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Deliverable 5
Transport and peri-urban communities in India

"Sustainable Settlements in Periurban Areas,"
(Acronym: PERIURBAN)

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Version 6.2 16/01/2006

Executive summary

This deliverable reports on the findings and activities of Workpackage 5 ("Transport") in the EU funded PERIURBAN thematic network. The objective of Workpackage 5 was to review current knowledge, and propose new lines of research, concerning various phenomena related to transport and mobility in peri-urban areas in India. The deliverable thus contributes to the PERIURBAN project's overall objective of understanding peri-urban development in India.

Activities of Workpackage 5 have included: reviews of published research; the hosting of a workshop in Bangalore (in July 2004), which included two "familiarisation" field visits to peri-urban districts near Bangalore; the hosting of a seminar in Leeds (in April 2005); and a session on transport in the PERIURBAN Final Policy Workshop in Delhi in September, 2005.

The deliverable is concerned with the following issues, each of which takes up a chapter: definitions of the peri-urban interface, with particular emphasis upon definitions relevant to transport and mobility; theoretical frameworks (including the Capital Assets Framework and the Sustainable Livelihoods Approach), and their relevance to peri-urban transport analysis; the travel needs and aspirations of peri-urban residents; the role of transport in a wider "land use / transport" context which explains the evolution of peri-urban areas; transport facilities and system performance in peri-urban areas; the impact of transport in peri-urban areas upon natural resources; issues concerned with transport safety in peri-urban areas; institutional issues of relevance to transport in peri-urban areas; and transport policy issues in peri-urban areas.

The final recommendations of the transport session in the Delhi workshop, which can be taken to be the main conclusions of WP5, were divided into two types: concerning "transport policy recommendations" and "recommendations for further research". The policy recommendations were stated in terms of a number of needs for planning authorities: to integrate transport policies with land use policies; to improve access to, and integration between, various types of transport (within peri-urban areas, to nearby cities, and to other cities/states); and to promote facilities for safe non-motorised transport within peri-urban areas.

The following recommendations were made with respect to future research:

- Develop a classification of different types of peri-urban area, based upon the initial classification made within PERIURBAN, and investigate the transport needs and aspirations associated with each type of area (taking into account the characteristics of the city to which the peri-urban area is near)
- Find empirical evidence of the role of public and private institutions (both local and global) in the development of transport infrastructure within peri-urban areas, and connecting peri-urban areas to cities and rural areas. Use this evidence to help build a theory to understand "peri-urban phenomena" within dynamic urbanisation processes.

- Find empirical evidence on the access to rail, road and other transport options, and use this evidence to develop indicators on transport for peri-urban areas.
- Find empirical evidence on traffic safety in different types of peri-urban areas, and to use such evidence to develop appropriate theory for use in accident reduction strategies.

1. Introduction

1.1 Context

This deliverable reports on the findings and activities of Workpackage 5 ("Transport") in the EU funded PERIURBAN thematic network. The thematic network is organised by six core partners, three from India and three from the EU. The Indian partners are The Energy and Resources Institute (TERI), Anna University and the Institute of Rural Management, Anand (IRMA), whilst the EU partners are the Institute for Transport Studies (ITS), the Stockholm Environment Institute (SEI) and the Technical University of Vienna (TUW-IVV). The project has developed a network of practitioners, academics, operators and users within India and the EU.

1.2 Objective

The objective of this deliverable is to review current knowledge, and propose new lines of research, concerning various phenomena related to transport and mobility in peri-urban areas in India:

- travel needs and aspirations;
- the role of transport in a wider "land use / transport" context;
- transport facilities and system performance;
- the impact of transport upon natural resources;
- issues concerned with transport safety
- institutional issues concerning transport
- transport policy issues.

1.3 Workpackage activities

Workpackage 5 carried out the following activities:

- It undertook reviews of internationally available published research on transport, travel and peri-urban areas. The review initially intended to focus only on work conducted in India, but due to the paucity of internationally available literature in these areas it has included relevant work from other parts of the world. Clearly, transferability issues are raised when considering the results from other countries, and these will be discussed further below in Section 1.5. In general, care has been taken in the report to make a clear separation of results from India and results from other areas
- It hosted a workshop in Bangalore in July 2004, involving two different types of activities:
  - presentations by transport academics and practitioners in a standard "seminar" format;
  - two "familiarisation" field visits to peri-urban districts to discuss transport issues with peri-urban residents.
- It hosted a seminar in Leeds in April 2005, attended by EU academics specialising in areas relevant to "WP5 themes".
- The final workshop of PERIURBAN, held in Delhi in September, 2005, included a presentation and discussion about transport policy issues in peri-urban areas.

1.4 Deliverable structure

The deliverable begins by reviewing (in Chapter 2) definitions of "peri-urban", discussing these definitions in the light of the needs of transport and travel analysis. Following this review, a summary is made as to how the various definitions were combined by Deliverable D2 ("A Socio-economic Framework") of the PERIURBAN project (henceforth simply referred to as "Deliverable D2"). Chapter 3 discusses some traditional paradigms in transport analysis, reviews literature on the "Capital Assets Framework" and "Sustainable Livelihoods Approach", and discusses how these theoretical frameworks might be used for understanding transport and travel in peri-urban communities. Chapter 4 reviews literature on the travel needs and aspirations of residents in peri-urban areas, and makes a speculative assessment of how these aims and aspirations might differ according to six different types of peri-urban area. Chapter 5 switches perspective from a person-oriented approach to one of systems analysis, by examining the combined "land use / transport system" for Indian cities, whilst Chapter 6 analyses the transport system in peri-urban areas as an autonomous sub-sector of this overall system. Chapter 7 makes an examination of the specific environmental impacts of the transport system and travel, and transport safety issues in peri-urban areas are considered in Chapter 8. The institutional context for peri-urban transportation systems is described in Chapter 9, whilst Chapter 10 discusses transport policy options for peri-urban areas in India.

1.5 Definitions: peri-urban; travel/transport; households; and transferability

It is firstly necessary to make some comments about definitions:

- Much analysis of "peri-urban" phenomena depends upon how peri-urban is defined. As stated above, the issue of alternative definitions will be discussed in Chapter 2.
- The deliverable differentiates between "transport" and "travel", with transport referring to the transport system available for people to use, and travel referring to the behaviour of people.
- The deliverable frequently refers to "households". These can be composed of one or many people, not necessarily living "under the same roof" (i.e. so that a household might be made up of a group of people living in different houses or even different locations).
- "Transferability" concerns the process by which theory and evidence is transferred from one place to another. In the context of the PERIURBAN project, it is important to remember that evidence gained from one region of India might not be relevant to other regions. Such issues are further complicated by the need to consult literature about peri-urban travel and transport from "non-Indian locations", due to the lack of literature about India.

2. What is the Peri-urban interface?

2.1 Various definitions

A review of the literature shows clearly that the "peri-urban interface (PUI)" has been defined in a number of different ways. Allen et al (1999) identify three general approaches to such definitions:

- The PUI as the Periphery of the City
- The PUI as a Socio-economic system
- The PUI as the Interaction of Rural-urban flows

Discussions of these definitions are provided in 2.2, 2.3 and 2.4, commenting on their appropriateness for discussing transport and travel. Section 2.5 then describes how all the various approaches were combined in PERIURBAN Deliverable D2.

However, before moving on to investigating these definitions in more detail, it is worthwhile quoting from an extremely comprehensive historical review of peri-urban concepts by Germán Adell (1999), which is recommended to anyone with interest in the subject. In discussing work by Dick and Rimmer (1998), who argue that middle-class aspirations and actions are the driving force underpinning the development of peri-urban areas in South East Asia, Adell points out that these authors make no mention of poverty. Such a stance is in direct contrast to the approach taken by most other authors on peri-urban development. Adell points out that whilst Dick and Rimmer "certainly do not completely explain the peri-urban fringe, their theoretical construct *explains a part of the reality* of the peri-urban interface". They continue:

> This problem of localised and partial knowledge and theories dealing with parts of reality is typical of a post-modern approach that considers objects, concepts and models as embedded in discourses that have internal legitimacy and deal in each context and case with a "regional" truth, as opposed to a universal one, commonly underpinning "modern" scientific statements. This epistemological position, nowadays widely approved in social sciences, can be useful to deal with the heterogeneity and multiple forms that take the *peri-urban interface,* once it is accepted first as a theoretical construct.
>
> In this sense, it is useful to bear in mind all the theories and models presented up till now in this paper, as they can be used to explain certain parts of the problem of the PUI. Thus, once their internal coherence has been established, no one of them will be right or wrong in absolute terms, but more or less adequate to conceptualise and explain *fragments* of the reality of these areas. (Adell, 1999: 33-34).

More will be said below about the work of Dick and Rimmer (1998). However, the reason to include the quotation above is to show how different theoretical approaches can (and probably should) be used to explain differing aspects of the PUI.

2.2 The PUI as the Periphery of the City

Peri-urban has traditionally been defined as the edge of the city, the "urban fringe", and thought of as the "spatial transition zone" between urban and the

rural areas. A recent example of this type of approach, using the concept of "footprints", is described by Morello et al (2003) in "Sustainable development and urban growth in the Argentine Pampas Region":

> A distinction is drawn between a city's landscape footprint and what William E. Rees defines as its ecological footprint (Rees, 1992). A city's landscape footprint includes the ecologically productive land, water, and natural and semi-natural landscapes that the city consumes, permanently changing its traditional uses and cover (Morello et al, 1998). It is the imprint of the appropriations and permanent changes of ownership and contiguous territory that the city requires to grow, obtain mineral resources, and dispose waste minerals. The landscape footprint is distinguished from the ecological footprint by contiguousness and border phenomena. The ecological footprint refers to the total area of productive land and bodies of water required on a permanent basis to produce all consumed resources and to absorb all waste materials produced by the agglomeration. Thus, a city has two types of hinterland. (Morello et al, 2003:120)

The authors then conclude that "*Periurban* can be defined as the area of urban and rural interaction where the landscape footprint is made." Thus spatial proximity to urban areas is an essential factor in the definition of peri-urban. This approach seems entirely consistent with a "natural science" analysis of the ecological impacts of urban areas upon their (peri-urban) "landscape footprints". These impacts will be discussed further in Chapter 7 from a transport perspective.

2.3 The PUI as a Socio-economic system

Allen et al (1999) write:

> Other approaches to the conceptualisation of the PUI move away from its physical features and focus on its socio-economic characteristics. "Peri-urban" is understood as a social category, regardless of its spatial dimension, but often related to the fringe of the city. In other words, peri-urban communities are those which have a dual urban-rural orientation in social and economic terms.

Iaquinta and Drescher (2000), in a paper entitled "Defining periurban: understanding rural-urban linkages and their connection to institutional contexts", explain further this approach. In so doing, they outline a classification of five different types of peri-urban area. The motivation for their analysis is the examination of the different types of informal institutional arrangements existing in peri-urban areas. However, the classification they provide is of potential use for a wide range of analytical uses, and will be used in later chapters of this deliverable to examine various transport/travel related issues. They describe this classification as follows:

> [W]e identify five classes of institutional arrangements that arise within the complex continuum from rural to urban and that fall within the range of phenomena that various scholars and practitioners have identified as periurban. Each of these institutional classes is connected to a specific periurban type and hypothesised to arise from a specific demographic process (in parentheses) underlying urbanization.

- Village PU: Network Induced – (Sojourning/circulation/migration)

- Diffuse PU: Amalgamated – (Diffuse migration)
- Chain PU: Reconstituted – (Chain migration)
- In-Place PU: Traditional – (In situ urbanization)
- Absorbed PU: Residual – (Traditionalism with Succession/displacement)

Further descriptions about the categories are provided in Box 2.1.

It can be seen from the information provided in Box 2.1 that only three (or possibly four[1]) of these five categories (i.e. Diffuse PU, Chain PU, and In-Place PU) have spatial proximity to urban centres within their definition, thus confirming that spatial proximity is not essential under this theoretical approach to defining peri-urban.

The paper by Iaquinta and Drescher opens with the statement "Increasingly, policy makers and researchers are acknowledging the potential role urban and periurban environments play in alleviating food insecurity and enhancing the nutritional status of urban poor and marginalized people". Thus the paper can be seen, like much other research into peri-urban issues, to have a "poverty focus" and the five-way classification, described in Box 2.1, should be seen in this light. Given this poverty focus, a further type of peri-urban area, driven by high- and middle-income development, is not included in this classification. Such developments are frequently referred to as "Edge Cities". Such areas are of extreme importance from a transport analysis point of view, since their inhabitants are typically highly mobile and consume a relatively large amount of transport-related natural resources. Axhausen (2000) provides, from a transport planner´s perspective, an interesting review on the literature associated with developments of such areas in the USA, whilst (as mentioned above) Dick and Rimmer (1998) describe such developments for South-East Asia, also foregrounding transport issues.

[1] Absorbed peri-urban (APU) might lie within or near to the urban area

Box 2.1: Classification of peri-urban areas according to Iaquinta and Drescher (2000)

VPU: Village Periurban or Perirural ("Rural" places with "urban" consciousness)

This category refers to areas that are geographically non-proximate to an urban area, yet are experiencing substantial urbanism (i.e., social psychological dimension of urbanization). While such influences can accrue solely through mass media and the diffusion of consumerist ideologies, they are more likely in developing countries to occur vis-à-vis such processes as:

- The inflow of out-migrant remittances,
- Out-migrant infusion of "urban" ideas and modes of behavior,
- Out-migrant infusion of non income resources, and/or
- Out-migrant participation--particularly strategic--in community decision-making.

IPU: In-place Periurban

These areas are proximate to the urban area and result from in-place (in-situ) urbanization. That is, they are in the process of being absorbed *whole*, whether by annexation (actual expansion of the city fringe) or simple reclassification (reflecting de facto urban expansion). In some instances they become more urbanlike under their own power through natural increase and/or rural in-migration. More commonly, they are formed from periurban villages by a combination of those processes combined with in-migration from the nearby urban area. Whichever is the case, because they are being absorbed "whole", such places tend to perpetuate and reinforce the existing power structure and bases of inequality.

CPU: Chain Periurban (In-migration from a single place)

Some areas proximate to the city undergo settlement vis-à-vis a process of chain migration, i.e., the geographic translocation of a village population to a specific locale in the urban periphery. These migrants tend to be the most opportunistic (i.e., risk-taking oriented) members of their original village population, hence most open to change. These areas have a high degree of ethnic homogeneity and numbers sufficient for a critical mass. Consequently, traditional or customary beliefs and institutions tend to be carried to and reconstructed in the new environment, integrating elements of the new surrounding urban institutions. This integration of urban institutions happens to a greater extent for *chain periurban* than for *in-place periurban* areas.

DPU: Diffuse Periurban (In-migration from various places)

A separate category of periurban is comprised of areas proximate to the city, which are settled vis-à-vis in-migration. In this instance the in-migrants derive from a variety of geographic source points rather than a single one. In-migration to these environments often also includes migrants from urban areas. These areas are characterized by greater ethnic heterogeneity and a greater density of varied beliefs about customary institutions and arrangements than *chain periurban* environments. The institutional patterns here reflect much greater inclusion of "urban" forms than is the case for either *chain* or *in-place periurban*.

APU: Absorbed Periurban

The final category of periurban refers to areas proximate to or within the urban context that have been so for a considerable period of time. The defining characteristic of these locations is the maintenance of customary or traditional institutional arrangements which are derived from the culture of original settlers/residents who have long since ceased to be the numeric majority in the area. These areas derive from either *in-place periurban* areas or from *chain periurban* areas. Over time either of these periurban types can undergo the compositional processes of succession and displacement while on the macro level being evermore absorbed into the urban environment--administratively, politically and social-psychologically.

The underlying approach of dick and Rimmer's paper is that the analysis of "Third world cities" should not be theoretically distinct to the analysis of cities in "developed countries", as implied in the title "Beyond the Third World City: the new urban geography of South-East Asia".[2] However, as pointed out in the quote by Adell (1999) given above, the issue of poverty in South East Asian peri-urban areas is ignored by Dick and Rimmer, presumably because this issue does not receive a large amount of attention in the literature concerning parallel developments in Europe, the USA and Australia.

Happily, from the point of view of this deliverable, available literature about India does in fact does include discussions of edge city developments alongside discussions of poverty in peri-urban areas. In particular, Benjamin (2000:38) writes:

> Bangalore´s urban periphery has also been transformed. In the 1980s, the city´s peripheral areas evolved as "revenue layouts" with minimal infrastructure and civic amenities. They catered mostly to low- and middle-income groups and small-scale enterprises. In the early 1990s, however, the southern periphery of Bangalore came to be known as the "non-resident Indian layouts". These are exclusive "farmhouse" clusters and apartment blocks with their own swimming pools and health clubs, walled-in private security, 24-hour electrical power backup and exclusive club facilities.

A footnote to the above text states:

> Non-resident Indians are people born in India but settled and taking up citizenship in other countries. India, as yet, does not allow dual citizenship. The high class country houses are known as "farmhouses". Being on the periphery, they usually have a large garden, swimming pool and private security, all set in a rural unpolluted environment. They first became evident in the federal capital, Delhi. There, as elsewhere, the term "farmhouse" is significant because on the local authority plan, the swimming pool might be shown as a cattle pond, while the twin car garage is shown as a tractor shed.

Clearly, the characteristics of such a peri-urban areas are likely to be very different to those areas described in the five-way classification above. It is thus proposed that, for the analysis in this deliverable, a sixth category be added: Edge City Peri-Urban (EPU).

2.4 Flows and networks

Allen et al (1999) state:

> A third approach, present in all the literature reviews analysed, attempts to explain the nature of the PUI by looking at the dynamics of rural-urban links and flows at the regional level. Peri-urban interfaces are assumed to be areas where urban-rural linkages, changes and conflict (economic, social, and environmental) are most intense.

[2] A similar argument is presented in more detail by Robinson (2002) in "Global and world cities: a view from off the map". The motivation for taking this approach is thus to undermine the rigid dualism between "the West" and "developing countries" that is generally found in academic literature.

As can be seen in Figure 2.1, the following flows should be considered: commodities, finance, people, information, natural resources, wastes, pollution and production. Examples of such flows include:

- women from peri-urban areas travelling to urban areas to work as domestic servants;
- the transportation and sale in urban areas of flowers grown on agricultural land in peri-urban areas;
- flows of workers travelling from urban areas to work for businesses located in the peri-urban areas.

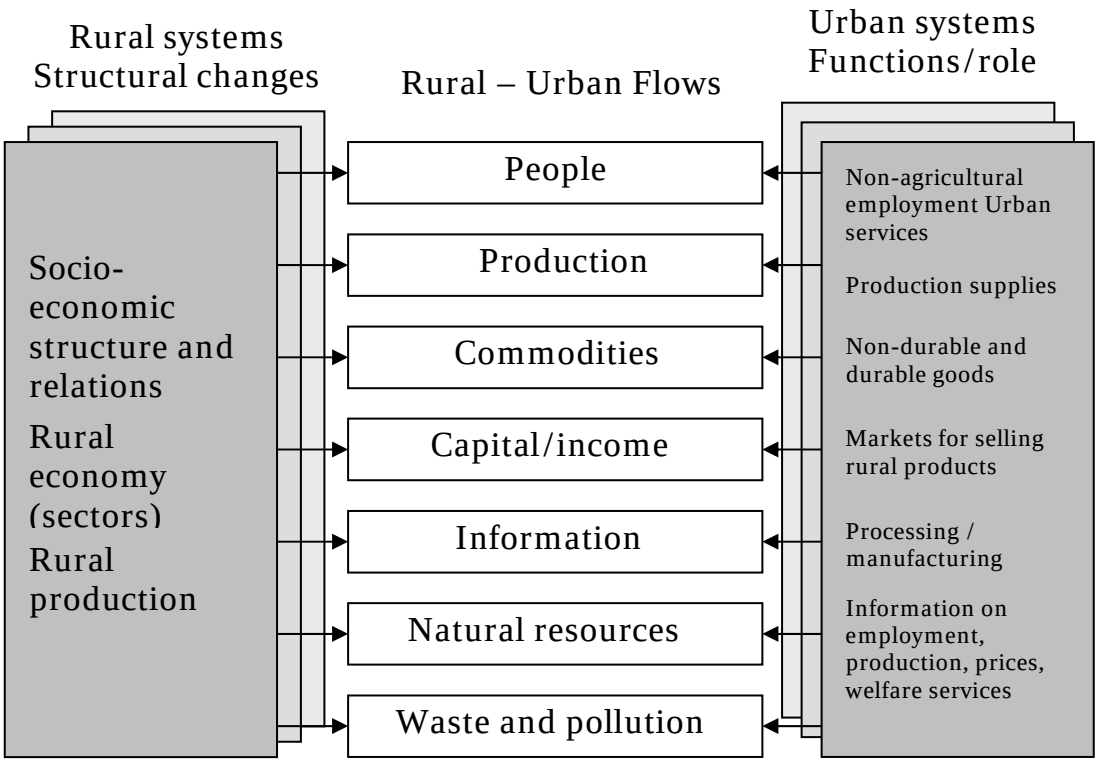


Figure 2.1: Rural-urban flows

Taken from Purushothanan and Allen (2004), "Towards rural-urban cooperative governance", presented to the 2nd workshop of the PERIURBAN project (Institutions in the Peri-Urban Interface). Based on Douglass (1998:31)

Thus peri-urban can be defined as an interface between the rural and the urban where these links are most intense. Allen, da Silva and Corubolo (1999) argue that one of the advantages of this definition is that it emphasises the dynamic nature of the peri-urban interface, focussing more on processes than on states. Furthermore, the focus upon flows leads to transport and travel as being seen as central to peri-urban development, to the extent that any understanding of peri-urban is defective without an understanding of them.

2.5 Approach taken in PERIURBAN Deliverable D2

The operational definition of peri-urban taken by PERIURBAN Deliverable D2 combines the various approaches described above, taking into account flows, socio-economic characteristics and spatial proximity to a city. In particular, Deliverable D2 devised a list of "factors influencing peri-urban formation". An extract from this list is provided in Box 2.2, and it can be seen that it includes factors directly related to transport, such as migration and higher transportation accessibility. Furthermore, many of the factors (particularly those concerned with flows) have transport and travel as significant contributory element.

Box 2.2 Extract from list of factors associated with peri-urban areas according to Deliverable 2 of the PERIURBAN project

The Driving Forces

Formation of ***Peri-urban*** settlements is influenced by several socio-economic factors, which ultimately impinge on the natural resources prevailing around major cities. The 'driving forces' are,

- Population growth in cities; Migration; Increased land value in the city
- Increasing congestion and deterioration of living environment in the city
- Higher transportation accessibility
- Availability of health and education facilities outside the city
- Desire to own a house at affordable prices
- Availability of communication facilities outside the city
- Community and friends influence

Potentials of Peri-urban area for development

The pressure on the rural fringe or ***Peri-urban*** areas is more for several urban activities in view of the potentials that the ***Peri-urban*** areas offer.

- Industries often find ***Peri-urban*** areas highly suitable in terms of cheaper land, water and unskilled labour.
- Educational institutions of varying types prefer the ***Peri-urban*** areas obviously because of cheaper land and water
- The recent trend is formation of 'Farm houses' – a typical pass time for the urban rich at the cost of conventional agricultural activities
- Corporate houses acquire extensive land in the ***Peri-urban*** areas for the purpose of creation of recreation centers, which attract huge crowd particularly during weekends.
- Horticulture activity is extensively practiced producing, vegetables and flowers for the urban market in most of the ***Peri-urban*** and the adjoining rural settlements.

Interaction between the urban and rural fringe or Peri-urban areas

- The ***Peri-urban*** areas are the predominant location of residence for majority of labour force required by the business community, construction industry and trade and commerce.
- It is the middle-income group of people residing in the ***Peri-urban*** area commute every day to the urban centers, for jobs in service and other industries
- It is the ***Peri-urban*** area, which supply fresh vegetables greens and flowers of certain varieties to the urban market.
- It is the ***Peri-urban*** area, which receive treated and untreated sewage from the urban centers and supply mainly fodder to cattle in and around the city.
- It is the ***Peri-urban*** area, which supplies groundwater to the city during dry seasons.

On the contrary urban areas are the major suppliers of consumer products to the ***Peri-urban*** area. The industries and the educational institutions receive professionals from urban centers through owned / hired vehicles. It is the urban centers, which have specialized hospitals to cater to the medical needs of ***Peri-urban*** and rural areas. Similarly specialized higher education centers are primarily located only in the urban centers.

Associated with the above factors, D2 identified three categories of characteristics to be used in making a definition of “peri-urban”, concerning agriculture, socio-economic processes and infrastructure development. In order to make an operational quantitative definition of peri-urban that reflected these characteristics, a number of measurable indicators were identified, such as: literacy rates; the distance from an urban centre; the percentage of the workforce engaged in agriculture; and the distance to major transport infrastructure. For each indicator a range was established to determine whether a given area was in the category of “urban” or “rural /peri-urban”. These indicators were then tested on 135 settlements in the Chennai Metropolitan area, and revised in the light of these tests.

3. Theoretical frameworks and their relevance to transport analysis

3.1 Traditional paradigms in transport/travel theory

Travel is a socio-economic process and is a vital aspect of the functioning of most people's lives. Furthermore, it is fundamental to many of the concepts about peri-urban described in Chapter 2. To understand travel it is not sufficient simply to describe travel patterns or the characteristics of the transport system. Rather, it is necessary to gain an understanding of what people do, why they do it, with whom they do it and what they would like to do if they had the opportunity.

Traditionally, transport theory has been dominated by two paradigms: the "atomised utility-maximising individual" paradigm and the "derived demand" paradigm. As the name suggests, the former paradigm involves two main aspects. Firstly, it leads to the representation of travel decisions as being made by individuals without considering communication with others, and hence ignores the complexity of interdependencies that are ever present in the lives of those people who coexist with others. In particular, the paradigm ignores the interactions within households and communities that influence travel decisions. Secondly, it represents individuals as being able to make decisions that "maximise their utility" where, in general, utility can be interpreted in two main ways. As a theoretical construct (typically used implicitly to defend the concept of utility) it represents "that which a utility maximiser seeks to maximise". Whilst such a statement is uncontroversial, in practice it is not helpful. Therefore in practical applications the transport analyst makes a working definition of utility, usually in terms of the time and money costs associated with the various transport alternatives that the traveller can choose. The paradigm then assumes that the traveller chooses the alternative with the highest (analyst-defined) utility.

In the derived demand paradigm, all travel is reduced to being the fulfilment of demands made elsewhere, so that there is no sense of any benefit in "travel for its own sake". On the other hand, as Mokhtarian, Salomon and Redmond (2001) argue (and demonstrate with an empirical study for travellers in San Francisco, USA), the derived demand paradigm is not a behavioural absolute and "travel has an intrinsic positive utility and is valued for its own sake, not just as a means of reaching a destination" (2001:355). Three particular factors are ignored in the derived demand paradigm. Firstly, travel might be carried out simply "because it is enjoyable to travel". Secondly, travel might be carried out because the process of travel is itself a "learning experience". Thirdly, and arguably most importantly, the "ability to move about" is an important aspect of power and status in society.

The reliance upon these paradigms is associated with the historical orientation of transport theory towards the development of transportation models as tools for making short-term predictions in relatively straightforward localised transport planning applications. Such applications, for example changing bus routes/schedules or designing traffic management schemes, lead to marginal

changes in behaviour against relatively static backgrounds. For such applications, the traditional paradigms of transport theory are probably sufficient. However, they are inadequate for understanding transport and travel in more complex situations. Given that peri-urban areas are extremely complex phenomena (as described in Chapter 2), a more sophisticated conceptualisation is required for understanding peri-urban travel.

It follows that future research needs to be carried out to find more appropriate paradigms for transport and travel. To help start this development process, the remainder of this chapter will explore the usefulness of two conceptual structures, "the Capital Assets Framework (CAF)" and the "Sustainable Livelihoods Approach (SLA)", given that an underlying aim of these structures is to be able to represent greater complexity of human behaviour than traditional models. In particular, since they focus upon a household level of decision-making, they immediately have the potential to take transport analysis beyond the bounds of the atomised utility-maximiser paradigm. Sections 3.2 and 3.3 provide an overview of CAF and SLA, whilst Section 3.4 reports how they have already been used in the field of transport in general, and for peri-urban transport in particular. Section 3.5 makes concluding comments about the usefulness of the approaches, thus answering the question "are these approaches worth emphasising, in research terms, to help understand transport and travel in the peri-urban interface?"

3.2 Capital Assets Framework

Underlying the Capital Assets Framework is the concept that a household has access to a range of different assets. A number of different types of categorisation of such assets has been made, some of which are provided in Table 3.1.

Chambers	UNDP	OXFAM, DFID	CARE	Moser	Tacoli
Tangible (stores, resources) intangible • claims for material, moral or practical support • opportunity to access resources	human social natural physical economic political	human social natural physical financial	human social economic	Labour economic and social infrastructure housing household relations social capital	human capital / labour financial / productive / physical social capital / household relations / cultural capital

Table 3.1 Assets categories, adapted from Farrington et al (2002) and Tacoli (1999)

The most widely cited categorisation (especially with respect to transport) is the OXFAM / DFID categorisation, in which different capitals are described as:

- human capital: resources related to skills, knowledge, ability to labour and good health;
- physical capital: the basic infrastructure, transport, water, shelter, energy, communications, production equipment and means;
- social capital: networks, memberships of groups, relationships of trust, access to wider institutions in society;
- financial capital: financial resources, saving mechanisms, suppliers of credit and remittances of pensions;
- natural capital: natural resource stocks, e.g., water, land, wildlife, biodiversity, clean air

These assets are shown in Figure 3.1 as the "asset pentagon". Of importance in this diagram is the idea that all the resources available to a household are represented figuratively to show relative amounts of different sources of capital.

Suggestions for other types of capital include political capital and cultural capital. In arguing for the inclusion of the former, Baumann and Sinha (2001) write:

> [Power] is best considered as a sixth capital asset – political capital. Specifically, the ability of the poor to press their claims depends on how they can build up this power in relation to that of others, and deploy it in the face of countervailing and often illicit exercise of power by others (usually elites) who contest their claims.

With respect to the addition of "cultural capital", Tacoli (1999) writes:

> This addition of the cultural capital is an important difference because the framework aims to build a notion of access to resources which brings together the material side ("making a living") as well as the ways in which perceptions of poverty determine livelihood strategies, and the cultural meaning attached to assets (this may be relevant in the PUI, for example with respect to land ownership). Moreover, assets are not only resources that people use, they are also what gives people the capability to be and act.

In general it can that, whilst human, physical, financial and natural capital are based on reasonably straightforward concepts, there is a lack of clarity with respect to social capital. This lack of clarity leads to the possible need for inclusion of related types of capital (i.e. political and cultural) that might or might not be included with the social capital concept. These issues will be discussed further below in the context to the applications of capital assets to transport and travel.

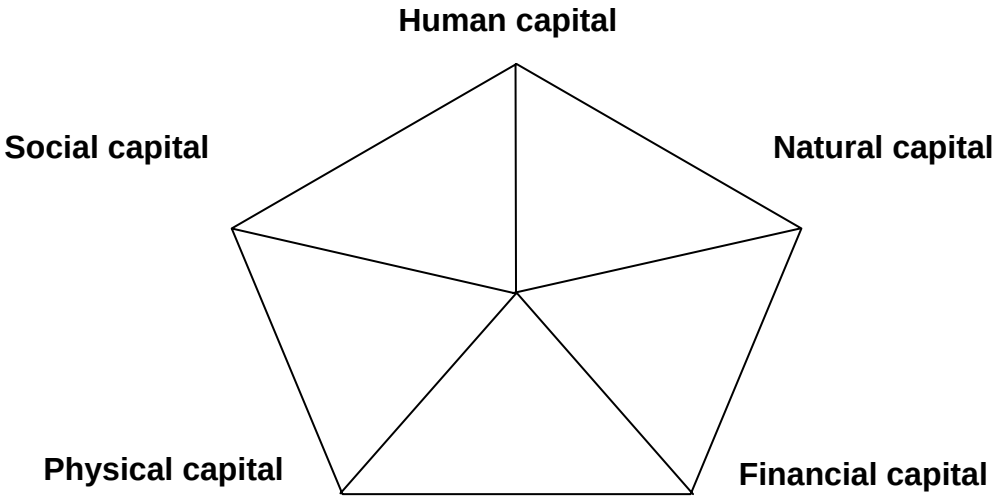
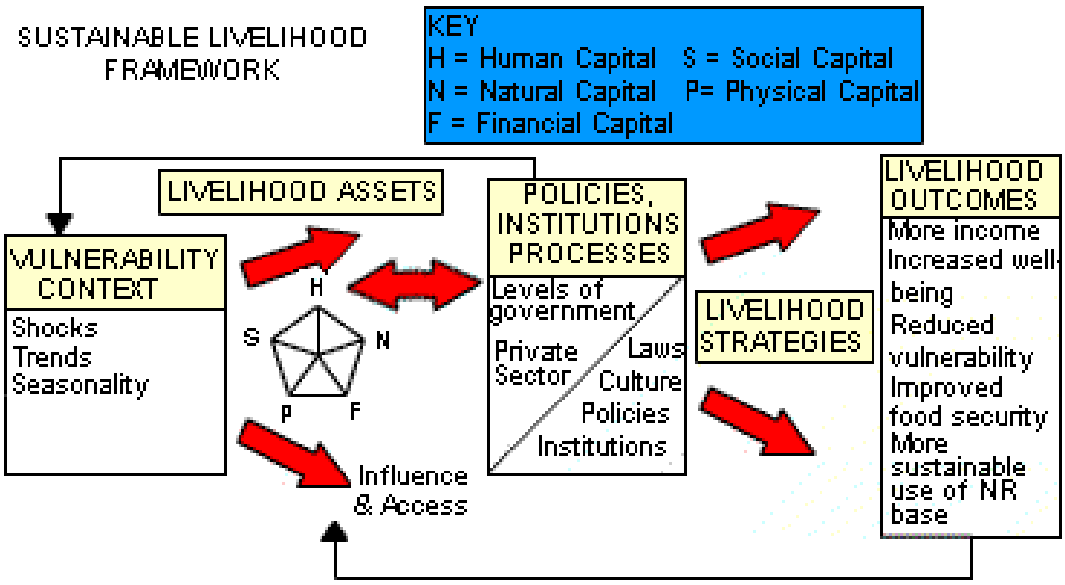


Figure 3.1: The asset pentagon
Taken from DFID Sustainable Livelihoods Guidance Sheets, Section 2.3 (DFID, 1999)

3.3 The Sustainable Livelihoods Approach (SLA)

3.3.1 Overview

One use of the capital assets framework is to understand how households engage in different strategies to "manage" their resources and to improve their ability to respond to change and reduce the household's vulnerability. In this respect, it is one of the main components of the "Sustainable Livelihoods Approach" (SLA), whose major elements are shown in Figure 3.2.



INSIGHT
The **arrows** within the framework are used as shorthand to denote a variety of different types of relationships, all of which are highly dynamic. None of the arrows imply direct causality, though all imply a certain level of influence.

Figure 3.2: The Sustainable Livelihoods Approach (SLA)
Taken from DFID Sustainable Livelihoods Guidance Sheets, Section 2.1 (DFID, 1999)

Of particular importance in the SLA is the concept of "vulnerability", being the ability of a household to cope or thrive in the face of a changing environment. Environmental changes threatening security can be ecological, economic, social or political and can be sudden shocks, long term trends or seasonal cycles. The concept of vulnerability thus provides a more sophisticated analysis tool than the static measure of poverty. Analysing vulnerability entails identifying not only the threat to stability and security but also the resilience of a household in recovering from changes, or exploiting the opportunities that arise through change. In order to assess the vulnerability of a household it is first necessary to characterise a household's stock of assets, as described above.

Farrington et al (2001) report how, in some donor interpretations of SL (including those of DFID), the framework can be interpreted as

- **A set of principles** (specifying what developmental activity should be)
- **An analytical framework** (suggesting how we can best understand poor people's options and constraints)
- **A developmental objective** (i.e. to enhance the overall level and sustainability of livelihoods)

The background to SLA is described by Toner (2003), who traces the history of the concept from initial work by Chambers and Conway (1992), "which argued for the creation of livelihood strategies (for rich and poor) that accounted for their long term impact in terms of maintaining the natural

resource base for use by others and future generations, whilst being resistant to external shocks and stresses." She reports how Carney (1998) and Scoones (1998) adapted the Chambers and Conway concept, putting a stronger emphasis on poverty and "focusing on the idea that people construct livelihoods by drawing on a range of assets and entitlements". Toner concludes:

> However in doing so, the idea of sustainable livelihoods has been reduced to a more benign conception of the way in which individuals or households manage their resources. A view, which makes it far easier to develop management theory for changing livelihoods as action, is "individualised" and depoliticised.

This statement reveals a concern with the general approach of SLA. On the one hand it is certainly welcome that "(n)ew approaches to poverty eradication [such as the SLA] have sought to bring the poor themselves to centre stage, acknowledging and supporting their own capacity to articulate their needs" (Baumann and Sinha, 2001). On the other hand it can argued that approaches such as SLA put too much onus upon poor people on resolving the problems of poverty (albeit with some support from "pro-poor" interventions) whilst ignoring changing macroscopic factors that lead to poverty. Thus, for example, SLA can distract attention away from neoliberal globalisation as a cause of creating poverty. Rather, it simply provides a mechanism as to how the negative effects of such processes are "tidied up".

On a more operational level, Bryceson et al (2003b) state:

> As an analytical framework, the SLA provides a good general starting point upon which researchers from social and physical sciences can begin. It has however been devised with changing economic livelihoods in mind. Social, political and cultural features tend to be conceived in contextual terms. It foregrounds how the target population achieves economic well-being.

This comment, echoing the remarks made above about the classification of different types of capital, stresses the importance in the SLA associated with economic livelihoods (and hence human and financial capital) compared with more social types of livelihood strategies, concerned with social, political and cultural capital. It will be explained in Section 3.4 how this issue is of direct relevance to the analysis of transport and travel in peri-urban areas.

3.3.2 Strategy types and strategy determinants

Farrington *et al* (2002) identified a number of different ways that livelihood strategies have been categorised by different researchers. One of the first distinctions is between short-term responses to a specific upheaval (coping strategies) and long-term responses to responses to upheaval (adaptive strategies). Farrington *et al* (2002) review the work of Chambers (1997), UNCHS (1996) and Moser (1998) on different livelihood strategies and created the categorisation of strategies for rural and urban areas as shown in Table 3.2.

Strategy	Mainly urban	Urban and rural
Income-enhancing/ investment	• Domestic services-cleaning and childcare (especially done by women and girls) • Urban agriculture • Renting out rooms	• Home gardening • Processing, hawking, vending • Transporting goods • Casual labour, piece work • Specialised occupations (e.g., tinkering, food preparation, prostitution) • Child labour • Migration off seasonal work • Begging • Theft
Expenditure-reducing/ Sacrifice	• Scavenging • Cutting transport costs	• Mortgaging and selling assets • Selling children into bonded labour • Changes in purchasing habits (e.g., frequent smaller quantities, not bulk buying • Buying less and/or cheaper goods and services • Discrimination within the household (e.g., giving less to less powerful or less favoured household members)
Collective support	• Communal kitchens • Communal childcare	• Mutual loans or savings groups • Putting out children for care in extended family • Remittances from household members working away

Table 3.2: Three main categories of livelihood strategies
Taken from: Farrington *et al* (2002:34)

As can be seen from Table 3.2, Farrington et al (2002) consider three main categories of strategies: income enhancement or investment; expenditure reduction or sacrificing; and collective support. Some of the strategies in Table 3.2 have a direct relation to transport and travel (e.g. "cutting transport costs" and "transporting goods") whilst other strategies have indirect relevance (e.g. "putting out children for care in extended family").

3.4 Applications of CAF and SLA to travel / transport

This section reviews the applications of the Capital Assets Framework (CAF) and the Sustainable Livelihoods Approach (SLA) to travel and transport. Bryceson et al (2003b: 178), in a paper resulting from the DFID-funded SLAM project ("Sustainable Livelihoods, Access and Mobility"), state:

> Until recently, applications [of the livelihoods approach] in the transport sector have been comparatively rare.....The concept and interpretation of transport as a livelihood asset is not well developed within the livelihoods literature. Consequently, the usefulness of the livelihoods approach as a means of improving the focus and design of interventions in the transport sector aimed at meeting the mobility needs of the poor, remains uncertain.

and:

> The livelihoods approach has provided the underpinnings for an analysis of households material-provisioning and income-earning, however, with the

> exceptional mention of transport as part of physical capital assets, it has had little to say about mobility patterns and the poor´s relative immobility. (Bryceson et al, 2003b: 191-192)

These views have been confirmed by the literature review carried out for the PERIURBAN project. However, the small amount of relevant literature is now reported and analysed.

3.4.1 Capital Assets

The DFID funded project "Partnerships to improve access and quality of public transport" has used CAF and SLA. In its final report, Sohail et al (2003) map "influences **on** the transport sector" and "influences **of** the transport sector" on to the five capital assets in the DFID framework:

> Within the [sustainable livelihoods] framework, transport can be viewed best as an asset. Access to transport influences the package of assets that is available to communities and the individuals within them. At the same time, access to transport is in turn influenced by those assets.

Asset	Influence on the transport sector	Anticipated influence of transport services
Financial	Availability of credit and investment finance for transport related investments (informal and sector) Ability to afford transport services	Access to work, employment and income generation activities Access to social networks needed for financial services and income generation
Human	Quality of staff undertaking services and regulatory duties	Access to education and health services. Extent of stress, injury, mortality from travelling
Natural	Terrain and climatic conditions will influence costs of transport provision and maintaining networks and services	Quality of local neighbourhood environment – extent of noise and air pollution
Physical	Road and rail network is critical to quality of formal and informal transport services. Facilities for pedestrians	Allows access and mobility to most areas of urban centres and rail to national locations
Social	Organizations to bring together transport services e.g. bus transporters. Citizen pressure on providers – is transport a political issue?	Ease with which city-based networks can meet to negotiate with local authorities. Ease of maintaining social networks to strengthen social capital. Access to social networks needed for financial services and income generation

Table 3.3: Livelihoods and transport: a summary
Taken from Sohail et al (2003)

These influences are summarised in Table 3.3, and provide an important input to the following discussion of the links between capital assets and transport.

Human capital

Tacoli (1999) writes about "human capital / labour":

> Labour is the most important asset for poor people, and is closely linked to human capital (the skills, knowledge and ability – also physical – to work)...the main determinant factors of employment opportunities in the PUI can be summarised as follows:
> - the nature and scale of economic activities in the PUI. This may vary widely around different cities, but also in different areas of the PUI
> - the spatial distribution of these economic activities and transport availability and costs.....Mobility needs to be included as an important factor allowing access to labour markets.

It should be pointed out that whilst the ability to work is an aspect of human capital, the results of such work (i.e. wages) are an aspect of financial capital, thus explaining the fact that "access to work, employment and income generation activities" are considered as financial capital in Table 3.3, rather than as human capital. As pointed above, it is typically finance-generating strategies that are considered most important in CAF/SLA analyses. There is a parallel here with the central importance given in traditional transport analysis (and in the derived demand paradigm discussed in Section 3.1) to the "journey to work".

Table 3.3 stresses the importance of access to education and health services as a part of human capital. Education trips (especially when conducted on a daily basis such as children's travel to school) take central importance, along with the journey to work, in traditional transport analysis. Fouracre (1999), in line with Table 3.3, adds a safety dimension to the analysis of human capital:

> Transport development provides employment, but also raises exposure to traffic and traffic accidents. Road safety issues are particularly important, if for no other reason than that they are a major cost to society (consuming perhaps 1-2% of gross national product in lost output and the commitment of medical and police resources). Furthermore, fatality rates are very much higher in the poorer countries, as compared to the industrialised world. Traffic accidents directly impinge on livelihoods of individuals, families and communities; in the absence of insurance, free health-care or other government support, households are vulnerable to the loss of earnings (temporary or permanent) when productive family members are incapacitated as a result of a traffic accident.

Issues about transport safety will be discussed later in Chapter 8.

Physical capital

Expanding the description given in Table 3.3, it can be stated that the transport system is determined by two main components: the infrastructure and the organisation of the transport system and services. The infrastructure includes roads, footpaths and railways, whilst the provision of public transport is part of the organisation of the transport system. These components are a part of the assets that make up physical capital.

Financial capital.

It has already been mentioned that "access to work, employment and income generation activities" are considered as financial capital in Table 3.3. Fouracre (1999) adds:

> In the past, the main goal of transport investment has been to reduce transport costs, and hence contribute to delivery of a more efficient economy.

> In the urban context, where congestion is a key problem, the main savings resulting from transport investment (like traffic management, public transport services and road widening) are in the form of reduced travel times, which feed through to improved labour productivity. In the rural context, the main savings are in vehicle operating costs, which feed through to lower farm input and produce prices.

These comments accentuate the traditional focus in transport analysis upon reduction in travel costs. In general, it can be stated that

Natural capital

Fouracre (2001) writes, with respect to natural capital:

> Transport development may bring in its wake the problem of environmental degradation. This is not just an urban problem, associated with the high volumes of traffic (air pollution, noise and severance). Rural road construction can have profound ill-effects on, for example, slope stability, erosion and natural drainage patterns. Of these, erosion is thought to have the major environmental impact. Mitigation measures to control erosion can be included in the designs (e.g. appropriate drainage channels and culverts) as well as in the implementation (e.g. quickly establishing vegetation on exposed slopes).

Issues about the impact of transport systems on natural capital will be discussed below in Chapter 7.

Social capital

The influences of transport services upon social capital given in Table 3.3 appear reasonable although very general (e.g. “ease of maintaining social networks to strengthen social capital”), and it is not clear exactly what type of travel results from these influences. This is not a criticism of Table 3.3; rather it illustrates the point made above that social capital is typically the most “awkward” type of capital to define clearly.

Influences of transport upon political capital could possibly be subsumed within the influences listed for social capital in Table 3.3, although since these influences are defined so broadly, it is not clear whether this is acceptable or not. On the other hand, it is clear that an important factor associated with cultural capital definitely does not fit in with these influences, concerning the cultural capital gained by a particular individual in being able to travel to places with a “different culture”, and thus having a greater insight about “how the world functions”. An obvious example here is particularly relevant to the VPU (Village Peri-Urban) type defined above, where individuals who have travelled “to the city” might be regarded as having higher status than those who have never travelled outside the immediate locality. At the other extreme of the range of peri-urban types of area, cultural capital might be gained by those in EPU (Edge City Peri-Urban) areas who have experience of intercontinental travel. It could be argued that such capital is simply a factor within human capital since it applies to an attribute of the individual concerned. However, since it is a relative social attribute (given that the measurement of cultural capital is very much dependent upon “how much other people travel”) it should not be ignored in terms of an analysis of social capital.

3.4.2 Sustainable Livelihoods Approach

Sohail et al (2003) suggest that the major positive influences of transport on the livelihood opportunities of the urban poor are:

- Access to work, income generation, and employment opportunities
- Access to education and health services
- Access to social relationships

Box 3.1 provides further information about these influences

It can be seen from Box 3.1 that there is far more clarity about "access to work, income generation, and employment opportunities" and "access to education and health services" than to "access to social relationships". This observation is in line with the discussion above about capital assets, which pointed out that human and financial capital is much easier to conceptualise than social capital.

Box 3.1: Major positive influences of transport on the livelihood opportunities of the urban poor, from Sohail et al (2003:10-11)

- **Access to work, income generation, and employment opportunities.** Urban households may participate in a multitude of activities including small-scale trading and service provision, work in factories, casual labour, and domestic work. In the context of structural adjustment and liberalization policies there has been a reduction in the proportion of the population employed in waged jobs in the formal sector. The subsequent proliferation of informal sector work in trade and services has meant a restructuring of livelihoods and a diversification to reduce the risk of loss of income from one source. In addition there has been an increasing labour force participation of women and children. The mobility of the urban poor can be seen to play a role in the diversification of livelihood; the access to production inputs, building up stores of saleable assets, social support networks related to work, market information, credit, and training and employment.
- **Access to education and health services.** Well planned and low-cost transport services can greatly reduce the difficulties of getting to education and health services. This is of direct assistance to households in securing and improving their livelihoods. Reductions in social service expenditures may have increased the distances the distances that residents have to travel. Many low-income settlements, especially those on the periphery of cities are very poorly served.
- **Access to social relationships.** The SLAM study (R-7784) highlighted the role of transport in linking rural and urban communities. Especially cultural and family links (such as traditional ceremonies) between such communities.

Household consolidation is an important strategy affecting mobility patterns. The formation of a household is not fixed since households change in size and composition over time. Apart from births and deaths, household members can disperse to different locations, whilst members of different and separate households can join together in one location. It is possible to see how some households can be thought of as having multi-spatial locations. Farrington *et al* (2002) make the point that some household members may move from rural locations to cities as part of a household strategy to improve security and livelihoods, whilst continuing to retain links between household members. Moser (1997), working in Ecuador, also identified the consolidation of households as being an important strategy, particularly for women dealing with crisis. All such strategies involve the need to travel.

Tacoli (2003) argues that good transport links will lead to people being more inclined to commute than to migrate. It is necessary to understand further how migration and commuting patterns interact in relation to particular country or city types.

3.4.3 Applications of CAF and SLA to travel / transport in peri-urban locations

Very little literature has been found mentioning the application of CAF and SLA to peri-urban transport and travel, although many of examples cited above about rural/ urban migration apply equally to rural/peri-urban migration.

The concluding section ("Priorities for Intervention") of the report "Partnerships to improve access and quality of public transport" (Sohail et al, 2003: 81) commences with the statement: "In summary, transport services are essential for livelihoods, particularly in the peri-urban settlements of cities". However, the report in general does not foreground the concept of peri-urban, although the following comment is of relevance:

> As noted in Colombo, relocation from central to more peripheral locations has been one factor that has increased difficulties for the urban poor. In Faisalabad, households were moved to the periphery of the city when their inner city *katchi abadis* were demolished. However, these new areas are not on any transport routes making it difficult for livelihoods to be maintained. People were not able to settle "...due to the non-availability of transport, thus returned closer to the city centre, relying on their relatives or squatting". (Sohail et al, 2003:43).

As part of the SLAM project (Bryceson *et al*, 2003a and 2003b), heads of low, medium and high income earning households, who were resident in villages, primate cities, secondary cities and peri-urban locations, were asked if they were born where they currently lived. It was found that the "peri-urban areas had the highest incidence of household heads born in the present location at 30% and 46% in Uganda and Zimbabwe respectively" (2003a:17). The researchers attributed this phenomenon to rising land prices, which are known to reward original inhabitants and early cohorts of migrants. In both countries, peri-urban areas had a thriving land market providing strong

incentives to remain. It would be interesting to know if Indian peri-urban communities show similar characteristics.

3.5 Summary and conclusions

Section 3.1 described two traditional paradigms in transport/travel analysis and highlighted their deficiencies with respect to the conceptualisation of transport and travel in complex situations. It was pointed out that the peri-urban interface is an example of a complex phenomenon, where traditional transport/travel theory was inadequate for gaining sufficient understanding. There is thus a need for considering new paradigms. A question was asked at the end of Section 3.1: "Are the Capital Assets and Sustainable Livelihoods approaches worth emphasising, in research terms, to help understand transport and travel in the peri-urban interface?". The current section tries to answer this question, using the discussion from Sections 3.2, 3.3 and 3.4.

Firstly, as pointed out in Section 3.1, the Capital Assets Framework (CAF) and Sustainable Livelihoods Approach (SLA) have potential advantages over traditional transport conceptualisations since they foreground households and household decision-making, which are ignored within the paradigm of the atomised individual utility-maximiser. Furthermore, many of the examples of livelihood strategies described in this chapter show that household decision-making is, in practice, a central factor in formulating strategies. A strong case is thus made for using CAF and SLA in transport/travel analysis.

However, a more complex question concerns whether CAF and SLA have potential advantages over the direct demand paradigm of traditional transport analysis discussed in Section 3.1. To answer this question, three different aspects of travel are in order to examine how much CAF and SLA can "add" to their analysis: day-to-day travel; migration; and social aspects of travel.

Day-to-day travel (particularly commuting to work and going to school). Under the CAF, these activities are considered to be "enhancing financial and human capital". However, the examples given in this chapter do not show any particular advantage to theorising about travel with the CAF. In particular, it would seem that nothing is added to the "traditional" transport categories of trip purpose such as "journey to work" and "journey to school".

Migration. Migration is a phenomenon that is disregarded in traditional transport theory, possibly because it is not obvious how to incorporate it in well-defined way within the derived demand paradigm. Given the centrality of different types of migration within examples of use of CAF and SLA (as described in this chapter), there seems to be a clear case for using these conceptualisations in transport/travel theory where (as in peri-urban areas) migration is an important factor.

Social aspects of travel. A number of examples were given in Section 3.1 about defects in the derived demand paradigm to take into account certain social aspects of travel, such as the individual's "potential for mobility" being seen as a sign of social status. In this respect the CAF and the SLA do not

appear (as presently formulated) to have a great amount to offer. This is particularly because, as described in this chapter, these frameworks are weak with respect to social capital, and related issues of political and cultural capital.

One of the central problems of theory identified is this chapter concerns the partial nature of different conceptualisations. As mentioned in the quotation by Adell at the start of Section 2.1, partial conceptualisations are neither necessarily "right or wrong in absolute terms" but "explain fragments of the reality of [PUI] areas". However, to understand transport/travel it is frequently necessary to integrate a number of these partial realities (even if not aiming at "universal truth"). Thus, on the one hand, traditional transport theory foregrounds issues of traffic congestion and other negative impacts resulting from too much transport (by the whole of society). On the other hand, the CAF and SLA foreground poverty and the particular problems faced by poor people in accessing opportunities to manage their livelihoods.[3] In order to gain a sufficient understanding of transport/travel in peri-urban areas, there is a need to combine these two approaches, and the remainder of the deliverable makes an attempt to do so.

[3] This distinction, in turn, reflects differences in the preoccupations of "western" urban theory and "Third World" development theory.

4. Travel needs and aspirations

4.1 Introduction

Very little literature is available about peri-urban travel needs and aspirations in India. What has been found is reviewed in Section 4.2. Section 4.3 provides an overview of the familiarisation visits that were made to peri-urban communities near to Bangalore, as part of the PERIURBAN project workshop in July 2004. Section 4.4 provides a speculation as to how travel needs and aspirations might vary according to the six-way classification of peri-urban communities provided in Section 2.3, and the chapter finishes with a list of resulting research questions.

Inevitably, this chapter focuses mostly upon the aspirations and needs of residents of peri-urban areas. However, when considering transport issues, it is important not to forget those non-residents who need to travel to peri-urban, for example as commuters.

4.2 Literature on travel needs and aspirations in India

4.2.1 Movement into and out of PUI as a household strategy

Deliverable D2 (PERIURBAN) described how within the middle income group one strategy was to buy land within the periphery of the city and build a dwelling, largely because this group could not afford to purchase houses or land within the city. In particular, it showed how the phenomenon of out-migration of urban dwellers into peri-urban areas was an important factor in the development of the peri-urban interface in Chennai Metropolitan Area. Such behaviour would lead to an example of the Diffuse Peri-urban (DPU) settlement defined in Section 2.3. It is interesting that whilst the motivation for migrating was economic, such behaviour would not be included within a "poverty focused analysis", since the migrants are middle class.

Furthermore, D2 proposed that the main criterion for a household when deciding on a particular location was the transport accessibility of the location. Once that was determined, and a location selected, further criteria concerned whether the land was affordable, the availability of ground water and the presence of relatives. Thus they argued that accessibility to the physical capital represented in the transportation system is a very important criterion in household location choice but on its own it is not sufficient. What is clear is that the rich and poor communities will adopt different strategies.

4.2.2 Peri-urban commuting in Calcutta

Evidence from West Bengal is provided by Mahua Mukherjee (2002) reported in the edited book "Balancing the Load" (Fernando and Porter, 2002), a collection of studies of women's travel throughout the developing world. Mukherjee regards her work on daily commutes from South 24 Parganas district to Calcutta as being a study of peri-urban flows to the urban area. Although most of her results concern transport system performance (and will thus be discussed more fully later in Section 6.2), they do throw some light on travel needs.

The district of South 24 Parganas was chosen because of its large number of commuters. It is one of the largest districts in West Bengal and Mukherjee reports that approximately 0.7 million people commute daily to Calcutta, of whom approximately 2% (i.e. 14,000) are women. Mukherjee concentrated solely on the travel of women and did not report on men's travel.

Women, says Mukherjee, have only recently begun to commute to paid employment and still form a small minority of all those commuting because:

> "Indian society has always imposed direct or indirect restrictions on the movement of women. Mobility of women was initially related to within household work, such as collection of firewood, fetching drinking water and collecting crops, or to visits to the parental home and relatives. Over time, however, women began to travel for income-generating activities." (2002:225)

Mukherjee found that there was no primary data available for this area of study, and consequently decided to conduct a primary data survey. Data was collected on-street, using a questionnaire, at a number of locations including a public transport station and a popular market location. The interview was brief and the questionnaire was completed by the interviewer.

In her sample, it was found that women commuted from the peri-urban to Calcutta for a variety of reasons, to visit the hospital or to meet relatives but mostly to travel to work. The women worked as street vendors, maidservants, factory workers, office assistants and hospital workers, as well as having domestic responsibilities. In those households with just one or two women they usually had responsibility for all the domestic tasks. Furthermore, in those households with more women it was not necessarily the case that the women who commuted had less domestic responsibilities

Most of the women interviewed were aged 20-40 with a third between 30 and 40. Women vendors were more likely to be in the older age groups and maidservants were more likely to be younger. Most of the women earned very small amounts and some were the sole income earners for the family. Women vendors earned more but faced higher levels of income uncertainty.

4.2.3 Case study on 11 settlements in Chennai

Deliverable D2 reported a case study on 11 settlements within the Chennai Metropolitan Area (CMA), of which five were classed as peri-urban, three as urban and three as rural. The case study included questions about location of employment (thus relating to the strategy to increase financial capital) and mode of transport, and the results are shown in Table 4.1. Various comments can be made about the information in this table:

- With the exception of Vanderloor, at least 80% of workers in all settlements travelled less than 5 kms in their journey to work. All workers in the three rural settlements travelled less than 5 kms.
- Only in Vanderloor did workers travel more than 10 kms in their journey to work
- There are no obvious differences between journey-to-work travel behaviour in the urban and peri-urban settlements

Name of settlement	Assigned status	Location of employment			Distance to employment			Mode of transport				
	U = Urban PU = Peri-urban R = Rural	% locally employed	% outside settlement	% no fixed place	< 5 kms (%)	5-10 kms (%)	> 10 kms (%)	Bus (%)	Train (%)	Motorised two wheeler (%)	Bicycle (%)	Walk (%)
Thiruneermalai	U	78	22		90	10		11			30	59
Naravarikuppam	U	100			100			10			20	70
Tirusulam	U	80		20	80	20			25		40	35
Chinnasekkadu	PU	80	20		100			10			30	60
Nandambakkam	PU	88	12		90	10				10	40	50
Thirumazhisai	PU	90	10		100						40	60
Nandiambakkam	PU	61	20	19	80	20					40	60
Vandaloor	PU	57	22	21	60	20	20		30	10	30	30
Pakkam	R	75	20	5	100						30	70
Thirumudivakkam	R	80	20		100						30	70
Sothuperambedu	R	75	20	5	100						30	70

4.3 Results of Bangalore workshop visits

The PERIURBAN workshop in Bangalore (July, 2004) included "familiarisation" visits to two peri-urban villages, Manchanahalli and Shanumangala, near to Bangalore. Each of these visits included an interview with a group of villagers to discuss transport/travel related issues, with each group speaking on behalf of all the villagers in the respective communities. Issues mainly concerned travel needs associated with financial capital (related to the journey to work and the cost of travel) and human capital (related to access to health and education services). With one notable exception, issues of travel aspirations were not discussed. Results concerning transport system performance (including vehicle ownership in the village) and policy recommendations are provided in Sections 6.5 and 10.4 respectively. It should be stressed that these interviews were carried out mainly to help PERIURBAN project participants understand issues concerned with travel, with no attempt being made to carry out a formal scientific survey.

Four women were interviewed together in the visit to Manchanahalli, a village 39 kms from the centre of Bangalore. The results relating to day-to-day travel needs are shown in Box 4.1. It can be seen that most of the "urban" needs of the villagers were met by travel to the regional centres of Birdi (12 kms distance) and Kengeri (16 kms distance). In fact, it appeared that very little travel took place to the centre of Bangalore, apart from a shopkeeper making regular trips to pick up provisions.

A group of approximately 10 men were interviewed together (the number changed throughout the interview) in the visit to Shanumangala, a village 33 kms from the centre of Bangalore. The results relating to travel needs are shown in Box 4.2. Although these results mainly concern day-to-day travel needs (as in Manchanahalli), an interesting factor to emerge was that the villagers were thinking of making a mass migration to Ooty, a high altitude town to the west of Bangalore. The motivation for this proposed migration was due to the problems caused my mosquitoes attracted to the nearby waste water treatment plant servicing Bangalore. As in Manchanahalli, most urban needs were met by travel to the regional centres of Birdi and Kengeri. Even though the percentage of workers in Shanumangala involved in wage labour (approx 90%) was much higher than the percentage in Manchanahalli (approx 20%) there was no large difference in distance travelled for the journey to work, with most such trips being made locally in both villages. The main difference was that, in Shanumangala, approximately ten skilled and semi-skilled goldsmiths worked in Bangalore.

Box 4.1: Travel needs in Manchanahalli

Basic information

- 300 households in village; 1000 inhabitants
- Distance to Birdi (12 ms), Kengeri (16 kms), Hejallel (1.5 kms) and Bangalore (39 kms)
- Area being planned for megacity (Toyota involved)
- Land acquisition had taken place: 1 acre sold for 8-10 lakhs
- Villagers previously had 5-6 acres of land: Sold 4 acres
- Average monthly income 2000-3000 rps
- Expenses: Education annually - 1150 per child; Festival (clothes)- 1500 rps per year for 3 people; Travel - 300 rps per month (Birdi) or 600rps per month (Bangalore); Food, household expenses - 1000 rps per month; Savings - 20 rps per week

Need for transport: Employment

- 80% worked in agriculture: raggi and sesame (no cash crops)
- 20% wage labour: wine bottling factory and other factories (wage 70 rps for men and 35 rps for women per day in bottling factory)
- ?% worked in house construction (wage 150 rps for skilled men, 100 rps for apprentices and 50 rps for women per day)
- ?% worked in garment industry in Kengeri
- factory work was seen as being more stable (though 1 factory (textile) had already been closed)

Other needs for transport

- Education
  - School (from 1st to 7th grade, 5-11 year olds) in village
  - School (from 8th grade, 12 year-olds) in Birdi (12 kms), Kengeri (16 kms) and Hejallel (1.5 kms)
  - College – 10 students (boys and girls) in Birdi and Kengeri
- Health
  - Government doctor will not come to village unless paid
  - Need to go to Birdi for doctor
  - No primary health care centre in village so need to go to Birdi or Ramnaga (?)
  - Private hospital close (Swami Ji) but just one doctor so generally need to travel further
  - For emergencies hire auto on main road (0.5 kms distance), 150-200 rps per round trip to Birdi or Kengeri
  - Innoculations: well-off to Bangalore; middle income to Birdi; lower income to Birdi (government hospital)
- Other
  - Shopkeeper goes to Bangalore for provisions

Box 4.2: Travel needs in Shanumangala

Basic information

- 130 households in village; 1200 inhabitants
- Current size of village: 200 acres
- Distance to Birdi (6 kms), Mansu (5 kms) and Bangalore (33 kms)
- Big problem of mosquitoes due to nearby waste water treatment plant (servicing Bangalore): Village considering migrating to Oooty

Need for transport: Employment

- 100 people worked in agriculture
  - some take vegetables to Birdi, from where others take them for sale in Bangalore
- 1000 people in daily wage labour: mainly local industry
  - none in wine bottling factory
  - 14 or 15 in nearby Coca-Cola factory
  - 10 in Bangalore (goldsmith and semi-skilled)
  - typical wage 50 rps for men and 30 rps for women per day
  - typically work 15 days per month

Other needs for transport

- Education
  - School (from 1st to 7th grade, 5-11 year olds) in village (120 children)
  - School (from 8th grade, 12 year-olds) and college in Birdi (6 kms) and Kengeri (? kms)
  - School and college – 30 students (15 in Birdi and 15 in Kengeri)
  - 50 – 60% of children go to school after grade 7, others are employed on daily wages
  - more children would go to school if transport costs were reduced by 50%
  - no children walk daily to school: children walk to highway/gate (3 kms) if they miss the bus
  - Rs 850 pa school fee; Rs 3000 uniform etc.
- Health
  - Nurse has government quarters in village
  - For emergencies hire auto, 100 rps per round trip to Birdi

4.4 Speculation about travel needs and aspirations for different types of peri-urban area

This section provides a "first principle speculation" about the travel needs and aspirations of inhabitants in the six different types of peri-urban area defined above in Section 2.3: five classes involving lower income people (VPU, IPU, CPU, DPU and APU); and a sixth class of wealthier people (EPU). The analysis makes (some) use of the Capital Assets Framework and the Sustainable Livelihoods Approach, along with some "stereotypical" attitudes that might be associated with the six peri-urban types. These types are not defined again in full, but various aspects of the definitions are repeated here where they are particularly relevant to the analysis. In general, these six classes can be distinguished between

VPU: Village Periurban or Perirural ("Rural" places with "urban" consciousness)

A VPU is a rural village that has developed some "urban influences". It would be expected that the day-to-day travel needs of VPU inhabitants would be very similar to the day-to-day travel needs of inhabitants of rural villages in general, oriented around work-related livelihood strategies to increase economic capital that involve "local" travel. However, it is likely that there would be greater long-distance travel needs associated with the urban links inherent in the definition of VPU, for example to maintain "split-site" (rural / peri-urban) extended families.

It is likely that there would be aspirations for greater level of long-distance travel than in a typical rural village, associated with the "urban influence" within a VPU.

IPU: In-place Periurban

Travel needs for IPU residents would be expected to be mainly local in nature, reflecting the previous existence of the IPU as a rural village. This would be accentuated if the area were the site for factories or other concentrated employment-generating activities. However, there would be expected to be some increase (from previous "rural times") in day-to-day travel to the city (to which the IPU is spatially proximate) for jobs, schools, health facilities etc.

It is likely that there would be greater aspirations for travel than for a VPU, given the greater urban influence (due to closer proximity) on the IPU.

CPU: Chain Periurban (In-migration from a single place)

A CPU area arises from the migration of a group of people from a specific (typically rural) location. Travel needs for CPU residents would be expected to be greater than those of the inhabitants of an IPU, reflecting the fact that the inhabitants of a CPU are "newly-arrived" migrants who have no local traditional livelihood strategies for improving economic capital (e.g.

agriculture)[4]. Thus they would be more likely to commute for work or education to the nearby urban area than inhabitants in an IPU area. Given the homogenous social nature of the CPU, however, it is likely that livelihoods strategies for enhancing social capital can be largely met within the CPU.

As "risk-taking" migrants, CPU inhabitants would be expected to have greater aspirations to travel than inhabitants of an IPU (who are not migrants).

DPU: Diffuse Periurban (In-migration from various places)

A DPU arises from the migration of individuals from differing locations (urban and rural). Travel needs for DPU residents would be expected to be greater than those of the inhabitants of a CPU, since they do not have a history of collective livelihood strategies amongst each other. Thus they would be more likely to commute for work to the nearby urban area than inhabitants in a CPU area. Given the heterogeneous social nature of the CPU, it is likely that livelihoods strategies for enhancing social capital will frequently be met by travel to locations outside the DPU.

Since a DPU is made up of inhabitants who have migrated as individuals rather than (as in a CPU) those who have migrated in a group, it would be expected that DPU inhabitants would, on average, be greater risk-takers than CPU inhabitants. It is likely that they would therefore have greater aspirations to travel.

APU: Absorbed Periurban

An APU is a long-established peri-urban area that might either be close to an urban area (as IPU, CPU and DPU) or actually within an urban area. In general, the travel needs of inhabitants of an APU would be likely to be more urban-oriented that those of the inhabitants of an IPU, a CPU or a DPU. In fact the travel needs would be very similar to those in typical poor parts of the city.

Similarly, the travel aspirations on inhabitants of an APU would be expected to be similar to those of the inhabitants of poorer parts of the city.

EPU: Edge city Periurban

The inhabitants of an EPU are relatively wealthy, and would be expected to have high needs in terms of travel. Jobs would tend to be specialist in nature and located in specific places that might or might not be near to the EPU. Even if the employment location is near, the EPU dweller would need to know that it is feasible to travel further away if an improved employment opportunity arose elsewhere.

[4] Of course it is likely that CPU residents will have "traditional" livelihood strategies associated with the village from whence they came. However, these might not be immediately transferable to the new location.

The inhabitants of an EPU would be expected to have particularly high aspirations for travel, particularly concerning overseas travel for work, education and leisure.

Due to the large service requirements of EPU dwellers, many non-residents will need to travel to an EPU area for employment or vending reasons, frequently as day-to-day commuters. Problems might arise for such “visitors”, particularly non-wealthy ones, in that the transport system in the peri-urban area is likely to be oriented solely towards the needs of its inhabitants.

5. The land use / transport system

The previous chapter considered travel and transport in peri-urban areas from the perspective of individual people and households. The current chapter provides an alternative, but complementary, "systems perspective" in which the peri-urban transport is seen as being part of a combined "land use / transport" system. Section 5.1 provides a discussion on these issues about general theory and evidence from India. Section 5.2 makes a speculative analysis of issues that might be considered in further research, taking into account the six-way classification of peri-urban communities given in Section 2.3.

5.1 Theory and evidence

The concept of "peri-urban as a dynamic process" has already been discussed in Section 2. A central part of this process is the interactive development of land uses and transportation systems. PERIURBAN Deliverable D2 describes the system as follows:

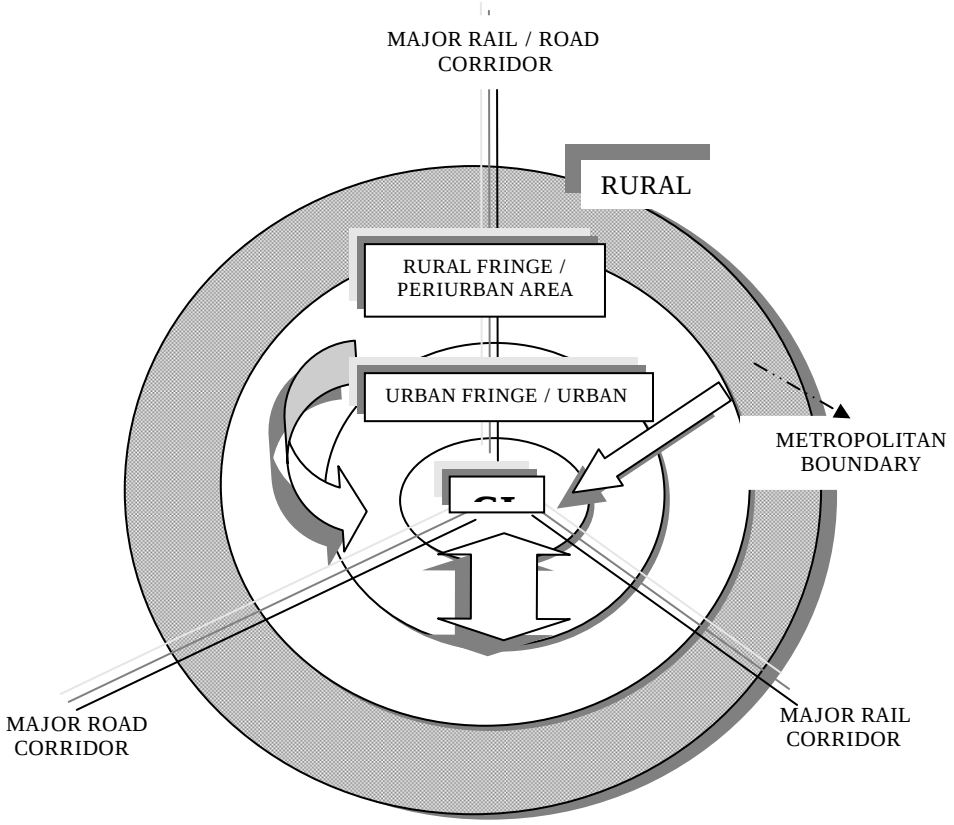


Figure 5.1: Formation of Peri-urban areas

> Urban centers face huge shortfall in urban infrastructure. The fast deteriorating environment often pushes the developments to the periphery of the cities, creating a rural-urban interface. Master plans prepared for all the cities in India encompass a larger extent of area beyond the city limit. The underlying principal for such inclusion is the strong influence exercised by the city over this area and the dependence and interaction induce urban – rural interface up to a certain distance from city center beyond which it is fully rural in character. Thus the Master Plans cover, urban, rural and peri-urban which are neither rural nor urban [Fig 5.1] areas in its fold. The extension of urban character or the urbanization trend beyond city limit is accelerated not only by urban pressure or driving forces but also the availability of transportation corridors facilitating easy access. During the process of urbanization in the area beyond city, the peri-urban area is assumed to exist, before it reaches rural areas.
>
> The process continues and the rural areas get converted into urban area passing through the peri-urban stage. However this pattern does not seem to take place uniformly all around cities.... High growth rate, faster developments are experienced along major transportation corridors, particularly where the corridor comprises of both road and rail. Comparative study of seven major cities (Delhi, Bombay, Calcutta, Chennai, Ahamedabad, Bangalore, Hyderabad) shows that urban extensions have taken place along major transportation corridors served by both road and rail. The areas abutting these corridors depending upon the proximity to the city center have all the urban characters or lost all the rural characters. The dependency on the city is more for job education etc. The [Fig 5.1] illustrates the Concept of formation of ***Peri-urban*** areas.
>
> Today's ***Peri-urban*** area is likely to become urban area of tomorrow, again when transportation network is augmented and the inflow and outflow of resources is facilitated. There is tremendous interaction that takes place between city and ***Peri-urban*** area, and ***Peri-urban*** and rural areas, but the magnitude and character differ. Here, the peri-urban area is assumed to be falling between urban and rural area or it is the rural fringe as shown in the diagram

This development needs to be understood against the background of the "traditional" development of Indian cities which, as Fazal (2001) explains, has differences fro the traditional differences in development of "western cities":

> While western cities have different land-use zones characterised by dominant uses, Indian cities tend to have different areal blocks with several activities in each (Surekha, 1988). This results in a division of a large city into smaller entities. Which are mostly self-contained and loosely co-ordinated with each other. It is the Indian way to compromise with space by saving long distances. This is because of the general tendency of the people to live near their workplace to save on travel. Even wealthier and higher-strata people try to settle in the city centre (Misra, 1998). Thus land uses of various sorts are so mixed that people find everything ordinarily necessary within walking distance. That is why Indian cities are rightly termed *pedestrian cities* (Surekha, 1988).
>
> This characteristic points towards the importance of roads and lanes, which serve as arteries in Indian cities. The zones near these roads and lanes enjoy comparatively high land values. Misra (1998) observed that the spatial

> expansion of the Indian cities is more pronounced along the urban arteries, and along roads in particular. These roads change the patterns of city growth from circular (as observed in western cities) to linear (as observed in Indian cities). With expansion, low-value land use is replaced by high-value land-use.

As with many other aspects of peri-urban transport phenemena, there is little hard detailed empirical evidence about the land use / transport development process. As a way of rectifying this lack of evidence, Sudhira *et al* (2003b, 2004) have developed Geographical Information Systems and mapping techniques to study urban sprawl. They have applied these techniques in two studies: one of the Bangalore-Mysore highway, analysing an area up to 4km either side of the highway (Sudhira *et al*, 2003b); and another of the Mangalore / Udupi region in Karnataka state, including National Highway 17, again analysing an area up to 4km either side of the highway (Sudhira *et al*, 2004). In these studies, they found that densities of built-up area were higher closer to the highways, thus suggesting that development patterns are affected by roads, and confirming the PERIURBAN D2 conclusions given above. In the study of the Bangalore-Mysore highway the authors conclude that "the degree of sprawl was found to be directly proportional to the distances from the cities." (2003b:299) However because of the nature of the study it was not easy to say if the development was residential, business or mixed.

Deliverable D2 found that, in a location around the Chennai Metropolitan Area, land values varied according to proximity to the rail system. In general, using the language of the capital Assets Framework, it would seem possible to conclude that the availability of physical capital, in the form of public transportation systems, is being valued as a household asset. However, further research is required on the effect on land values of the actual use that can be made of the transportation system, taking into account the distance to stations and the levels of timetable service. Furthermore, it is necessary to investigate which social groups benefit most from transport infrastructure investment, and how such development affects the everyday lives of different types of peri-urban residents.

Purushothanan and Allen (2004) highlighted the fact that multi-national businesses are now frequently locating in peri-urban areas. Such location decisions are of importance for issues concerning natural resources, and because they have an impact on the transportation system. Multi-national businesses and large national businesses have the potential to be attractors of high numbers of commuters. If they locate in a peri-urban area where the public transport system is sparse, they are likely to stimulate a reliance on private transport among the workforce.

5.2 Speculation of land-use / transportation development with respect to different types of peri-urban areas

This section provides a “first principle speculation” about the land-use / transportation development process in the six different types of peri-urban area defined above in Section 2.3: five classes involving lower income people (VPU, IPU, CPU, DPU and APU); and a sixth class of wealthier people (EPU). As with the comparable speculative analysis of travel needs and aspirations, in Section 4.4, it is based upon “stereotypical” attitudes that might be associated with the six peri-urban types.

VPU: Village Periurban or Perirural ("Rural" places with "urban" consciousness)

A VPU is a rural village that has developed some “urban influences”. It would be interesting to research the extent to which the urban influence has an effect on the land-use / transport development of the village. If these urban influences result from village members making temporary migrations to urban areas for (higher-paid) employment, it would be expected that more cash would be available in the village for various types of land-use developments, all of which have their own transportation requirements.

IPU: In-place Periurban

IPUs are proximate to an urban area and result from in-place (in-situ) urbanisation. If new business development (either multinational or national) takes place in an IPU, it is likely that the are is already well populated before the business location decision is made. An important empirical question then concerns the extent to which the profile of the IPU residents (in terms of their number, their work experience, and their qualifications) has an influence on the business location decision. A related set of questions concern the level of already-existing and potential future transport infrastructure (road and rail based) connecting the IPU to the nearby city.

CPU: Chain Periurban (In-migration from a single place); and
DPU: Diffuse Periurban (In-migration from various places)

With respect to new business location in a CPU or a DPU, it might frequently be the case that the migration of workers to the area “follows” the business location decision, i.e. the reason for the migration is precisely due to the new work opportunities created by the new business. In such cases, it would be useful to research how the businesses are involved in promoting such a migration process. In particular, in the case of a CPU, it would be useful to research whether, and if so in what ways, businesses actively seek workers in the home locations from where migration takes place. It would generally be expected that the level of transport infrastructure in CPUs and DPUs would be lower than in an IPU (at the time that the business location takes place), simply because the CPU/DPU area would be expected to be less dense

population-wise. This situation might well lead to the negative phenomenon described above, in which a newly located business in a peri-urban area generates a high degree of new private transport. However, these issues should be researched on an empirical level.

APU: Absorbed Periurban

An APU is a long-established peri-urban area that might either be close to an urban area (as IPU, CPU and DPU) or actually within an urban area. The issues concerning the land-use / development of an APU would generally be similar to those in typical poor parts of the city.

EPU: Edge city Periurban

The inhabitants of an EPU are relatively wealthy, with a high level of demand for various types of services. An important land-use question concerns how many of these services can be supplied locally. Given the elite nature of the residents' demands, many services for education, health and leisure can only be provided in relatively few dispersed locations, and it is likely that in many cases they will be at a long distance from EPU residents' homes, thus leading to high degrees of car travel. In many cases, short distances to services might be welcomed by EPU residents. However for some services, such as access to air travel, it is likely that there would be a strong resistance to an airport being built "too close" (even though the EPU residents would be major users of the facility). In general, it is likely that EPU residents have far greater weight in terms of the privileges that they can demand from the political process (compared to residents of other types of other peri-urban areas, or to "ordinary" urban inhabitants), so it is likely that metropolitan-scale land-use / transportation development is organised according to the needs of EPU residents, unless the political culture puts a strong emphasis upon democracy and equity. It would be useful to carry out empirical research for a number of Indian cities to examine these issues in detail.

6. Transport system performance

6.1 Overview

The aim of this chapter is to consider the characteristics of the transport system and its performance in peri-urban areas. As mentioned previously, there is a severe lack of empirical data to support this discussion. Section 6.2 reports a discussion on the issue carried out at the PERIURBAN workshop in Bangalore (July 2004). Section 6.3 presents results from the study carried out by Mukherjee (2000), which was introduced in Section 4.3. Section 6.4 reports results from the peri-urban village visits during the Bangalore workshop.

6.2 Results of Bangalore workshop

The PERIURBAN workshop on transport and energy in Bangalore (July 2004) included a session entitled "working group on transport". This session addressed two questions. The first of these was "What are (specifically) 'peri-urban transport problems'?"[5]. The remainder of 6.2 presents the subsequent discussion.

In order to answer this question it is necessary to distinguish between two types of transport for peri-urban dwellers:

- "Internal" transport taking place within the peri-urban area concerned
- "External" trips to outside locations, typically including an internal trip to access the outside transport network

Furthermore, it is necessary to distinguish between travel by the inhabitants of a peri-urban area and the trips made by others through their area.

Finally, it is necessary to distinguish between transport problems associated with peri-urban areas in the "big five metropolitan areas" (Bangalore, Chennai, Delhi, Kolkata and Mumbai) and other urban centres.

Transport modes typically associated with internal trips are: walk, cycle and two-wheelers. Transport modes typically associated with external trips are: bus, train and shared taxis.

Two types of problem are associated with external trips:

- Lack of integration of peri-urban areas within an extended (urban + peri-urban) transport system, due to inadequate planning
- Safety problems due to overcrowding (e.g. jeeps with 20 people or autos with 7 people)

It was pointed out that in the EU, rich people live in peri-urban areas and are in a position to reorganise the transport system to their own advantage. This is not the case with most peri-urban settlements in India, whose inhabitants are

[5] The second question was "What are the potential solutions to these problems and which solutions do we prefer?". The resulting discussion is presented in Section 10.3.

generally less well-off. However, following Dr Benjamin's presentation at the workshop (showing how poor and rich peri-urban areas both existed in Bangalore, albeit with the minority being rich), a question arises as to whether the rich peri-urban areas in India also suffer problems of lack of integration in the overall transport system.

For internal trips, the question was raised as to whether it is unsafe for an auto-rickshaw to carry 10 people. There was a divergence of opinion over this, and it was agreed that an effort should be made by the project to find relevant research / statistics on the issue.

With respect to problems associated with "other people's transport", it was pointed out that typically the government does not own the land adjacent to highways and so is not in a position to implement measures to deal with problems of excess rainwater and oil running off highways. With respect to the general problem of "too much through traffic", it was discussed how freight traffic did not "pay its own way", effectively being subsidised by the government. If freight traffic were made to pay all its costs, then the level of through traffic by trucks in peri-urban areas would be reduced.

A final problem that was raised concerned wastage of energy in the transport sector. It was pointed out that an overcrowded vehicle might be "energy efficient". However, an overall assessment of such issues needs to take into account safety and comfort issues also.

6.3 Peri-urban commuting to Calcutta

This section provides the results from Mukherjee´s study on peri-urban commuting to Calcutta (Mukherjee, 2002), first mentioned above in Section 4.2.

Typically the women in the survey started journeys before dawn (as early as 3am in one case) and began their journeys in the dark, which made them feel unsafe and vulnerable from being robbed, sexually harassed or assaulted. Many also ended their journeys in the dark, typically reaching home around 7pm. Commute journeys usually began with a walk and then involved a bus or train.

The study showed that the average time spent away from the home by the women was 12 hours per day. 54% of the women interviewed had a combined working and commute time of more than 12 hours and 5% of the women had a combined job and commute time that took less than 8 hours. Typical journeys began with a walk, with an average length of 90 minutes and a maximum length of 180 minutes. Average journeys took 4.5 hours and the women in the sample spent 50-60 minutes waiting for the bus or train. Many of the respondents spent up to 3 hours a day on trains or buses. Time spent working and travelling was time out of house and away from family, thus reducing time available for interaction and creating a potential source of tension between household members.

Mukherjee reported that, out of the 122 women who answered the question about costs, 64 reported that they did not pay the train fare, presumably because they found a way to avoid the train inspectors within the train, or took the risk of riding on top of the train. The fares ranged between 5 and 20 Rupees per journey.

The women interviewed identified a specific set of travel problems associated with the commuting journey to work, which included:

- Over-crowding
- Difficulties transporting loads on public transport
- Lack of toilet facilities (a major problem on an average journey of 4.5 hours
- Delays and cancellations
- Lack of street lighting
- Lack of provision for walking
- Women's train compartments inadequate
- Theft
- Sexual harassment
- Lack of footpaths
- Long journey times
- Feeling of insecurity
- Bribery from staff and police

Mukherjee concludes by making the important point that peri-urban residents commuting to urban areas use both rural and urban transportation services, stating that:

> The problems of transport for rural women, and particularly for rural women commuting to the city, have yet to be identified and recognised. They are the victims of both the almost non-existent rural transport system and the badly managed and overcrowded urban system. (Mukherjee, 2002:225)

6.4 Transport in peri-urban settlements in Chennai

This section reports results on monthly expenditure on transport and mode share for 16 peri-urban settlements in the southern part of the Chennai Metropolitan Area. This information has been taken from Thirumurthy (2005). Table 6.1 shows the income distribution in the sixteen settlements, providing, for each settlement, the percentage of the population in four income groups (less than 3000 Rs per month; between 3000 and 5000 Rs per month; between 5000 and 10000 Rs per month; and more than 10000 Rs per month). Table 6.2 shows the monthly expenditure on transport, providing, for each settlement, the percentage of the population spending an amount according to five levels of expenditure (less than 300 Rs per month; between 300 and 600 Rs per month; between 600 and 1000 Rs per month; between 1000 and 1500 Rs per month; and more than 15000 Rs per month). Table 6.3 shows the mode shares for work trips for the settlements, distinguishing between the following modes: bus; motorised two-wheeler; car; walk; cycle; and train.

Settlement name / Rs. Month	<3000	3000-5000	5000-10000	>10000
Kilampakkam	4.00%	8.00%	64.00%	24.00%
Mannivakkam	7.14%	17.86%	75.00%	0.00%
Mudichur	17.95%	10.26%	38.46%	33.33%
Nedunkundrum	31.82%	9.09%	45.45%	13.64%
Kulapakkam	14.29%	42.86%	17.86%	25.00%
Semmancheri	28.57%	14.29%	28.57%	28.57%
Sholinganallur	25.00%	38.89%	13.89%	22.22%
Uthandi	66.67%	26.67%	6.67%	0.00%
Jallidiampet	27.66%	59.57%	8.51%	4.26%
Medavakkam	20.00%	45.71%	20.00%	14.29%
Vengavasal	43.59%	35.90%	17.95%	2.56%
Perumbakkam	20.00%	13.33%	46.67%	20.00%
Thiruvanjeri	41.03%	33.33%	20.51%	5.13%
Madampakkam	18.75%	37.50%	33.33%	10.42%
Maduraipakkam	44.44%	44.44%	11.11%	0.00%
Ottiyambakkam	83.33%	16.67%	0.00%	0.00%

Table 6.1 Income Level In The Settlements

Settlement Name/ Rs month	0-300	300-600	600-1000	1000-1500	1500-2000
Kilampakkam	4.76	57.14	38.10	0.00	0.00
Mannivakkam	7.69	76.92	11.54	3.85	0.00
Mudichur	13.89	50.00	36.11	0.00	0.00
Nedunkudrum	23.53	52.94	23.53	0.00	0.00
Kulapakkam	15.38	38.46	42.31	0.00	3.85
Semmancheri	46.15	0.00	53.85	0.00	0.00
Sholinganallur	28.17	21.13	19.72	14.08	16.90
Uthandi	50.00	33.33	10.00	6.67	0.00
Jallidiampet	28.00	38.00	12.00	16.00	6.00
Medavakkam	17.14	38.57	17.14	14.29	12.86
Vengavasal	34.15	26.83	21.95	9.76	7.32
Perumbakkam	26.67	46.67	20.00	6.67	0.00
Thiruvanjeri	30.77	53.85	15.38	0.00	0.00
Madampakkam	15.19	20.25	40.51	11.39	12.66
Maduraipakkam	0.00	100.00	0.00	0.00	0.00
Ottiyambakkam	33.33	50.00	16.67	0.00	0.00

Table 6.2 Monthly Expenditure On Transport (%)

SETTLEMENT NAME	BUS	T/W	CAR	WALK	CYCLE	TRAIN
Kilampakkam	13.00	16.00	1.00	10.00	0.00	59.00
Mannivakkam	46.15	19.23	0.00	23.08	11.54	0.00
Mudichur	34.29	28.57	2.86	5.71	8.57	20.00
Nedunkudrum	10.53	57.89	0.00	10.53	5.26	15.79
Kulapakkam	41.67	45.83	0.00	8.33	0.00	4.17
Semmancheri	21.74	34.78	4.35	39.13	0.00	0.00
Sholinganallur	44.23	44.23	0.00	0.00	11.54	0.00
Uthandi	10.71	25.00	0.00	57.14	7.14	0.00
Jallidiampet	55.00	24.00	0.00	10.00	10.00	0.00
Medavakkam	12.50	53.13	3.13	18.75	12.50	0.00
Vengavasal	40.48	16.67	0.00	26.19	16.67	0.00
Perumbakkam'	20.37	40.74	1.85	14.81	22.22	0.00
Madampakkam	28.41	46.59	5.68	5.68	9.09	4.55
Thiruvanjeri	51.16	23.26	2.33	9.30	4.65	9.30
Maduraipakkam	30.00	50.00	0.00	10.00	0.00	10.00
Ottiyambakkam	50.00	14.29	0.00	28.57	0.00	7.14

Table 6.3: Mode shares

The following comments can be made about Tables 6.1-6.3:

- We would expect that the settlements with the highest levels of walking and cycling (for the work trip) would be those with lowest costs of travel per month. From table 6.3, we can see that the settlement with the highest combined walk/cycle mode (64.28%) is Uthandi. This settlement has the highest (out of the 16 settlements considered) percentage of its population (50%) paying 0-300 Rupees per month on travel, thus confirming the hypothesis. Furthermore, Uthandi has the second highest percentage of inhabitants (66.67%) in the lowest salary range of less than 3000 Rs per month.
- The poorest settlement, Ottiyambakkam, with 83.33% of its population in the lowest salary range of less than 3000 Rs per month, has the second highest mode share for bus (50%).
- From Table 6.1, the richest settlement appears to be Kilampakkam. It seems significant that this has a far higher mode share for rail (59%) than any other settlement. Interestingly, the monthly expenditure on transport is relatively low, as can be seen in Table 6.2, with 0% of inhabitants in the highest ranges of 1000-1500 Rs per month and 1500-2000 Rs per month.

As stated above, further information about this study can be found in Thirumurthy (2005).

6.5 Results of Bangalore workshop visits

As stated in Section 4.3, the PERIURBAN workshop in Bangalore (July, 2004) included "familiarisation" visits to two peri-urban villages, Manchanahalli and Shanumangala, near to Bangalore. Each of these visits included an interview with a group of villagers to discuss transport/travel related issues, with each group speaking on behalf of all the villagers in the respective communities. This section reports on transport system performance issues discussed in these visits, which are summarised in Boxes 6.1 and 6.2

Box 6.1: Transport system performance for Manchanahalli

Distances to urban centres

- Birdi: 12 ms
- Kengeri: 16 kms
- Hejallel: 1.5 kms
- Bangalore: 39 kms

Vehicle types owned in village

- 3 cars
- 2 matadors (go to Birdi and wait in matador stand)
- 10 motorised two-wheelers
- 15 bicycles
- 2 tractors
- 2 auto-rickshaws (autos)
    - 1 waits at gate for local travel
    - 1 commutes (empty on both outward and return journey) to Bangalore

Available transport and cost of travel

- Bus, from main gate (0.5 kms)
    - Two types of bus to Bangalore (6.50 and 8 rps)
    - 3 rps to Birdi
    - Buses not there 30 years ago
- Train, from Hejallel (need to access by foot through fields)
    - Frequency: 3 or 4 times per day ("morning" train at 6)
    - Other Mysore to Bangalore trains do not stop
    - Don't know cost to Bangalore
- Auto
    - 40 rps to Birdi (for example 4 people at 10 rps each)
    - Don't know about cost to Bangalore

Box 6.2: Transport system performance for Shanumangala

Distances to urban centres

- Birdi: 6 kms
- Mansu: 5 kms
- Bangalore: 33 kms

Vehicle types owned in village

- 0 cars
- 4 matadors
- 4 motorised two-wheelers
- 30 bicycles
- 3 tractors
- 5 auto-rickshaws (autos)

Available transport and cost of travel

- Bus from village
  - Four public bus per day (6.30, 9.15, 19.00 and 22.00) to gate/highway (3 rps), Birdi (? rps) and Bangalore (10 rps)
  - No private bus from village
  - Bus services from village started in 1982
- Bus from highway (3 kms distance)
  - Fare on public bus to Birdi 3 rps
  - Private buses do not stop at gate
- Auto from village to highway (5 or 6 autos making journey)
  - 5 rps per head
  - Between 7-10 people per auto
  - Auto waits until enough people want to use it, sometimes leading to a waiting time of more than one hour
  - Each auto makes 2 or 3 trips per day to highway
  - No work places on auto route
  - Autos started in 1998 (autos bought on private finance in Birdi)
- Auto from village to Birdi
  - 10 rps per head
  - 7 people maximum per ride

Travel behaviour

- Many walk to work (up to 10 kms distance, 90 minutes)
- Bicycles used to go to Birdi
- 50-60% use motorised modes to work
- One person cycles to Vikula (30 kms)
- 25% of people walk to highway

As can be seen in Boxes 6.1 and 6.2, each of the two villages have access to a major highway, from which buses and auto-rickshaws can be taken to various urban centres. The distance to the highway is 0.5 kms in the case of Manchanahalli, and 3 kms for Shanumangala. It would appear that the major transport problem for the latter village concerns access to the highway. 25% of people walk to the highway, and the remainder use buses, autos (auto-rickshaws) and bicycles. The problem with the bus service from the centre of the village is that only four buses are scheduled per day. The problem with the autos is that they wait in the centre of the village until the driver considers that there are a sufficiently high number of people to carry. Given that payment is made on a per-head basis, it is in the interests of the driver to wait as long as possible until the rickshaw is at maximum capacity (between seven to ten people per auto). This potentially leads to problems of safety, lack of comfort, and potentially long waits by the passengers.

For the inhabitants of Manchanhalli, there was a 1.5 km trip to the train station at Hejallel, which needed to be accessed by foot through fields, lies on the Mysore to Bangalore line. Whilst the frequency of trains using this line is high, only 3 or 4 trains per day stop at Hejallel.

7. Transport and natural resource use

7.1 Overview

As stated in Section 2.2 above, it is most appropriate, when considering transport-related natural resource use and pollution, to define "peri-urban" as being proximate to the city, rather than using sociological definitions. Thus the specific types of peri-urban area defined in Section 2.3 will not, in general, be mentioned in this chapter. An exception to this rule is that a useful sociological distinction can be made between "poorer" peri-urban areas (comprising IPU, CPU, DPU and APU) and richer peri-urban areas (EPU). The discussion in this chapter will assume that peri-urban refers to the former type of area unless there is a specific mention of EPU.

Allen, da Silva and Corubolo (1999) conducted a comprehensive study of the environmental problems and opportunities relevant to peri-urban areas throughout the developing world. They concluded that in such areas there are four main processes of environmental change:

- Land use changes
- Use of renewable resources
- Use of non-renewable resources
- Generating wastes and pollution

This chapter considers these issues in general in Section 7.2, and with respect to equity in Section 7.3. Section 7.4 provides empirical evidence on transport-related air pollution in Varanasi, India.

7.2 Environmental impacts

In general, when considering the environmental problems of transportation it is necessary to take into account the different stages in the life of such a system from the building and installation of transport infrastructure, from its maintenance and operation, from its use and from its dismantling.

One of the most important characteristics of peri-urban areas is that land is under increasing pressure, and land use changes from natural or agricultural use to urban use. Allen, da Silva and Corubolo (1999) identify one of the causes of the loss of agricultural land as the physical expansion of the city. As described in PERIURBAN Deliverable 2 (and summarized in Chapter 4 above) such expansion often occurs along the lines of the existing transportation system, both road and rail. In addition, large transportation infrastructure projects, such as airports and multi-lane highways, are often sited in peri-urban areas. Important issues of equity arise in such cases.

Peri-urban areas are frequently the sites for mineral extraction operations and quarries, to build transportation infrastructure of the types mentioned above. Such activities are carried out within the peri-urban areas (as opposed to rural areas) to minimise the cost of freighting building materials. As stated by Allen, da Silva and Corubolo (1999:20): "Due to its comparative locational

advantages in terms of accessibility, production, and transport cost and time, the PUI is the prime area subjected to extraction of construction materials, which results in increasing natural resource depletion".

Transportation systems can add to water resource degradation involving the contamination of ground water, due to the run-off of water mixed with fuel oil on roads. In addition, inadequate drains and filtration systems can lead to water rushing off roads after heavy rainfalls, causing flooding in immediate areas.

Environmental problems caused by transportation systems in peri-urban communities affect households' human and natural capital, increase levels of vulnerability and provide risks to households' livelihoods. These problems can be direct and immediate such as the impacts of air pollutants upon people with bronchial problems, or they can be indirect and long term, such as a slow poisoning of the land, water and air.

Peri-urban communities sited next to road infrastructure will experience dust, noise pollution and airborne pollutants. With respect to the effect of air pollution from transport on agriculture, Agrawal et al (2003) state:

> Many developing countries, including India, have experienced a progressive degradation in air quality as a consequence of rapid development over the last two decades. In particular, the levels of air pollutants are increasing rapidly in urban and peri-urban areas in many mega cities of the developing world (UNEP, 1999). In India, urban air pollution has increased rapidly with urban populations, numbers of motor vehicles, use of fuels with poor environmental performance, badly maintained roads and ineffective environmental regulations. As a result, agricultural land adjacent to urban areas is exposed increasingly to air pollutants of urban origin. A major threat to crop production is gaseous air pollutants, particularly sulphur dioxide, nitrogen dioxide, and the secondary photochemical oxidant, ozone. These phototoxic gases could have important and increasing adverse impacts on the livelihoods and well being of producers and consumers through effects on urban and peri-urban crop production.

7.3 Equity issues

It is important to identify who experiences the environmental problems resulting from transport. In particular, it is important to identify when those adversely affected by transport constitute a different social group to those that benefit from it.

As stated above, large transportation infrastructure projects, such as airports and multi-lane highways, are often sited in peri-urban areas. Important issues of equity arise in such cases. With respect to the poorer types of peri-urban area, it is unlikely that the main users of the airports will be the inhabitants of the area, though they face the negative environmental impacts, particularly noise. With respect to multi-lane highways, the inhabitants of peri-urban areas, whilst possibly making use of such infrastructure, will not be the major beneficiaries but will face all the associated environmental problems (as discussed below).

An issue arises as to whether EPU areas face similar environmental problems to those in poorer peri-urban areas. With regard to multi-lane highways, such problems would be expected to be similar, though the inhabitants of the EPU (due to their greater mobility) would be expected to gain stronger benefits from their use of the highway. An interesting question arises as to whether an airport might be sited near to an EPU, or whether the strong political capital associated with its residents would over-rule such an option. This issue requires further research.

7.4 Case study of Varanasi

It has been pointed out a number of times in this deliverable that there is little available empirical evidence concerning transport in peri-urban areas in India. An exception to this rule concerns a paper by Agrawal et al (2003), who report on a case study of the effects of air pollution on peri-urban agriculture in Varanasi. In this study, four sites were chosen with characteristics summarised in Table 7.1 (all information in Table 7.1, and subsequent tables, is taken directly from the paper). The level of air pollution was measured at these sites, and four types of plants were grown under controlled conditions. Measurements were made of plant sizes to examine whether these were affected by air pollution.

Site number	Site name	Area type	Transport-related characteristics
1	Tikari	Agricultural area	3 kms south from a bypass highway linking Allahabad and Varanasi
2	Banaras Hindu University (BHU)	University campus	3 kms north from a bypass highway linking Allahabad and Varanasi
3	Sunderpur	Medium density residential area	
4	Government Agricultural Farm	Medium density residential area	100m from a major national highway

Table 7.1: Information on sites

Table 7.2 shows the relative levels of concentration of three pollutants (SO_2, NO_2 and O_3) for summer and winter, with "1" indicating the highest level of pollutant and "4" indicating the lowest level. It can be seen that Site 4 typically had the highest level of air pollution, presumably because of its proximity to a national highway. Site 2 consistently has the lowest levels of air pollution, presumably because of the lack of traffic within the university campus.

Site number	SO_2 summer	SO_2 winter	NO_2 summer	NO_2 winter	O_3 summer	O_3 winter
1	3	3	3	3	1	2
2	4	4	4	4	4	4
3	2	2	2	2	3	3
4	1	1	1	1	2	1

Table 7.2: Ranking of sites in terms of quantities of air pollutants

Four plants were grown at each of the four sites: mung and palak in summer, and wheat and mustard in winter. Table 7.3 shows the ranking of the average sizes of these four plants, with "1" indicating the largest and and "4" indicating the smallest. It can be seen that plant sizes at Site 4 (where there is the highest level of pollution) are typically the smallest.

Site number	Mung	Palak	Wheat	Mustard
1	3	2	1	1
2	1	1	2	2
3	2	3	3	4
4	4	4	4	3

Table 7.3: Ranking of sites in terms of average size of plants

In the words of Agrawal et al (2003):

> The study clearly shows that gaseous pollutants such as SO_2, NO_2 and O_3 have detrimental effects of varying magnitude on wheat, mustard, mung and palak plants depending upon individual pollutant concentration in combination, plant species and season. During summer, O_3 seems to play a greater role in yield losses at a far away rural site, while O_3, SO_2, and NO_2 combinations caused yield losses at the most polluted site. During winter, however, SO_2 and NO_2 combinations were more detrimental in causing yield loss.
>
> The study emphasizes that urban air pollution is becoming a serious threat to peri urban agricultural production in India. However, more studies are required with chamber filtration and fumigation experiments to elucidate the magnitude of the effects caused by individual pollutants.

8. Transport Safety

It appears that no information is available about transport safety in peri-urban areas in India. The approach therefore taken in this chapter is to highlight various universal transport safety issues (in 8.1) and hypothesise safety issues for different types of peri-urban areas in 8.2.

8.1 Generic factors in transport safety

According to a joint report by the World Health Organization and the World Bank "World Report on Road Traffic Injury Prevention" (2004), as reviewed by Dalvi (2004), the magnitude of road traffic injuries globally can be summarized as follows:

- More than 1 million people are killed world wide every year as a result of road traffic crashes
- Road traffic injuries are the eleventh leading cause of death and the ninth leading cause of disability-adjusted life-years lost world wide
- Poor and vulnerable road users – pedestrians, cyclists and motorcyclists – bear the greatest burden
- Some 90% of road traffic deaths occur in the developing world, which comprises two-thirds of the global population
- As motorization increases, many low- and middle-income countries might face a growing toll of road traffic injuries, with potentially devastating consequences in human, social and economic terms
- Males are more likely to be involved in road traffic crashes than females
- Economically active adults, aged 15-44 years, account for more than half of all road traffic deaths
- Without new or improved interventions, road traffic injuries will be the third leading cause of death by 2020

From these statements, and from the statistics upon which they are based, it is clear that there is a connection between speed of economic development and level of transport accidents. Hence, whilst transport accidents are generally decreasing in higher-income "western countries" (whose economies are relatively static), they are increasing rapidly in countries where there is fast economic development, such as India. Following this observation, a hypothesis can be made that transport safety problems might be of particular significance in peri-urban areas (in India), since peri-urban areas frequently have relatively high economic growth compared to rural or urban areas. If transport accidents are related to speed of economic change, then it follows that accidents would be likely to be higher in peri-urban areas. However, no statistics are currently available to test this hypothesis.

8.2 Speculation about transport safety for different types of peri-urban area

This section makes hypotheses about transport safety according to the six-way classification of peri-urban areas used previously in this deliverable.

VPU: Village Periurban or Perirural ("Rural" places with "urban" consciousness)

VPU areas would generally be expected to have accident levels similar to other rural villages. The one proviso here is that the “urban influence” in the VPU might lead to traffic behaviour by users of motorised vehicles that is somehow different to “traditional” behaviour in rural areas, which might lead to safety problems.

IPU: In-place Periurban

IPU areas and other “poor” peri-urban areas located proximate to the city (i.e. CPU and DPU areas) would be expected to have specific transport safety problems for the following reasons:

1. Peri-urban areas are likely to contain a mixture of urban and rural standards of regulation, enforcement, engineering design and traveller behaviour. Urban transport would be generally be expected to have greater discipline safety-wise than rural transport, as a result of: a higher level of accident-preventative regulation (and enforcement) in urban areas; a higher degree of safety-oriented engineering design in urban areas; and the higher level of experience of urban inhabitants in dealing with complex traffic situations. The mixture of urban and rural standards in one location is likely to lead to safety problems.
2. (Urban proximate) peri-urban areas would, in common with many urban areas, be expected to have a large heterogeneity in terms of mode types (i.e. buses, cars, three-wheelers, motorised two-wheelers, bicycles and pedestrians). The resulting safety problems are anyway of particular importance for transport in urban areas. However, in line with the comments about the mixed “urban/rural” traffic planning/behaviour in peri-urban areas mentioned in (1), it could be the case that mixed-traffic safety problems are even greater in peri-urban areas than in urban areas.
3. The severity of accidents in urban areas is, to a certain extent, reduced due to the slow motorised-vehicle speeds resulting from traffic congestion. However, such congestion would typically be expected to be less in peri-urban areas, due to their relative lower densities, resulting in higher motorised-vehicle speeds and a higher severity of accidents.
4. As pointed out in Chapter 7, such areas frequently contain multilane intercity highways, with a typically high level of fast moving traffic. Often such highways will pass through (or near to) the centre of villages, creating problems of severance. Transport safety problems will inevitably arise due to the need of slower-moving local traffic (including pedestrians) to cross from one side of the highway to the other.

CPU: Chain Periurban (In-migration from a single place)
CPU areas might be expected to have greater transport safety problems than IPU areas since, in CPU areas, the inhabitants are recent migrants from a rural area and so might be less accustomed to urban transport behaviour (the inhabitants of an IPU have, by definition, for an extended period lived "close' to an urban area).

DPU: Diffuse Periurban (In-migration from various places)
DPU areas might be expected to have even greater transport safety problems than CPU areas since, in DPU areas, the inhabitants have recently migrated from a number of different locations (rural and urban), each with its own traditional attitudes towards transport safety (the inhabitants of a CPU have, by definition, migrated from a single source region where, presumably, there was a homogeneous attitude towards transport safety).

APU: Absorbed Periurban
APU areas would be expected to have "typical" transport-safety problems associated with poor neighbourhoods within urban areas, especially if the APU lies inside the city. Hence transport safety for APU areas would not usually need to be considered as a separate issue to the more general issue of urban traffic safety.

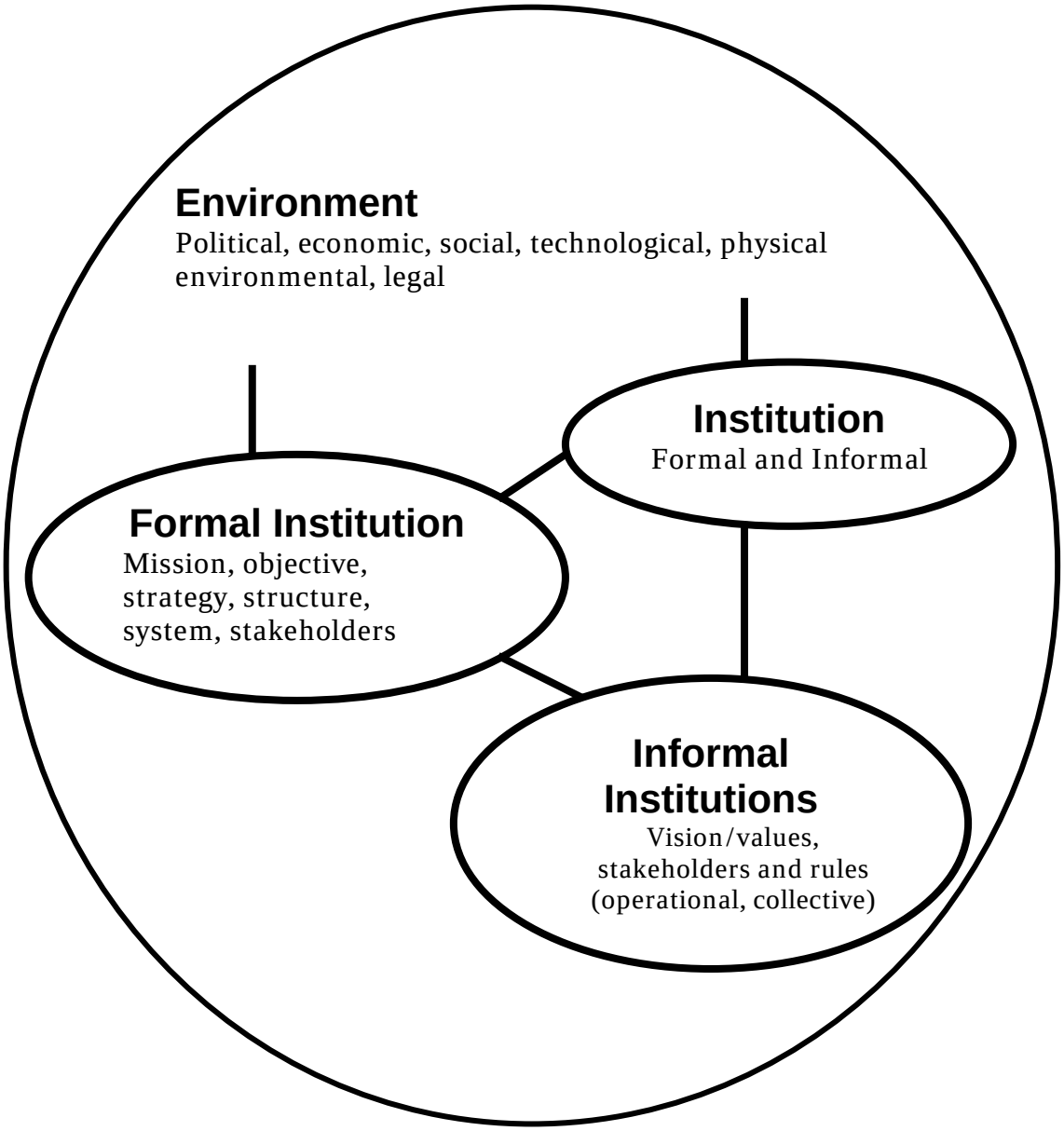
EPU: Edge city periurban
EPU areas would be expected, for two main reasons, to have fewer transport safety problems than the poorer types of city proximate peri-urban areas discussed above. Firstly, it would be expected that engineering design standards would be higher in such areas. Secondly, the residents would be expected to have a greater (urban) level of traffic safety consciousness. However, both these statements need to be qualified. In the first case, the improved engineering design will lead to higher traffic speeds (especially on multi-lane highways connecting the area to the city). Higher traffic speeds lead to greater severity of accidents. Secondly, the high status of the inhabitants of the EPU might lead to a refusal to consider the safety problems of perceived lower status road users in the area, such as pedestrians and cyclists. As pointed out above in Section 4.4, travellers within the geographical area of an EPU will include many low-income non-residents servicing the needs of the residents of the area. For example, in an EPU (as in a city centre), a car driver might refuse to slow down to avoid a collision with a pedestrian crossing a road, putting the onus solely upon the pedestrian to avoid an accident. However, the car speed in an EPU would be likely to be higher than in a city centre, thus making it more difficult for the pedestrian to avoid a collision and leading to a higher severity of accident when a collision does take place.

9. Institutional context

9.1 Overview

PERIURBAN Deliverable D3 (2005) has examined generic institutional issues for peri-urban areas. This work made the distinction between formal and informal institutions, as represented diagramatically in Figure 9.1. This chapter considers formal institutional issues with respect to the transport sector.

Figure 9.1: Formal and informal institutions



Unfortunately (as is the case with many other subjects covered in this deliverable) there is little empirical data on the institutional context of the peri-urban transportation system in India. Whilst there is ongoing research on cooperative governance, see Purushothanan and Allen (2004), and there is other work on governance institutions and structures by Allen, da Silva and Corubolo (1999) and Farrington *et al* (2002), this is not focussed on the transport sector. It is clear that all these authors agree that the formal institutional context within the peri-urban can be characterised as fragmented, by which they mean that there are a multitude of different government bodies responsible for provision and governance of peri-urban areas. This fragmentation of formal institutions responsible for the peri-urban results in a lack of institutions that are capable if linking rural and urban activities. There is in addition a convergence of sectoral and overlapping institutions with different remits. As stated by Allen, da Silva and Corubolo (1999):

> [A] distinctive characteristic of the PUI is the lack of institutions capable of addressing the links between rural and urban activities. This is reinforced by the convergence of sectoral and overlapping institutions with different remits. Institutions of local government tend to be either urban or rural in their focus, metropolitan governments – few in any case – rarely include rural jurisdictions, special purpose authorities bridging urban and rural areas are not created, and district and regional governments do not adequately link urban and rural concerns. Poor management of per-urban areas obstructs both rural and urban development.

Whilst, as stated above, there is little empirical evidence about the peri-urban transport sector in India, it is likely that it shares in the institutional fragmentation associated with the peri-urban in general. Thus, there is likely to be no over-arching responsibility being taken by one body with respect to the transport issues discussed in pervious chapters of this deliverable (i.e. land-use / transportation planning, transport system performance, and environmental and safety issues). The resulting lack of integration leads to such outcomes as reported by Mukherjee (2002), who stated that "[women commuters] are the victims of both the almost non-existent rural transport system and the badly managed and overcrowded urban system." (2002:225)

Tables A1.1 and A1.2 in Appendix 1 show the organisations and institutions involved in the transport sector at national level and urban level in India. Deb (1999) describes the responsibility for the transport sector at the national level as one based on the principle of federalism. At the urban level the responsibility for transport is that of the state government, although this is not the case for railways. Deb states also that there is confusion between the land use planning departments and those responsible for transport. It would be useful to examine which institutions have formal responsibility for transport in peri-urban areas, taking into account the list of institutions provided by Deb, and how effectively these responsibilities are carried out.

9.2 Institutional issues associated with different types of peri-urban area

This section uses a familiar approach in this deliverable, speculating on issues of relevance to the six different types of peri-urban area defined above in Section 2.3: five classes involving lower income people (VPU, IPU, CPU, DPU and APU); and a sixth class of wealthier people (EPU). As with the other uses of this approach, it is based upon "stereotypical" attitudes that might be associated with the six peri-urban types. Since the first five classes were in fact constructed by Iaquinta and Drescher (2001) to examine institutional issues, their work will be referred to frequently in this section, and interpreted in the light of transport issues.

VPU: Village Periurban or Perirural ("Rural" places with "urban" consciousness)

A VPU is a rural village that has developed some "urban influences". It would be useful to research the extent to which the urban influence has an effect on the formal and informal institutional structures of the village. In particular, what effect does the urban influence have upon the different types of participation by villagers concerning transport issues?

IPU: In-place Periurban

Iaquinta and Drescher (2001:10) describe how IPUs tend to have a "traditional institutional context", where

> The processes of growth and annexation, combined with in-migration, create *in-place periurban* environments. Unlike *chain periurban* environments, which have benefited from risk-taking immigrants, these environments are populated by the converse of migration selectivity, namely those least likely to have migrated out of the traditional environment. These environments generate traditional institutional contexts. While proximate to the city, they have long-term stable institutions that respond to the in-migration of "others"—particularly urbanites—through defensive insulation.

As in the case of a VPU, it would be useful to research how the informal institutional structures with respect to transport are changed as an IPU moves from being a rural village to a peri-urban community. Furthermore, it is important to research how the formal institutional structures change. For example, does the new status of "peri-urban" lead to greater incorporation in the metropolitan decision-making associated with the nearby city? In terms of practical results, does this incorporation lead to a greater of transport integration, easing the journeys of peri-urban residents to the urban centre?

CPU: Chain Periurban (In-migration from a single place)

Iaquinta and Drescher (2001:10) describe how CPUs tend to have a "reconstituted institutional context", where

> This institutional context exists when an area proximate to the city becomes an end-point of chain migration. In these environments the dense concentration of migrants with similar cultural origins leads to the recreation of the institutional forms that existed in the village. This recreation is never exact; therefore, we use the term reconstituted. This reconstruction of collective cultural identity is defensive in posture as the new migrants attempt

> to re-establish the familiar amidst the alien. It is exacerbated by the challenge of dealing with urban formal institutions.

Various questions arise over transport institutions in CPUs. In particular, to what extent are informal institutions of the source location affected by the migration to the CPU, and how are "transport norms" affected by such a change, in terms of attitudes towards mode use, safety and use of natural resources?

DPU: Diffuse Periurban (In-migration from various places)

Iaquinta and Drescher (2001:10) describe the institutional driving forces in DPUs as follows:

> *Diffuse periurban* environments are formed by the influx of migrants from a variety of geographic and cultural sources..... These are environments that have a high need for change due to their proximity to the city. The influx of new migrants, the demands of coping with the nearby urban sector, and the need to overcome cultural barriers require that resistance to change will be low. The very selectivity of migration, whereby the "innovators" are most likely to have migrated, supports this low resistance to change. These environments are most likely to spawn democratic or consensus-based change and institutions. Therefore, they are environments, which have the greatest opportunity for egalitarianism and erosion of traditional stratification systems.

Transport institutional issues concerning DPUs have many similarities to those concerning both IPUs and CPUs. Thus, a central question arises concerning the differences between these three types of peri-urban area that are located nearby a city. In particular, what different effects result from the risk-taking nature of the inhabitants of the DPU?

APU: Absorbed Periurban

Iaquinta and Drescher (2001:12) describe how APUs tend to have a "residual institutional context", where

> Residual institutional contexts are created when others have replaced the original culture group though a process of residential succession and displacement yet left in place a set of arrangements whose roots lie in the culture of the original residents. The institutional context is upheld through ritualism or traditionalism (i.e., rigid adherence to custom simply for tradition's sake even when the basis for the tradition no longer holds) or because members of the original culture group still control the local power structure, precluding access by newcomers and rewarding compliance.

Questions arise as to whether they are as integrated within the metropolitan transport system as other parts of the city, or whether they have a "separated (ghetto) status" due to their peri-urban nature, within a resulting lower level of transport infrastructure/services. Furthermore, given that (by definition) APUs have typically been longer established that other types of peri-urban area, it would be useful to research the history of the development of the institutional processes associated with such areas.

EPU: Edge city Periurban

Issues were raised above (in Section 5.2) about the potentially strong political influence of EPU residents in the processes of metropolitan land-use / transport decision-making. In general, it would be useful to make a comparison between EPU areas and other peri-urban areas concerning all the issues raised in this section, focussing upon the different levels of power exercised by the residents of different types of area. One issue of particular interest in this respect concerns the level and quality of integration of peri-urban areas into the wider metropolitan area, both in terms of transport policy-making processes and transport infrastructure/services.

10. Policy Options

10.1 Overview

Since PERIURBAN is a policy-oriented project, it has produced various different outputs with respect to transport policy-making. These outputs are summarised in the present chapter. Section 10.2 provides a summary of the policy options resulting from the study by Mukherjee (2002). Section 10.3 provides the results of a discussion on transport policy at the PERIURBAN Bangalore Workshop (July, 2004), whilst 10.4 presents the transport policy suggestions made by villagers during the familiarisation visits during this workshop. Section 10.5 provides a summary of the results from the transport session at the final PERIURBAN workshop in Delhi (September, 2005).

10.2 Commuting in Calcutta

The women surveyed by Mukherjee (2002), as described in Section 4.2, suggested a number of transport and non-transport solutions to the problems they experienced when commuting. These suggestions included:

- Increase capacity by increasing number of buses and trains
- Reducing delay by introducing dual train tracks
- Reducing delay by building new roads to shorten journeys
- Reducing delay by introducing a more direct bus route
- Increasing security by improving street lighting
- Increasing security by increasing the number of women's compartments on trains
- Increasing security by reducing the corruption among railway staff and police
- Improving walking by introducing cement walkways
- Improving journeys by introducing toilet facilities
- Reducing the need to travel by establishing income generating activities in villages

However, as Mukherjee (2002) concludes, these suggestions should be explored more thoroughly with communities to make sure that there is ownership of the policies. Mukherjee (2002) concludes that "Though the women made recommendations for the solution of their problems, they don't think they can play any role, however minor, in the improvement of the present situation. They lack the confidence." (2002:233)

10.3 Results of Bangalore workshop discussion

The PERIURBAN workshop on transport and energy in Bangalore, July 2004, included a session entitled "working group on transport". This session addressed two questions. The first of these ("what are (specifically) 'peri-urban transport problems?') was discussed above in Section 6.2. The second question was: "What are the potential solutions to transport problems, and

which solutions do we prefer?". The remainder of this section presents the subsequent discussion on this question.

When discussing solutions it is necessary to distinguish between two levels:

- A "high level" which recognises that transport and land use are closely interconnected, and that solutions should reflect this interconnection
- A "transport sector level" which is concerned with the provision of everyday transport facilities, with transport seen as an isolated sector

Both these levels need to be considered in parallel. Ideally, solutions on both levels can be found which are mutually consistent. However, it was recognised that in certain circumstances there might be conflict between the two types of solution.

For high level solutions, it was generally agreed that there was a need for a relocation of facilities, thus bringing them closer to people and reducing the need for transport. One type of measure involved the establishment of "regional centres". For example, in the visits on the day before, it had been noted that most of the villagers used Birdi to provide for many "urban needs" (non-agricultural employment, education and health), thus reducing the need to make the much longer journey to Bangalore.

For transport sector solutions, three general points were agreed:

- There was a need for better integration of transport provision across the combined urban / peri-urban region
- There was need for better regulation of existing laws, for example involving safety, and a need for new regulation if current regulation were inadequate
- The type/size of transport provided or any one location should depend upon the demand for travel (which might vary by season)

Within this context, various suggestions were made:

- That minivans or minibuses could be used, in the place of buses, for peri-urban dwellers to make external trips if there were insufficient demand for buses.
- That there should be a frequent public transport vehicle (bus or minivan) as appropriate in the peak hours.

There was discussion about government intervention in transport. Whilst it was generally agreed that there should be such intervention in terms of formulation of overall policy, planning and regulation, it was not agreed whether this intervention should also extend to supply of transport services. It would be useful to pursue this issue further.

A question arose as to whether the transport issues / solutions associated with regional centres within a metropolitan area were the same as (or least similar to) those associated with free-standing urban centres. It would be useful to consider this issue further.

10.4 Policy recommendations suggested by villagers in Bangalore workshop visits

As described in Section 4.3 above, the Bangalore Workshop included two visits to peri-urban areas. As part of these visits, villagers were asked to suggest transport policies that would improve their lifestyles.

In Manchanahalli, the villagers made the following suggestions:
1. Train to stop nearby so that Bangalore can be easily and cheaply accessed, with a morning train at 8.30
2. Cost for bus to Bangalore should be reduced to 5 rps
3. School for 12+ to be in village (demand exists from 150 children)

In Shanumangala, the villagers made the following suggestions:
4. Higher frequency of bus (than 4 per day) from village to Birdi and Bangalore
5. There is already a regular bus from a nearby village to Bangalore (costing 7 rps): the route should be extended to Shanumangala

As can be seen, three out of these five suggestions (1, 4 and 5) involve extensions of the transport network, thus improving the integration of the two villages within the overall Bangalore metropolitan region. Suggestion 2 involves reducing the cost of travel. Suggestion 3 is more located on the level of land-use / transport planning, involving the creation of a new school in Manchanahalli, which would get rid of the need for large amounts of travel.

10.5 Results from Delhi workshop discussion

The final PERIURBAN workshop was held in Delhi in September, 2005, and was devoted to discussing peri-urban policy options. Part of this workshop involved a discussion on transport policy. Two types of recommendations resulted from the discussion, concerning "transport policy recommendations" (provided in 10.5.1), and "recommendations for further research" (provided in 10.5.2). Taking into account that these recommendations were based upon the results of earlier work on transport in the PERIURBAN project (as reported above throughout this deliverable), they can be seen as the "final conclusions" of the project with respect to transport.

10.5.1 Transport policy recommendations for peri-urban areas

The workshop discussions identified the following needs for transport planning authorities:

- Need for planning authorities to decide/provide transport options (both strategic and short term) integrated with land use policies
- Need for access to and integration between various types of transport
    - Within peri-urban areas
    - To nearby cities
    - To other cities/states

- Need to promote facilities for safe non-motorised transport (walking and bicycling) within peri-urban areas

It can be seen that (not surprisingly) these needs reflect very much many of the transport-related issues raised previously within the PERIURBAN project, as described in the above chapters. These suggestions would arguably not be seen as controversial, reflecting a "standard" (present day) approach to transport planning. They should therefore be implemented with some urgency in those situations where they are not fully implemented in current practice.

10.5.2 Research Recommendations for Transport Policy

The workshop made a number of recommendations with respect to future transport-related research. These recommendations have been extended to provide the following suggestions:

- Develop a classification of different types of peri-urban area, based upon the initial classification made within PERIURBAN, and investigate the transport needs and aspirations associated with each type of area (taking into account the characteristics of the city to which the peri-urban area is near).
- Find empirical evidence of the role of public and private institutions (both local and global) in the development of transport infrastructure within peri-urban areas, and connecting peri-urban areas to cities and rural areas. Use this evidence to help build a theory to understand "peri-urban phenomena" within dynamic urbanisation processes.
- Find empirical evidence on the access to rail, road and other transport options, and use this evidence to develop indicators on transport for peri-urban areas.
- Find empirical evidence on traffic safety in different types of peri-urban areas, and to use such evidence to develop appropriate theory for use in accident reduction strategies.

The overall philosophy underlying these research requirements reflects the approach taken in this deliverable. Firstly, a greater level of distinction should be made, between different types of peri-urban areas, than is usual in much of the literature about peri-urban phenomena. An example of such classification is the six-way distinction, used frequently in this deliverable, between five classes involving lower income people (VPU, IPU, CPU, DPU and APU) and a sixth class of wealthier people (EPU), and this classification can provide the starting point for future research. However, the workshop suggested that the classification also take into account a distinction between the different types of urban area to which the "peri-urban area is attached". In particular, a distinction should be made between peri-urban areas close to large metropolitan cities and peri-urban areas close to small cities. Once a suitable classification of peri-urban areas has been made, there is a need for a large amount of empirical investigation with respect to finding evidence on transport.

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Appendix 1

Organisations	Functions	Relevant acts
Roads		
Ministry of Road Transport and Highways	Development of road transport infrastructure and National Highways, and overall regulation of freight road transport in the country	Motor Vehicles Act 1988, Central Motor Vehicle Rules 1989
National Highway Authority of India	Development and maintenance of national highways in the country	National Highways Act 1995
Roads department, State Government	Development and maintenance of state highways in the country	VII Schedule of the Indian Constitution (Article 246), List II (State List), Item 13
Ports, shipping and inland water transport		
Ministry of Shipping	Co-ordination of various activities related to ports, shipping and inland water transport	
National Shipping Board	Advisory body to the Ministry	Merchant Shipping Act, 1958
Director General, Shipping	Implementation of various provisions of the Merchant Shipping Act, 1958, of various international conventions relating to safety, and mandatory requirements under the International Maritime Organisation	Merchant Shipping Act, 1958
Port Trusts	Managing daily activities of the individual major ports in the country	Major Ports Trust Act, 1963
Inland Water Way Authority of India	Regulation and development of national water ways for the purposes of shipping and navigation	Inland Waterways Authority of India Act, 1985
Transport Department, State Government	Regulation and development of water ways other than national waterways for the purposes of shipping and navigation	VII Schedule of the Indian Constitution (Article 246), List II (State List), Item 13
Tariff Authority for Major Ports	Independent regulation of tariff setting in Major Ports	Major Ports Trust Act, 1963
Civil aviation		
Ministry of Civil Aviation	Planning and development of infrastructure for regulation air traffic. Responsible for Airport Authority of India, Director General of Civil Aviation Security	Air Corporation Act, 1953
Airport Authority of India (AAI)	Infrastructure and facility for Air traffic is provided by AAI. It is also responsible for maintaining domestic and international airports and civil enclaves at defence airports in country.	Airport Authority of India Act, 1995
Director General of Civil Aviation/Bureau of Civil Aviation Security	Perform regulatory functions.	

Railways		
Ministry of Railways	Planning and development of railway infrastructure	Railway Act, 1989

Table A1.1 Organisations in transport sector at the national level

Taken from: Deb (1999)

Organisations	Functions	Relevant acts
Urban transport planning		
Ministry of Urban Development	Overall responsibility for urban transport policy and planning	
Land Development Authority, State Government	Land use allocation and planning	State Development Acts
Roads		
Transport Department, State Government	Licenses and controls all road vehicles, inspection of vehicles, fixing motor vehicle tax rates	Motor Vehicles Act 1988
Ministry of Surface Transport	Administer the Motor Vehicles Act and notify vehicle specifications as well as emission norms	Motor Vehicles Act 1988
State Transport Undertaking, State Government	Operation of bus services	Road Transport Corporations Act 1950
Public Works Department, State Government	Construction and repair of State roads	VII Schedule of the Indian Constitution (Article 246), List II (State List), Item 13
Local Municipality	Construction and repair of smaller roads, road signage, traffic lights, licensing and control of non-motorised vehicles, clearing of encroachments and land use planning	Constitution (Seventy-Fourth Amendment) Act, 1992
Police	Enforcement of traffic laws and prosecuting violators	State Police Acts
Railways		
Ministry of Railways	Own and operate urban rail transit systems wherever they exist	Railway Act, 1989
Others		
Ministry of Petroleum and Natural Gas	Regulation of prices and quality of transportation fuels	Essential Commodities Act, 1995 The Petroleum Rules, 1976
Department of Environment, State government	Monitoring air quality	

Table A1.2: Institutions involved with urban transport in India

Taken from: Deb (1999).