The Implementation Gap in Land Use Transport Integration: A Case of Path Dependence?

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Introduction

A question that comes to mind in research on transport governance is: 'Why do matters persist when they need to change?' The guiding concept of transport planning in the twentieth century was based on universal personal mobility made possible by mass production of the private vehicle and cheap oil. The negative of this concept is today all too apparent: fossil fuel based energy leads to dangerous climate change; as oil production peaks and ultimately declines it can no longer function as a cheap energy source; the systemic effects of car dependence on public health are being brought into sharp focus: the diseases arising from air pollution and lack of exercise, and the horrific carnage on the roads. Finally there is the unquantifiable but no less significant loss of urban quality imposed by the drive to facilitate bursts of high speed by building vastly expensive motorway infrastructure.

No-one can deny the pleasures of individual mobility afforded by the private car. But these pleasures are vitiated in congested urban areas, and for this reason it is noticeable that advertisements for cars nearly always situate their use in open landscapes, in fact anywhere but the urban settings in which cars are overwhelmingly used. What is needed is not just a new appraisal of the balance of costs and benefits of the existing individual mobility paradigm, but a new transport paradigm for the twentieth century, one in which active and collective transport play a much more highly valued role in city life. The Australasian Centre for Governance and Management of Urban Transport (GAMUT) has sought to define this paradigm as 'Model 2: Sustainable Transport', a model that is already being partially implemented in some of the world's finest cities, and which several leading transport and land use philosophers such as Todd Littman, John Whitelegg, Robert Cervero and Peter Newman have elaborated in their work.

An essential element of the new paradigm is the planning of urban form for optimum accessibility to all the activities and delights of urban life: land use transport integration (LUTI). This is in many ways an image of what inspires the illusive quality of urban place: a particular blending of landscape and buildings, the human scale of built environment, an environment where walking is a pleasure and where it is safe to extend the range of accessibility through pedal power, where people gather without stress and at leisure. They are places linked to many destinations in the city by rapid transport. The places in Australian cities which exhibit these qualities of public place are now among the most highly prized - and highly priced.

To a significant degree, as we illustrate below, the LUTI vision has been adopted into public policy in Australia. But, as we also demonstrate in the case study reported here, public policy has not resulted in very much change in the urban fabric itself. There is an 'implementation gap'. So this brings us back to the question posed at the start: 'why do matters persist?' Our wider aim in this research is to explore this question, so we begin the paper by a discussion of the theory of 'path dependence' which offers a potentially fruitful explanation. Our specific aim in this paper, however, is to offer a demonstration that matters do indeed persist even when policy changes. The low density car dependent urban environment persists even where policy asserts that higher densities should be created around railway stations. In conclusion we consider the next stage in our research to test the hypothesis of 'path dependence'.

Path Dependence and LUTI

The concept of path dependence emerged from a critique of markets by economists (David, 1985; Arthur, 1988a). They argued that self-reinforcing mechanisms exist in the logic of production to ensure that a type of product prevails on the market even though better alternatives exist. Some economists have argued that the evidence base for economic path dependence is thin (Liebowitz and Margolis, 1990, 1995). However the path dependence work focused attention on the need both for empirical evidence of the effects, beneficial and otherwise, of markets and on the historical evolution of economic and policy-making behaviour. The counterpart of the critique of markets is the critique of liberal democracy: just as markets are assumed to reflect the balance of preferences of a population for commodities, so liberal democracies are assumed to reflect the balance of preferences of a population for policies. Political institutionalists have questioned this orthodoxy (March and Olsen, 1989, 1994; Peters, 1999). The idea of path dependence has been transferred from the world of the market, which is of course one kind of institution, to the wider domain of policy formation and implementation by governments (North, 1993; Torfing, 2001; Pierson, 2004).

Before proceeding we should be clear about what path dependence is not. The persistence of 'paths' can be the result of deliberate action by political players to resist change or innovation, or to respond to beliefs in their constituencies (as also occasionally the dislocation of existing paths and establishment of new ones at critical junctures), or conspiracy to those ends. Persistence may also be explained by sheer ignorance, incompetence or other lack of capacity. These micro-political influences are not signals of path dependence. Equally at the macro-political level, path dependence is not equated with the structural 'forces' of class and capital identified by Marx and his successors. Neither micro nor macro political forces are ever absent from the societal stage. But path dependence, as a middle range theory owing more to Weber, Karl Polanyi and Foucault than to Marx, fills a significant theoretical space in which neither day-to-day politics and markets nor mighty structural forces seem to capture the reasons why matters persist.

In analyzing path dependence, two distinctions seem useful. The first is between technical and institutional path dependence. Secondly, institutional path dependence may be further divided between organizational and discursive path dependence.

In the technical domain, city form can be shaped by the dependence on a particular form of transport (Newman and Kenworthy, 1989, 1999). The widespread adoption of the private vehicle for getting around and servicing the city has made possible the choice of low density residential environments (evident in Australian and North American cities, and the outer suburbs of European cities. Vehicles and roads are the key technologies. Cervero (2005) argued that road investment and urban development are co-dependent, where:

> '…a road investment increases travel speeds and reduces travel times …; increased utility, or a lowering of "generalized cost", in turn stimulates travel, …including new motorized trips (e.g. latent demand previously suppressed), redistributions (modal, route and time-of-day shifts), and over the longer term, more deeply rooted structural shifts like land use adjustments and increased vehicle ownership rates (that in turn increase trip lengths and vehicle miles travelled). While evidence on the induced-growth effects of new highways is limited, roads and prominent fixtures of America's suburban landscape – big box retail, edge cities, and campus-style executive parks – that they serve are clearly co-dependent' (Cervero, 2005, pp. 128-129).

Very much the same can be said of Australian cities. Arthur (1988b) and Woodlief (1998) commented on 'path dependent cities' in this sense. Low, Gleeson and Rush (2005) term this

element ‘technical path dependence’: that is arising from technologies of mobility as distinct from that arising from the institutions within which these technologies are implemented.

Whilst there is no single and definitive concept of an ‘institution’, there is widespread agreement among analysts that institutions are about rules and norms of the polity, whether those rules/norms are embedded in formal political constitutions (Buchanan and Tullock, 1962), are constitutive of organizations (March and Simon, 1958) or are embodied in belief systems shaping individual behaviour (Denzau and North, 1994). The formation of urban structure is influenced by a variety of institutions. As well as the most fundamental rules embedded constitutionally (for instance rules relating to private property and the definition of crime), rules are manifest in organizations. Rietveld and Stough (2005) argue that one of the primary barriers to the delivery of sustainable transport is institutional. Such a barrier can either reduce the potential for delivery, or make it impossible to achieve (Banister, 2005). This requires an understanding of two components – the rules and rule structures that guide action (see North, 1990) and the organisations as agents of those rules and the way in which they act (culture). The organisational element of path dependence in Melbourne, Victoria, is discussed by Low and Astle (forthcoming, 2009) in an analysis of the historical evolution of the governance of roads and public transport in Victoria, Australia.

Within the field of institutions there is also is a cultural or discursive element relating to understandings about what is true and what ought to be done, what are the problems and what the solutions. These are the ‘storylines’ that people with the power to decide tell one another to explain the situation their city finds itself in, to identify its transport problems, and to find solutions that are appropriate to the problem (Low, Gleeson and Rush, 2003; Low, 2005). This element of path dependence may be termed ‘discursive’. The discursive and organizational elements of institutional path dependence appear to reinforce one another over time.

The picture becomes somewhat more complex when we extend the investigation of path dependence to LUTI. We have to consider not just transport planning but the institutions of land use planning and of urban development: not just two forms of planning but also a quasi-autonomous institutional field, that of urban development (Table 1). The assumption that the producers of urban development are always subordinated to the regulation imposed through policy deserves at least to be open to question. Although regulation can prevent development of a given kind it cannot make it occur.

Land use planning is one element in the institutional framework of urban development, but it is not the only or necessarily the most important determinant. There is the structure of the development industry and its internal rules: the scale of operations of builders and developers, the differences between housing and commercial developers and builders, and the institutional relationships amongst builders, land owners and developers. These relationships vary in different countries. In Australia, for instance, it is most common for developers and builders to be different organisations operating under separate ‘rules of the game’. Unlike the house building industry in many European countries, the Australian industry consists of many small firms and just a few large ones, and there are differences between the behaviour of small firms and that of large ones.

Table 1. Elements of path dependence and institutional fields

Path dependence elements	Institutional fields		
	Transport planning	Land use planning	Development industry
Organizational	Structural evolution of transport planning agencies	Structural evolution of land use planning agencies	Structural evolution of the development industry
Discursive	Storylines around transport planning	Storylines around land use planning	Storylines around urban development and land market

In summary, then, we have identified two conceptual domains of path dependence: technical and institutional. Within the institutional domain there are two fields: organizational and discursive. In LUTI we need to consider three intersecting spheres: transport planning, land use planning, and the urban development industry. The source of path dependence, if it occurs, could lie in any one or a combination of them. First, however, we have to investigate the capacity of government to deliver LUTI, and to discover if there is a disjuncture between LUTI policy and the evolution of urban form: the 'implementation gap'. The rest of the paper describes the research method and the results of the first of two case studies, in Perth, Western Australia. A similar case study is currently under way in Melbourne, Victoria.

LUTI in Australia

LUTI gives attention to the way the built form can support the public transport network, and vice versa. The main criteria for LUTI are contained under the rubric of 'transit-oriented development': siting more intensive urban land use close to stations on the rapid transport network. In Perth, Australia, there have been planning policies for the past 20 years requiring transit-oriented development around railway stations throughout the metropolitan area. The LUTI message is further reinforced by the Australian National Charter on Integrated Land Use and Transport Planning (DOTARS, 2003) and in 2001 Western Australian metropolitan local governments agreed to work cooperatively with the state in accordance with an 'Integrated Transport Planning Partnering Agreement' (Richardson, 2002).

However the limited capacity of local and regional government to implement policy and invest in transport decisions has emerged as a significant problem for transport policy in urban areas (EMCT/OECD, 2003). One type of institutional barrier arises where there is an inability of one jurisdiction of government to influence the actions of another (Ubbels and Verhoef, 2005) and it is this area of research which is the subject of our investigation: the ability of state agencies to affect the delivery of sustainable transport through other agencies (including local government); and the ability for agencies at the local level to influence each other for more holistic and integrated outcomes. This gives rise to the following research questions:

- What is the current capacity of state and local public agencies to deliver infrastructure/services for collective and active modes of transport (using statutory and non-statutory powers)?
- What is the current capacity of state and local public agencies to manage car-based travel?
- What are the institutional constraints (rules, finance, structures, cultures etc) to delivery?
- How can the capacity be improved?

This paper focuses on these key questions to report on the first stage of the research.

The Research Method

The research method involved document mapping and narrative analysis to evaluate the range of policies and plans of state and local agencies. The capacity of state and local government to deliver LUTI was assessed by conducting a content analysis of their planning and transport policies using a pre-established framework derived from earlier research (see Curtis, 2005, for a detailed discussion). This framework is shown in Table Two. It sets out the physical planning principles that define LUTI required for the delivery of the built form. The aim was to provide insight into the extent of state and local government capacity to deliver land use transport integration in relation to the built form. It was envisaged that four potential conditions could occur, or a degree of concordance, where:

1. There is complete concordance between the LUTI principles and policies;
2. There is a gap in the capacity to deliver the principles;
3. There is complete discordance between principles and policies;

4. There are new principles in the policies suggesting an enhanced capacity to deliver sustainable transport.

The LUTI criteria are grouped into three key components: access, land use, and 'people places'. 'Access' principles involve creating a transport network connected to centres, capable of meeting local and regional travel needs. The assumption is that many of the daily activities should be served locally. The network must provide for transport choice enabling local trips to be undertaken by walking and cycling and inter-suburban trips by public transport, with the less frequent trips outside centres and further afield by car. 'Land Use' principles focus on locating higher density/intensity uses close to transit and clustering complementary uses in walking proximity. 'People places' focuses on design at the human scale assuming pedestrian and bicycle priority.

The LUTI criteria were categorized to create a set of planning considerations. Policy documents were then examined for the presence of these as a means of assessing the capacity to deliver LUTI. As well is assessing the extent to which these LUTI criteria featured, a rating system measured the extent to which that criterion could be put into effect, given the way it was communicated. The rating scale was:

+3 Strongly satisfies LUTI criterion and works to deliver it
+2 Satisfies LUTI criterion and works to deliver it
+1 Weakly satisfies LUTI criterion
0 Ambiguous
-1 Weakly works against LUTI criterion
-2 Works against LUTI criterion
-3 Strongly works against LUTI criterion

The following examples show how the scoring was applied. For the 'Access' LUTI criteria 'Service - cycle friendly; secure cycle storage; connective networks of adequate capacity':

Example 1 scored '3+',

> '… end of trip bicycle facilities are to be provided in accordance with the standards for respective uses detail in Austroads standards *Guide to traffic engineering practice part 14 - Bicycles* as set out in schedule 11B.' (City of Armadale, 2005).

Example 2 scored '1+',

> '… in considering an application for planning approval shall have due regard …. whether adequate provision has been made for access for pedestrians and cyclists' (City of Fremantle, 2007).

In Example 1 the policy gives clear guidance that bicycle facilities <u>are</u> to be provided, and also refers to precise design standards. In Example 2, the words 'due regard' suggest a level of flexibility dependant on the decision maker ('due regard' may have been given but the result may still be no provision). Also 'adequate provision' is not defined.

In another example from the 'Land Use' suite of considerations, for 'medium to high residential densities', an example of a rating '-2' clearly works against the LUTI intent:

> '… the predominant use shall be low density residential development to a maximum of two stories' (Town of Kwinana, 1998).

This can be compared to an example of a rating '+3':

> 'The Council may permit a site to be developed at a density exceeding R80 to a maximum of R100 where any 4 or more of the following 8 Performance Criteria are met.' (City of South Perth, 2003).

In the second case above an explicit indication is given of the desired density required.

Table 2 Land Use Transport Integration – Physical Planning Principles

Access	
The Network	• high degree of interconnectedness to urban system (adjacent centres, residential catchments, transit interchanges) • balance of access between through-travel and travel to the place; local and regional access requirements • choice of transport options in close proximity to many homes and facilities - the possibility of substituting the right mode for the specific trip
Activity function (rather than transport function)	• highly connected street network focussed on access to centres and transit stops, permeable for people • well designed walkable catchments, high quality pedestrian experience - safe, well lit, trees, shelter • arterial roads have safe pedestrian facilities, on-road cycle lanes
Traffic Management	• lower traffic speeds, moderate traffic volumes, narrower streets (but not at the expense of conditions for cyclists) • effective traffic management • pedestrian priority
Service	• integrated transport - easily accessible by all modes and interchange between these modes to destinations reached on foot; seamless and safe connections, ease of movement • in operational terms – timetabling; easy to navigate system, high frequency, reliable, efficient public transport service to many destinations– no need for consulting timetables • safe, secure, convenient and comfortable stations, stops and interchanges • accessible by people with disabilities, seniors, children, mothers with prams etc. • cycle friendly; secure cycle storage; connective networks of adequate capacity • good business servicing opportunities
Land Use	
Land use configuration	• land use integrated with integrated transport • a robust urban form – can adjust to changes in demand for transport and land use • greater diversity, vibrant mix of land uses (within precincts and within buildings) • high pedestrian trip generating uses at ground floor, housing above in close proximity of transit stop • buildings oriented to station/streets/paths • active ground floor uses for surveillance • frontage development - human scale
Density/Intensity	• highest residential density in close proximity to activities (but ensure includes family housing types) • medium to high residential densities
Proximity	• compact cluster of related (compatible) activities (highly visited) in close proximity (walking distance), clustered around rail station/high frequency bus stop • more intensive/ high-medium density office, retail and other commercial uses (measured by high worker densities) within walking distance of transport facilities
Parking	• car parking areas managed so pedestrian access, amenity and safety not compromised • parking provided in shared structures rather than on individual sites • car parking behind buildings not fronting street • street parking • short term parking but limited commuter parking • car-based retailing (drive-thru') and light industry located on periphery of town with good car access
'People Places'	
Scale and Design	• human scale – less demand for 70kph scale advertising, more public art opportunities, sense that cars are not the priority mode • integration of character and scale of development within precinct • respecting existing development (through retention or sympathetic re-development) • diversity of architectural styles • legible design - is easily understood for residents and visitors
Amenity	• high amenity precincts – a place you want to go to – a destination in its own right • community/neighbourly feel – mixed ages – family friendly • good 'people places' – public open space, public seating, public art • more social encounters due to more walking, cycling, use of public transport • busy places

Capacity for LUTI: Local Town Planning Schemes

The analysis here focuses on the local government Town Planning Scheme (TPS). Theoretically the policy content of the TPS must be in accordance with State planning policy. Furthermore as a statutory policy, TPS have significant weight in the decision making process. They direct the approach to development, defining such things as the location of given land uses, the intensity of activity, the orientation and design of buildings and so on.

There are 32 local governments in the Perth metropolitan area. Figures 1, 2 and 3 show the extent of coverage in local government TPS for the 'Access', 'Land Use' and 'People Places' suites of LUTI criteria. For each criterion the bars show the number of local governments that positively address this criterion. Overall it can be seen that there is greater capacity for the delivery of the 'Land Use' and 'People Places' considerations. Less than half of all local governments (LG) have any 'Access' considerations in their statutory TPS.

In the 'Access' suite, five considerations are not covered at all – four of these concern public transport operations and one concerns street design. While the public transport considerations may not be perceived as land use matters by those preparing town planning schemes, it would be reasonable to expect a focus on creating narrower streets as part of any new sub-division. This is not dependent on the operations of an outside agency. This result is particularly odd given that of all the 'Access' considerations, 'effective traffic management' is considered by the majority of TPS.

In the 'Land Use' suite, parking considerations are the most well covered set of considerations. Management of parking access to favour the pedestrian scores highly, as does a concern to focus on shared parking schemes rather than provide separate structures serving individual buildings. These are positive findings in the pursuit of LUTI. However, LUTI is not fully delivered because considerations for the location of parking either on-street or at the rear of buildings (rather than in large frontage car parks which create an unfriendly pedestrian environment) are only considered by about a quarter of all LG's. This issue is amplified given the low number of LGs considering building orientation to the street and frontage development – all considerations strongly advocated by the new urbanism movement as part of a philosophy of creating places that favour non-car modes.

Density of residential development is reasonably well considered by many LGs, but mix of development and the intensity of commercial development in close proximity to transit are considerations addressed only by about one quarter of all LGs – this despite a much larger number of LGs supporting the LUTI consideration 'greater diversity and mix'.

The 'People Places' suite were the most well covered by LG town planning schemes. There was a strong focus on creating precincts of high amenity and for development which respected the scale and character of the existing area, although a specific focus on design around non-car modes was lacking.

In addition to the examination of the extent of coverage of LUTI criteria, policies were rated according to how well, or otherwise, they satisfied the individual criterion. Overall, where criteria were included, the majority were rated positive, but a significant concern is that the average score was around 1 to 1.5 out of a possible 3 which indicates that policies are not strongly worded and directive, so not so easy to action. On a positive note, there were very few negative ratings: instances where policies worked against the LUTI criteria. Here there were only 11 of the LUTI criteria (including items such as cycle provision and car parking). The impact of this was quite limited since it was only one or two LGs that had such policies.

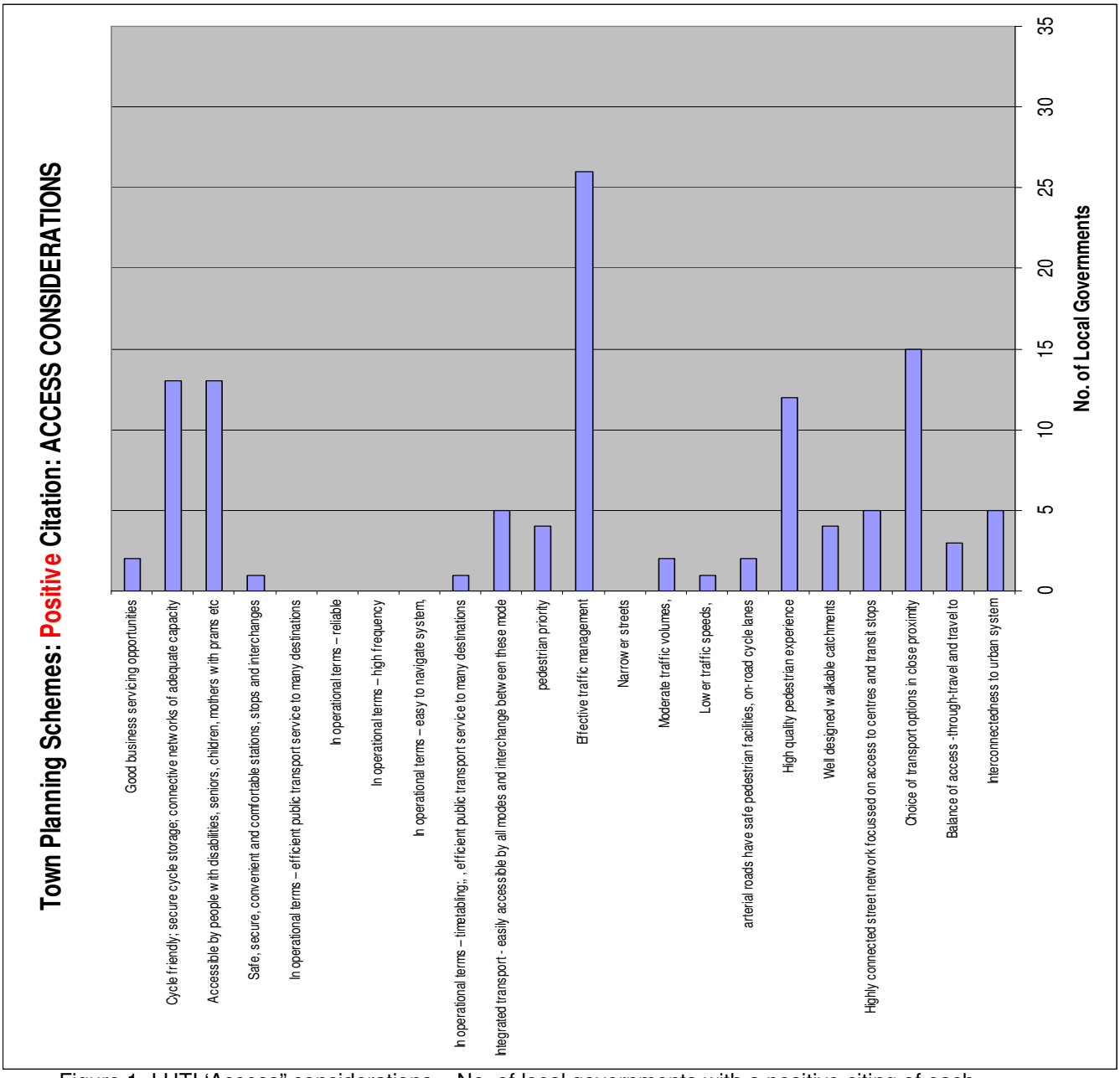

Figure 1. LUTI 'Access" considerations – No. of local governments with a positive citing of each consideration

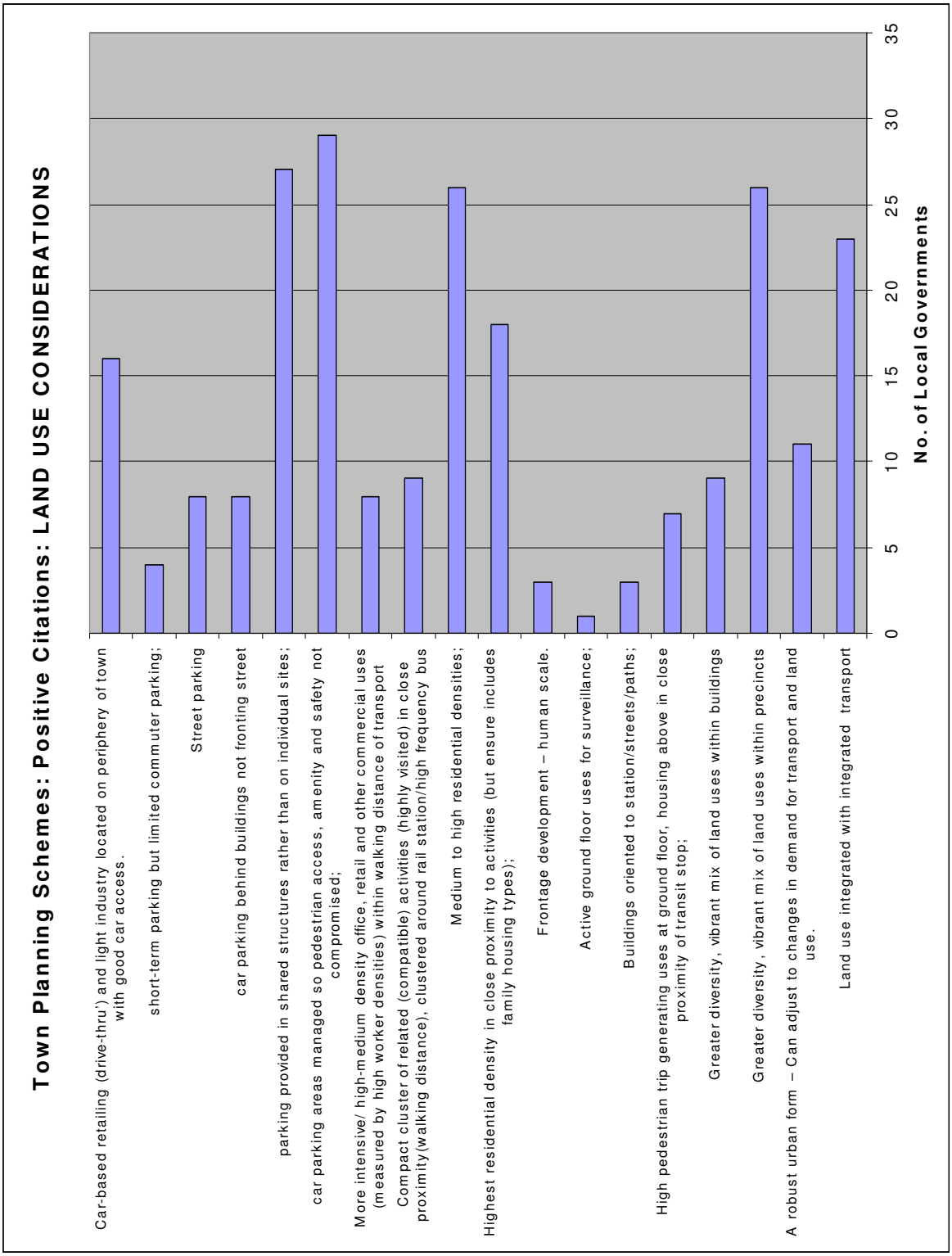

Figure 2. LUTI 'Land Use' considerations – No. of local governments with a positive citing of each consideration.

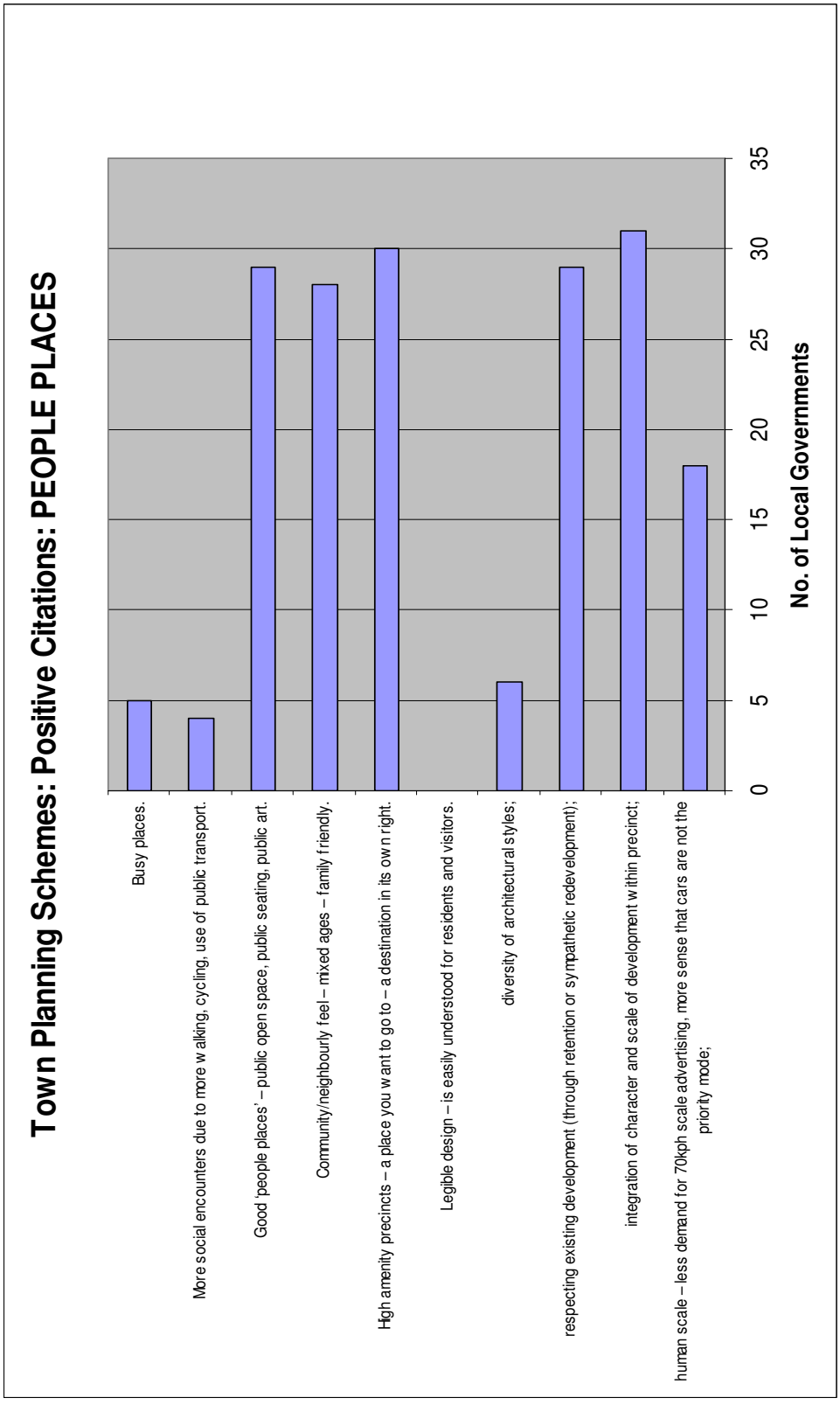

Figure 3. LUTI 'People Places' considerations – No. of local governments with a positive citing of each consideration.

Delivering land use transport integration: A case study of transit-oriented development

As indicated above, transit-oriented development would appear to capture the type of built form deemed important in land use transport integration. In Perth there have been State planning policies for the past 20 years requiring transit-oriented development around railway stations throughout the metropolitan area.

State planning policy

1989 marks the start of a period where the State Planning agency began explicitly to direct land use decisions around railway station precincts. The Western Australian Planning Commission (WAPC) policy *Development Control Policy 1.6 Residential Development near Metropolitan Railway Stations* (WAPC, 1988) promoted the need to achieve a higher intensity of development around Perth's metropolitan railway stations. In 1999 the policy was revised and renamed *Planning to Enhance Public Transport Use* (WAPC, 1999) so further reinforcing the policy approach. A third revision was made in 2005, now renamed *Planning to Support Transit Use and Transit Oriented Development* (WAPC, 2006).

The re-write was designed to reinforce the strong messages outlined in two key higher order State policies focused on a sustainable future: the *State Sustainability Strategy* produced by the Premier and Cabinet's Department and endorsed by government in September 2003; and *Network City*, the new metropolitan planning strategy for the Perth and Peel regions (endorsed in 2004). The development control policy provides a means to articulate these higher order strategies into action through control of development. Furthermore the policy is strengthened by reference to the statutory policy – *Statement of Planning Policy 3 Urban Growth and Settlements (SPP3),* which for example includes policy measures such as:

> 'Supporting higher residential densities…around high frequency public transport nodes and interchanges'… and ….'Clustering retail, employment, recreational and other activities which attract large numbers of people in activity centres around major public transport nodes…'

The 2005 development control policy sets out expectations that are even more explicit than in earlier versions, particularly in identifying specific density goals:

> 'In reviewing town planning schemes and proposed scheme amendments that include transit precincts as defined by this policy, the WAPC will expect local governments to identify and promote opportunities for residential development at a minimum density of 25 dwellings per hectare, and will expect the application of densities substantially higher than 25 dwellings per hectare where sites have the advantage of close proximity to a rail station, major bus interchange or bus route that provides service frequencies equivalent to rail…' (WAPC, 2006).

Guidance on the need to locate high trip generating development close to transit facilities was made explicit, particularly the type of uses, although a potential problem is that no guidance was provided to define 'significant generators',

> 'Other uses that are likely to be significant generators of transit trips should also be located close to transit facilities wherever possible. Relevant uses include office and other 'high-density' employment-generating activities, intensive leisure facilities and retailing. Similar considerations apply to such uses as aged persons development, schools and tertiary education uses, hospitals, community facilities and social services" (WAPC, 2006).

Transit oriented precincts were not only defined in text, but also mapped,

> 'Defining "transit oriented precincts"… there is a common "threshold" for walking to those facilities. This equates to: about 10-15 minutes walking time, or 800 m distance, for rail stations, transit interchanges or major bus transfer stations or terminals, and about 5-7 minutes walking time, or 400 m, for bus stops located on bus routes with multiple bus services that are high frequency of 15 minutes or less during peak periods' (WAPC, 2006).

So by the mid 2000's there was a strong set of policies emanating from the State government demonstrating clear intent in the need for development around the metropolitan railway stations. This is not only found in a wide range of documents within the State planning agency, but also in those of other state agencies. As well as these higher order policy statements (often more generalised) the long standing development control policy outlined above was designed to operationalise the broader policy aspirations of the strategy-type documents.

The mechanisms of delivery are of two types. Planning legislation requires each LG to produce a statutory TPS for its entire area. The content of the TPS is dictated by a State planning agency guide, the Model Scheme Text (see Figure 4). TPS include a set of policies that will be used to determine applications for planning permission and building approval. In addition a land use zoning map and accompanying zoning table set out the type of land use, and its residential density, in specified locations. The TPS is required to conform to state planning policy, and is checked for compliance and consistency by this state agency and finally signed off by the State Minister for Planning. A further mechanism for delivery is provided through the decision process for sub-division of land. In this case it is the State planning agency that assesses sub-division applications which are then determined by the WAPC and Minister. This structure not only provides strong vertical linkages for policy articulation, but strong powers for decision makers.

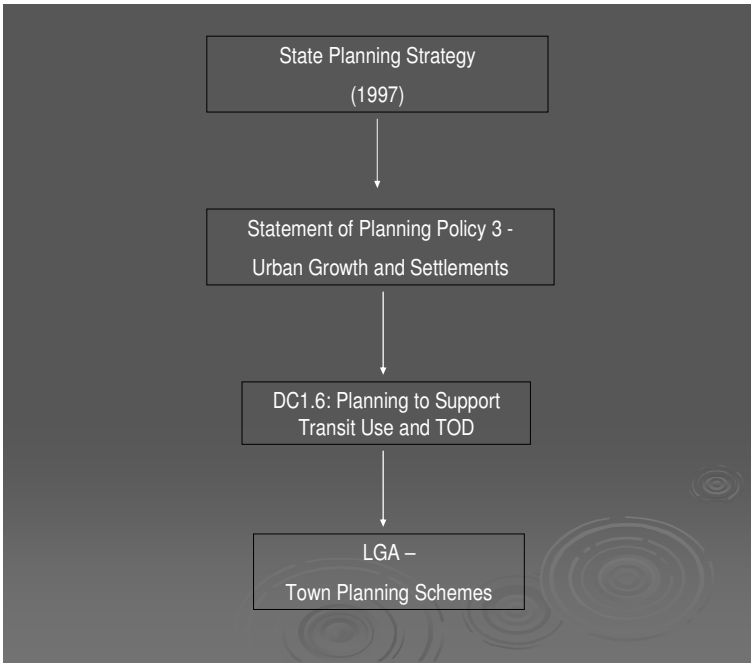

Figure 4. State planning policy is articulated into local Town Planning Schemes.

Local planning policy: town planning scheme intentions

The sub-set of LUTI considerations which would deliver transit-oriented development around rail precincts includes those concerning density and intensity of use. As indicated in the earlier section of this paper, residential density was well covered in these schemes, but to a lesser extent was mix and intensity of commercial development. In addition to the analysis of the written policies in the TPS, mapping and analysis of zoning maps was conducted for land use in the 69 station precincts (using the state definition of transit precinct above).

The data enables the mapping of the proportion of land within each transit precinct zoned for residential, employment and 'other' uses. In addition, residential land zoning includes an 'R Code' to give an indicative residential density for that land parcel. For example a one hectare parcel of land zoned R20 would theoretically be permitted to develop up to 20 dwellings. In practice, due to other planning controls concerning dwelling set backs, provision of private open space and so on, only about 75% of the given density will be delivered. So in this example R20 would more likely deliver a maximum of 15 dwellings on the one hectare parcel. One other issue is that the developer is at liberty to develop residential land at densities lower than the given R Code, and this in itself is one issue for the implementation of LUTI. For our purposes we have assumed that zoned land will be developed at the maximum density (anecdotal evidence suggests that land usually is developed at lower densities), so erring in favour of the most optimistic outcome. In some cases the zoning map permits a 'dual R Code', here we have assumed that higher density will be delivered.

There is no density equivalent for land zoned for employment purposes, thus limiting the possibility of analysis of any intent to intensify the number of employees on any given zoning parcel. Clearly this also has implications for the ability of local government to deliver high intensity employment in station precincts.

Table 3 shows the net residential density intent of all current Perth metropolitan TPS. A dramatic 97% of all station precincts provide the possibility for residential development to be built at a net density of 15 dwelling units per hectare (du/ha). For ease of analysis three categories of net density have been created: in the Perth context, low density includes those sites with a net density lower than 10 du/ha; medium density those between 10 and 15 du/ha; and higher density, those greater than 15 du/ha. Over the last year the state government have settled on 15 du/ha as a benchmark for net residential density in support of transit.

Table 3: Town Planning Scheme Intent: Net Residential Density of Station Precincts by Location (no. of precincts)

	Net density <10 dwelling units/ha	Net density 10 - 15 dwelling units/ha	Net density >15 dwelling units/ha
Inner Suburb	0	0	26
Middle Suburb	0	0	13
Outer Suburb	2	0	24
Total	2 (3.1%)	0	63 (96.9%)

While TPS intent for net residential density looks promising, to gain a more accurate picture of the extent to which residential intensity may be being maximised through the TPS it is necessary to consider both the footprint of these high net densities in proportion to the whole station precinct and the gross residential density – both measures give a clearer indication of the extent of planned policy implementation. Of the 63 precincts planning net residential densities of 15 du/ha or more, in only ten precincts this residential development covers more than three quarters of the precinct and a further 18 precincts have this taking half the precinct.

The gross residential density intent of town planning schemes shows a less optimistic picture (Table 4), 63% of station precincts still plan to develop at very low gross residential densities. At the lowest gross densities there are as many inner city precincts as outer suburban precincts. A further analysis is required to establish if these inner city precincts are strong employment centres instead, otherwise the outcome would be poor. For those 27% of precincts planning higher gross residential densities, middle suburban and outer suburban precincts show the higher proportion of precincts.

Table 4. Town Planning Scheme Intent: Gross Residential Density of Station Precincts by Location (no. of precincts). NB Four precincts have no data available for residential zoning.

	Gross density <10 du/ha	Gross density 10 - 15 du/ha	Gross density >15 du/ha	Total (row %)
Inner Suburb	8 (35.7%)	13 (46.4%)	5 (17.9%)	26 (40%)
Middle Suburb	3 (23.1%)	3 (23.1%)	7 (53.8%)	13 (20%)
Outer Suburb	9 (39.3%)	5 (17.9%)	12 (42.9%)	26 (40%)
Total	20 (30.8%)	21 (32.3%)	24 (36.9%)	65 (100%)

The current suite of TPS's were written over a long time period ranging from 1983 to 2007 (Table 5). Ten of the station precincts are governed by TPS written before the 1988 state development control policy for development around railway stations, it may be reasonable to expect these schemes to not to show a high residential density intent. 55 precincts are governed by schemes written after DC1.6 – one would expect these schemes to show higher density intent if they are to implement state policy and this is confirmed (Figure 5). Gross residential density shows a different picture (Figure 6) with only 22 precincts out of 55 (40%) showing higher residential densities.

Table 5. Age of Town Planning Scheme by suburban location

	Pre 1988 State policy DC1.6	1988 – 1998 Policy DC1.6 original version	1999 – 2005 Policy DC1.6 version 2	2006 or newer Policy DC1.6 version 3
Inner Suburb	1	11	14	2
Middle Suburb	5	3	5	0
Outer Suburb	4	3	21	0
Total	10 (14.5%)	17 (24.6%)	40 (58%)	2 (2.9%)

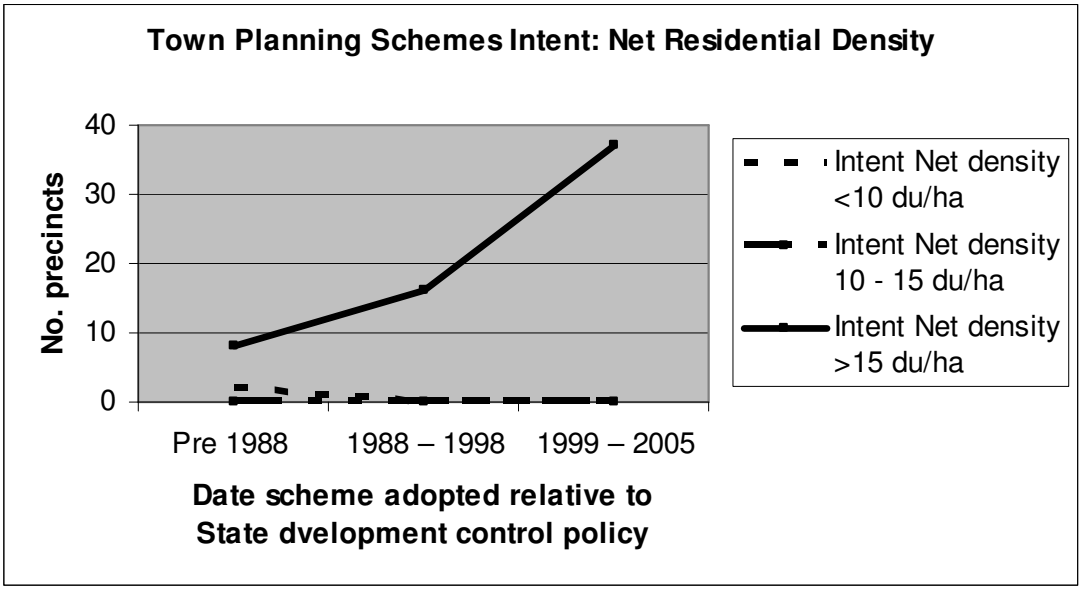

Figure 5. Age of scheme by Town Planning Scheme Intent - Net Residential Density (number of precincts)

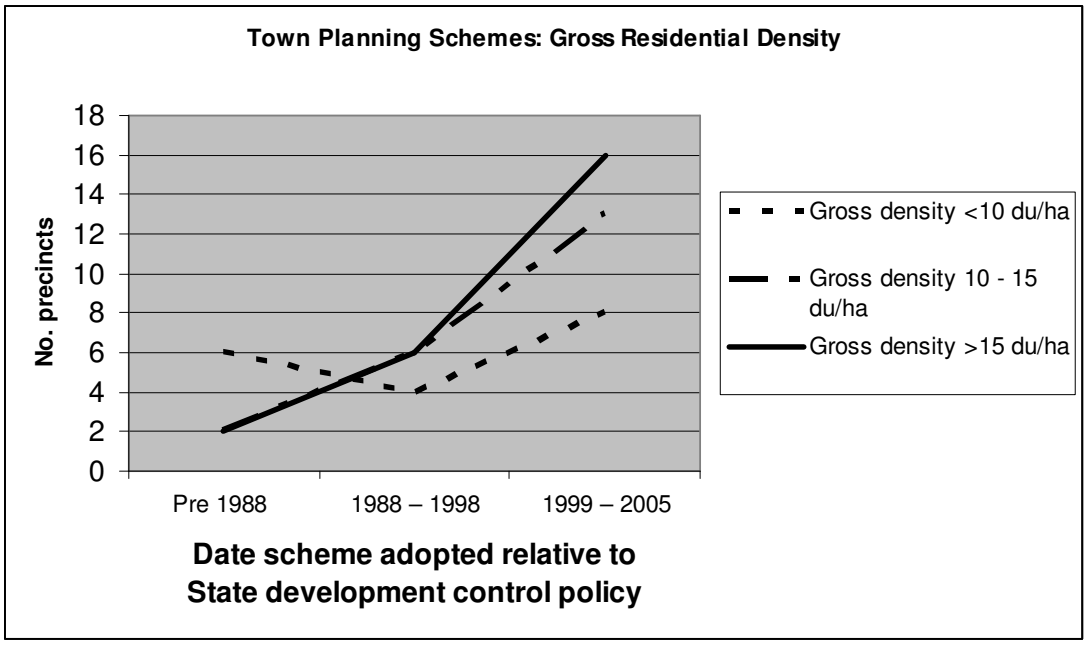

Figure 6. Age of scheme by Town Planning Scheme Intent - Gross Residential Density (no. of precincts)

Evidence of Implementation

Given this long standing policy in favour of delivering TOD, over two decades, it would seem reasonable to expect some evidence of development change on the ground. What follows is an analysis of the 69 metropolitan railway stations in Perth using data from the Valuer General's Office for land use within precincts[1] at 2001 and census data for population and employment from the Australian Bureau for Statistics 2001.

Intensity of use at 2001

The gross residential density ranged between 0 and 18 dwellings per hectare, with three quarters of all precincts having a gross density of 8 du/ha or less. Net densities ranged from 0 to 21 dwellings per hectare, although again three quarters of all precincts had a net density of 12 du/ha or less. These densities fall considerably short of the state's benchmarks of 15 du/ha for net density and 25 du/ha.

Set in an international context, both the State benchmark and the actual densities fall well below other benchmarks. Calthorpe recommends a benchmark of a gross density of 40 du/ha (this figure in addition to commercial uses within the precinct) required to support public transport (see Bressi, 1994). Others have used a level of service specification for public transport to determine minimum residential densities required to support a particular service frequency (Table 5). Perth's station precincts fall considerably short of all of these benchmarks (Figure 7)

Table 6: The relationship between density and service frequency
(Sources: Ministry of Transportation and Ministry of Municipal Affairs, 1995 citing Pushkarv B S and Zupan JM (1977) Public Transportation and Land Use Policy; Messenger and Ewing, 1994 cited in Dittmar and Ohland, 2004; Dittmar and Ohland, 2004.)

Service Frequency	**Min. Residential Density Required (Units)**		
	Puskarev & Zupan, 1977[1]	Messanger & Ewing, 1994[2]	Dittmar & Ohland, 2004[3]
Bus - 1 hour service	10/ha (4/acre) adjacent to corridor	N/A	N/A
Bus - 1/2 hour service	17/ha (7/acre) adjacent to corridor	19/ha (8/acre)	>12/acre (suburban neighbourhood)
Bus - frequent service (<15 mins)	37/ha (15/acre) adjacent to corridor	>26/ha (>11/acre)	48/ha (20/acre) (urban neighbourhood)
Rapid Transit 5 minute headway in peak hour	30/ha (12/acre) over extensive area with high density close to station	N/A	>144/ha (>60/acre) (hub of radial transport system – urban downtown)

[1] Using the same definition of a 'transit oriented precinct' in D.C 1.6 – land within 800m distance of the railway station (10-15 minutes walk) – or 201 ha.

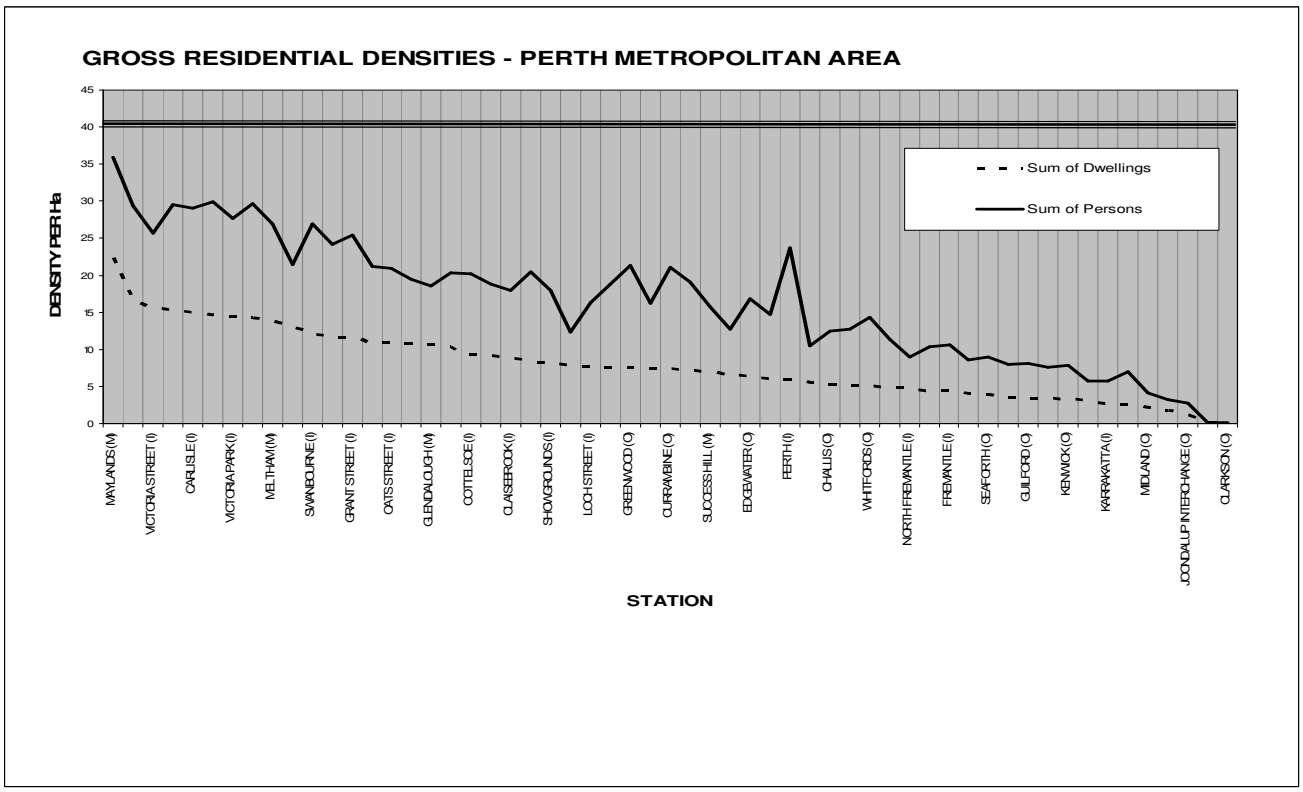

Figure 7: Residential Density – Perth Railway Stations

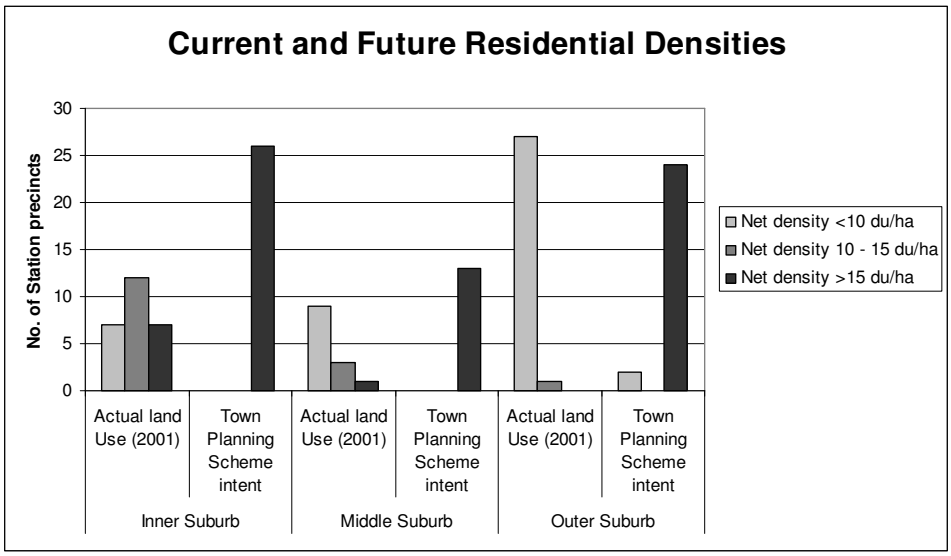

Figure 8: Perth station precincts: Current and Future Residential densities.

In comparison with the actual net residential densities in 2001, it is evident that LGs show a clear intent to implement State planning policy (Figure 8): in 2001 only 8 station precincts had a net density of 15 du/ha, but if TPS were implemented this would rise to 63 precincts. The most dramatic change would be in outer suburban station precincts.

In addition to the density consideration above, Newman contends that for a station precinct to capitalise on its public transport accessibility and also offer best efficiency for supporting public transport, a threshold of 10,000 employees and/or residents should be based in the station precinct. None of Perth's stations reach this figure for residents alone; only 5 stations meet this benchmark on employees alone. The maximum number of dwellings in any one precinct was 3645, the minimum 35 and the mean 1237. Number of residents living in station precincts ranged between 18 and 5995. The number of employees based within each precinct ranged between 0 and 59,012 with the mean at 4118. Three quarters of all stations had less than 2335 employees. The combination of residents and employees puts only 8 of the 69 stations within this benchmark; all are based within the inner suburbs.

Figures 9 and 10 show the land use mix for each station precinct at 2001. The pie diagrams show the proportion of land allocated to residential use, employment use and other uses, as well as indicating the intensity of use (net residential density or employment intensity expressed as a worker floor space density). Two thirds of the precincts had more than 50% of the precinct area allocated to housing. Yet only 8 stations (12%) had a net residential density of more than 15 dwellings per hectare - the density stipulated in the latest version of DC1.6, almost all are within the inner suburbs of Perth (Table 7). There is a clear density gradient - highest densities are close to the centre, towards low density in outer suburbs. 62% of precincts have very low net residential densities of less than 10 dwellings per hectare.

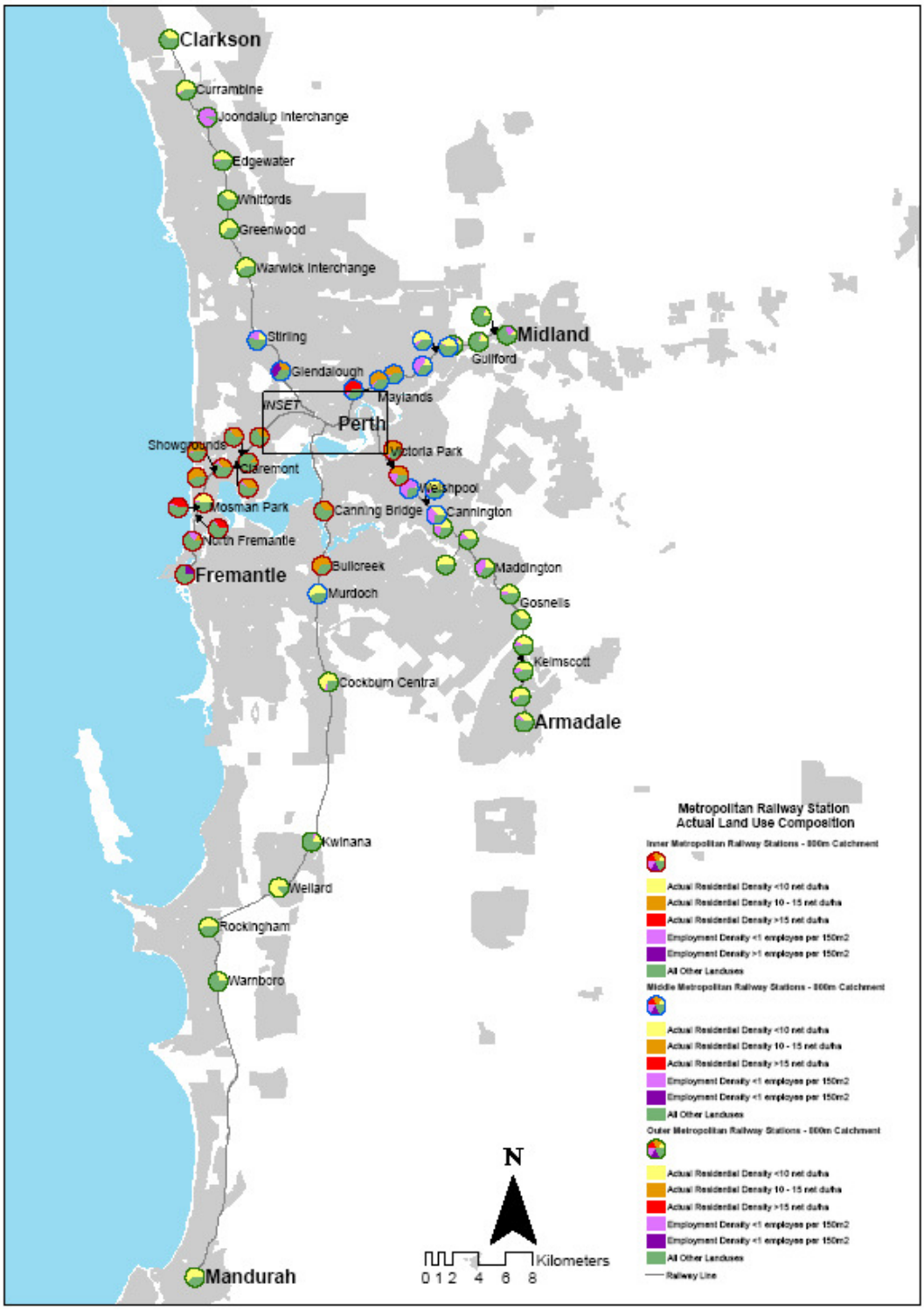

Figure 9. Perth metropolitan railway precincts: Land Use 2001

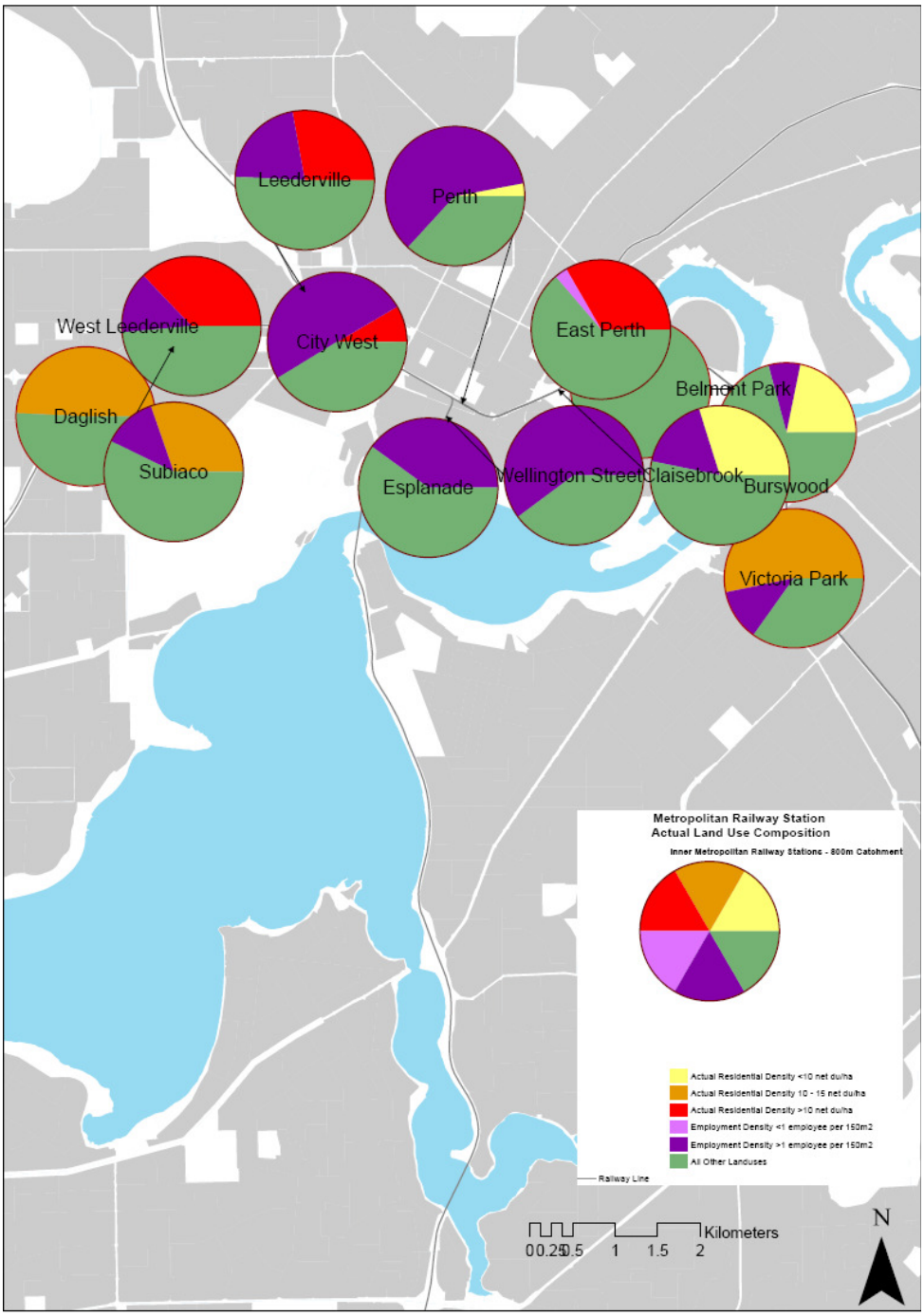

Figure 10. Perth central area railway precincts: Land Use 2001

Table 7. 2001 Net Residential Density of Station Precincts by Location (no. of precincts)

	Net density <10 du/ha	Net density 10 - 15 du/ha	Net density >15 du/ha
Inner Suburb	7	14	7
Middle Suburb	9	3	1
Outer Suburb	27	1	0
Total	43 (62.3%)	18 (26.1%)	8 (11.6%)

The picture for gross residential density was worse (Table 8): 84% of station precincts had a gross residential density of less than 10 dwellings per hectare (compared to the policy stipulation of 25 dwellings per hectare); only 1 station achieved a gross residential density greater than 15 du/ha (Maylands an inner suburb precinct at 18 du/ha).

Table 8. 2001 Gross Residential Density of Station Precincts by Location (no. of precincts)

	Gross density <10 du/ha	Gross density 10 - 15 du/ha	Gross density >15 du/ha
Inner Suburb	20	8	0
Middle Suburb	11	1	1
Outer Suburb	27	1	0
Total	58 (84.1%)	10 (14.5%)	1(1.4%)

Outside the central area very few precincts have any employment land (18 precincts), and even fewer (2 precincts) have high employment densities (>1 employee per 150 sq. metres). Within the central area of Perth 11 of the 13 precincts contain employment land; all but one has a high employment density.

Where station precincts are governed by a Town Planning scheme adopted after the 1988 state development control policy one would expect the 2001 actual densities to be higher. Figure 11 shows that this is clearly not the case with a higher proportion of precincts in each category having the lowest net density, and the same for actual gross density (Figure 12). There would, however, appear to be some evidence that local government zoning schemes written in the ten year period after the first version of DC1.6 have translated to the delivery of some higher density precincts (30% of precincts are medium density compared to only 13% post 1998).

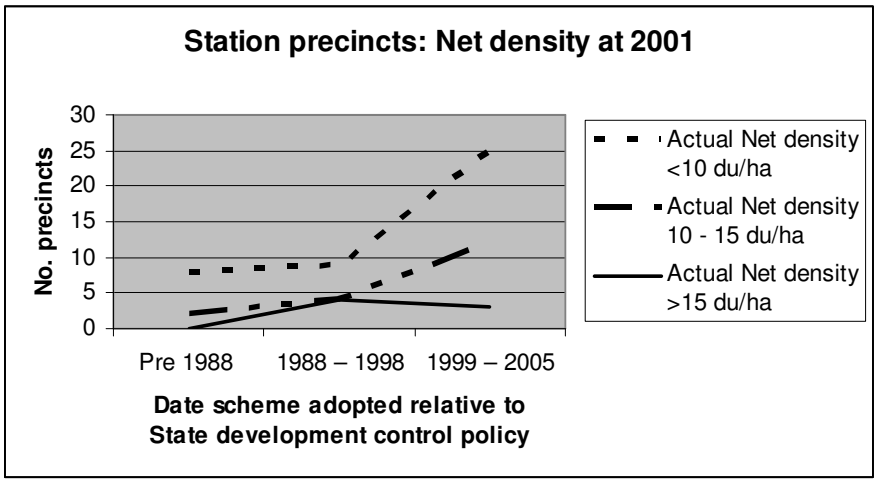

Figure 11: Age of scheme by Actual Net Residential Density (no. of precincts)

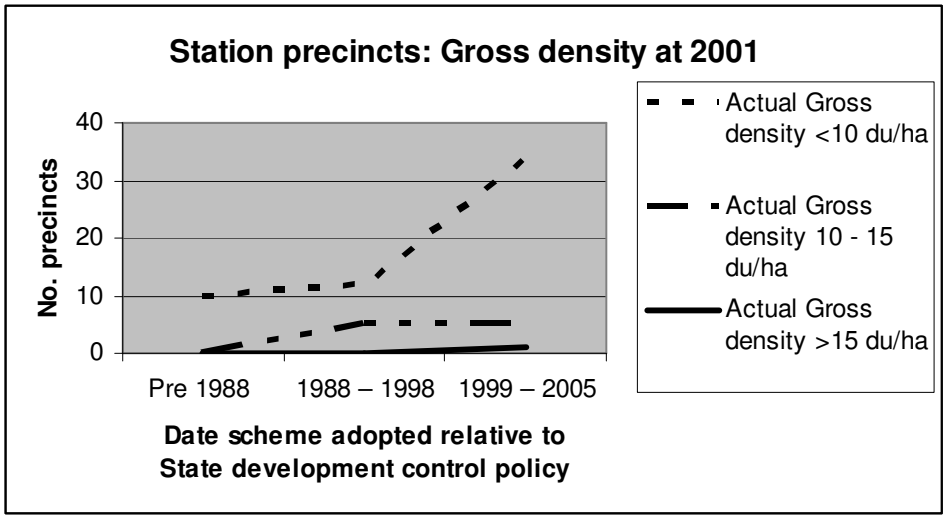

Figure 12: Age of scheme by Actual Gross Residential Density (no. of precincts)

Discussion

This research is concerned with the question of the capacity of government to deliver integrated transport. We have established that there is clear national, state and local agreement with the broad principles of LUTI and the need to implement them. If LUTI principles are to be implemented at a physical planning level then implementation must be achieved through the development of strong policy which gives clear direction for action. Therefore an analysis of policy intent will enable the question of 'capacity to deliver' to be assessed, at least in the policy dimension.

The analysis of state and local government policy coverage confirms that there is a capacity to deliver LUTI principles. There is evidence of vertical linkage – the direction and translation of LUTI policy principles from state government to local government. There is also some evidence of horizontal linkage amongst different state agencies.

A closer analysis of local government policy as set out in the core statutory planning policy – the 'Town Planning Scheme' – finds a much more mixed capacity outcome. The full suite of LUTI considerations are not all covered by local government. This is particularly so of those concerned with the public transport service. Where LUTI considerations are found in the policy documents, not all councils include them, and in some cases less than half of the metropolitan councils demonstrated such capacity. Further detailed analysis is needed in order to understand whether the differences are a result of differences in types of local government (by location, by size of council and so on) or by age of TPS, or by relationship with other policy documents (perhaps these give greater coverage). This analysis will be the subject of a future paper.

Even where LUTI considerations are included they are not always well supported by the full set of complementary LUTI considerations – the example of this is shown above with reference to car parking and to street design and traffic management. A further factor which impinges on the ability to implement policy is the strength of the policy statements. The rating system used to measure the capacity of any policy to be operationalised (that is to have some effect) showed that many policy statements were fairly general, loosely defined and open to interpretation. In such cases implementation will depend on the whim or ability of the planner or decision maker. Again this aspect will be examined in detail in the next stage of the research.

Finally, in the context of the case study on transit-oriented development, it is evident that despite clear policy intent to deliver a more transit-oriented development – expressed in this case by the requirement for development in station precincts to be built at higher residential densities, high intensity of commercial use and in a more mixed use form – it has not translated in many instances into actual development on the ground. By 2001, despite a 20 year policy 'lead time' only one station precinct out of 69 had a 'high' gross residential density (18 dwelling units per hectare). Even this precinct did not measure up either to state or international benchmarks for the appropriate density. The picture for net residential density was slightly more promising; here 8 precincts contained residential development built at a net density greater than 15 du/ha. All but one of these are located in the inner city, the other on the edge of this area. In some of these locations implementation has been achieved by the proactive actions of development authorities rather than through the normal town planning process. The inner city location would suggest the influence of high land values is likely a catalyst for development, facilitated by town planning schemes – but in 'reactive' mode rather than 'proactive'.

The case study has shown so far that government is not without the capacity to implement LUTI. Yet the effect on urban development has very modest and patchy. There is a significant 'implementation gap'. Is this then evidence of path dependence? It is too early to answer this question definitively but the results of the study tend to support a path dependence explanation. First, what is occurring is not the result of either lack of policy, or policy directed against the aims of LUTI. On the contrary LUTI is strongly inscribed in policy at all three government levels. It appears also that the observed implementation gap is not the result of a lack of planning or implementation capacity. The technical path dependence of the car-dependent, low density urban fabric is a possibility. Yet this explanation seems over-deterministic – suggesting that change is impossible even when the public through the polity desire it. It seems more probable to us that the explanation lies in the interwoven discursive and organizational elements of institutional path dependence. But this remains a hypothesis to be tested in the final stage of the study.

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References

Arthur, W.B. (1988a) 'Self-reinforcing mechanisms in economics' in Anderson, P.W. Arrow K.J. and Pines D. (eds) *The Economy as an Evolving Complex System*, Addison-Wesley, Redwood CA. pp. 9-32.

Arthur, W.B. (1988b) 'Urban systems and historical path dependence', in Ausubel J.H., and Herman R. (eds) *Cities and Their Vital Systems, Infrastructure, Past, Present and Future*, National Academy Press, Washington DC.

Banister D. (2005) 'Overcoming barriers to the implementation of sustainable transport', in *Barriers to Sustainable Transport: institutions, regulations and sustainability*, eds. Rietveld P and Stough R, Spon Press, Abingdon, UK.

Bressi T.W. (1994) 'Planning the American Dream', in *The New Urbanism: Toward an Architecture of Community*, ed. Katz P, McGraw Hill, New York.

Buchanan, J.M. and Tullock, G. (1962) *The Calculus of Consent, Logical Foundation of Constitutional Democracy*, Ann Arbor MI: Michigan University Press.

Cervero R. (2005) 'Progress in coping with the complex urban transport problems in the United States, in Jönson, G. and Tengström, E. eds *Urban Transport Development, A complex issue*. Berlin: Springer pp. 118-143. pp. 128-129.

City of Armadale, (2005) Local Planning Scheme No.4, City of Armadale: Perth, Western Australia.

City of Fremantle (2007) Local Planning Scheme No.4, City of Fremantle: Perth, Western Australia.

City of South Perth, 2003, Town Planning Scheme No.6, City of South Perth: Perth, Western Australia.
Curtis C. (2005) 'The Windscreen World of Land Use Transport Integration: Experiences from Perth, a Dispersed City'. *Town Planning Review* Vol 76 (4) pp.423-453.
David, P. (1985) 'Clio and the Economics of QWERTY' *American Economic Review*, 75, pp. 332-37.
Denzau, A.T. and North, D.C. (1994) 'Shared mental models: ideologies and institutions', *Kyklos* 47(1) pp. 3-31.
DOTARS [Department of Transport and the Regional Services] (2003) *National Charter of Integrated Land Use and Transport Planning*, Department of Transport and Regional Services, Canberra.
EMCT/OECD [European Conference of Transport Ministers & Organisation for Economic Co-operation and Development] (2003) *Implementing Sustainable Urban Travel Policies: National Reviews*, OECD Publications Service, Paris.
Liebowitz, S.J. and S.E. Margolis, S.E. (1990) 'The Fable of the Keys', *Journal of Law and Economics*, 22 pp. 1-26.
Liebowitz, s.J. and S.E. Margolis, S.E. (1995) ''Path Dependence, Lock-In and History', *Journal of Law, Economics and Organization* 11/1 pp. 205-226.
Low, N.P. and R. Astle (forthcoming 2009) 'Path dependence in urban transport, an institutional analysis of urban passenger transport in Melbourne, Australia, 1956-2006', *Transport Policy*.
Low, N.P., Gleeson, B.J., and Rush, E. (2003) 'Making believe: institutional and discursive barriers to sustainable transport in two Australian cities' *International Planning Studies* 8(2) pp. 93-114.
Low, N.P., Gleeson, B.J., and Rush, E. (2005) 'A Multivalent Conception of Path Dependence: The case of transport planning in metropolitan Melbourne, Australia, *Environmental Sciences* 2(4) pp. 391-408.
Low, N.P. (2005) 'The Gordian Knot, Resisting sustainability in urban transport in Australia, in Williams, K. ed. *Spatial Planning, Urban Form and Sustainable Transport*, Aldershot, UK: Ashgate, pp. 171-182.
March, J.G. and Olsen, J (1989) Rediscovering Institutions, The organizational basis of politics, New York: Free Press.
March, J.G and Olsen, J. (1994) 'Institutional Perspectives on Political Institutions', Governance, 9, pp. 247-264.
March J.G. and Simon, H.A. (1958) *Organizations*, New York: Wiley.
Newman, P. and Kenworthy, J. (1989) Cities and Automobile Dependence, An International Sourcebook, Aldershot, UK: Gower.
Newman, P. and Kenworthy, J. (1999) Sustainability and Cities, Overcoming Automobile Dependence, Island Press, Washington DC.
North D. (1990) *Institutions, Institutional Change, and Economic Performance*. Cambridge University Press, New York.
North, D.C (1993) 'Institutional change: a framework of analysis' in Sjöstrand, S.E. ed. *Institutional Change: Theory and Empirical Findings*, London: M.E. Sharpe.
Peters, G. (1999) Institutional Theory in Political Science: The 'New Institutionalism', London and New York: Pinter.
Pierson, P. (2004) *Politics in Time, History, institutions and social analysis*, Princeton and Oxford: Princeton University Press.
Rietveld P and Stough R (eds.) (2005) *Barriers to Sustainable Transport: institutions, regulations and sustainability*, Spon Press, Abingdon, UK.
Richardson E (2002) 'The role of local government in integrated transport'. Proceedings of the Integrated transport for local communities conference: local solutions to local problems, December 2002, Melbourne.
Torfing, J. (2001) 'Path-dependent Danish welfare reforms: the contribution of the new institutionalisms to understanding evolutionary change', *Scandinavian Political Studies* 24(4) pp. 277-309.
Town of Kwinana, 1998, Town Planning Scheme No. 2, Town of Kwinana: Perth.

Ubbels B and Verhoef E (2005) Barriers to transport pricing, in *Barriers to Sustainable Transport: institutions, regulations and sustainability*, eds. Rietveld P. & Stough R. Spon Press, Abingdon, UK.

WAPC [Western Australian Planning Commission (1988) *Development Control Policy 1.6 Residential Development near metropolitan railway stations*. WAPC: Perth, Western Australia.

WAPC [Western Australian Planning Commission] (1999) *Development Control Policy 1.6, Planning to Enhance Public Transport Use*, WAPC: Perth, Western Australia.

WAPC [Western Australian Planning Commission (2004) *Network City: Community Planning Strategy for Perth and Peel*. WAPC, Perth, Western Australia.

WAPC [Western Australian Planning Commission] (2006) *Development Control Policy 1.6 Planning to support transit use and transit oriented development*, WAPC: Perth, Western Australia.

Woodlief, A. (1998) The path-dependent city', *Urban Affairs Review*, 33/3 pp. 405-437.