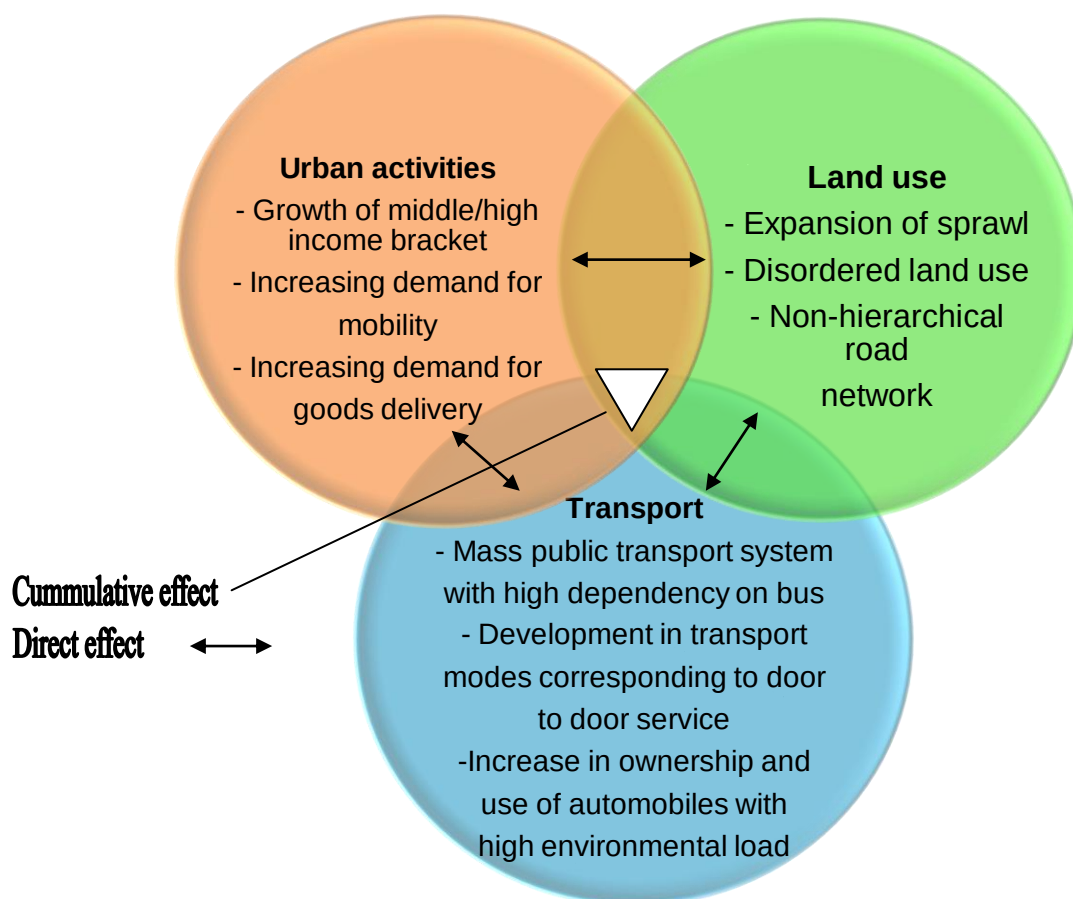


Figure 7: Relationship between transportation, urban activities and land use and its implications

Source: As amended from Doi & Hayashi, 2005:8

In North America, the transportation-orientated development concept has gained widespread acceptance over the last decade as an effective land-use and transportation planning mechanism. It focuses on a) maximising the development potential of transit areas with the highest levels of access by non-car modes of transportation, b) giving priority to people over traffic and more road space to pedestrians, cyclists and public transportation, and c) supporting social inclusion and ensuring equal opportunities for all (Doi & Hayashi, 2005:8, 9).

The cumulative and direct effects of the factors of this effective land use and transportation planning mechanisms are illustrated in Figure 7.

In the 1950s and 1960s, Munich in Germany was one of the most congested cities in Europe. In the late 1960s, a multimodal transportation plan was developed for the city. The plan comprised the development of a regional rail system and an underground rapid transit system. Streets around the city centre were improved and traffic flow in the city centre was impeded, while some of the most congested streets were pedestrianised. By the early 1970s, a 12% shift in modal split in favour of transit occurred for travel into the central area. Since the 1970s, car ownership in Munich has remained high, but the modal split has continued to change in favour of transit usage.

In Washington and Portland, in the United States, transit-orientated developments that aggressively promote transit have experienced an average increase in transit ridership of 58%. Not only has ridership increased in these developments, but there has also been a change in car ownership patterns in these developments. Only 35% of households in transit-orientated developments own two cars, as opposed to 55% for the city as a whole. For

example, the Orenco Station transit-orientated development on the outskirts of Portland has significantly higher transit usage rates than the rest of the region, with 22% of residents regularly using transit as opposed to 5% for the rest of the region (Frieslaar, & Marks, 2007:26).

Already in this early stage of planning, the question arises whether spatial planning objectives should be considered which exceed motorway planning but which include accessibility matters and are therefore able to accelerate or decelerate spatial trends. If one were to focus on the main goal of road planning, one has to abnegate as motorway planning is influenced by today's circumstances, the general congestion and the inadequacy of the network as well as needs of traffic which militate strongly the desirable spatial development (Tschopp & Axhausen, 2008:88).

A regional policy, coordinated at national level and consisting of spatial, agricultural and infrastructure planning (which in particular should include public and individual mobility networks) is crucial during the decades of fastest economic growth, mass motorisation and suburbanisation in such a federal system of government as Switzerland, for example, enjoys.

During the last three or four decades, the Swiss transportation policy has been characterised by sectoral development. Each transportation mode has its own legislation and infrastructure planning as well as a specific method of financing. Public transportation needs are dealt with in five different federal departments and in twenty-five cantons. No authority is able to overlook the overall impact on land requirements, settlement structures, environmental pollution and public finances as well as the co-ordination of transportation regarding its financial aspects (Tschopp & Axhausen, 2008:88).

The notion that Swiss transportation infrastructure might have a strong influence on space and landscape was included relatively late in regional planning considerations. In the initial phase of motorway network planning, the main object was to absorb the massively swollen traffic flows. Nevertheless, aspects of spatial planning were ubiquitous from the first moment on because the early inclusion of the cantons in the decision-making process influenced the motorway network tremendously. Particular interests of the stakeholders such as cantons or urban areas, the desire to secure the best access to the network possible for each region made coordinated planning on a national level extremely difficult (Tschopp & Axhausen, 2008:95).

Transportation helps to shape spatial patterns of development and location remains all-important as space/time relationships have collapsed differentially. Indeed, one could argue that over the last 250 years, the relative disparities in transportation cost and time have widened between the most and least economically developed areas of the world.

Transportation is an enabling technology. Transportation innovations enable the specialisation of production and the division of labour to occur, widening market areas and enhancing opportunities for trade. Mechanized transportation and industrial production facilitated mass production and global and regional trade.

Twentieth century transportation innovations, particularly those pertaining to bulk shipping, containerisation, air transportation and motorised road transportation, have helped to enhance this process of economic interdependence (Knowles, 2006:407, 408).

2.3.3 Transportation modes and systems

In recent years Transportation planning has become more multi-modal and comprehensive, considering a wider range of options and impacts. Transportation planners have started to apply Level-of-Service ratings to walking, cycling and public transit, and to consider demand management strategies as alternatives to roadway capacity expansion (Litman, 2009:5).

The level-of-service ratings pertain to the green transportation hierarchy laid out in table 2 below.

Table 2: Typology of transportation hierarchy

Green transportation hierarchy	
1.	Pedestrians
2.	Bicycles
3.	Public transportation
4.	Service and freight vehicles
5.	Taxis
6.	Multiple occupant vehicles
7.	Single occupant vehicles
<i>The green transportation hierarchy favours more affordable and efficient (in terms of space, energy and other costs) modes.</i>	

Source: Litman, 2009:5

Illustrated below in Table 3 are the different modes of transportation relative to the costs, limitations and density needs required. With reference to this table, comparisons between modes can be examined and the relevant information used to apply these modes where best applicable within cities.

Table 3: Model profiles

Mode	Availability	Speed	Density	Loads	Costs	Potential users			Limitations	Appropriate uses
	Portion of locations and times served	Typical speeds	Space requirements	Ability to carry baggage	User costs	Non-drivers	Poor	Handicapped		
Walking	Wide (nearly universal)	2-5 mph	High	Small	Low	Yes	Yes	Varies	Requires physical ability. Limited distance and carrying capacity. Sometimes difficult or unsafe.	Short trips by physically able people
Wheelchair	Limited (requires suitable facilities)	2-5mph	Medium	Small	Med.	Yes	Yes	Yes	Requires suitable sidewalk or path. Limited distance and carrying capacity	Short urban trips by people with specific physical disabilities.

Bicycle	Wide (feasible on most roads and some paths)	5-15mph	Medium	Small to medium	Med.	Yes	Yes	Varies	Requires bicycle and physical ability. Limited distance and carrying capacity.	Short to medium length trips by physical able people on suitable routes.
Taxi	Moderate (in most urban areas)	20- 60 mph	Low	Medium	High	Yes	Limited	Yes	High costs and limited availability.	Infrequent trips, short and medium distance trips.
Fixed Route Transit	Limited (major urban areas)	20-40 mph	High	Small	Med.	Yes	Yes	Yes	Limited availability. Sometimes difficult to use.	Short to medium distance trips along busy corridors.
Para transit	Limited	10- 20 mph	Medium	Small	High	Yes	Yes	Yes	High cost and limited service	Travel for disabled people
Auto driver	Wide (nearly universal)	20- 60 mph	Low	Medium to large	High	No	Limited	Varies	Requires driving ability and automobile. Large space requirements. High cost.	Travel by people who can drive and afford an automobile.
Ride sharing (auto passenger)	Limited (requires motorist, matching service)	20- 60 mph	High	Medium	Low	Yes	Yes	Yes	Requires cooperative motorist. Consumes driver's time if a special trip (chauffeur).	Tips that the driver would take anyway (ridesharing). Occasional special trips (chauffeur).
Car sharing (vehicle rentals)	Limited (requires nearby service)	20- 60 mph	Low	Medium to large	Med.	No	Limited	Varies	Requires convenient and affordable vehicle rentals services.	Occasional use by drivers who don't own an automobile.

Motorcycle	Wide (nearly universal)	20- 60 mph	Medium	Medium	High	No	Limited	No	Requires riding ability and motorcycle. High fixed cost.	Travel by people who can ride and afford a motorcycle.
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Source: Litman 2009:6

Multi-modal transportation planning is a complex process, because modes differ in various ways, including their availability, speed, density, costs, limitations, and most appropriate uses. They are not equal substitutes; each is only appropriate for specific users and uses. Similarly, public transit (also called public transportation or mass transit) includes various types of services and vehicles. Table 4 below summarises the performance of various types of public transit. Actual performance depends on specific circumstances; for example costs per trip can vary depending on which costs are included (for example, whether major new road or rail improvements are required, whether park-and-ride facilities are included in transit budgets, construction and operating costs, load factors and types of trips (Litman, 2009:8).

Table 4: Transit modes compared

Name	Description	Availability	Speed	Density	Costs
		Destinations served	Passenger travel speeds	Passenger volumes	Cost per trip
Heavy rail	Relatively large, higher speed trains, operating entirely on separate rights-of-way, with infrequent stops, providing service between communities	Limited to major corridors in large cities	High	Very High	Very high
Light rail Transit (LRT)	Moderate size, medium-speed trains, operating mainly on separate rights-of-way, with variable distance between stations, providing service between urban neighbourhoods and commercial centres.	Limited to major corridor	Medium	High	High
Street cars (also called trams or trolleys)	Relatively small, lower-speed trains, operating primarily on urban streets, with frequent stops which provide service along major urban corridors	Limited to major corridors	Medium	High	High

Fixed route bus transit	Busses on scheduled routes	Widely available in urban areas	Low to medium	High	Low to medium
Bus rapid transit (BRT)	A bus system with features that provide a high quality of service.	Limited to major corridors	Medium to high	High	Low to medium
Express bus	Limited stop bus service designed for commuters and special event	Limited to major corridors	High	High	Low to medium
Ferry services	Boats used to Transportation people and vehicles.	Limited to major corridors	Low to medium	Low to medium	Medium to high
Para transit	Small busses or vans that provide door-to-door, demand-response service.	Widely available	Low	Low	High
Vanpool	Vans used for ridesharing.	Widely available	Medium to high	High	Low
Shared taxi	Private taxis that carry multiple customers	Limited to busy corridors	Medium to high	Low to medium	Medium to high
Taxi	Conventional taxi service.	Widely available	Medium to high	Low	High

Source: Litman 2009, p. 9

❖ Automobile dependency and multi-modalism

Automobile dependency refers to transportation and land use patterns that favour automobile travel and provide relatively inferior alternatives. Its opposite, multi-modalism, refers to a transportation system that offers users diverse transportation options that are effectively integrated, in order to provide a high degree of accessibility even for non-drivers. Table 5 compares automobile dependency and multi-modal Transportation systems (Litman, 2009:12).

Table 5: Auto dependency and multi-modal transportation compared

Factor	Automobile dependency	Multi-modal transportation
Motor vehicle ownership	High per capita motor vehicle ownership.	Medium per capita motor vehicle ownership.
Vehicle travel	High per capita motor vehicle mileage.	Medium to low vehicle mileage.
Land use density	Low. Common destinations are dispersed.	Medium. Destinations are clustered.
Land use mix	Single-use development patterns.	More mixed-use development.
Land for Transportation	Large amounts of land devoted to roads and parking.	Medium amounts devoted to roads and parking.
Road design	Emphasizes automobile traffic.	Supports multiple modes and

		users.
Street scale	Large scale streets and blocks.	Small to medium streets and blocks.
Traffic speeds	Maximum traffic speeds.	Lower traffic speeds.
Walking	Mainly in private malls.	Mainly on public streets.
Signage	Large scale, for high speed traffic.	Medium scale, for lower-speed traffic.
Parking	Generous supply, free.	Moderate supply, some pricing.
Site design	Parking paramount, in front of buildings.	Parking sometimes behind buildings.
Planning practices	Non-drivers are a small minority with little political influence.	Planning places are high value on modal diversity.
Social expectations	Non-drivers are stigmatised and their needs given little consideration.	Non-drivers are not stigmatised

Source: Litman 2009:12

❖ The following are recommendations for multi-modal transportation planning:

- ◆ Consider a variety of transportation improvement options, including improvements to various modes, and mobility management strategies such as pricing reforms and smart growth land use policies. Also, one should consider various combinations of these options, such as public Transportation improvements plus supportive mobility management strategies.
- ◆ Consider all significant impacts, including long-term, indirect and non-market impacts such as equity and land use changes. This should at least include:
 - Congestion
 - Roadway costs
 - Parking costs
 - Consumer costs
 - Traffic accidents
 - Quality of access for non-drivers
 - Energy consumption
 - Pollution emissions
 - Equity impacts
 - Physical fitness and health
 - Land use development impacts
 - Community liveability

Furthermore,

- ◆ Impacts that cannot be quantified and monetised (measured in monetary values) should be described.
- ◆ Multi-modal comparisons should be comprehensive and marginal, and should account for factors such as transit system economies of scale and scope.
- ◆ Special consideration should be given to transportation system connectivity, particularly connections between modes, such as the quality of pedestrian and cycling access to transit stops and stations.
- ◆ Special consideration should be given to the quality of mobility options available to people who are physically or economically disadvantaged, taking into account universal design (the ability of transportation systems to accommodate people with special needs such as wheelchair users and people with wheeled luggage) and affordability.
- ◆ One needs to indicate impacts with regard to strategic objectives, such as long-range land use and economic development.
- ◆ Also, one should use comprehensive transportation models that consider multiple modes, generated traffic impacts (the additional vehicle traffic caused by expansion of congested roadways), and the

effects of various mobility management strategies such as price changes, public transit service quality improvements and land use changes.

- ◆ People involved in transportation decision-making (public officials, planning professionals and community members) should live without using a personal automobile for at least two typical weeks each year that involve normal travel activities commuting, shopping, social events, etc) in order to experience the non-automobile Transportation system (Litman, 2009:14).

By means of the implementation of these recommendations for multi-modal transportation, the collective improved understanding of the multimodal transportation and public transportation will most likely contribute to the future building blocks in the integration between development and transportation.

2.3.3.1 Privatisation and deregulation

Privatisation and deregulation of transportation can reduce costs, encourage innovation, stimulate demand and create time/space convergence. Deregulated and privatised transportation tends to be market-driven, follows the main demand flows and reinforces what is called “a continuing spiral of metropolitan advantage”. This can create time/ space divergence, especially where places are served via hubs instead of directly and in places which lose services.

Most governments have intervened in the transportation market for many years with a view to safeguard customers and employees by introducing quality and safety controls and often to control the quantity of services to ensure a comprehensive transportation network, regulate the entry of new transportation operators and control fares. Intervention in many cases involved state or municipal ownership of transportation companies

Contestable markets suggested that the free entry or even just the threat of entry, of new operators into the transportation market was the key mechanism to ensure efficiency, price moderation and welfare maximisation. Regulation was believed to be responsible for increasing prices by limiting competition. State and municipal ownership of transportation services was widely viewed as inefficient, bureaucratic and unresponsive to the market. Advocates of transportation deregulation and privatisation agreed that the state should limit its role to ensuring fair competition and safe operation of transportation services (Knowles, 2006:419).

2.3.3.2 Transportation’s environmental externalities and sustainability

Sustainability requires comprehensive and integrated planning, which accounts for a broad set of economic, social and environmental impacts, including those that are difficult to measure. Sustainability planning requires adequate stakeholder involvement to allow diverse perspectives and preferences to be incorporated. Sustainability tends to support transportation planning and market reforms that result in more diverse and economically efficient transportation systems, and more compact land use patterns that reduce automobile dependency. These reforms help increase economic efficiency, reduce resource consumption and harmful environmental impacts, and improve mobility for non-drivers (Litman & Burwell, 2006:346).

Many investments made in transportation routes and terminals and new transportation modes with a view to meet the growing demand for movement of people and freight have paid little regard to its sustainability or its impact on the environment until the 1980s. By that time, concerns began to grow about the effects of transportation such as air pollution, accident toll, noise and degradation of the landscape and its reliance on non-renewable fossil fuels. Environmental impact assessments (EIA) became a formal requirement after 1985 for all new transportation routes and terminals within the European Union with mitigation measures required to lessen environmental externalities (Hunter *et al.*, 1998). Strategic environmental assessment (SEA) of the environmental consequences of transportation policies are believed to help encourage the introduction of less environmentally harmful policies (Knowles, 2006:420).

Over the last two centuries, transportation systems have developed from small to large in scale; from slow to fast, simple to complex, ad hoc to standardised and rigid to flexible. Time/space and cost/space have both collapsed differentially –especially over the last 50 years. It was found that small but incremental changes can have significant consequences for time/cost-space convergence or divergence whilst response lags and inefficient decision making retard change. Collapses in time/space and cost/space are due to innovations in air, rail, road and sea transportation technology, communications and handling technology.

These differential spatial effects reflect a more unequal world and are largely due to unequal investment in modal capacity, routes and terminals at local, national and international scales. This tendency tends to enhance the importance of the largest demand centres in developed countries and of nodal centrality and intermediacy.

At a time when personal mobility, inaccessibility of dispersed activity sites for the car-less and socially excluded and environmental externalities of transportation are becoming big issues in other disciplines, it is time that environmental managers/geographers, and in particular transportation geographers, made the most of their intellectual property (Knowles, 2006:423).

In recent years, transportation planning has expanded to include more emphasis on non-automobile modes and more consideration of factors such as environmental impacts and mobility for non-drivers. One indication of this shift is that over the last two decades, many highway agencies have been renamed transportation agencies, and have added departments and experts related to environmental analysis, community involvement and non-motorised planning. Transportation modelling techniques are improving in their pursuit to account for a wider range of options (such as alternative modes and pricing incentives) and impacts (such as pollution emissions and land use effects). In addition, an increasing portion of transportation funds are flexible, meaning that they can be spent on a variety of types of programs and projects rather than just roadways (Litman, 2009:2).

Since the publication of the UN report “Our Common Future” (World Commission on Environment and Development, 1987), the issue of sustainable development has been a common challenge for all nations. Sustainable mobility is understood as mobility in accordance with the general principles of sustainable development, involving, among other things, a volume of physical mobility, a modal split and a transportation technology that meets basic mobility needs in an efficient way, takes care of ecosystem integrity, limits emissions to an environmentally sustainable level and is safe and consistent with human health (Naess, Naess, & Strand, 2010: 113,114).

2.4 Environmental and development relationship

The Hermanus, Cape Town and Eden Municipalities all have large and bio-habitually important natural environments of *fynbos*, and that comprises of coastal zones and natural mountainside areas. In this section, the literature about environmental issues concerning development and transportation will be reviewed with reference to how these issues should be approached.

“Environmental management is a field that is rapidly growing in importance as a discipline on its own” (Kidd, 2008:3).

The field of environmental management entails the process of handling, supervising or administering the relevant environment in order to achieve a desired outcome, which in the case of this study is the integration between spatial development and transportation planning.

- ❖ The question as to why transportation planning should be linked to environmental processes can be answered as follows:

- **Relationship-building:** By enhancing inter-agency participation and co-ordination efforts and procedures, transportation planning agencies can establish more positive working relationships with resource agencies and the public.
- **Process efficiencies:** Improvements to inter-agency relationships may help to resolve differences on key issues as transportation programmes and projects move from planning to design and implementation. Conducting some analyses during the planning stage can reduce duplication of work (such an approach would lead to reductions in costs and time requirements, thus moving through the project development process faster and with fewer issues).
- **On-the-ground outcomes:** When transportation agencies who conduct planning activities are equipped with information about resource considerations and in co-ordination with resource agencies and the public, they are better able to conceive of transportation programmes and projects that will serve the community's transportation needs effectively. This can reduce negative impacts, and will tend to entail more effective environmental stewardship.

Planning and environmental linkages in decision-making processes are depicted by the arrows in Figure 8 below which shows the relationship between transportation and environment planning, as well as the relationship between systems planning and project level decisions.

The concept of sustainability is aimed at accommodating the needs of the present population without compromising the ability of future generations to meet their own needs. When applied to the transportation sector, planning for sustainability can incorporate a variety of strategies with a view to conserve natural resources (including the use of clean fuels), to encourage modes other than single occupant vehicles, and to promote travel reduction strategies. Current trends in transportation contribute towards unsustainable conditions (such as including greenhouse gas emissions, energy insecurity, congestion, and various other ecological impacts). Although widespread uncertainty exists about how to address the goal of a sustainable transportation system, transportation officials and stakeholders are now recognising that their decisions have long-term implications and impacts; therefore, they are directing their attention on how to prepare metropolitan and state-wide transportation plans and programs accordingly. Attaining a sustainable transportation system will require action by the public sector, private companies, and individual citizens (U.S. Department of Transportation, 2007:34, 35).

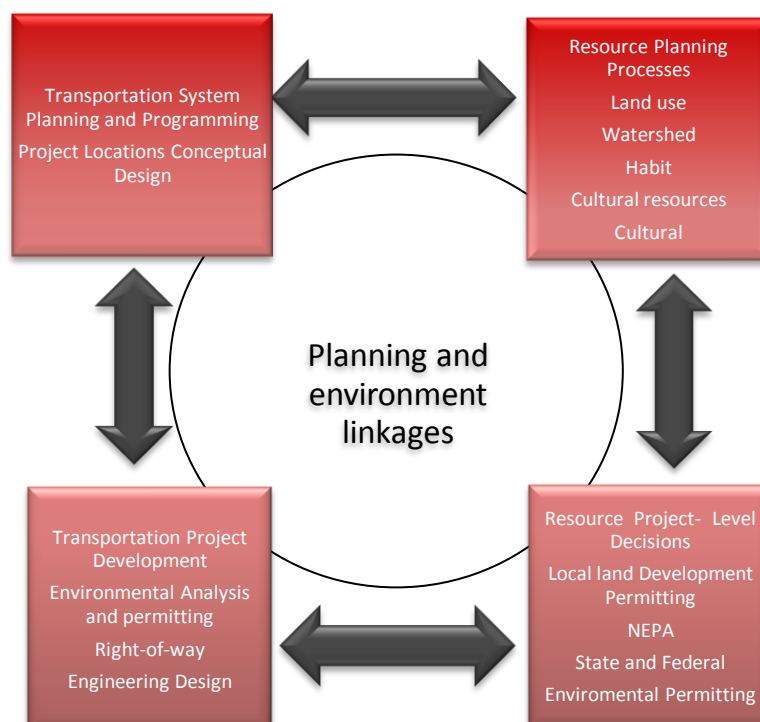


Figure 8: Planning & environmental linkages

Source: U.S. Department of Transportation, 2007: 34

2.4.1 Environmental instruments from international standards and perspectives

Environmental impact assessment (EIA) has been successfully established World-wide as an effective tool that can be used to address the environmental impacts of project development proposals.

Strategic environmental assessment (SEA) has evolved over the last ten years as an appropriate answer to project development questions. This type of assessment entails taking impact assessment ‘up-stream’ in the decision-making process, with a view to address the impacts of policies, plans and programmes in a preventative manner; it also sets out to identify sustainable development opportunities.

SEA is seen in various forms, one being as an important step towards integrated decision-making, promoting sustainable development by assessing the strengths, weaknesses and therefore the potential of environmental resources to support development (Eggenberger & do Rosário Partidário 2000:201).

At a conference held at Christchurch, New Zealand in 1998 for spatial planners in particular, SEA was conceptualised as a range of “reinventing” procedures and approaches already in place. It was suggested that SEA should be considered as a learning and communicative process which should be developed in such a way as to provide real information and value for decision-makers and affected people. In order to enhance SEA, it would have to be integrated as far as possible into the existing policy, institutional and organisational framework and must be coordinated with initiatives sharing complementary goals.

In the case of the coastal zones (with reference to the selected areas) environmental issues are of great concern to the respective municipalities.

A coastal zone offers an array of ecosystem goods and services; as a result it has always been a focus of human activities. Historically, it has provided ports for trading linkages to the international market as well as a range of resources. More recently, this association has been driven by the aesthetic appeal of the coast and the recreational opportunities it offers. It is estimated that approximately 45% of the world’s population resides within 150 km of the coast, which is projected to increase to 75% by 2025. This tendency has raised concern regarding human impacts on the coastal environment, particularly through coastal development, which ultimately leads to changes in land cover. Changes in land cover are considered to be the single most important variable affecting ecosystems (Hill, McGregor, Palmer & Paterson, 2010:117).

Environmental impact assessments (EIAs) have been an accepted part of international practice related to development and project planning and development financing since the late 1970s when the USA first instituted environmental assessments in terms of the US National Environmental Policy Act (NEPA). Most industrialised nations around the world have legislation in place that requires environmental impact assessment in one form or another. Environmental management systems (EMSs) have been around in an informal guise for over 50 years, but formal environmental management systems only date back to the first formal EMS, British Standard 7750, which was published in 1992 and shortly followed by its international successor, ISO 14001, in 1996.

International norms and standards dictate that environmental and sustainability factors must be incorporated into business and financial affairs. The Equator Principles, first adopted by ten leading banks from seven countries on 4th June 2003 (drawn up by the international banking and investment sector), require that environmental and sustainability assessments must be undertaken for all major projects requiring loans. The World Bank Group has a detailed set of environmental, health and safety requirements (International Finance Corporation (2004)), which include provision for environmental assessments, which must be complied with as a condition of loans being made.

The combination of EIA and EMS makes sense, as the EIA forms part of the feasibility process which indicates the risk associated with the project and loan, and the EMS provides the lender with the ability to monitor the outcome

of the loan and ensure that risks remain acceptable. From an international perspective, EIA and EMS are combined and form an important part of the risk management process for international commerce and industry.

2.4.2 Environmental assessments and spatial planning

EIA and EMS could be said to fit together like hand in a glove. The best known formal manifestation of an environmental management system is ISO 14001, the international standard for environmental management systems.

Whilst having a formal environmental management system such as ISO 14001, which is a preferred option, other systems can also be used – provided that they include the necessary environmental prerequisites necessary to meet minimum environmental requirements. Those prerequisites should have long-term objectives which include:

- Ensuring continuing compliance with legislation and company environmental policy;
- Achieving, enhancing and demonstrating sound environmental performance;
- Ensuring that environmental issues continue to be integrated into business decisions;
- Rationalising and streamlining environmental activities throughout the lifetime of the development to add value and efficiency;
- Encouraging and achieving a high level of environmental performance and response from all employees, contractors and suppliers;
- Providing the standards for overall environmental planning, operation, audit and review; and
Enabling management to establish environmental priorities (DEAT, 2005:5, 7, 9).

There is evidence of planning traditions where it is customary to integrate environmental issues and concerns into the planning process. One aspect, however, remains to be demonstrated: whether such planning traditions actually carry out the systematic identification and integrated assessment of alternatives, in participatory contexts, in a way that is informative, and accountable (Eggenberger & do Rosário Partidário, 2000:202,203).

“Planning” as a generic term implies systematically addressing problems and exploring future expectations, by defining goals and new strategies, measures and means to resolve the problems, and identifying actions to follow up. In the context of this research, planning is conceptualised as a rational process used to help attain goals in a most efficient and effective manner, driven by the best possible allocation of resources, according to their suitability and availability.

Spatial planning, as a relevant task of modern society, deals with the pre-emptive co-ordination of human activities with an impact on development. Spatial planning aims to allocate different land-use functions and activities as efficiently and effectively as possible. This allocation is aimed at maximising the ‘benefits/profits’ at a given location.

The need for strategic environmental assessment (SEA) emerged approximately 15 years after environmental impact assessments (EIA), at first largely due to the limitations experienced with project level environmental assessment (Retief, 2008:6).

SEA can play a significant role toward enhancing the integration of sustainability concerns in policy and planning processes, thereby helping to implement sustainable development. SEA can be approached through highly structured and rationalised processes; highly regulated; or result more simply from providing principles and informal procedures and changes in the decision-making process (Eggenberger & do Rosário Partidário, 2000:203).

Herein also lies a significant distinction in that planning follows a “bottom-up” approach, while environmental assessment is governed from the provincial level downwards. Therefore, while policy seems to have been well aligned, institutional arrangements and approaches are markedly different.

It is evident that SDFs provide a link between land use management and integrated development planning. Integrating environmental considerations with SDFs could potentially make a significant contribution towards more sustainable development and land use patterns (Retief, 2008:11).

2.4.3 Public transportation and the environment

➤ Environmental benefits of using public transportation

Using public transportation is a great way for people to contribute toward a cleaner environment. Given the proportion of South Africa’s total carbon emissions that can be attributed to private cars, there is a very strong need for investing in public transportation to mitigate the effects of these emissions.

The South African National Roads Agency Limited (SANRAL) also plays a role in preserving the environment by providing and managing a sustainable national road network, while keeping environmental issues clearly in mind (The South African National Roads Agency Limited, Horizon Twenty Ten). By removing cars from our roads in favour of public transportation, air pollution from private vehicles could be reduced dramatically, with obvious health and economic benefits to all. In addition, reducing pollution is essential to preserving South Africa’s unique natural environment. Increasing the use of public transportation would not only contribute to a cleaner environment and improved living standards, but would have long-term economic benefits as well, which indeed makes public transportation the way forward (Gqaji, 2011:30, 32, 33, 34).

2.4.4 Integration

Approaches to environmental impact assessment have recognised the need for integration from the outset. The trend into the 21st century is certainly towards greater integration of policies, approaches and measures. Integration, however, is difficult to achieve.

Perhaps the only way to get around this problem and improve the human integration capacity is by allowing environmental assessment to take place at different levels of decision-making, integrated with other mechanisms, rather than just as an end-of-the-pipe assessment. The involvement of the different stakeholders in this process is very important, as much as the different planning and impact assessment practices that can strongly influence the perception of what constitutes key integrative issues and priorities (Eggenberger & do Rosário Partidário, 2000:205).

2.5 Nodal and corridor development

Below follows an overview of the development of nodes and corridors as well as a number of issues pertaining to the corridor approach. This section of the research sets out to establish whether the implementation of node and corridor approaches can help to solve some transportation and development problems within three study areas.

2.5.1 The starting point

The Industrial Development Corporation (IDC) states that *“corridors of development are defined by the complex and diversity of activity, which are generally supported by other spatial strategies, such as nodes, economic spines and individual clusters”* (Kleynhans, 2002:96).

As a starting point, one can imagine corridors to be bundles of infrastructure that link two or more urban areas (or nodes). These can be highways (sometimes via different routes), rail links (high-speed trains, intercity lines, local trains or trams), separate bus lanes, cycle paths, canals, short-sea connections and air connections. In general, however, corridor development concerns connections that use different transportation modes (such as car, train, tram, ship, and airplane), and carry both passenger and freight Transportation. (Priemus & Zonneveld, 2003:167).

Such centres are intended to “provide the key focal points of regional employment and in-centre residential development” and to be “key nodes in the regional public transportation system” (O’Hare, 2008:371).

According to several authors, metropolitan-level decentralisation of workplaces and residences is a strong and more or less general tendency in Europe. According to the European Environmental Agency (2006:5), urban sprawl is now a common phenomenon throughout Europe. In post-communist East European countries, urban sprawl is proceeding “at a pace which leaves anything experienced in the west far behind” (Schwedler, 1999:slide 1). Seen from the perspective of sustainable mobility, such urban development is highly problematic (Naess, Naess, & Strand, 2010:114).

Development and transportation corridor planning is a multidisciplinary task which involves collaborative decision-making among stakeholders who often have conflicting values and objectives.

Evaluating the best corridor alignments is a complex process that involves many decision-makers and stakeholders. Integrating current and future transportation scenarios with future planned development, as presented in long-term plans, plays a vital role in accessing the benefits, costs, efficiencies, and impacts of planned transportation improvements as well as the performance of the planned system with improvements (Dumass, Nobrega, O’Hara, & Sadasivuni, 2009:623).

Nodes and corridors are interlinked to each other. Improvement of “green” functions of these is needed both in and around the corridors. Similarly, space should be created at nodes for a broad range of residential and work environments, interspersed with green areas. This arrangement would lead to greater variety of nodes, while at the same time maintaining open natural areas and water for recreation and for use as buffers between the cities within and between the corridors (Priemus & Zonneveld, 2003:172).

This process will require the identification and establishment of appropriate development corridor (DC) management institutions, which can then also assume responsibility for investment promotion and marketing activities. The establishment of such corridor management institutions is the joint responsibility of the participating governments (national, provincial and/ or local) and the private sector, as well as requiring the support of donors.

Such an approach would need to commence on the scoping and packaging of “anchor” economic and infrastructure projects in the development corridors, not only to facilitate marketing but also to optimise linkages (densification) into the local, national and regional economies (Thomas, 2009:5).

Project development should be done by technical experts in the areas concerned, by means of feasibility studies and cost-benefit analyses. Where project developers are not available, assistance and finance through donor resources will be the key. Several project preparation facilities exist to perform this type of work, but individually and collectively they do not control adequate resources to meet the kinds of demands that these DCs hope to generate.

NGOs and aid agencies whose task it will be to engage with local government and community-level entities in the development corridor process, primarily to support and facilitate maximum socio-economic impact via coordinated strategies and initiatives in the densification.

The value of such an approach is lodged in its ability to:

- address the need for effective investment prioritisation;
- provide linkages to and synchronise private sector economic investment project opportunities with key infrastructure projects;
- promote wider development potential (through densification strategies and clustering) catalysed by infrastructure provision and anchor investments; and
- Provide a spatial focus to optimise regional economic development and integration.

(Thomas, 2009:6).

The development of corridors over the course of time has reflected technological advances in transportation modes, and the construction legacy of different varieties of infrastructure.

The consequence of historical development is not only that cities are currently situated at a node (or better: nodes) of different kinds of infrastructure, but also that these infrastructure nodes are laid out differently vis-à-vis the cities and each other; this fact has seriously compromised the interconnectivity and interpretationalism of various traffic networks (Priemus & Zonneveld, 2003:167, 168).

Global city regions are defined as “enormous expanses of contiguous or semi contiguous built-up space surrounded by hinterlands of variable extent (and) marked by ramifying local institutions and an increasingly distinctive political identity, and, concomitantly, by a growing self-assertiveness on the global stage” (Scott 2008:31).

Hesse and Rodrigue (2004) suggest that logistics activities are located in and around the large physical nodes of seaports and airports, but are also found at inland centres in the suburbs and in hinterland corridors beyond the edge of a metropolitan area (O'conner, 2010:345, 355).

2.5.2 Nodal development patterns (structures)

“Nodal development patterns” are based on a multi-modal higher intensity development pattern for selected node areas in the study area. Development would be concentrated in and around the transportation master plan development nodes established by the transportation master plan.

These development nodes call for the provision of “a mix of uses and densities which can support transit and other modes including walking and bicycling along multi-modal travel corridors” (Staley/ Rising Road Corridor Study, 2009: Appendix 4:10). Such nodes should have a strong mix of uses.

Nodes should also integrate the modal integration of transit, pedestrian and bicycle facilities and with public open spaces, and a mix of housing choices. Transportation improvements should be planned ahead of time in order to coincide with the time frames for development. Improvements should reflect multi-modal corridors which facilitate all forms of transportation and should be constructed to include transit stops of varying sizes depending on a nodes development pattern (Staley/ Rising Road Corridor Study, 2009: Appendix 4:10).

2.5.3 Corridor development patterns (structures)

Corridor development patterns tend to follow a linear progression of development. This allows for a balanced approach to growth in the area by dispersing development and the future population.

Such a development pattern would still have similar elements found in the nodal scenario; i.e. multi-modal travel routes, mixed use development, public open spaces, and the like, but would have slightly lower density developments to disperse the population along each corridor (Staley/ Rising Road Corridor Study, 2009: Appendix 4:10).

2.5.4 Planning urbanisation

The use of corridors as a planning concept is, in fact, rather old. About a century ago, linear city models were presented as alternatives for the densely populated, concentric industrial city. Nevertheless, history tells us that urbanisation in the shape of linear and fragmented development has taken place on a grand scale (Priemus & Zonneveld, 2003:168).

Technological innovations clearly made this possible, first with the arrival of tram and railway lines and electricity, and later on with the internal combustion engine and the private car. However, the private car made decentralisation in entirely fragmented patterns possible, although a measure of clustering is often still discernable at a higher level of scale. The corridor concept thus forms part of the ongoing debate on patterns of urbanisation and urban spatial structure (Priemus & Zonneveld, 2003:168).

In regional policy, there used to be a firm belief that enhancing the level of connectivity would stimulate the economic performance of regions lagging behind. This was linked in part to the expectation that certain areas and regions would profit more from integration than others, and that there will also be some clear losers. Geographical location has a lot to do with this, so it was assumed (Priemus & Zonneveld, 2003:169).

All the various strands of thinking and emerging policy issues focused on the idea of linkages have been brought together under the umbrella of the (mega) corridor concept. Thus, behind this “policy scenario” lies the assumption that (new) infrastructure is of crucial importance— maybe even decisive—when it comes to competitiveness (Priemus & Zonneveld, 2003:169).

- The corridor as an infrastructure axis

In this context, the corridor is defined in terms of transportation. A corridor is used in this sense by the Department of Transportation, Public Works and Water Management when developing or improving (interconnected) infrastructure modalities on a particular route. A simultaneous approach to the various modalities within a corridor offers important advantages, such as opportunities for bundling, and with these, a reduction in further criss-cross traffic.

- The corridor as an economic development axis

Here, an implicit or explicit relationship is supposed between opportunities for economic development and major traffic axes. This point of view assumes that the spatial results of functional economic activities are strongly determined by the infrastructure network.

- The corridor as an urbanisation axis

In this context, the infrastructure network functions as the basis for the directions of future urbanisation for residential and work activities. This view is related to the aim of supporting public transportation infrastructure and is the approach used by the Ministry of Transportation, Public Works and Water Management

All three of the above interpretations of the corridor concept are, in fact, good examples of what could be referred to as ‘implicit theory’. The assumption is that traffic and infrastructure are not only derived from social and economic processes, but to a high degree also determine these functions. Following this logic, corridors have a considerable impact on spatial developments and spatial patterns. Companies (especially those operating in the realm of distribution and logistics) find areas through which large volumes of passenger and freight transportation pass particularly attractive as locations. It is at this point that spatial policy is playing—or will have to play—an important role (Priemus & Zonneveld, 2003:173).

2.5.5 Strengthening the development of prominent nodes

The principle of strengthening the development of prominent nodes is not always at work in development corridors. However, it seems as if by promoting the development of major metropolitan nodes, the development of activity corridors linking such nodes can be further strengthened between such nodes.

For urban development corridors, typical design elements incorporated into a development corridor concept include, amongst others, those identified design elements schematically illustrated in Figure 9 and further summarised below:

- Economic activity nodes: Economic activity nodes (central business districts, neighbourhood centres, industrial parks, office parks) as urban elements are often used as economic anchors for the establishment of development corridors between such nodes;
- Direct public transportation links between economic activity nodes: Development corridors, especially the urban development corridors, are characterised by the design of a supportive integrated public transportation system. The most prominent part of the integrated public transportation system seems to be the part that links one economic activity node with the other, since the rest of the system is planned to feed into or support the movement towards the link between the economic activities;
- Activity (accessibility) links: An activity link is normally established parallel to the main public transportation link with a view to enhance access to job creation in a single trip found between the economic activity nodes;
- Mixed land use: Mixed land use is normally promoted next to the activity links;
- Higher density residential development: To create the appropriate levels of thresholds needed for both the public transportation systems as well as economic activity next to the activity links, a higher residential density-zone next to the activity link is a key to the success of establishing proper operating development corridors;
- Mobility links: Higher and lower order mobility links are established parallel to the other end of the corridor or within the development corridor, respectively;
- Accessible public facilities: Public facilities often form some of the most known bases to encourage the need to travel. It is therefore argued that these facilities should be established within or close to public transportation corridors in order to reduce the need to travel far distances;
- Open spaces: This design element is regarded as an essential element of the concept, as it is regarded as a main ingredient to promote environmental sustainability, easy access to recreation opportunities and the overall productivity of the city population. In South Africa, urban farming is also incorporated as part of this element; and
- Urban edges: Urban edges in the form of rural areas, natural areas and farmland are used to promote growth towards the development corridor (Kleynhans, 2002:83-87).

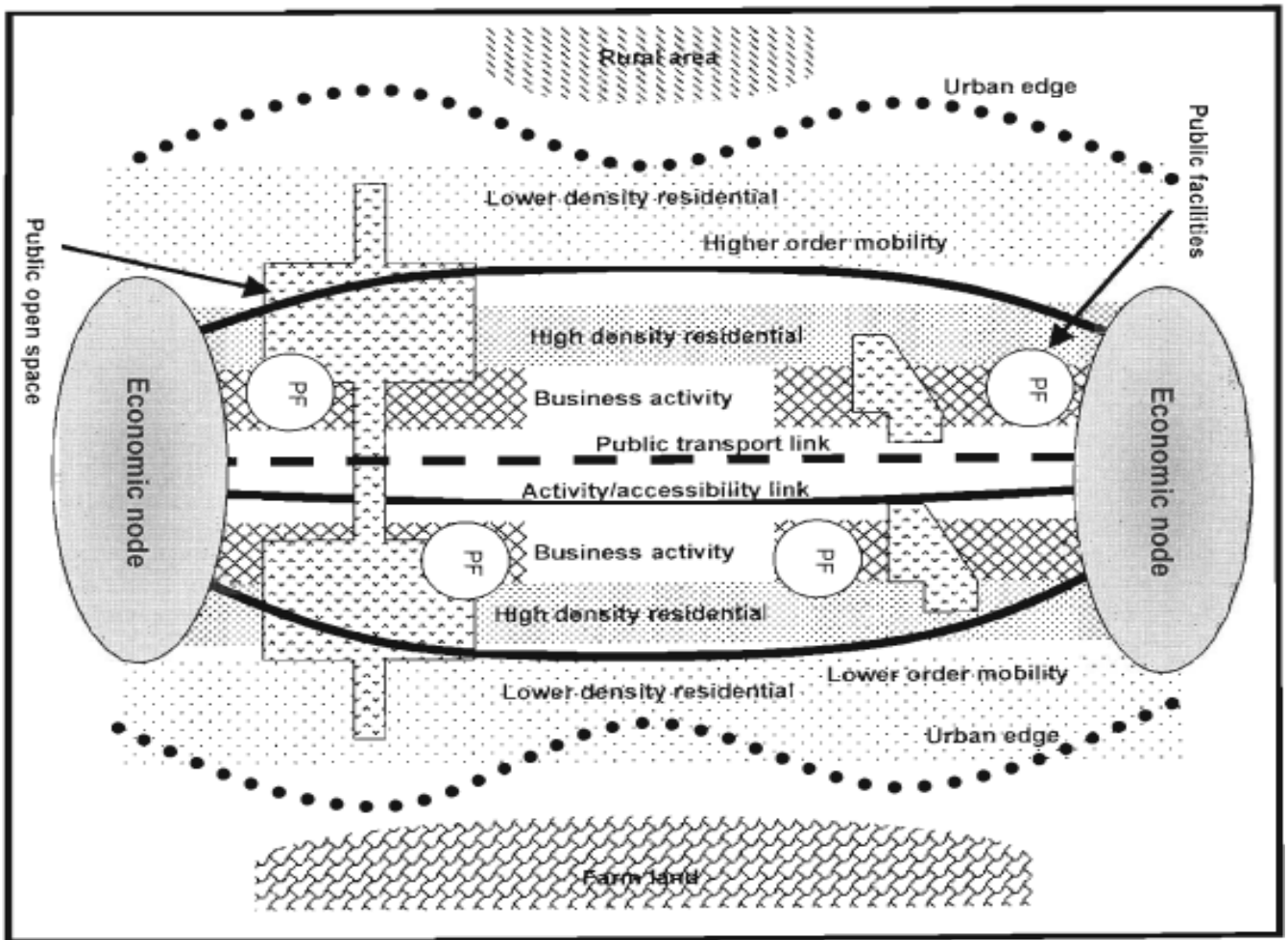


Figure 9: A schematic illustration of design elements for urban development corridors

Source: Kleynhans, 2002:87.

The application of the above-mentioned design elements (as proposed for the implementation of urban development corridors), will allow for the integration of a transportation system with land use that can contribute to the future integration between spatial development and transportation. The use of nodal and corridor planning perspective could also in future contribute towards the integration of spatial development instruments and integrated transportation plans by improving governance structures with respect to infrastructure, urbanisation and economic development.

2.5.6 Corridor challenges

When one observes the development of traffic infrastructure and the dynamics of mega corridors between urban areas, one becomes aware of a number of specific challenges:

- How should long distance and short distance traffic be regulated? Increasingly, the solution to this question is being sought in disentangling the infrastructure of these two traffic types. For example, one can levy fees for long-distance traffic (e.g. toll roads or road pricing), and for short-distance traffic during parts of the day with high congestion. In general, this entails the optimisation of the traffic infrastructure.

- How can one prevent corridor development from taking place at the expense of existing urban centres? Furthermore, how can one prevent infrastructure networks from fragmenting the open countryside and damaging natural areas? In addition, how can the spatial quality of landscapes and the biodiversity and ecological significance of natural areas be guaranteed with the development of corridors? These issues will require one to gain further insight into the location and logic of green–blue networks (the dimension of ‘blue’ is used because of the increasing relevance of water systems for spatial planning and green refers to natural green areas), and prioritising these as much as possible over traffic network routes. Where conflicts arise, underground infrastructure or stacking (e.g. eco-flyovers) may offer a way out.
- Corridors situated between urban regions usually cross municipal borders, regional borders and even national borders. These necessitate the coproduction of policy between municipalities, regional authorities and national governments, and also between different sectors: spatial planning, housing, economic affairs, agriculture, environment and transportation. Particularly, differences in regulation and policy practices between nations must be overcome. Successful examples of multi-level governance, policy coproduction and multi-actor systems can offer guidance in this regard.

(Priemus & Zonneveld, 2003:174-175).

The opinion is that the development of major new regional economic activity nodes in close proximity to presently peripheral low income areas is an essential element of development corridors (Kleynhans, 2002:81).

Corridor development in particular demands an improvement of the governance structure with respect to infrastructure, urbanisation and economic development. Priemus and Zonneveld argue that corridor development clearly requires an improvement in the co-ordination between various policy areas: an improvement in the co-ordination between different policy sectors and segments of society; an improvement in cooperation between public and private organisations; improvement in co-ordination at the cross-border level (because corridors do in fact cross borders); and finally, an improvement in the co-ordination between central and local governments. Corridors refer to areas which require efforts to arrive at an integration of a multitude of social interests. In this sense, a corridor is neither a sectoral nor a spatial concept, but rather the indication of a challenge: that of improving the governance of infrastructure and area development (Priemus & Zonneveld, 2003:176).

Given the inevitable constraints on funding and other resources, it is essential for local authorities to direct their efforts and funding to those corridors where development will have the greatest impact on urban restructuring, the use of public transportation, economic growth, environmental improvement and the amelioration of negative environmental impacts. It is recognised that decisions on the allocation of resources are ultimately taken at the political level, but appropriate technical analysis needs to be conducted so that these decisions are taken within a rational and coherent framework which ensures appropriate trade-offs and maximises the overall public good. Maintaining a balanced and sustainable approach to development of corridors requires a prioritization system based on economic, public Transportation, environmental, spatial and social factors (Green, Aberman & Dominik, 2002:10).

2.6 Conclusion

The literature review presented in this chapter focused on the integration of transportation plans and spatial development frameworks. Four issues were taken as departure points in this regard: an international/global perspective concerning integration, public transportation, environmental management, and nodal and corridor development. Using this perspective, a framework for planning has been established which can serve as a basis for comparison to the South African perspective.

2.6.1 Main results of literature review process

The literature has identified some correlating goals between each of the departure points. These goals have been placed into a matrix with the points of departure illustrate show the results.

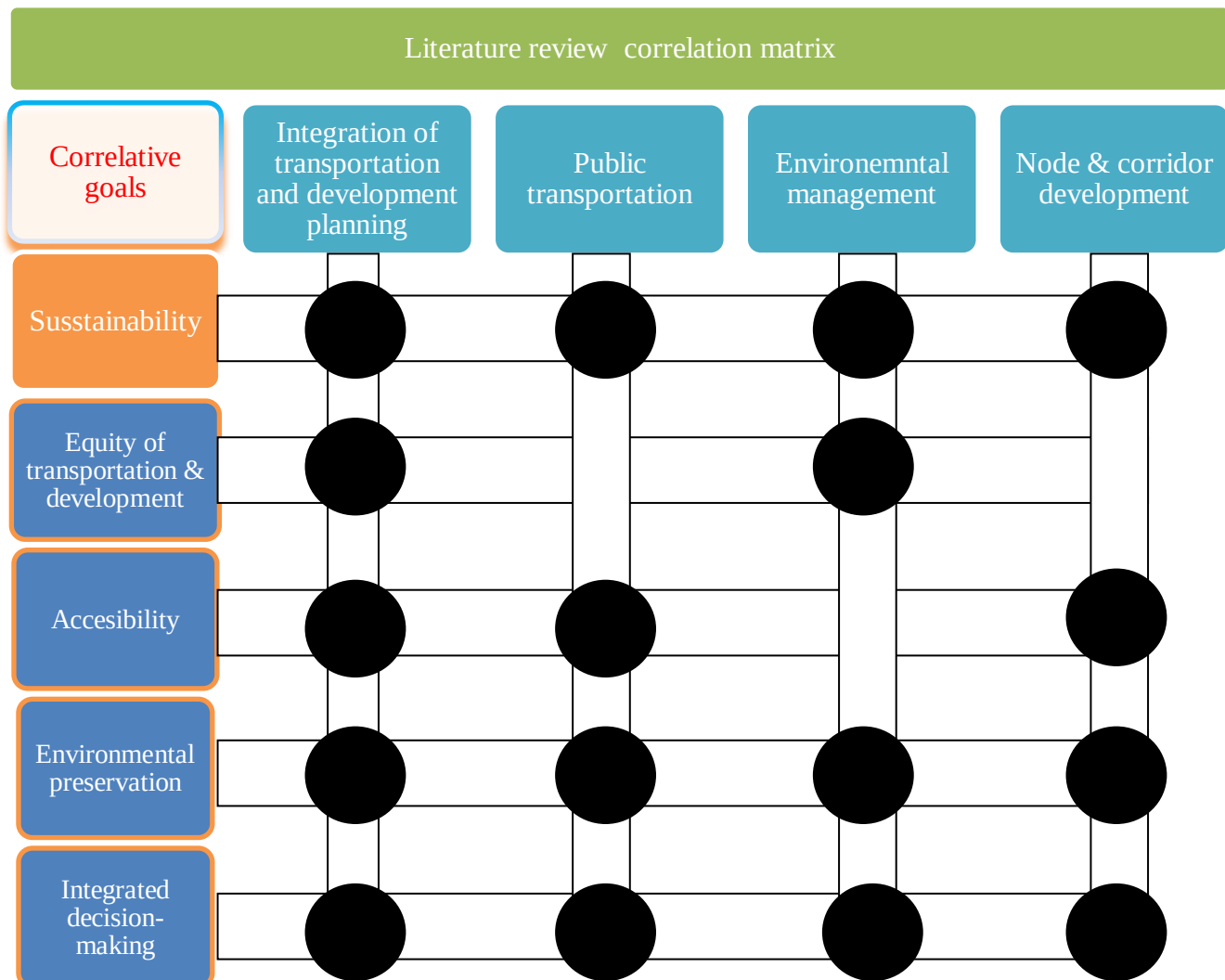


Figure 10: Literature review matrix

Source: Own construction

2.6.2 Discussion of the results of the literature review

From the matrix above, it becomes clear that there is a strong correlation between some of the goals and some of the departure points.

The strongest correlation as shown in the matrix is between

- Sustainability,
- Environmental protection and
- Integrated decision-making.

As indicated in the literature, these goals are essential in order to achieving the best possible outcome of each of the departure points.

The components of transportation and spatial development are a main theme throughout the literature. For the success of achieving the best integration decision making to enhance sustainability is at the forefront including the integration of environmental protection.

Public transportation is a key element regarding the preservation of the environment. As seen in the literature case studies, the correct implementation of public transportation can lead to better and more sustainable and development and better integration. The implementation of public transport will result in a decrease in pollution through a decrease in private car ownership and an increase in less environmentally harmful transport nodes.

It was found in the literature that the implementation of environmental management practices can help to prevent or manage urban sprawl. Through the proper implementation of environmental management, more sustainable transport and development can be achieved and a more integrated decision-making process can be used during the planning process. In this process, the uses of various instruments are of importance. Regarding the notions of a node and corridor development, the literature focuses mostly on sustainability, accessibility, environmental preservation and integrated decision-making.

The literature review also touched on the goal of equity and accessibility. There is little mention in the literature studied regarding the importance of these goals especially concerning the equity within public transport and node and corridor development as well as the enhancement of accessibility concerning environmental management.

Although these goals are not a main concern of the current study, they are points that can be further researched in the future.