APPENDIX A: CONDUCT OF THE INQUIRY

The reference was sent to the Commission on 21 November 1991 with a reporting date of 20 February 1993. This was later extended to 3 April 1993 following the appointment of new Commissioners.

The Commission conducted a large number of visits, meetings and public hearings in late 1991 and during 1992. The initial round of public hearings was held in April 1992 in Hobart, Melbourne, Brisbane, Sydney, Perth, Adelaide and Canberra.

The draft report was released in December 1992. Copies were sent to all participants, interested parties and relevant government bodies, and were freely available to members of the public. In all over 2000 copies were distributed. Wide press coverage of the draft report further increased awareness of the inquiry and the dissemination of its conclusion and recommendations. Sixty-six submissions commenting on the draft were received. Hearings to discuss the draft report were advertised through the circular that accompanied the draft report and through the national press. The draft report hearings began in Perth on 9 February 1993, and were subsequently held in Adelaide, Brisbane, Sydney, Melbourne and Canberra, concluding on 23 February 1993.

A1 Submissions

The following is a list of submissions received. Participants who presented their submissions at a public hearing are identified by a letter after the submission number, denoting the city in which the submission was presented:

A = Adelaide, B = Brisbane, C = Canberra, H = Hobart, M = Melbourne, P = Perth, S = Sydney

List of participants

Company/ Organisation	*Hearing attended* Initial	Draft	*Sub. No.*
Australian Capital Territory Government	C	C	63, 71, 136, 157
Action for Public Transport			102
Addison Yeates Pty Ltd	B	B	14, 73, 115
Adelaide Planning Review	A		56, 88
AGI, Gas Companies and AGI, Petroleum Ltd			35, 113
Albury-Wodonga Development Corporation			29
Australian Automobile Association	C		17
Australian Council for Infrastructure Development			112
Australian Council of National Trusts			31
Australian Federation of Construction Contractors			53
Australian Local Government Association	C		61, 81
Austroads			39
Ballarat Water Board			51
Barcrest Developments		B	125
Bowie, Mr 1 J S			145
Brisbane City Council	B	B	45, 117 156, 162
Bureau of Transport & Communication Economics			143
Cassegrain, Mr C			68
Castlemaine & District Water Board			26
City of Altona			122
City of Bendigo	M		32, 90 94, 116
City of Croydon			142

Company/Organisation	Hearing attended Initial	Draft	Sub. No.
City of Melbourne	M		*25*, *75*, 144
City of Noarlunga			43
City of Traralgon			24
City of Werribee			69
Coalition for Urban Transport Sanity			82
Commonwealth Grants Commission			149
Commonwealth Treasury			160
Construction Forestry Mining & Energy Union			100
Cotgrove, Mr R D M	H		47
CSIRO, Division of Building Construction & Engineering	M		89,164
Day, Mr P D	B		91, 101
Delfm Property Group	A		59, 98, 111
Department of the Arts, Sport, the Environment & Territories	C		62
Department of Health, Housing & Community Services			85, 115
Department of Housing (New South Wales)			95
Department of Planning & Urban Development (Western Australia)	P		49, 166
Department of the Premier & Cabinet (South Australia)			87
Department of Road Transport (South Australia)			154
Dunham, Mr J		M	134
Economics IV Class, University of Sydney			83
Edwards, Mr G			121

Company/Organisation	Hearing attended		
	Initial	Draft	Sub. No.
Environment Managers Industry Association of Australia		S	123
Forster, Dr C A		A	103
Geelong & District Water Board			27
Gosford City Council			42
Grigg, Prof T J			66, 80
Hassan, Prof R			141
Henry George League Inc South Australia Division	A	A	8, 104
Herborn, Mr P			22
Homestead Award Winning Homes Pty Ltd			93
Homeswest	P	P	57
Housing Industry Association/ Australian Housing & Land	C	C	52, 138
Hunter Water Corporation			55, 140
Jennings Housing	S	B	21, 124
Kiama Municipal Council			13
Kingaroy Shire Council			37
LandCorp (Western Australia Land Authority)		P	109, 152
Latrobe Region Water Authority	M		23
Leagh-Murray, Mr C & Tait, Mr S		B	127
Local Government & Shires Association of New South Wales	S		46, 137
Mant, Mr J		S	127
Martin Goff & Associates	P		16
McLoughlin, Prof B		M	133
Melbourne Water	M		40, 128

Company/Organisation	Hearing attended Initial	Draft	Sub. No.
Municipal Association of Tasmania	H		36
Municipal Association of Victoria	M		15
Municipal Group of Valuers Victoria			135
National Capital Planning Authority	C		65, 76, 131
National Freight Forwarders Association	C		64
National Housing Strategy			10
National Shelter			1
Neutze, Prof M			12, 110
Newcastle City Council			34
Newman, Assoc Prof P	P		54, 79 92, 107
New South Wales Department of Transport			148
New South Wales Government			70, 96 150
Office of Local Government	C	C	67, 139
Outer Urban Research & Policy Unit Victoria University of Technology			28
Peet & Company Ltd		P	119
Planning Power for People			147
Price Waterhouse*		M	
Queensland Government			153
Real Estate Institute of Australia			44
Realty Research		B	118
Reduct Pty Ltd		B	114
Royal Australian Planning Institute (New South Wales Division)	S		48

Company/Organisation	Hearing attended Initial	Draft	Sub. No.
Royal Australian Planning Institute (Tasmania Division)	H		19
South Australia Government			161
South Australia Urban Land Trust		A	99, 108
Shire of Arapiles			2
Shire of Bacchus Marsh			130
Shire of Ballarat			20
Shire of Creswick			7
Shire of Kerang			9
Shire of Pakenhain			165
Shire of Serpentine-Jarrahdale			11
Shire of Yackandandah			5
State Electricity Commission of Victoria	M		30
Sunraysia Water Board	M		4
Sydney Water Board			151
Tasmanian Fanners & Graziers Association			6
Tasmanian Government			86
Town & Country Planning Association			84
Trades & Labour Council of Western Australia			50
Troy, Prof P N	C		33
Urban Development Institute of Australia (National Office)	S	A	18, 74 106
Urban Land Authority			97
Urban Spatial & Economic Consultants			72
Victod'an Government	M		41, 77
Vintila, Mr P	P	P	78, 158
Western Australian Municipal Association	P		60, 105
Western Australia Treasury		P	120, 159

Company/Organisation	*Hearing attended* Initial	Draft	Sub. No.
Water Authority of Western Australia	P		58
Watson Community Association		C	132, 146
Wilbow Peck Corporation Queensland Pty Ltd		B	129
Wollongong City Council			38
Yates, Dr J			3

* Did not provide written submission but gave oral evidence at the public hearings. This is recorded in the transcript of proceedings.

A2 Visits

Commission visited the following organisations:

Date	**Organisation**
November 1991	*Melbourne*
	State Electricity Commission
	Gas and Fuel Corporation
	Department of Planning and Housing
	Melbourne Water
	Municipal Association of Victoria
	CSIRO, Division of Construction and Engineering
	Public Transport Corporation
	Urban Land Authority

Sydney

- NSW Treasury
- Dr Judy Yates, Sydney University
- Department of Planning
- Roads and Traffic Authority
- Ministry of Environment
- Department of Housing
- Local Government Association of NSW
- Department of Public Works
- Sydney Water Board

Adelaide

- Adelaide Planning Review
- Engineering and Water Supply Department
- Adelaide City Council
- Office of Transport Policy and Planning
- SA Urban Land Trust
- Mancorp
- Department of Environment and Planning
- SA Housing Trust

Perth

- Local Government Association
- Swan Shire Council
- Homeswest
- Water Authority of Western Australia
- Department of Planning and Urban Development
- Premier's Department
- Urban Development Institute Association
- Department of Transport
- Treasury

Darwin

- Territory Construction Association

Darwin City Council
Department of Lands and Housing
Department of Transport and Works
Power and Water Authority
Conservation Commission of NT

Hobart

Department of Treasury and Finance
Department of Construction
Municipality of Brighton
City of Glenorchy
Hobart City Council
Department of Resources and Energy
Department of Roads and Transport
Department of Environment and Planning

December 1991 *Adelaide*

Delfin Property Group

Sydney

Baulkham Hills Council
Lane Cove Council

January 1992 *Sydney*

Department of Planning

February 1992 *Canberra*

Department of urban Services

March 1992 *Canberra*

Australian Local Government Association
Chief Minister's Department
ACT Treasury
Department of Urban Services
National Housing Strategy
ACT Conservation Service
ACT Planning Authority

	Brisbane
	Brisbane City Council
	Queensland Department of Housing and Local Government
	Jennings Industries
	Queensland Treasury
July 1992	*Melbourne*
	Melbourne Water
	Sydney
	Sydney Water Board
October 1992	*Melbourne*
	Melbourne Water

In September *1992*, while the Presiding Commissioner was visiting the Organisation for Economic Co-operation and Development, he discussed urban settlement issues with officials from the the General Secretariat, and from the Directorates of Science, Technology and Industry; Trade; Employment, Labour and Social Affairs; and Environment (Urban Unit).

A3 Consultancies

Two consultancies were let:

- to the Federalism Research Centre for a report entitled *Federal Fiscal Arrangements in Australia: their potential impact on urban settlement* (prepared by Professor Cliff Walsh and Associate Professor Norm Thomson); and
- to the CSIRO Division for Building, Construction and Engineering (principally, Dr Joe Flood) for analysis and maps of urban densities in capital cities.

APPENDIX B: AN ANALYSIS OF DWELLING CHOICE IN MELBOURNE AND SYDNEY

B1 Background

Recent debate over urban development in Australia has directed attention to government charges for infrastructure, such as water and sewerage, power and roads. Misalignments between charges and costs are often blamed for conveying inappropriate incentives to users of infrastructure, leading to excessive urban sprawl or other inefficiencies 'in urban land use. As explained later in this appendix and in appendix Q the reforms which are typically indicated by these criticisms would have the effect of increasing the cost of residential land, particularly on the urban fringe.

A question which this raises, and which no econometric study in Australia has addressed, is whether demand for residential land is sensitive to changes in costs. It is known that most Australians live in detached houses and disclose an aversion to alternative forms of housing when surveyed. But the attachment to detached houses is neither universal nor absolute, and with land costs higher, some households would gravitate toward higher-density options. Others, unwilling to make this shift, would choose a detached house on a smaller block than at present. A quantitative understanding of these effects would help evaluate government policies including charges for infrastructure. Large effects would indicate greater potential for inappropriate charges to impair the efficiency of urban land use and, hence, a greater need to ensure that such distortions are removed.

The present analysis models choices between detached houses and higher-density alternatives (collectively termed 'flats'), using data on approximately 7000 households in Melbourne and Sydney. Although comprehensive in many other respects, the data do not measure the site area of each dwelling, which is inferred here from its classification as a house or flat. Since changes in demand for land are thus constrained to occur through shifts between houses and flats, the other effect mentioned above - adjustment in site area of a given dwelling type - is not modelled. That said, the analysis is the first to quantify a demand relationship for residential land using Australian data, and estimates based on imperfect, yet detailed, information are preferable to uninformed judgements. Moreover, while the research is still at an exploratory stage, it yields largely plausible estimates of the effects on housing choices of changes in land costs, incomes and demographic factors. Also presented here is a supporting analysis, which relates the cost of each dwelling to location, structural characteristics and other factors.

B2 Evidence from previous studies of housing demand

Econometric studies of housing demand have generally focused on the 'overall' quantity of housing consumed rather than on bundles of characteristics. Follain and Jimenez (1985) reviewed the minority of studies (none of them Australian) which distinguish particular attributes of housing. For the most-researched attribute - interior living space - they concluded that demand responds positively but weakly to increases in household income and negatively to increases m the attribute's cost. The evidence suggested that the latter response is probably inelastic as well, but its magnitude varied quite a bit between studies. The reviewers cited only one study of the demand for residential land, which analysed lot sizes among 500 rented dwellings in urban North Carolina (Witte et al 1979). The results upheld expectations that the lot size demanded depends positively on income and negatively on residential land prices. The estimates of these effects were moderately large, equating to elasticities of +0.40 and -0.32 respectively. Ohsfeldt and Smith (1988) obtained a similar estimate of the own-price elasticity of lot size demanded (-0.24), using data on households in Houston. The Commission has found no other econometric study dealing with demand for residential land.

Mayo (1980) surveyed the econometric literature on overall demand for housing m the United States, including studies using aggregated data (for example, per capita averages by city) and studies using data on individual households. The latter avoid the pitfalls of aggregation (specification errors and loss of detail) and have come to dominate the field with advances in data processing. Among such studies surveyed, estimates of income elasticifies are less than one in all cases, and well below one on average. Mayo persuasively attributes to aggregation bias the variance between these findings and those from some studies using aggregated data, which indicated quite elastic responses to income. More tentatively, he concludes that price effects on housing demand are also likely to be inelastic. These generalisations have been echoed in much subsequent commentary on housing demand. Anas (1987), for example, hazards an educated guess that the price-elasticity of overall demand is about -0.5. Even if accurate, such estimates reveal little about the demand for particular attributes such as residential land.

Tupule and Powell (1978), in one of the few econometric studies of housing demand in Australia, examined changes from 1964-65 to 1975-76 in the composition of national consumption between housing and other broad commodities. Demand for each commodity was related to consumer prices, household incomes and other factors. Aggregation bias aside, it is extremely difficult to disentangle these influences from so few annual observations (eleven), and the results of such an effort should be viewed cautiously. The results indicate that aggregate housing demand responds appreciably and in the expected directions to changes in incomes and housing prices. Evaluated at 1985-86 consumption shares, the implied elasticities are +1.3 and -0.9, respectively.

The 1970s saw a spurt of econometric research on Australian housing markets, which abated after finding a forum in the 1978 National Housing Economics Conference. Published in 1980, the papers at the conference included separate contributions by Hensher and Bethune on choices between renting and owning, a topic separate from the analysis of land consumption. Cahill and Rasmussen, on the other hand, analysed the preferences of public housing applicants among four housing density-categories: detached house, terrace house, low rise and high rise. Respondents to a survey, restricted to families with children, were asked to rank their preferences among hypothetical dwellings defined by density category, neighbourhood and rent level. This stated preference approach is rare among econometric studies of housing demand, as it is difficult to convey hypothetical situations to respondents and for them to decide on the spot how they would react. However, in the study under consideration, photographs and other depictions made the dwelling options as realistic as possible. The authors used the responses together with information on the incomes and other characteristics of the respondents to estimate a model of housing preferences. Unfortunately, they did not report estimates of price and income effects on choices, although it would have been possible to do so with their model, nor did they provide sufficient information for these estimates to be inferred. Thus, while taking an interesting and innovative approach, the study does not address the core questions in this appendix.

B3 Theoretical framework

The framework for the present analysis is a simple model of housing choice which explains the demand for residential land. It is estimated with data on individual households in Melbourne and Sydney, including information on dwelling characteristics, taken from the 1991 Housing and Location Choice Survey (HALCS). The survey distinguishes between detached houses and several higher-density categories, collectively termed 'flats' in this discussion. The model uses this dichotomy to proxy the area of land each dwelling occupies. Basically, it assumes that houses occupy more land than flats, but that site sizes are identical within each category. However, one component of the model distinguishes between medium density 'flats', or semi-detached houses, and flats in the conventional sense, termed high-density.

The demand for residential land is influenced by land prices, which vary across localities in the same city and, within a locality, across land zoned for different uses. Zoning rules are typically biased against flats, resulting in a price premium for the restricted supply of flat sites. Moreover, this premium can be proportionally larger in some areas than others due to differences in local attitudes toward higher density housing and other factors.

Data on residential site values in Sydney and Melbourne are scarce. The HALCS and most other data collections indicate the total cost of a dwelling without allocating this cost between site and structural components. Data published by the Valuer-General's office in each State provide a rough indication of site values, but only for selected suburbs 'in the case of Sydney. For Melbourne, average sale prices are reported for vacant residential land in each local government area (LGA), but for inner areas, the sales occurring in a given year are too few for reliable inferences.

The first stage of this analysis is thus to quantify the inter-area variation in site prices. For houses and flats separately, the differences in dwelling costs are decomposed between structural and site components through a statistical analysis of the HALCS data. The structural component is captured through several variables for dwelling attributes, such as age and the number of bedrooms. The market valuation of these attributes (for example, the cost of an additional bedroom) is assumed to be uniform across areas. (The analysis thus abstracts from evidence of higher construction costs for inner-area redevelopment than for greenfield sites on the fringes; see the submission to this inquiry from the Department of Health, Housing and Community Services). Inter-area differences in site values are estimated as residuals after standardising for structural attributes. Standardising is important because the attributes may differ between localities. If, for instance, houses in the outer areas average more bedrooms than those in the inner areas, the gross difference in average house costs will understate the true difference in site values. Standardising entails estimation of the 'hedonic price' equations in (B 1) and (B2), where J is the number of localities. Without loss of generality, the benchmarks for comparisons are site values in locality 1.

$$P_h = a_{h0} + a_h \cdot X + \sum_{j=2}^{J} \Delta R_{hj} \times Z_j + u_h \qquad (B1)$$

$$P_f = a_{f0} + a_f \cdot X + \sum_{j=2}^{J} \Delta R_{fj} \times Z_j + u_f \qquad (B2)$$

Where: P_h, (P_f) is the price of a house (flat);

X is a vector of structural characteristics;

ΔR_{hj} (ΔR_{fj}) is the difference in the site value for a house (flat) between locality j and locality 1;

Z_j is a dummy variable equal to 1 for locality j, and equal to zero otherwise, j=(2,….,J);

u_h, u_f are random disturbance terms;

a_h, a_f are vectors of coefficients; and

a_{h0}, a_{f0} are constants.

The estimates from this equation indicate dollar *differences* in site values across areas, but not the absolute levels of site values. However, as discussed in the technical annex to this appendix, absolute figures have been inferred from the differentials and information published by the Valuer-General's department of each State.

The database for the analysis does not reveal the work locations of household members, which largely prevents any analysis of the reasons which underlie where households choose to live. The present analysis takes residence locations as given and models the choice between houses and flats. In the model, the probability that a household makes a particular choice depends on site values in its neighbourhood and on its income and demographic traits. An increase in site costs of houses should tilt the decision towards flats, and conversely for an increase in site costs of flats. In addition, since people normally opt for more living space when they can afford it, an increase in income should attract people toward houses.

The equation explaining housing choices is given a 'logit' form in the present mathematical model (equation B3). The logit function is a popular tool for analysing categorical choices in economics, such as those of housing tenure, mode of commuting, and labour force participation. It has also been used on occasion to model the demand for specific housing attributes, as in this current exercise and in Quigley (1985). It has the necessary property that the probability of a particular choice is greater than zero (no chance) and less than one (a certainty). It is easier to estimate than other functions with this property, such as probit, and yields similar findings.[1]

$$\log\left(\frac{F_h}{1-F_h}\right) = \beta \cdot Y + \beta_h R_{hj} + \beta_f R_{fj} \qquad (B3)$$

where: F_h is the probability that a household will choose a house;

Y is a vector of household characteristics, including income;

R_{hj} and R_{fj}, are measures of the site costs for houses and flats in the household's locality; and

β, β_h and β_f are coefficients.

Another appealing feature of the logit model concerns the impact on decisions of marginal changes in household circumstances (say, a small increase in income). Intuitively, these impacts should depend on the probability of choosing a house before the change occurs. They should be smallest for households whose current probability is near the extremes of one or zero, as this reveals a very firm attachment to either houses or flats, and largest for households currently about equally drawn to each option. This is indeed the case in the logit framework, as can be seen from the partial derivatives of the logit function, in equation (B4). The partial derivatives are at a maximum when the choice probability equals 0.5. In the empirical analysis that follows, impacts of changes in household circumstances are evaluated for illustrative households.

[1] Fora description of logit and related techniques, see Greene (1991).

$$\frac{\partial F_h}{\partial s} = F_h \cdot (1 - F_h) \cdot \beta_s \qquad (B4)$$

Where: F_h is the probability of a household selecting a house;

s is any one of the determinants of housing choice in equation (3), and

β_s is the corresponding co-efficient.

Finally, a brief discussion of the demand for residential land. The Commission requested data on site areas by dwelling type from several participants to this inquiry and other potential providers, but little information was obtained. Hence, the demand for residential land is calculated under a range of assumptions about the relative site areas of flats and houses. The initial assumption, borrowed from Horridge (1991), is that a house occupies twice the land area of a flat. This is incorporated in equation (B5), which defines a household's *expected* demand for land in the probabilistic sense.

$$L = F_h A_h + (1 - F_h) A_f \qquad (B5)$$

$$= \frac{A_h}{2} (1 + F_h)$$

Where: L is the household's expected demand for land; and

A_h (A_f) *is* the site area of a house (flat).

Demand elasticities for residential land can be calculated using the above expression and equation (B3). For example:

$$\varepsilon(R_{hj}) = \frac{\partial L}{\partial R_{hj}} \frac{R_{hj}}{L} = \frac{F_h (1 - F_h)}{(1 + F_h)} \beta_h R_{hj} \qquad (B6)$$

Where: R_{hj} = the site value for houses in the household's chosen neighbourhood (j); and

$\varepsilon(R_{hj})$ = the elasticity for the household's expected demand for land with respect to R_{hj}.

The above elasticity relates to a household which stays in its current neighbourhood after local costs for house sites increase. (Recall that household locations are taken as given in this analysis.) It approximates the percentage reduction in demand for land which can be expected when costs increase one per cent. As in equation (B4), the response goes toward zero as the household's initial probability of house habitation approaches either extreme.[2] In addition, the elasticity is larger, the higher the initial cost of land for houses. Thus, if costs decrease with distance from the city centre, a household in the fringe areas will have a less elastic response than an inner-area household with the same initial probability of choosing a house.

B4 The HALCS database

Conducted in 1991 for the National Housing Strategy (NHS), the HALCS covered 8530 households evenly split between Sydney and Melbourne (NHS 1992). Information was collected in detail about the housing situations of surveyed households, and in lesser depth about the demographic characteristics and financial positions of household members. The NHS released to the Industry Commission the complete unit record data tape, including far more location detail on households than in the unit records available from ABS housing surveys, but excluding information that could reveal the personal identifies of respondents and households. The unit record nature of the HALCS database, combined with the scope and currency of its information, make it the best source of data for the present study.

Certain households in the HALCS sample were dropped from the analysis because responses to key questions were missing or fell outside the categories relevant to the analysis. Among these were a small number of households living in 'other dwellings' which were neither houses nor flats (apparently). About 3400 observations remain for each city after these exclusions, a far larger sample than has been used in previous econometric studies of Australian housing markets.

The composition of the sample is summarised in table 1, according to type of dwelling, tenure and geographic zone. The location of households was identified in the data base at the LGA level, but our analysis has aggregated the LGAs into broader zones (refer to technical annex on derived variables). The nine zones used for Melbourne are those in Horridge's model, comprising a centre

[2] But unlike the response measured in equation (B3), it does not attain a maximum when the household is initially equally drawn to houses and flats, ie. when $F_h = 0.5$. Over the range of F_h, the elasticity peaks at a value less than 0.5, and decreases monotonically as F_h increases above this value.

zone plus inner and outer suburban zones in each direction (Inner North, Outer West, etc.). Sydney has been treated in a similar fashion, except that an Outer East zone is omitted due to the proximity of the centre to the ocean.

The hedonic price equations were estimated with pooled samples of renters and owner-occupiers. To measure housing costs on a comparable basis, a rent-equivalent was imputed for owner-occupied dwellings, using the estimated resale value and an assumed yield factor. Details of the imputation and the derivation of certain other variables are given in the technical annex.

The theoretical framework in the preceding section foreshadowed several of the variables in table 2 which are used as explanators in the hedonic price equations. In addition to the zonal indicators, these include the direct measures of structural characteristics - dwelling age, condition, and number of bedrooms. Other explanators of housing costs are an index of accessability to services and amenities, and variables flagging public housing units, owner-occupied dwellings, and high-density flats.

The *accessibility index* restores some of the geographic detail that is lost in the present analysis through the use of broad zones. Dwelling sites which score high on this index can be expected to command rental premiums.

Public housing units can be expected to rent for less than comparable private units, but it is difficult to make matched comparisons in a statistical analysis. Public and private dwellings may appear identical in the HALCS database, yet differ in respects which the data do not capture. For example, they could be equivalent in number of bedrooms, dwelling condition and so on, but one could be next to a park and the other on a noisy highway. If the latter were the public unit, then it could rent for less than the private unit, even in the absence of any subsidy. The variable flagging public housing units is intended to capture both the pure subsidy and unmeasured differences in quality.

Owner-occupied tenure may also be seen as a proxy for quality. Some argue that rented dwellings are generally less desirable than otherwise similar owner-occupied ones, with regard to some factors that are not easily measured such as quality of the fittings. The hedonic price equations include an indicator of tenure status for this reason, and to partly safeguard against errors in estimating rent-equivalents for owner-occupied dwellings.

High-density flats generally offer less space and privacy than medium density units such as townhouses and thus should fetch a lower rent. A variable distinguishing such dwellings is therefore included in the hedonic price equation for 'flats'.

Table 1: **Summary information (households)**

Location variable	*Dwelling type*		*Tenure*		*Total*
	Flat	*House*	*Renter*	*Owner-occupier*	
Melbourne:					
1: Central	342	178	346	174	520
2: Inner West	42	170	59	153	212
3: Outer West	28	308	62	274	336
4: Inner North	55	315	116	254	370
5: Outer North	0	87	16	71	87
6: Inner East	88	552	135	505	640
7: Outer East	10	175	19	166	185
8: Inner South	160	599	229	530	759
9: Outer South	9	286	52	243	295
Total:	734	2670	1034	2370	3404
Sydney:					
1: Central	192	50	137	105	242
2: Inner West	120	200	128	192	320
3: Outer West	36	400	98	338	436
4: Inner North	82	107	71	118	189
5: Outer North	97	814	194	717	911
6: Eastern Suburbs	149	99	116	132	248
7: Inner South-West	263	509	291	481	772
8: Outer South-West	70	315	122	263	385
Total :	1009	2494	1 157	2346	3 503

Source: HALCS data base.

The logit equation, which explains the choice between flats and houses, has been estimated using two alternative specifications. The basic version is estimated with the full sample of households, but without information on the net housing equity of owner-occupiers; the alternative specification is estimated with a restricted sample for which this information is available.

The explanatory variables in the basic version are the site costs in the household's zone of residence, income, and measures of household size and composition (see table 2). Individual incomes are reported in the HALCS database in $5000 intervals, with a separate category for zero incomes. The present analysis estimates incomes within these ranges based on the individual's age, education and sex (see technical annex). Incomes are then summed for individuals in the same household.

Incomes are measured before-tax and exclusive of notional flows from owner-occupier equity in dwellings. For households that own their dwelling outright, such equity can be measured in the HALCS database as the dwelling's estimated resale value. However, it cannot be inferred for other households with liabilities on their dwellings, since there is inadequate information on the amounts and terms of their debts. Net equity in housing is therefore absent from the basic logit equation which is estimated with the full sample, despite its undeniable influence on the demand for living space. To get some idea of the resulting bias, an alternative logit equation has been estimated after restricting the sample to full owners; this specification includes both net equity (ie. the resale price), income and the other explanatory variables described above.

Table 2: **Explanatory variables used in hedonic and logit models**

Explanatory variable names	*Description*
Hedonic model.	
Bedrooms	number of bedrooms per dwelling
Dwelling age	estimated age of structure
Condition	index of dwelling condition (poor = 0; excellent =1)
Accessibility	index of accessibility to services (poor = 0; excellent = 1)
Public	dummy variable for public housing
High density	dummy variable for high density flats
Owner-occupier	dummy variable for owner-occupied dwellings
Neighbourhood	dummy variable indicating if dwelling is in a particular zone
Logit model	
Household income	gross weekly household income before-tax
Flat site value	difference in flat site value between the respondent's zone and the central zone (5 per week)
House site value	defined as for flat site value
Dwelling resale value	resale value of dwelling ($'000)
Household size	size of household (in persons)
Couple	dummy variable indicating presence of couple
Children	dummy variable indicating presence of children
Young children	dummy variable indicating presence of children under the age of 15 years
Elderly	dummy variable indicating household head is aged 65 years or more
Group	dummy variable indicating group household

Note: dummy variables equal one if the dwelling has the indicated characteristic and equal zero otherwise.

B5 Results

B5.1 Hedonic price regressions

The hedonic price equations were estimated with ordinary least squares regressions, drawing on the pooled samples of renters and owner-occupiers. (Rent-equivalents were imputed for the latter, as discussed in the technical annex). The separate results for houses and flats are shown in table 3 (Melbourne) and table 4 (Sydney). Each parameter estimate in the tables represents the dollar value attached to a particular attribute, given that all other attributes are held constant. For example, a coefficient of 50.0 on the variable 'bedrooms' indicates that the weekly cost of the dwelling increases by $50 per additional bedroom. Also reported in the tables are measures of statistical significance. The estimated coefficient of a variable is Judged statistically significant if the evidence strongly refutes the hypothesis that the variable has no real effect. There is no hard and fast rule about the degree of confidence required, but estimates are usually regarded as significant if there is no more than a five per cent chance of zero impact. Results of this test are indicated in the tables, together with those using the less stringent criterion of a ten per cent probability. Estimates passing the latter test can be regarded as suggestive of true effects, while those passing neither test provide inadequate grounds for inference.

The statistically significant results in the tables nearly all make economic sense. Rents are found to increase with the number of bedrooms, and to be lower for public housing. Owner-occupied dwellings cost more than ostensibly equivalent rented housing, suggesting an unmeasured difference in quality. In addition, high-density flats are less expensive than medium density units such as townhouses (about $15 per week cheaper).

The one finding which is significant and counter-intuitive is that house rents increase with dwelling age, holding other factors constant. Dwelling age has insignificant effects in the regressions for flats, and its perverse influence on house rents may reflect the limited geographical detail in the analysis (nine zones in Melbourne and eight in Sydney). Within each zone, housing costs are likely to increase with distance from the city centre, and older dwellings may be typically closer in.[3]

[3] Other hedonic studies of housing costs in Australia obtain a similar mixture of mostly sensible findings and a few unpalatable ones. Dwyer and Wilson (1992) found that most structural attributes, including dwelling age, have the expected influences on the cost of detached houses in Campbelltown. Yet their variable for lot size indicates a significantly negative effect. See also Applied Economics and Travers Morgan (1991) and a survey of hedonic price studies by Streeting (1990).

The crude measurement of dwelling condition may explain its poor performance as a variable (insignificant in all cases). Much the same can be said of the index of accessability to services. It has a positive and significant estimated effect on house rents in Melbourne, as was expected, but it does not seem to matter otherwise.

The findings differ between cities in a few other salient respects. In Melbourne, an extra bedroom costs an estimated $41 per week for houses and only slightly less for flats. In Sydney, the cost is substantially higher and more dependant on the type of dwelling ($54 for flats and $77 for houses). The estimated saving in going from a private unit to a seemingly comparable public one varies erratically between the cities. It is larger for flats in Sydney than for those in Melbourne ($110 versus $79), but the pattern is reversed when it comes to houses ($55 and $66 respectively). How far these findings reflect actual differences between cities rather than being statistical artefacts is unclear.

Land values, as represented by the coefficients on the zonal dummy variables, can be expected to vary inversely with distance from the CBI) (Central Business District). For Melbourne, this classic monocentric pattern is upheld for houses but only weakly so for flats. Essentially similar houses located in the outer regions of Melbourne rent for significantly less than in the corresponding inner regions. However, the cost of houses depends not only on distance from the CBI) but also on direction. The results indicate that the eastern and southern suburbs are more desirable, and hence attract smaller rental discounts than the western and northern suburbs. For flats in Melbourne, the estimates indicate cheaper rents outside the central zone for comparable dwellings. But they are statistically significant only for the Outer West, where the discount is about $35 per week relative to the centre. The weak monocentricity in these results could partly stem from the relatively small sample sizes for flats in outer regions. (Indeed, flats in the Outer North were unrepresented in the sample, which explains the absence of an estimate for that zone.) Another possibility is that the zoning restrictions are increasingly hostile toward flats as one moves from the centre, thus preventing flat site values from falling in tandem with values for houses.

For Sydney, monocentricity and directional biases are in evidence for flats and houses. Inner areas are cheaper than the corresponding outer areas, and the Inner South-West and West zones are, in turn, cheaper than the centre. However, the bias in favour of the eastern and northern suburbs is so strong that house rents in the Inner North and Eastern Suburbs are markedly higher than in the centre. For flats, the central zone is significantly more expensive than any other, except for the Inner North with which it is on a par.

B5.2 Logit analysis

Econometric studies of housing demand generally abstract from moving costs, as does the present logit model. Because moving is implicitly assumed to be costless, a household's choice between houses and flats depends in the model only on current circumstances - the current financial and demographic characteristics of the household, and the land prices it presently faces. In reality, there are major costs in acquiring or disposing of housing assets, (search time, agents fees and so on), and these greatly add to the moving expenses of owner-occupiers. In consequence, the living arrangements of owner-occupiers may partially reflect expectations of future circumstance - as when a childless couple chooses a large dwelling in anticipation of having children - and on housing decisions made in the past. Renters can generally move more easily, despite costs in search time, removal and possibly negotiating the termination of a lease.

For this reason, and because of the problem in measuring net equity in owner-occupied housing (discussed in the preceding section), the logit equation has been estimated separately for each tenure category, and more reliable results can be expected for renters. Maximum likelihood estimates for renters and the full sample of owner-occupiers are presented in tables 5 and 6. Unlike in the hedonic price regressions discussed earlier, the parameter estimates do not have a simple interpretation. Hence, the findings are presented in a more transparent way in table 7, which defines four illustrative households (one renter and owner-occupier for each city). Impacts on each household's probability of choosing a detached house are reported in the table for changes in site values, incomes, and demographic characteristics. The flavour of the findings is thus conveyed without burdensome computations. However, the diversity of each city's population precludes any pair of households being fully representative and, as was emphasised above, the responses to identical changes in circumstances can vary substantially between households. In the present logit model, the directions of response are constrained to be uniform within each subgroup analysed. However, the magnitudes vary and those for the illustrative households cannot be generalised without risk. Thus, for the variables which are of paramount interest here - site values and household incomes - aggregate effects have been estimated by combining predictions for all sampled households. Estimates are thus obtained for the entire population of each city and for each tenure subgroup.

B5.2. 1 Results for renters

Previous predictions about economic influences on renters' choices are mostly upheld. Higher income appears to sway decisions toward houses, as does a reduction in land costs for houses, and each of these findings is statistically significant. One can also anticipate a shift toward houses when flat sites become dearer, a prediction which is weakly supported in the results for Melbourne (at the ten per cent level of significance). In the Sydney findings, the cost of flat sites is altogether insignificant. Results for both cities indicate that a uniform percentage increase in land costs raises the odds of a flat being chosen by the illustrative renters. When site values rise ten percent, the percentage point increase in this probability is 2.9 for the Melbourne household and 2.4 for its Sydney counterpart.

The findings overwhelmingly confirm that when households gain a member their probability of house-dwelling increases (by about 12 percentage points for the illustrative renters). By contrast, the composition of the household does not emerge as all that important - holding the number of members constant, no effects are discernible from the presence of a couple, older children, or a group of unrelated persons. The only compositional effects which are manifestly not statistical noise are observed in the Sydney results, which reveal a bias toward flats among households with young children and an opposite preference among the elderly. These findings are suggestive of life-cycle effects associated with capital accumulation. Young families may choose to rent a flat and apply the consequent cost savings toward purchasing a house in the future. Conversely, the elderly may have little interest in saving and may thus be more likely to rent a house than someone younger on a similar income. These considerations may also shed some light on why similar effects were not observed in Melbourne. Housing costs are much higher in Sydney, making the need to save for homeownership more of a concern.

B5.2.2 Results for owner-occupiers

The findings for owner-occupiers are less plausible than those for renters, consistent with the difference in moving costs and with the. absence of a variable for housing equity. Changes in income are estimated to have an essentially zero effect on the attraction to houses among Melbourne owner-occupiers, whereas theory suggests the positive effect that was obtained for renters. The corresponding estimate for Sydney is perversely significant, as it implies that affluence steers owner-occupiers toward flats, albeit slightly. (For the illustrative household, the odds increase 0.4 percentage points when income rises 10 percent.)

Some of the demographic variables may be capturing the effects of housing wealth. Equity in housing tends to accumulate over the life-cycle, so mature households are often better placed than younger ones to afford a detached house. This could be partly why, in the Sydney findings, the proportion of owner-occupiers in houses is higher for families with older children than for those with younger children, and high for the elderly households than the non-elderly, once other factors are standardised. Another statistically valid finding for Sydney is that owner-occupied households containing a group of unrelated persons are more attracted to houses than are similar non-group households. Estimated demographic effects among owner-occupiers in Melbourne are qualitatively similar but often lack significance. The variables which clearly matter in both cities are household size, the presence of children and presence of a couple, all of which raise the probability of living in a house.

Higher land costs for houses demonstrably reduce demand for houses among owner-occupiers. If the illustrative owner-occupiers had many clones, then a ten per cent increase in land costs for houses would cause 1.7 per cent of them to shift from houses into flats in Melbourne and 0.6 per cent to make this change in Sydney (table 7). There is no evidence of a reverse effect when flats become more expensive, holding other factors constant.

The estimated coefficient on the site value of Melbourne flats is statistically insignificant, while that for Sydney owner-occupiers is significant and 'wrong-signed' (ie. Indicating that flats become more attractive when their costs increases). The anomalous Sydney estimate does not arise from the choice of an illustrative household, being independent of the particular household for which the effect is measure.

B5.2.3 Results for full owners

Restricting the sample of owner-copiers to full owners permits re-estimation of the logit equation with the inclusion of a variable for housing equity (the estimated resale price). In addition, as table 8 shows, it limits the analysis to an older population, containing proportionately more households with retired heads and fewer households with children (especially young children). Both the change in the population being analyzed and the inclusion of the equity variable contribute to differences in findings. These influences are disentangled to some extent in table 9 and 10, which report estimates of the logit equation for full owners, both with and without the equity variable.

The results of the expanded analysis confirm that an increase in wealth (or at least the housing component of it) raises the demand for living space, as indicated by a shift from flats into houses. In the Sydney results, the addition of the equity variable renders insignificant the coefficient on the variable for elderly households, supporting the previous speculation that this variable was acting as proxy for housing equity. Otherwise, the findings are largely unchanged from those obtained previously, using the full sample of owner-occupiers. For Sydney, increases in income are again estimated to reduce the demand for detached houses or to have statistically insignificant impacts.

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B5.2.4 Aggregate results

Based on the estimates in tables 5 and 6, demand responses have been calculated for the entire population of each city, and for sub-populations by tenure category (see tables 11 and 12). On these results, a ubiquitous ten per cent increase in site values would draw about 2 per cent of each city's households from detached houses into flats, bringing the proportion 'm houses down to 76.0 per cent 'm Melbourne and 69.3 per cent m Sydney. Coupled with the previously stated assumptions about site areas, these estimates translate to reductions M" residential land area of 1.3 per cent and 1. 1 per cent, respectively. Larger declines are predicted for the renting population, particularly in Melbourne (2.4 per cent), but even these responses are fairly modest. *The basic message is that demand for residential land is inelastic with respect to the overall level of land prices.*

Responses of similar magnitudes are estimated with respect to a change in land prices for just one type of dwelling. The findings for Melbourne confirm that the 'law of demand' operates for both houses and flats. Fewer flats are demanded when site values increase for flats while remaining unchanged for houses. For this scenario, a ten per cent increase in the flat values is predicted to trim 1.3 percentage points from the flat-share of Melbourne households. The corresponding estimate for an unaccompanied increase in site values for houses indicates that 3.8 per cent of households would shift from houses into flats. This price-response is the largest among the estimates for the entire populations of Melbourne and Sydney. However, the corresponding decline in demand for land is estimated at only 2.1 per cent, conforming to the inelastic pattern described above.

In the Sydney findings, higher site values for houses reduce demand for houses and, somewhat oddly, so do higher values for flats. However, the shift toward houses is small in both cases: a ten per cent increase in either flat or house site values is estimated to move about one per cent of households or less.

Estimates have also been calculated for the populations of the outer zones of each city (tables 13 and 14). It is in these fringe areas that increases to developer charges would commonly be expected to influence land affordability the most, and where preferences for detached housing appear strongest. Based on the present estimates, a uniform ten per cent increase in land costs would have minor effects on the mix of dwellings in outer-zones. In Melbourne, detached houses would still account for 92.5 per cent of these dwellings, compared with 93.1 per cent currently; in Sydney, the proportion would be 79.7 per cent, or just about one percentage point less than at present. Expressed as demand elasticities for residential land, the estimates are notably smaller than the city-wide figures.

Estimated responses are also smaller for changes in income than for changes in land costs. For each city as a whole, the income elasticity of demand for land is about +0.07 for renters and essentially zero for owner-occupiers.

B5.2. Qualifications and sensitivity tests

The demand elasticities just presented are based on an assumed 2:1 ratio of house to flat site areas. If a larger ratio is more realistic, the elasticities will have been understated. However, the ratio would have to be substantially larger to change the nature of the current findings. Even at a four-to-one ratio, demand for residential land still emerges as weakly responsive to a general increase in land prices, with elasticities of -0.21 for Melbourne and -0.18 for Sydney.

Also corroborating this inelastic pattern are the results for full owners, from the analysis which takes account of housing equity. Based on these results and Horridge's assumption about site areas, the demand elasticities are estimated at about -0.13 for each city, compared to the estimate of -0.10 for all owner-occupiers. Thus, the absence of an equity variable in the equation for all owner-occupiers appears to bias the estimates of price elasticities only marginally.

More difficult to assess is the bias from assuming constant site areas for each type of dwelling. Under this restriction, demand for residential land can change through substitution between houses and flats, but not through adjustments in lot sizes among houses or in site areas among flats. One of the mechanisms by which changes in prices and incomes affect the demand for residential land has thus been omitted, biasing downwards the estimated responses. Somewhat higher responses were in fact obtained in the U.S. studies referred to previously, which had access to household-level data on lot size. (Ohsfeldt and Smith 1990; Witte et al 1979). However, the demand for land still came out as price-inelastic, with the own-price elasticity estimated at -0.3 or less.

Moreover, it cannot be concluded that the estimated responses will be too small, since there is also a countervailing bias. This arises because the analysis has taken the locations of households as given, even though the choices of location and dwelling type are intertwined. Households with a large demand for residential land are pulled toward areas where land is cheap. Land prices may thus be negatively correlated across neighbourhoods with the house-to-flat ratio, even in the hypothetical case where prices have no bearing on the choice of dwelling type. Although the present econometric analysis attempted to control for relevant household characteristics, some are undoubtedly absent in the HALCS data base, and 'in terms of these unmeasured characteristics, households in high land-cost areas will tend to be more 'land-hungry' than residents elsewhere (due to the self-selection mechanism just mentioned). So the negative impact of land prices on the demand for residential land, as estimated here, may be partly a pure price effect and partly a proxy for demographic influences.[4]

B5.3 Summary

This appendix has examined the demand for residential land in Sydney and Melbourne, as manifested by the choice of dwelling type, and its sensitivity to land prices, incomes and demographic factors. An essential first step was to estimate the differentials in land prices by locality, without imposing the same pattern for houses and flats. In the process, estimates were also obtained of the effects on housing rents of factors other than land costs, such as the number of bedrooms and dwelling age. The findings from this first stage are mostly in accord with expectations. Land values tend to decline with distance from the city centre, but direction from the centre also matters. Public ownership of housing reduces the rent, while additional bedrooms increase it. Dwelling age is found to have an apparently perverse positive effect on rents, but this could be an artefact of the broad zonal definitions. (Within' a zone, older dwellings may be closer to the CBD.)

Renters augment their demand for residential land as their incomes increase, according to the present logit findings and standard economic theory. But the estimate of this effect is quite small and demand among owner-occupiers appears to increase more with wealth than with current income. Demand for residential land is found to be influenced by land prices, though the elasticities concerned are fairly modest. For the urban population as a whole, the elasticity with respect to a general increase in land prices averages about -0.12, based on the present estimates. Even smaller responses are implied for residents of the fringe areas. These findings basically agree with evidence from American studies using better data on land area and with the present results for renters, which are more reliable than those for owner-occupiers. The combined evidence points to price effects on demand for residential land which are inelastic, perhaps larger than the all-population figures reported here, but unlikely to equate to elasticitities above -0.5 in absolute value.

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4 Ingrain (1975) makes this point in commenting on King's (1975) analysis of housing demand in an American city (New Haven). King's use of within-city price differentials partly inspired the framework used here.

The result that large households have an above-average demand for land comes as no surprise. Other demographic findings are of greater interest and appear consistent with the typical life-cycle patterns of saving.

The conclusion that price increases for urban residential land are likely to have moderate effects on demand has substantial relevance to the current inquiry. The concerns that government charges for infrastructure are inadequate and that urban sprawl is thereby exacerbated have already been mentioned. To this it must be added that the cost of new infrastructure on the fringes increases with the area taken up per dwelling, since a less compact settlement increases the area to be traversed by pipes, wires and roads. A near halving of lot sizes on the fringes would reduce associated infrastructure costs by thirty-seven per cent, according to one estimate (cited in the Department Health, Housing, and Community Services submission to this inquiry). So charges for infrastructure which reflect costs must be partly land-based, and a move toward full-cost recovery could raise serviced land prices. The increased charges would impinge in the first instance on the fringe areas, where most of the new development is occurring. On the results of the present analysis, an increase in serviced land prices would shift the mix of residential development on the fringes toward higher-density alternatives to detached houses. But the estimated size of this shift implies that the decline in demand for land will be proportionately much smaller than the increase in prices.

Table 3: **OLS hedonic price regression of housing rents - Melbourne**

Independent variables	Houses: Parameter estimate	Houses: t-value	Flats: Parameter estimate	Flats: t-value
	$ per week		$ per week	
Intercept	54.49**	2.62	49.58*	1.90
Bedrooms	40.85**	13.81	37.66**	9.55
Dwelling age	0.37**	2.37	0.19	0.99
Condition	-17.30	-1.13	21.56	1.15
Accessibility	20.47**	2.01	3.89	0.26
Public	-65.57**	-4.30	-78.75**	-9.45
High density	n/a	n/a	-14.07**	-2.19
Owner-occupier	39.29**	6.59	23.02**	3.48
Neighbourhood:				
Inner West	-57.81**	-5.07	-19.34	-1.51
Outer West	-84.40**	-7.87	-35.22**	-2.34
Inner North	-70.82**	-6.98	-12.41	-1.14
Outer North	-61.60**	-4.27	a	a
Inner East	-16.15*	-1.66	-1.78	-0.20
Outer East	-46.44**	-3.86	-16.15	-0.60
Inner South	-9.73	-1.03	-10.06	-1.32
Outer South	-59.22**	-5.30	-1.75	-0.07
Summary statistics:				
- sample size	2 586		652	
- adjusted r-squared	18.09%		32.93%	
- mean dependent variable (rent)	$185.93		$134.12	

a The Outer North zone contains no flats so a zonal dununy coefficient was not estimated.
** Denotes significance at a 95 percent level of confidence (t-value in excess of 1.96).
* Denotes significance at a 90 percent level of confidence (t-value in excess of 1.645).

Table 3: **OLS hedonic price regression of housing rents - Sydney**

	Houses		*Flats*	
Independent variables	*Parameter estimate*	*t-value*	*Parameter estimate*	*t-value*
	$ per week		$ per week	
Intercept	7.84	0.20	109.83 *	4.33
Bedrooms	77. 11**	17.08	53.86**	13.41
Dwelling age	0.55**	2.16	-0.22	-1.09
Condition	19.57	0.79	-2.72	-0.15
Accessibility	28.18*	1.81	17.20	1.23
Public	-54.82**	-2.98	-109.71**	-11.86
High density	n/a	n/a	-16.33**	-2.52
Owner-occupier	83.63**	8.14	42. 11**	6.87
Neighbourhood				-5.31
Inner West	-130.41**	-4.81	-56.37**	
Outer West	-205.87**	-7.92	-81.40**	-4.90
Inner North	135.75**	4.66	-8.00	-0.70
Outer North	-106.14**	-4.20	-48.90**	-4.25
Eastern Suburbs	97.76**	3.32	-18.29**	-1.96
Inner South-West	-134.76**	-5.29	-78.36**	-9.03
Outer South-West	-185.61**	-6.98	-98.32**	-7.19
Summary statistics:				
- sample size	2 410		904	
- adjusted r-squared	32.72%		47.53	
- mean dependent variable (rent)	$254.94		$176.02	

** Denotes significance at a 95 percent level of confidence (t-value in excess of 1.96).
* Denotes significance at a 90 percent level of confidence (t-value in excess of 1.645).

Table 5: **Estimated logit model of dwelling choice - Melbourne**

Independent variables	*Renters*	*Wald-Chi Square*	*Owner occupiers*	*Wald-Chi Square*
Intercept	-0.05	a	2.97**	19.01
Household income ($'00 per week)	0.07**	15.07	-0.01	0.33
Flat site value (V0 per week)	0.21*	3.33	0.20	2.16
House site value ($'0 per week)	-0.28**	59.02	-0.33**	50.62
Household size	0.49**	26.39	0.35**	5.55
Couple	-0.07	0.11	1.12**	21.31
Children	0.31	1.02	1.01**	7.16
Young children	0.01	a	-0.46	1.80
Elderly	-0.22	0.42	0.28	1.76
Group household	0.23	0.74	0.44	1.01
Summary statistics:				
Sample size	1026		2366	
Percent of sample in houses		48.40	91.60	

a Denotes a value between -0.005 to +0.005.
** Denotes significance at a 95 percent level of confidence (Wald-Chi statistic in excess of 3.84).
* Denotes significance at a 90 percent level of confidence (Wald-Chi statistic in excess of 2. 71).

Table 6: **Estimated logit model of dwelling choice - Sydney**

Independent variables	*Renters*	*Wald-Chi Square*	*Owner occupiers*	*Wald-Chi Square*
Intercept	-1.26**	25.05	1.28**	21.33
Household income ($'00 per week)	0.07**	15.04	-0.03**	6.21
Flat site value (V0 per week)	-0.02	0.25	-0.11**	5.50
House site value (V0 per week)	-0.06**	12.90	-0.05**	12.20
Household size	0.57*	47.99	0.52**	18.64
Couple	0.13	0.43	0.95**	22.52
Children	0.43	2.32	1.00**	11.77
Young children	-0.85**	12.32	-0.82**	11.18
Elderly	0.55**	3.96	0.54**	8.69
Group household	-0.23	0.64	0.89**	6.01
Summary statistics:				
Sample size	1 149		2343	
Percent of sample in houses	42.60		85.40	

a Denotes a value between -0.005 to +0.005.
** Denotes significance at a 95 percent level of confidence (Wald-Chi statistic in excess of 3.84).
* Denotes significance at a 90 percent level of confidence (Wald-Chi statistic in excess of 2.71).

Table 7: **Sensitivity of dwelling choices of illustrative households**

Household	*1*	*2*	*3*	*4*
Characteristics:				
Household type	Group household: two singles with no	Couple with no children children	Couple with one child over 15 years	Couple with no children
Age of household head	<65	<65	<65	<65
Gross household income (per week)	$450	$800	$700	$900
Tenure type	Renter	Owner-occupier	Renter	Owner occupier
City	Melbourne	Melbourne	Sydney	Sydney
Zone	Inner West	Outer East	Outer North	Inner South west
Site cost of flats ($ per week)	$49	$52	$78	$48
Site cost of houses ($ per week)	$80	$91	$147	$118
Probability of household living in a house	56.8%	94.1%	60.8%.	86.6%
Effect on probability of living in a house of:				
(i) a 10% increase in weekly household income	0.8%	a	1.2%	-0.4%
(ii) a 10 % increase in the weekly site cost of flats	2.6%	0.6%	-0.4%	0.6%
(iii) a 10 % increase in weekly site cost of houses	-5.5%	-1.7%	-2.0%	-0.6%
(iv) a 1 person increase in household size	12.0%	1.9%	13.5%	6.0%
(v) being a couple as against being single	-1.8%	6.2%	3.1%	11.0%
(vi) having older children compared to no children	7.7%	5.6%	10.3%	11.6%
(vii) having young children compared to no children	8.0%	3.1%	-9.9%	2.1%
(viii) household head over the age of 65 years	-5.3%	1.6%	13.2%	6.2%
(ix) Group household or not	5.7%	2.4%	-5.6%	10.3%

a Denotes a value between -0.05 to 0.05. .

b The price of land for flats in the central zone is assumed to be half that of the price for house land in the central zone.

Table 8: **Sample means for logit model of dwelling choices**

Independent variables	*Renters*	*Owner-occupiers*	*Owners only*
Melbourne			
Household income ($ per week)	680.90	870.70	772.71
Estimated resale value ($'000)	n/a	n/a	170.93
Household size	2.59	3.01	2.71
Couple	0.39	0.73	0.69
Children	0.34	0.53	0.43
Young children	0.22	0.27	0.13
Elderly	0,06	0.16	0.26
Group household	0.29	0.08	0.07
Sydney			
Household income ($ per week)	715.46	909.14	813.32
Estimated resale value ($'000)	n/a	n/a	247.15
Household size	2.79	3.04	2.70
Couple	0.46	0.74	0.68
Children	0.40	0.53	0.41
Young children	0.27	0.26	0.12
Elderly	0.09	0.18	0.29
Group household	0.25	0.08	0.08

Table 9: **Estimated logit model of dwelling choices among full owners - Melbourne**

Independent variables	*Coefficient*	*Wald-Chi Square*	*Coefficient*	*Wald-Chi Square*
Intercept	2.98**	10.47	2.84**	9.31
Household income ($'00 per week)	0.01	0.08	-0.02	0.54
Flat site value (V0 per week)	0.18	1.00	0.17	0.94
House site value (V0 per week)	-0.35**	34.15	-0.38**	38.70
Estimated resale value ($'000)	n/a	n/a	3.57**	6.81
Household size	0.66**	6.09	0.69**	6.63
Couple	0.95**	7.00	0.95**	6.97
Children	0.53	0.97	0.49	0.81
Young children	-0.81	2.36	-0.84	2.52
Elderly	0.27	1.23	0.20	0.65
Group household	0.04	a	-0.01	a
Summary statistics				
Sample size	1 366		1 366	
Percent of sample in houses	90.5		90.5	

a Denotes a value between -0.005 to +0.005.
** Denotes significance at a 95 percent level of confidence (Wald-Chi statistic in excess of 3.84).
* Denotes significance at a 90 percent level of confidence (Waid-Chi statistic in excess of 2.71).

Table 10: **Estimated logit model of dwelling choices among full owners - Sydney**

Independent variables	*Coefficient*	*Wald-Chi Square*	*Coefficient*	*Wald-Chi Spare*
Intercept	1.57**	18.94	1.30**	12.25
Household income ($'00 per week)	-0.03	2.57	-0.08**	16.27
Flat site value (V0 per week)	-0.12*	3.74	-0.15**	5.55
House site value (V0 per week)	-0.04**	6.74	-0.07**	15.01
Estimated resale value ($'000)	n/a	n/a	6.31**	41.17
Household size	0.43**	6.66	0.39**	5.03
Couple	1.01**	16.23	0.98**	14.38
Children	0.98**	6.70	1.12**	8.10
Young children	-0.96**	7.22	-1.03**	7.92
Elderly	0.33	2.56	0.33	2.23
Group household	1.10**	5.12	1.20**	5.82
Summary statistics:				
Sample size	1 392		1 392	
Percent of sample in houses	84.7		84.7	

A Denotes a value between -0.005 to +0.005.
** Denotes significance at a 95 percent level of confidence (Wald-Chi statistic in excess of 3.84)
* Denotes significance at a 90 percent level of confidence (Wald-Chi statistic in excess of 2.71)

Table 11: **Sensitivity analysis of demand for residential land - Melbourne**

	Renters	Owner-occupiers	Combined[a]
with respect to a 10% increase in all residential land prices			
Probability of living in a house:			
- Before change	48.21%	91.47%	78.39%
- After change	44.63%	89.62%	76.01%
- Net change	-3.58%	-1.85%	-2.38%
Elasticity of demand for land	-0.24	-0.10	-0.13
with respect to a 10% increase in flat site prices only			
Probability of living in a house:			
- Before change	48.21%	91.47%	78.39%
- After change	50.74%	92.26%	79.70%
- Net change	+2.53%	+0.78%	+1.31%
Elasticity of demand for land	+0.17	+0.04	+0.07
with respect to a 10% increase in house site prices only			
Probability of living in a house:			
- Before change	48.21%	91.47%	78.39%
- After change	42.21%	88.65%	74.60%
- Net change	-6.00%	-2.82%	-3.78%
Elasticity of demand for land	+0.40	-0.15	-0.21
with respect to a 10% increase in income			
Probability of living in a house:			
- Before change	48.21%	91.47%	78.39%
- After change	49.10%	91.42%	78.62%
- Net change	+0.89%	-0.05%	+0.24%
Elasticity of demand for land	+0.06	b	+0.01

a Weighted average of renters and owner-occupiers. b Denotes a value between -0.005 to +0.005. Source: Commission estimates using the HALCS database.

Table 12: **Sensitivity analysis of demand for residential land - Sydney**

	Renters	*Owner-occupiers*	*Combined* [a]
with respect to a 10% increase in all residential land prices			
Probability of living in a house:			
- Before change	42.43%	85.21%	71.13%
- After change	40.41%	83.44%	69.28%
- Net change	-2.02%	-1.77%	-1.85%
Elasticity of demand for land	-0.14	-0.10	-0.11
with respect to a 10% increase in flat site prices only			
Probability of living in a house:			
- Before change	42.43%	85.21%	71.13%
- After change	41.94%	84.30%	70.36%
- Net change	-0.49%	-0.91%	-0.77%
Elasticity of demand for land	-0.03	-0.05	-0.05
with respect to a 10% increase in house site prices only			
Probability of living in a house:			
- Before change	42.43%	85.21%	71.13%
- After change	40.88%	84.38%	70.07%
- Net change	-1.54%	-0.84%	-1.07%
Elasticity of demand for land	-0.11	-0.05	-0.06
with respect to a 10% increase in income			
Probability of living in a house:			
- Before change	42.43%	85.21%	71.13%
- After change	43.40%	84.93%	71.26%
- Net change	+0.97%	-0.28%	+0.13%
Income elasticity of demand	+0.07	-0.02	+0.13

a Weighted average of renters and owner-occupiers.
Source: Commission estimates using the HALCS database.

Table 13: **Sensitivity analysis of demand for residential land on the city fringe - Melbourne**

	Renters	*Owner-occupiers*	*Combined* [a]
with respect to a 10% increase in all residential land prices			
Probability of living in a house:			
- Before change	71.37%	97.29%	93.05%
- After change	69.83%	96.90%	92.48%
- Net change	-1.53%	-0.38%	-0.57%
Elasticity of demand for land	-0.09	-0.02	-0.03
with respect to a 10% increase infringe flat site prices only			
Probability of living in a house:			
Before change	71.37%	97.29%	93.05%
- After change	73.24%	97.54%	93.57%
- Net change	+1.87%	+0.01	+0.03
Elasticity of demand for land			
with respect to a 10% increase infringe house site prices only			
Probability of living in a house:			
- Before change	71.37%	97.29%	93.05%
- After change	67.85%	96.58%	91.88%
- Net change	-3.52%	-0.70%	-1.16%
Elasticity of demand for land	-0.21	-0.04	-0.06

a Weighted average of renters and owner-occupiers.
b denotes a value between -0.005 to +0.005.
Source: Commission estimates using the HALCS database.

Table 14: **Sensitivity analysis of demand for residential land on the city fringe - Sydney**

	Renters	*Owner-occupiers*	*Combined* [a]
with respect to a 10% increase in all fringe residential land prices			
Probability of living in a house:			
- Before change	52.04%	89.96%	80.90%
- After change	50.53%	88.89%	79.72%
- Net change	-1.52%	-1.08%	-1.18%
Elasticity of demand for land	-0.10	-0.06	-0.07
with respect to a 10% increase in fringe flat site prices only			
Probability of living in a house:			
- Before change	52.04%	89.96%	80.90%
- After change	51.62%	89.34%	80.33%
- Net change	-0.43%	-0.62%	-0.57%
Elasticity of demand	-0.03	-0.03	-0.03
with respect to a 10% increase infringe house site prices only			
Probability of living in a house:			
- Before change	52.04%	89.96%	80.90%
- After change	50.95%	88.53%	80.31%
- Net change	-1.09%	-0.44%	-0.59%
Elasticity of demand for land	-0.07	-0.02	-0.03

a Weighted average of renters and owner-occupiers. Source: Commission estimates using the HALCS database.

Technical annex: derived variables

The analysis in this appendix uses several variables derived from the raw HALCS data, sometimes supplemented with information from other sources. The procedures for creating these variables are described in this technical annex.

Locational variables

The HALCS database distinguished location by local government areas (LGAs) and five zones based on distance from the city centre (see appendix G for details). This zonal classification ignores variations in characteristics between areas similarly distant from the central zone, though in different directions. For example, Toorak in the inner south of Melbourne is considerably more expensive than Footscray in the city's inner west, yet both of these suburbs are in the same HALCS zone.

To cater for such differences, new zones were defined with greater geographic detail than the original five region classification. Disaggregation to the level of individual LGAs was considered inappropriate due the resultant small sample sizes in many regions. For Melbourne the nine zones of the Horridge model (Homidge 1991) were adopted, comprising a central zone, and inner and outer zones for each direction from the city centre (ie Inner North, Outer North and so on). Sydney was dealt with similarly, with the exception that an Outer East region was omitted due to the proximity of the city to the ocean. This process yielded eight zones for the city of Sydney.

Between these zones, any differences in dwelling costs not explained by the characteristics of the dwellings were attributed to variations in land costs. The differences in land costs relative to the central zone were estimated separately for houses and flats in the hedonic price regressions (see section B3). The estimates are reproduced in table 15 and are in terms of weekly rent equivalents. For example, it is estimated that a house in the Outer West of Melbourne costs $84 per week less than an equivalent house in the city's central zone, due to the difference in site costs. Importantly, the estimates relate only to dollar differences in site costs between zones and not to the absolute levels.

The logit analysis, however, used absolute site values to model the choices households make between houses and flats. Benchmark values for 1990 were obtained for Melbourne from the Victorian Valuer-General (1991). For each LGA, the Valuer-General reports the average price of vacant lots sold for house construction and the number of these lots sold. These data can be converted to weekly rent equivalents, and then aggregated to the nine-zone level used in this analysis. However, in any one year, few lots of vacant residential land are sold in most inner LGA's, and their average price may not be representative of local land values. In view of this, only data for the outer LGA's have been used here. Average site values for houses in the four outer zones in this analysis were calculated from these data. The absolute site values in all zones can be estimated given the hedonic results and any *one* of these four benchmarks. However, rather than selecting one zone's data arbitrarily, the procedure used here exploits all this information. The initial step is to calculate central-zone site value implied by each individual benchmark. A weighted average of these four central-zone estimates is then computed in which the weights are the HALCS sample sizes in each respective outer zone.[5] In this way, an estimate is derived for the site cost of a detached house in Melbourne's centre. This single estimate is the final benchmark for scaling the hedonic results.

It was not possible to make similar use of the Valuer-General's data on flat sales. Few sales of vacant land for flat construction are reported and the number of flats to be built on a given lot is not known. (This contrasts with the data for houses, in which there is a generally one-to-one correspondence between lots and houses). In the absence of adequate data, it has been assumed, following Horridge (1991), that houses average twice the site area of flats. But this does not mean

[5] Estimates of the difference in land cost between an outer zone and the centre will generally be more precise the larger the sample in the zone concerned. Accordingly, zones with more respondents are assigned a larger weight.

that site costs are in the same ratio, since zoning rules appear to favour houses and can thus create a price premium for the limited supply of flat sites. Horridge (1991) produces some evidence suggesting that, in Melbourne, this bias may be absent in the central zone, but significant elsewhere. Accordingly, it has been assumed that in the central zone of Melbourne land prices are the same for flats and for houses. Given the assumed ratio of site areas, this implies a site cost for flats in the central zone of $68.74 per week, which is half the corresponding estimate for houses (see table 15).

Table 15: **Estimated dwelling site costs (Melbourne and Sydney)**

	Houses		*Flats*	
Region	*Estimated site cost*	*Difference from centre*[a]	*Estimated site cost*	*Difference from centre*[a]
Melbourne				
1: Central	137	0	69	40
2: Inner West	80	-58	49	-19
3: Outer West	53	-84	34	-35
4: Inner North	67	-71	56	-12
5: Outer North	76	-62	b	b
6: Inner East	121	-16	67	-2
7: Outer East	91	-46	53	-16
8: Inner South	128	-10	59	-10
9: Outer South	78	-59	67	-2
Sydney				
1: Central	253	0	126	0
2: Inner West	123	-130	70	-56
3: Outer West	47	-206	45	-81
4: Inner North	389	136	118	-8
5: Outer North	147	-106	78	-49
6: Eastern Suburbs	351	98	108	-18
7: Inner South-West	118	-135	48	-78
8: Outer South-West	67	-186	28	-98

a From hedonic price regressions.
b The Outer North zone of Melbourne contains no flats so an estimate for the difference from the central zone was not calculated
c All values shown in dollars per week.

Essentially the same procedures were used to determine site values for the eight zones in Sydney. The Valuer-General of New South Wales (1991) reports land site values for houses in selected suburbs of Sydney. The present exercise assumes that the selected outer suburbs identified are representative of the broad zones in which they are located. Preliminary estimates were thus obtained for the site cost of a house in the three outer zones, which were the inputs to the benchmarking procedure described above.

Dwelling specific variables

The physical characteristics of a dwelling, including the condition or quality of the structure itself, will influence the dwelling market price (rent). Respondents to the HALCS survey were asked to indicate whether or not specific problems were present in their dwellings over the previous year: leaking roof, white ants; plumbing problems; electrical or wiring faults; and so on. A variable measuring the overall dwelling condition has been calculated here as the proportion of problems *not* experienced, with a potential range between 0 (worst condition) and 1 (best condition).

Housing costs should also depend on accessibility to services and amenities: dwellings in areas with above-average access could be expected to attract a rental premium, and the converse would apply for dwellings in areas with below-average levels of accessibility. However, what determines these premiums are perceptions of accessibility and these vary between households, even within the same area. A single male, for example, would attach a much smaller weight to proximity to a child care centre than would a family with young children. The method used here to measure accessibility attempts to allow for such differences.

The HALCS database contained information on which services or amenities each household considered *important* and which they believed to be *reasonably accessible.* From this information an index representing each household's level of accessibility was calculated, using the ratio of important and accessible factors to the total number of important factors. For example, if a respondent household identified 6 factors as important, yet considered only 2 of these accessible, then the accessibility index would be 0.33 (2 divided by 6). An index approaching 1 represents a high level of accessibility while a value closer to 0 would point to a lower level of access.

The dependent variable in the hedonic price equations was a measure of the cost of each dwelling to the inhabitants. For renters, this was simply the weekly rent. For owner-occupiers, the HALCS reports mortgage repayments but these are not meaningful measures of cost. (A household with no mortgage still incurs a cost in occupying its dwelling.) As an alternative measure, cost was calculated for owner-occupiers as 6 per cent of the estimated resale value of the dwelling, scaled to a weekly figure.[6]

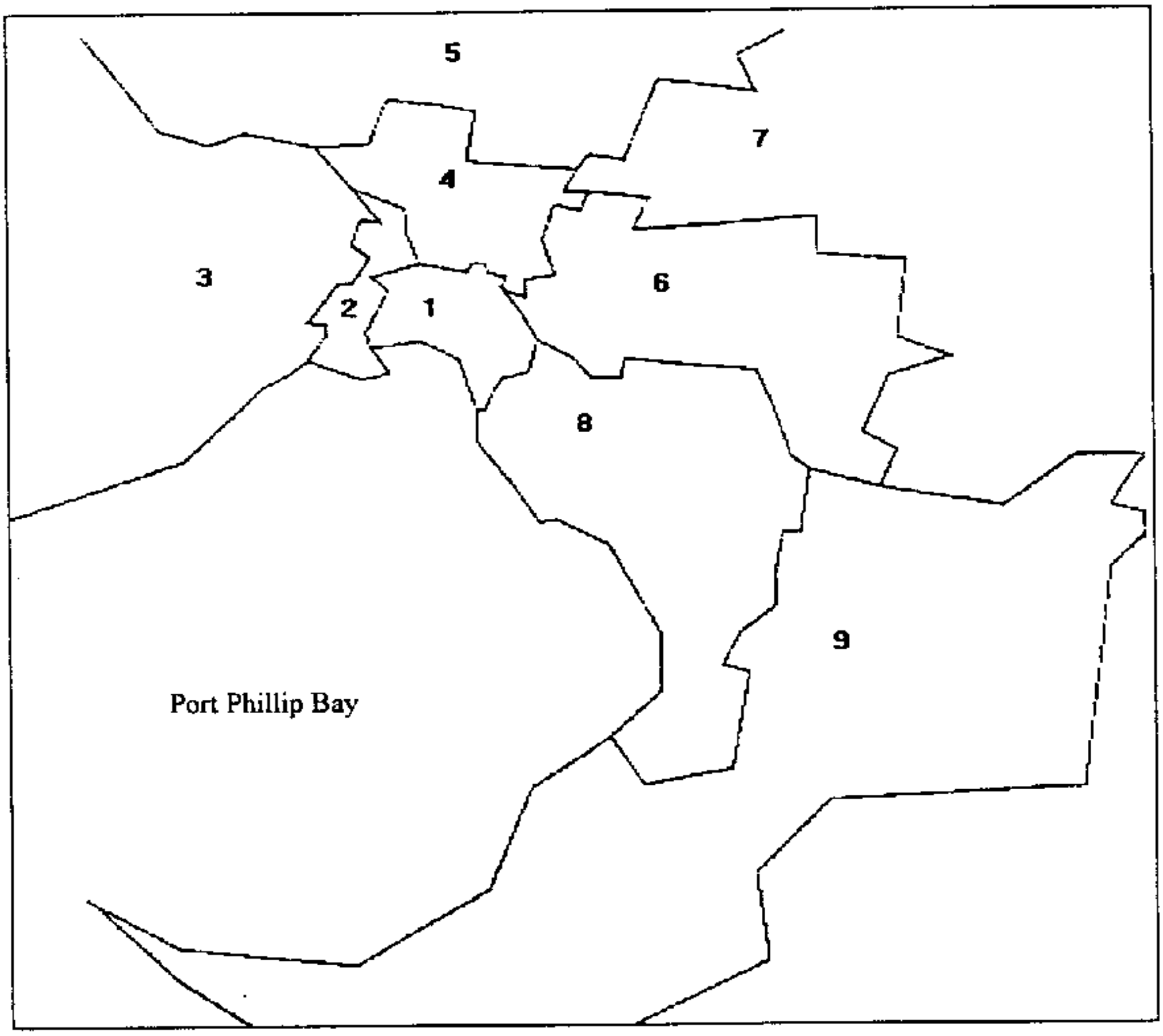
[6] The figure of 6 per cent was obtained following discussions with industry sources.

Household income

Household income is an explanatory variable in the logit model, which seeks to explain household choices between houses and flats. It was derived from HALCS data on individual before-tax income together with information from an income survey conducted by the Australian Bureau of Statistics (ABS).

For each member of surveyed households aged 15 and over, the HALCS sought an estimate of current income from the household respondent. After identifying members with zero incomes, the respondents were asked to place each remaining member's income within $5,000 intervals. Although precise incomes within these ranges cannot be known, the present analysis infers incomes based on the reported characteristics of each individual. Median incomes were obtained from the ABS survey of income distribution (ABS 1992), for persons in each $5,000 income band, cross-classified by age (less than 15 years, 15 to 24 years, 24 to 55 years, over 55 years), educational qualifications (no post secondary qualifications, trade certificate, non-degree diploma, bachelors degree), and sex. Each individual with a non-zero income in the HALCS database was placed in this cross-classification and assigned the corresponding median income for the relevant income band. Incomes were then summed for members of the same household to estimate total household income.

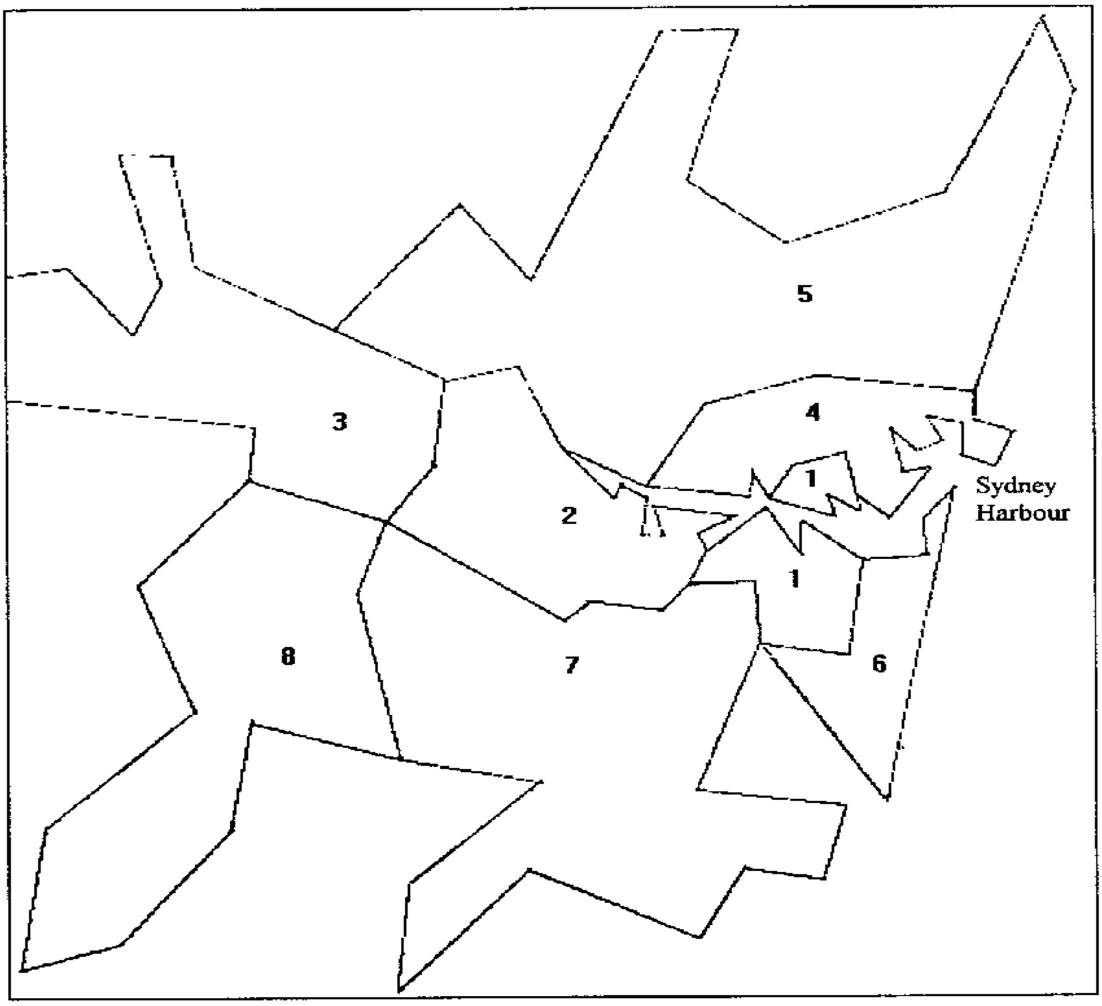
Figure 1: **Zonal boundaries in Melbourne**



Source: Horridge (1991).

Zone	**Local Government Areas (LGA)**
1: Central:	Collingwood, Fitzroy, Melbourne, Prahran, Port Melbourne, Richmond, St Kilda, South Melbourne.
1Inner West	Essendon, Footscray, Williamstown.
3: Outer West:	Altona, Keilor, Melton, Sunshine, Werribee.
4: Inner North:	Broadmeadows, Bn~ck, Coburg, Northcote, Preston.
5: Outer North:	Bulla, Whittlesea.
6: Inner East:	Box Hill, Camberwell, Croydon, Doncaster, Hawthorn, Heidleberg, Kew, Knox, Nunawading, Ringwood.
7: Outer East:	Diamond Valley, Eltham, Healewille, Lillydale, Sherbrooke.
8: Inner South:	Brighton, Caulfield, Chelsea, Dandenong, Frankston, Malvern, Moorabbin, Mordialloc, Oakleigh, Sandringham, Sprinpale, Waverley.
9: Outer South:	Bermick, Cranbourne, Flinders, Hastings, Mornington, Pakenham.

Figure 2: **Zonal boundaries in Sydney**



Zone	**Local Government Areas** (LGA)
1: Central:	North Sydney, Leichhardt, Sydney (inner), Sydney (remainder).
2: Inner West:	Drurnmoyne, Ashfield, Concord, Strathfield, Burwood, Parramatta, Auburn.
3: Outer West:	Holroyd, Blacktown, Penrith, Blue Mountains.
4: Inner North:	Mosman, Willoughby, Lane Cove, Hunters Hill, Manly.
5: Outer North:	Ryde, Homsby, Warringah, Ku-Ring-Gai, Hawkesbury, Gosford, Wyong, Baulkam Hills.
6: Eastern Suburbs:	Woollahra, Waverley, Randwick, Botany.
7: Inner South-West:	Marrickville, Bankstown, Canterbury, Hursmille, Rockdale, Kogarah, Sutherland.
8: Outer South-West:	Liverpool, Fairfield, Wollondilly, Camden, Campbelltown.

APPENDIX C: LAND USE IMPACTS OF INFRASTRUCTURE CHARGES

Participants in this inquiry directed attention to common perceptions of government charges for infrastructure such as hydraulic services, power, and local roads. Prominent among then were the following:

- Charges for residential infrastructure fail to recover the full up front and recurrent costs of their provision, encouraging wasteful consumption.
- Capital costs are higher for low-density development than for more compact settlement, due to the greater area which must be covered by roads, pipes and wires. But charges for higher-density settlements are not commensurately discounted. Excessive consumption for land per dwelling may result.
- The inner/middle areas of cities have spare capacity in existing infrastructure, so infrastructure costs fall as redevelopment of these areas replace s new development on the fringes. Charging policies do not fully reflect these cost differences and so cause excessive urban sprawl.

Whether charging policies are seriously biased in these ways is a difficult question to answer. The evidence in chapter B4 of this report points to fairly small distortions, but may not be sufficient for establishing a consensus. This appendix addresses the hypothetical question of what would be the effect of correcting major misalignments between charges and costs. Proceeding on the promise that distortions are the directions described above, it considers a move toward 'user pays' charges and how this would affect the patterns of settlement. From this perspective, such reform could increase the cost of serviced residential land, particularly on the fringes. This, in turn, would encourage consolidation and higher-density housing. Whether these effects would be large is the issue which this appendix deals with. Recourse is made to an econometric study of housing demand (see appendix B) and a model of land use in Melbourne developed by Dr. Mark Horridge of Monash University.[7]

The choice of Horridge's model is explained below, after briefly discussing the econometric study and its implications. The features and resent application of the model are then described in detail.

[7] The model and its initial applications are described in Horridge (1991) and, less technically, in Horridge (1992).

Implications of the econometric analysis

One of the least-challenged conclusion about housing demand is that most people prefer detached houses to other dwellings. When asked their first choice (financial constraints absent), relatively few name a flat, townhouse or other higher-density alternative. Yet about one fourth of the residents of the two largest Australian cities do live in such dwellings, as estimated from the 1991 housing and Location Choice Survey (HALCS). For many of these, cost considerations swamp the appeal of a detached house. In a recent Sydney survey, about half of the residents in higher-density housing gave a detached house as their first preference, and thirty-four per cent named the greater cost of a detached house as a primary reason for their current choice (Plant Location International 1991; for other survey evidence, see Mueller et al 1991 and Burke 1991).

Such statements of preferences can illuminate attitudes about housing, but are not much of a guide for quantifying demand relationships. Admittedly, quantitative statements have been sometimes elicited – the HALCS, for example, asked renters whether they would go on renting if their income were to rise permanently by 25 per cent. Rightly or wrongly, however, most economists are quite sceptical of this approach. They object that even when the hypothetical situations are accurately conveyed (itself a problem), many respondents cannot decide on the spot hot they would react. This is particularly so when the circumstances described are unlikely. Reverting tot he HALCS question, a 25 per cent rise in income would be a pipe dream for many respondents.

Because of such doubts, the favoured course of economists is to infer preferences from actual behaviour. The econometric analysis in appendix B follows this approach, relating actual dwelling choices of HALCS respondents to their incomes, land prices, and demographic characteristics. The choice examined is that between detached houses and other alternatives, collectively termed ‘flats’ in appendix B and here. Selection of neighbourhood is not modelled because HALCS does not identify work locations. The location of a household is thus taken as given, and choice of dwelling is related to the price for land in the household’s neighbourhood. The thrust of the findings is in accord with expectations – the likelihood of choosing a house increases when income rises or when land prices fall across the board (with relativities constant). In addition, if land costs increase for houses while remaining unchanged for flats, there is a shift from houses into flats. However, each of these effects is modest, particularly among residents of the fringes. It is estimated if site costs for fringe-area houses increased by ten per cent, holding other influences on dwelling choices constant, the proportion of fringe-area households selection houses would still be 91.9 per cent in Melbourne and 80.3 per cent in Sydney, down only 1.2 and 0.6 percentage points, respectively from current levels.

These findings shed light on one of the questions raised above. They suggest that if serviced land prices increase on the fringes (due to higher charges for infrastructure), new development in these areas will shift only slightly toward higher-density housing. This odes not address the other question of how many households would be drawn back to the inner areas as land prices increase on the fringes. One approach to this question is to reason as follows. The econometric analysis indicates that if site costs for houses were to increase, without any change in the cost of flats, little substitution toward flats would occur on the fringes. In other words, residents on the fringes appear to be fairly reluctant to trade-off between houses and flats in their current neighbourhood. They should be even more reluctant to substitute between a detached house in one region and a flat in another. For many of the typical fringe-area residents who are in detached houses, exactly this substitution would be entailed in moving to the inner areas, where thigh housing costs would place only a flat within their budget. This would incline them to stay put, even when land prices on the fringe increase substantially.

However, there are major flaws in this argument. To begin with, some inner areas are almost as affordable as fringe regions – for example, in Melbourne, house sites do not appear to cost more in the Outer North than in the Inner North (see appendix B table 12). In addition, commuting costs are often lower from central locations, which makes housing in these areas somewhat more affordable than land prices would imply. Further, not all households are budget-constrained in the way suggested above. Indeed, some of the households now opting for fringe locations are on high incomes and could easily afford a house closer in. Such households need not compromise their preference for a detached house by relocating toward the centre and might do so if the fringe areas became more expensive.

It is also important to consider the changes in employment. Fuller recovery of infrastructure costs would probably not raise charges for commercial development, with the evidence suggesting that commercial users are now over-charged for water supply and possibly other infrastructure items. But if charges for new residential development increase, the resulting influx of population toward the centre will raise prices for the scared supply for inner-area land, for both residential and commercial use. And with inputs of inner area-land now more expensive, industry would have incentives to relocate toward the fringes. A related consideration is that producers can economize on land to some extent as its costs increases (for example, by erecting taller buildings). Substitution of other inputs for land would moderate the pressure on inner city land prices and, hence, would also dampen the outward movement of employment.

Models of urban land use

An increase in charges for fringe residential development would trigger a range of complex responses, some of which have already been described. Estimation of the overall impacts on settlement patterns thus requires a fairly elaborate model. Models of urban land use came into prominence in the 1960s and 1970s and were designed to capture the two-way linkages between land use patterns and the transport system. By contrast, conventional urban transport planning (UTP) models are unidirectional in this regard. Such models relate the demand for transport to the spatial distributions of population and economic activity, features of the transport systems and demographic factors. However, they do not incorporate the feed backs from transport costs to the location decisions of households and producers. The continuing dominance of these conventional models reflects common failings among full-fledged models of transport and land use interactions. These include: lack of transparency, which has earned them a 'black box' reputation; patchy realism, as exemplified by the frequent absence of any role for land prices; and parameter values which are frequently unsupported by econometric evidence. The contrast between these unsupported by econometric evidence. The contrast between these shortcomings and the heady optimism of some early proponents of the interactive models contributed tot he disappointment of urban planners. [8]

The interactive models fell from favour during the overreaction of the 1980s, and it is only recently that planners are coming to a balanced assessment of their potential. Although the changes in land use patterns cannot be precisely estimated, orders of magnitude are often possible and the robustness of findings can be checked by varying assumptions and parameter values. Equally importantly, they can highlight economic mechanisms which escape casual intuition: some of these may be second-round effects which countervail the aim of government policies. Morever, while no model can capture all the relevant mechanisms, transparency can make plain the omissions and allow some assessment of resulting biases.

With the recent rise in their standing, interactive models of land use and transport are enjoying a mini-renaissance. In Australia, this has spurred Horridge's work and another model of Melbourne which is being built by Professor William young, also of Monash University. The only other extant models for Australia are RJ Nairn and Partner's TRANSTEP and the TOPAZ model of Melbourne

[8] This is exemplified by the study of land-use impacts of a proposed ring road around Melbourne. The Melbourne Metropolitan Board of Works conducted the study with the assistance of a consultant and commissioned a port-study evaluation by Loder and Bayly (1980). The evaluators rightly argued that land-use impacts had been under-estimated because the study took as given the levels and locations of 'basic' employment – that is, employment in industries like manufacturing which sell most of their output outside the region. This treatment of basic employment is common among models of urban land use. Webster et al (1988) discuss the history of these models and their features, and compare simulations results across nine models based in seven countries.

created by CSIRO.[9] The latter has not been used for some time and its database if fairly archaic. TRANSTEP has been implemented for most capital cities, including recently for Melbourne. In common with other UTP models developed for Australia, TRANSTEP omits consideration of commercial transport, for which data are quite limited. It does, however, include a wealth of detail on the transport network and on how demand for household travel is determined. In addition, it does beyond the conventional UTP models by incorporating two-way interactions between land use and transport. However, it does not recognise the role of land prices in guiding location decision and as such is not suitable for the present analysis.

Horridge's model has only a skeletal representation of the Melbourne transport systems. Yet it is the framework for the case study in this appendix since its advantages more than offset this. These include transparency and a rigorous paradigm of location choices which takes land prices into account. The prices of land are allowed to vary by location and category of use (due to zoning), and are explained by the interaction of supply and demand. Some of the parameter estimates are conjectural, but this is a general problem with models of urban land use and it is mitigated here by recourse to the econometric analysis of the HALCS data. This and other aspects of the modeling framework are explained in the next section of this appendix.

C2 Horridge's model of Melbourne

The model divides Melbourne into nine zones (figure 1), and considers the decisions of households about where to live and work, and how much land to live on. It assumes away many hard-to-model phenomena, including households with multiple jobs, but includes enough realism to be of value. The determinants of household decisions which are pre-eminent in the 'monocentric' models – land rentals, incomes and commuting costs – are also captured in Horridge's model, along with zonal wage levels and the intrinsic attractiveness of different zones. (Land 'rentals' are the annualized costs corresponding to land prices.) Detailed features of the model are discussed below.

Commuting costs

Money costs of travel are assumed proportional tot e shortest road distance between zones. The database assumes that motorists, through fuel taxes and other charges, meet the full annualized cost of providing road services. That is, transport costs include social and private costs. Absent from the model are several important aspects of the transport system; time costs o travel; rail modes' endogenous traffic congestion; and transport for non-commuting purposes.

[9] See Nairn (1986) and Brotchie et al (1980), respectively, for descriptions of TRANSTEP and TOPAZ.

Demographic stratification

Households are divided between landowners and landless, assumed to form ‘rich’ and ‘poor’ halves of the population. Horridge (1991) observes that insufficient data were available to support an occupational stratification , which is more conventional in models of land use, yet he also contends that the property distinction is more relevant. Housing demand, he argues, depends more on accumulated wealth than on human capital because of borrowing constraints. In the absence of adequate data on wealth, he uses land rental income (including imputed rents) as a proxy.

Labour markets

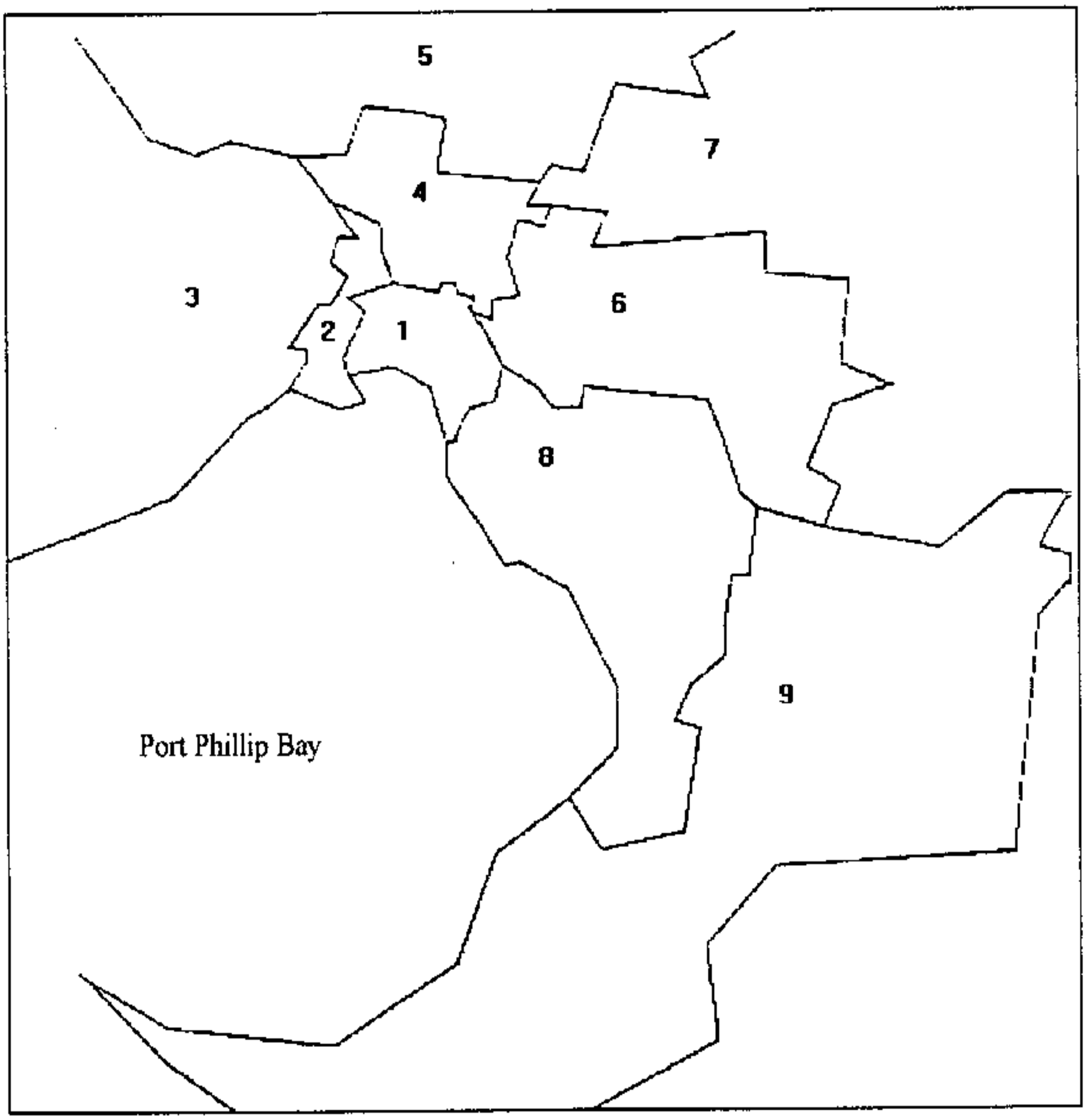
The model abstracts from occupation and other skills attributes and thus treats labour as an homogeneous input. In concept, it allows wages to differ between local labour markets because of competitive pressures. An example of such pressures is the high cost of commuting to remote locations, which might require premium wages to attract workers. In practice, the model assumes that wages are currently uniform since estimates by locality are not available. However, it allows differentials to arise in the future.

Household choices

The categories of dwellings in the model are ‘flats’ and ‘houses’. Within each zone, a house is assumed to occupy twice the area of a flat. However, the site area per house caries with distance from the city centre (positively) and with direction. Importantly, the model takes the site areas as predetermined. Changes within this menu are how changes in the demand for residential land are viewed within the model.

Households choose among 162 options defined by type of dwelling and locations of home and workplace (9 zones x 9 zones x 2 densities). For each population stratum (rich or poor), the distribution of households between options is derived in a utility-maximizing framework. The determinants of choices include wage rates and income from land, commuting costs and land prices, and intrinsic attractiveness of different zones. The effects of unobserved variation in household tastes are captured through the use of a multinomial logit model.

Figure 1: **Zones of the Melbourne Region**



Source: Horridge 1991.

Zone	Local Government Areas (LGA)
1: Central:	Collingwood, Fitzroy, Melbourne, Prahran, Port Melbourne, Richmond, St Kilda, South Melbourne.
2: Inner West	Essendon, Footscray, Williamstown.
3: Outer West	Altona, Keilor, Melton, Sunshine, Werribee.
4: Inner North:	Broadmeadows, Brunswick, Coburg, Northcote, Preston.
5: Outer North:	Bulla, Whittlesea.
6: Inner East:	Box Hill, Camberwell, Croydon, Doncaster, Hawthorn, Heidleberg, Kew, Knox, Nunawading, Ringwood.
7: Outer East..	Diamond Valley, Eltham, Healesville, Lillydale, Sherbrooke.
8: Inner South:	Brighton, Caulfield, Chelsea, Dandenong, Frankston, Malvern, Moorabbin, Mordialloc, Oakleigh, Sandringham, Springvale, Waverley.
9: Outer South:	Berwick, Cranbourne, Flinders, Hastings, Mornington, Pakenham.

The attractiveness of each zone is summarised by an index which is treated exogenously. Hence, the model abstracts from externalities associated with pollution, congestion and other factors. In reality, influx of population to a neighbourhood may add to local traffic congestion, thereby detracting from neighbourhood appeal. Likewise for pollution. But in Horridge's framework, as in many other models of urban land use, changes in the pattern of settlement do not feed back to neighbourhood attractiveness.

The logit function, referred to above, is widely used for econometric analyses of categorical choices. The binomial logit function was discussed 'm appendix B, where it modelled the choice between flats and detached houses. In the multinomial case (more than two choices), the logit function has an additional property known as the 'Independence of irrelevant alternatives' (i.i.a.). Since this is an important feature of Horridge's model, it is worth taking some time to understand it.

The independence of irrelevant alternatives

To grasp this concept, consider a scaled-down version of Horridge's choice paradigm. The location of jobs is fixed and households face the four options defined by type of dwelling (house versus flat) and two broad regions of residence ('inner' versus 'outer'). Now suppose that the cost of a house in the outer region declines, while conditions for other options stay the same. In any well-behaved model, this should attract additional households to outer-region houses. Moreover, if the population of the city is assumed constant, that many fewer households will select the other options combined. What the i.i.a. assumption requires is that each of the other options individually loses the same number of households in percentage terms. (See box 1 below for numerical example and explanation of the name of the i.i.a. assumption.) Put another way, all options are restricted to be equally close substitutes. But in reality, people are more willing to trade-off between some options than others. For example, flat-dwellers would generally see a nearby house as a better substitute for their current option than a house which is distant. So if houses in the outer region become cheaper, the percentage declines in the population of flat-dwellers should be larger locally than for the inner region. However, this cannot happen using a multinomial logit specification.

The appeal of the i.i.a. restriction is not realism, but the reduction in data requirements. Once the nature of people's preferences are simplified, fewer parameters need to be estimated. The econometric analysis in appendix B measured the readiness of households to trade off between flats and houses in the same neighbourhood. Under the i.i.a. assumption, the same degree of substitution applies to other option pairs as well, such as a house in one neighbourhood and a flat in another. Thus, the econometric analysis goes a long way toward estimating the parameters of Horridge's model, despite taking location choices as given. The realism of Horridge's model could be improved by incorporating a *nested* multinomial logit function which relaxes the i.i.a. restriction (see Maddala 1983). But to estimate the model's parameters through an econometric analysis would then require attention to choices of home and work locations as well as dwelling choice. Lamentably, the HALCS does not identify work locations and there is no other database which would support such an analysis. The present analysis thus relies on Horridge's model with the i.i.a. restriction intact.

Estimates of parameters of household preferences

Horridge used conjectural parameter values to describe household preferences between residential land and other goods. The Commission has checked these values against the econometric analysis in appendix B, which treated the locations of households as constant and modelled choices between houses and flats. The findings of this analysis indicated that a ten per cent increase in all residential land costs Melbourne would induce about 2.4 percent of households to choose flat rather houses, reducing the proportion in houses to 76.0 per cent. This translates to a 12.7 pre cent reduction in the *ratio* of hoses to flats. Horridge's model implies a 21 per cent increase in all land costs with location distributions constant. Hence, Horridge's parameters have been adjusted here to reduce this response to 14.5 per cent, a compromise figure which is close to the econometric estimate.[10]

The parameter adjustment reduces by about half the associated demand elasticity for residential land with respect to a uniform change in residential land prices. Under Horridge's assumptions about site areas, this elasticity is -0.16 in the original model and -0.08 in the version used here. It should be noted that these estimates are not strictly comparable to the elasticities reported in appendix B. The latter analysis, while adopting Horridge's rule that within each zone a house occupies twice the area of a flat, treats the site area of each dwelling type as geographically uniform. It thus abstracts from the impressionistic variation between zones which Horridge embeds in his model. Even so, there is a negligible difference between the elasticity reported for Melbourne in appendix B (-0. 11) and that implied by the amended model (-0.08).

[10] Specifically, the value for Horridge's was raised from 0.750 to 0.807

Box 1: **Numerical example of the 'independence of irrelevant alternatives' assumption**

Consider a situation in which households choose between four options defined by type of dwelling (house versus flat) and zone of residence (inner versus outer). The initial distribution of households is the following:

Inner zone		Outer zone	
house	flat	house	flat
30	100	70	10

Now suppose that the cost of outer-zone houses declines, all else unchanged, boosting the number of households choosing this option from 70 to 84. Combined with the i.i.a. restriction, and assuming no change in total population, this implies the following distribution after the change in costs occurs:

Inner zone		Outer zone	
house	flat	house	flat
27	90	84	9

Note that for each option other than an outer-zone house, the number of households has declined by ten per cent, as compared with the original situation. Thus, the proportions in which households distribute among the remaining options is unchanged.

The formidable name for the i.i.a. restriction can be understood as follows. If a households rejects an outer-zone house, that option is *irrelevant* to the decision among remaining alternatives. This might tempt one into thinking that the proportional distribution of households among the remaining alternatives should be *independent* of the costs and characteristics of the outer zone house. This is exactly the i.i.a. assumption. However, the disadvantage of the assumption is that it does not allow some pairs of options to be closer substitutes than others.

The production sector

Two outputs are distinguished, transport services and 'other goods'. These are produced using cost-minimising combinations of the two inputs, land and labour. The model omits commercial transport, along with all other material and service inputs. In addition, capital stocks are not explicitly represented.

Zonal indices allow some zones to be intrinsically more productive than others. This could be seen as a way of allowing for natural features of the environment - for example, if we think of 'outdoor recreation' as a product, the productivity of land and other inputs should be higher in scenic areas. More persuasively, the indices can be interpreted as proxies for 'agglomeration economies' which are absent from Horridge's model - the savings in transport and communication costs which producers and consumers derive from spatial clustering of certain activities. These can show up in aggregated data as higher productivity in areas of concentrated production. In line with this, the index of productivity is highest in the central zone (including the CBD), being almost ten per cent higher there than in the four outer zones. The magnitude of this advantage is not precisely estimated, however, as it is very much dependent on the assumption that, initially, wages are the same in all zones.

As with the indices of zonal attractiveness to residents, the exogenous treatment of the productivity indices is not without problems. Under the agglomeration economy interpretation, the productivity of a zone can be seen both as cause and consequence of the pattern of settlement.

Within each zone, all producers operate with the same technology which features constant returns to scale and a constant rate of trade-off between the two outputs. Horridge sets the substitution elasticity between land and labour at a constant value of 1.0, which means that land can be substituted fairly easily for labour input. In this 'Cobb-Douglas' case, each input has an output-constant elasticity of -1.0 with respect to its own price and +1.0 with respect to the price of its substitute. Horridge provides no evidence supporting this pattern and the Commission has found no empirical study on land-labour substitution in urban production. However, evidence is available on substitution between land and structures, which, in a long run sense, are akin to embodied labour. McDonald (1983) reports estimates of the land-structures substitution elasticity from his own analysis with Melbourne data and from a few overseas studies. For the office sector, the estimates are close to 1.0, suggesting that the land can be readily economised by occupying taller buildings. For the manufacturing and commercial sectors, where the choice of building height is more constrained, McDonald reports somewhat smaller estimates. Overall, the estimates he cites imply significant scope for replacement between land and other factors in urban production, consistent with Horridge's assumption.

Zoning

The model distinguishes three categories of land use: residential, industrial, and other (non-market uses such as parks). Zoning policies are represented through area or price constraints, which may discriminate by dwelling type. Land rentals can thus differ between residential and industrial land, and between houses and flats.

Market equilibrium

Equilibrium in Horridge's model requires all markets to clear, with supply equal to demand. The prices which producers receive for each commodity are equated with average costs, which is the break-even implication of perfect competition and constant returns. The prices of labour and land can vary across zones in equilibrium, but the overall cost of production is equalised. Thus, producers are left indifferent to where they operate, unlike households, which have distinct preferences for where they live and work. The reason for this asymmetry is that the model assumes heterogeneous tastes among households and uniform technology among producers.

Another noteworthy feature of the equilibrium is the treatment of transport supply. In reality, the configuration of the transport system, including the land area occupied by roads, is quasi-fixed in the short run. By contrast, Horridge treats all inputs into transport, including land area, as changing in pace with demand. This favours a long-run interpretation of the equilibrium his model describes.

Horridge's model cannot trace out a time path of year-by-year changes, as it tells no story about investment in fixed capital. It is designed for comparative static analyses which simulate the impacts of specific 'shocks' to the urban form. Under a very long-run interpretation of the market equilibrium, estimates from the simulations are indications of the ultimate effects when all adjustments to the hypothesised event are completed. For example, if an improvement in transport productivity is estimated to raise the demand for transport by five per cent, this means that in the long run, demand will be five per cent higher than if the improvement had not occurred. Such estimates are not forecasts of changes over time, which depend on many influences apart from the particular shock being modelled.

Horridge (1992) has reported simulations of the following: a 30 per cent increase in Melbourne's population; a 20 per cent transport tax; changes in zoning rules which favour urban consolidation; and construction of a harbour bridge which reduces road distance. Apart from the analysis of urban consolidation, the simulations made the same assumptions about the zoning environment.

They assumed, firstly, that the degree of price discrimination resulting from zoning would not vary. Thus, for each zone, land rental prices were held in constant ratio between market uses - industrial, houses and flats. However, the division of land between these categories was endogenous, being demand determined. In other respects, assumptions differed between the inner zones of Melbourne and the outer zones around its perimeter. The five inner zones are said to be effectively 'built-out', so land area for market use is assumed exogenous. Market clearing in this case means that changes in demand for land lead to changes in rental prices. In the outer zones, land is more available for development, and is assumed to be released from 'other' use in sufficient quantities to meet demand at a target price.

The allowance for reallocation of land in the inner zones between houses, flats and industry reinforces the long-run interpretation of equilibrium. (In the short run, the division of land between these uses is largely determined by past investment.) However, as Horridge has noted, the assumption of a fixed target price for land in the outer zones imparts a short-run element to his model, since increased demand M" the outer zones should lead to higher land prices in the longer run. A similar bias results from the population of Melbourne being treated exogenously. This precludes the feedback from wage levels to the population which occurs in the long run through migration. Despite these ambiguities about the time frame, it is preferable to give a fairly long run interpretation to Horridge's simulations.

An illustrative simulation

Horridge’s model is used in this section to simulate the adoption of 'user pays' for infrastructure such as hydraulic works and power lines. Current charges and costs for infrastructure are assumed to conform to the popular perceptions described earlier in this appendix. It can then be speculated that the reform in question would require an increase in land-based charges for the infrastructure supporting residential development. This would primarily affect the fringe areas in the first instance and would likely be passed on to serviced land prices.

Horridge's model does not explicitly recognise infrastructure and other capital, much less charges for their provision. Hence, the distinction between serviced and raw land prices does not arise, and the present simulations deal simply with increased land prices in the outer zones of Melbourne. To stay within the confines of Horridge's model, one would have to attribute these increases to tougher government policies on land release. However, increased prices for land on the fringes should have similar effects on settlement patterns, be they induced by added developer charges or constricted release of land. The budgetary ramifications of increased charges for fringe development - lower charges for other users of infrastructure or a tax cut - are not modelled.

Assumptions about zoning are essentially those described above. Within each inner zone, land prices must change by a uniform percentage for all categories of use (houses, flats, and industrial). In outer zones, they increase by the same percentage for houses and flats, due to the increased infrastructure charges, but remain constant for industrial users (who probably pay enough for publicly provided infrastructure already). The increase in outer residential land prices is set at 10 per cent, purely for illustration, and is simulated with two versions of Horridge's model. The simulation presented first uses the amended version, which incorporates the findings from the econometric analysis of the HALCS data (see above discussion). It is then re-run with the original model.

To add perspective to the simulations at the outset, it is worth considering what a ten percent increase in residential land costs represents. The submission to this inquiry from the UDIA itemises development costs for a representative house in Cranbourne, a suburb in Melbourne's Outer South. According to this breakdown, 38 per cent of the dwelling's total price is accounted for by the serviced land cost, of which about 70 per cent stems from development expenses as opposed to the costs of the raw land and miscellaneous items. So a ten percent increase in serviced land costs in Melbourne's outer zones might result from about a 14 per cent increase in development costs and lead to about a 3.8 per cent increase in the dwelling price.

Results from the amended version of Horridge's model

Not surprisingly, population is predicted to shift toward the inner areas of Melbourne as outer residential land prices increase. The 2.3 per cent gain which is projected for the inner areas exactly cancels out the 6.0 per cent loss estimated for the outer zones, since the total population of the city is assumed fixed. Projected gains among the inner zones range from 0.6 per cent in the Inner East and 7.8 per cent in the central zone (figure 2). Estimated per cent losses in population among the outer zone populations are more uniform.

The raised demand for central locations generates a ripple effect on residential land prices, in which increased costs on the fringes beget smaller proportional increases closer in. Predicted increases in the inner zones average about five per cent, as against the ten per cent increase posited for the fringes (table 1). These increases in residential land prices would reduce the quantity of land demanded per household within most zones as some residents switch to flats.[11] (Total residential land area is projected to expand in the inner zones despite this, due to the increase in population.) City-wide, the population in flats increases by 8.8 per cent, due to this intra-zonal substitution between dwelling types and to relocation of households toward inner zones, where high land prices are conducive to flats. Conversely, the number of houses would decline by an estimated 2.2 per cent. At 1991 levels, these shifts would amount to an increase in the flat share of Melbourne dwellings from 21.6 per cent to 23.5 per cent.

Inner zone prices for land are assumed in the simulation to vary in equal proportion across usage categories. Hence, the envisaged inward movement of population would stimulate inner zone prices for industrial as well as residential land. Since prices for outer zone industrial land are assumed here to be unaffected, this implies an incentive for producers to relocate outwards. Moreover, with total employment assumed constant in the analysis, the gain in employment in the outer regions (4.3 per cent) matches the loss in the inner regions (0.8 per cent).

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[11] The flat to house ratio is predicted to increase in each zone except the Outer East and Outer North, for which decreases are projected, The latter findings reflect features of the model and of the database used for the simulation. The model predicts that a general increase in land prices (by the same percentage) will induce households to move to dwellings with relatively low land costs. This normally means shifting from houses into flats. However, the present database records higher site costs for flats than for houses in the two zones distinguished above. The estimated price for land in these zones is higher for flats (a possible outcome of zoning controls), and this outweighs the cost savings from flats taking up less space. Whether land use controls could so restrict the supply of flat sites as to create this large bias in land prices needs to be further investigated. 'Re values for flat sites in the database are not 'hard' estimates, but are generated within the model through a calibration process (see Horridge 1991a). The database was recalibrated by the Commission after changing the parameters in Horridge's model to better agree with the findings from the analysis of the HALCS data in appendix B. In Homdge's original database, site values are universally higher for houses than for flats in the same zone. Hence, the house to flat ratio was predicted to increase in all zones when the present simulation was rerun using the original data and parameters (compare tables 1 and 2).

Wages in the inner zones are projected to decline by 0.4 per cent to preserve the local competitiveness as land costs rise. Producers in inner locations would react to this change in input costs by embracing less land reliant technologies. Accordingly, the amount of land used per unit of output is projected to decline by about four per cent in the inner zones, which feeds through to a 2.4 per cent drop in this ratio city-wide. The economies in land usage would be achieved by substituting labour for land. However, while the ratio of labour to land increases, this occurs purely through a fall in land input since aggregate employment is constant by assumption.

The findings for commuter travel (the only form of transport in Horridge's model) are also instructive. The decline in overall commuter travel of 1.4 per cent occurs partly because population has shifted to the inner areas, where commuting distances are typically shorter than on the fringes. In addition, while inner-area wages would decrease to offset locally higher land costs, labour and land costs in the outer zones would remain unchanged. This decrease in inner zone wages relative to wages farther out would encourage residents of the outer-zones to work closer to home and thus commute less. Conversely, residents of the inner areas would have an incentive to look farther afield for employment. However, while transport use per resident is predicted to increase in the Inner East due to this influence, decreases are foreshadowed for the other inner zones. The latter results can be explained by reference to the index of zonal attractiveness, which is defined for each pair of residence and work zone. For a given area of residence, the model posits that some workplaces are inherently more appealing than others. To take an example slightly outside the model, some workplaces could be close to after-hours recreational facilities. The relevance of this is that the simulation predicts a decrease in average income, and people on constrained budgets will attach lesser weight to these enjoyments and more to low commuting costs. Hence, workplaces which are appealing but distant are less likely to be selected, and travel per resident will fall.

Figure 2: **Effects of increased residential land prices in outer regions on population (per cent)**

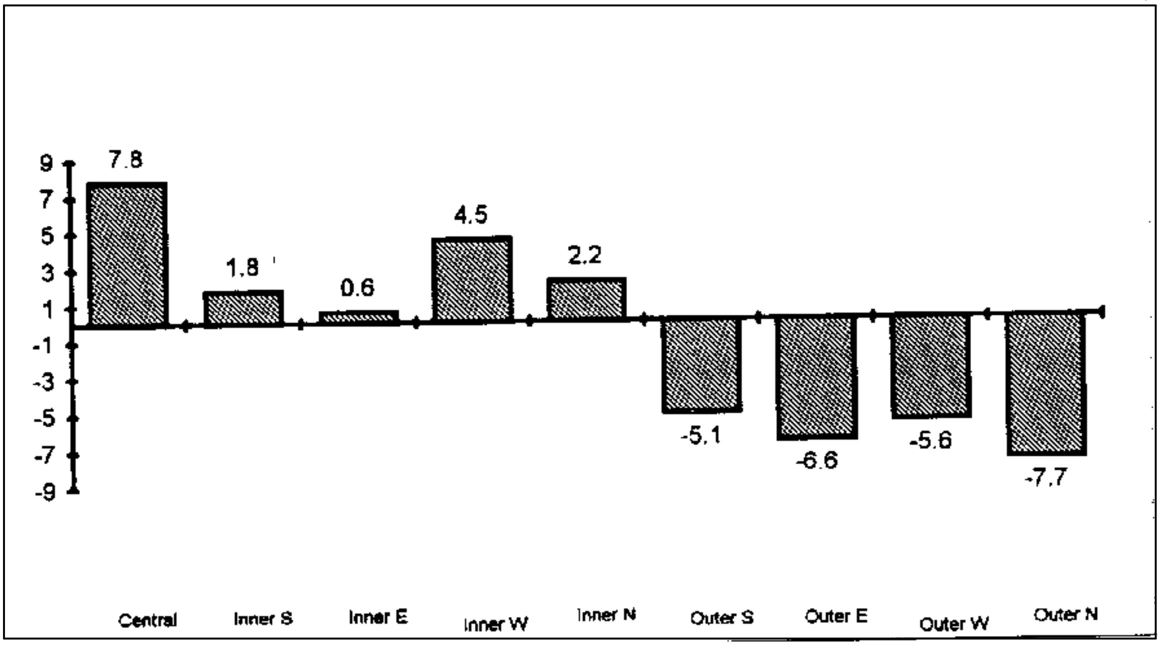
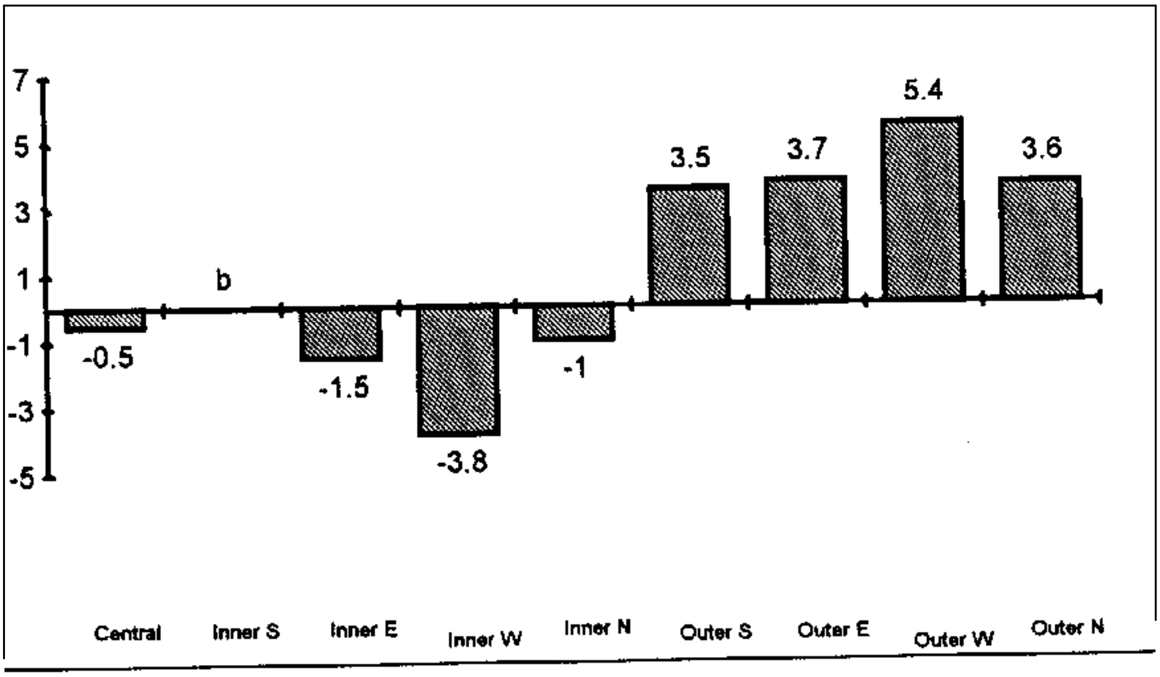


Figure 3: **Effects of increased residential land prices in outer regions on employment (per cent)**



Sensitivity analysis

For comparison, the simulation has been re-run with Horridge's original model. The change in parameters would double the response of demand for residential land to uniform changes in residential land prices, when simulated 'm a partial equilibrium framework. (The elasticity rises in absolute value from -0.08 to -0. 16, as was noted before.) 'Partial equilibrium' refers here to holding constant the location distributions of home and workplace, household incomes and other factors.

Such factors are not held constant in the simulation, which exploits the general equilibrium features of Horridge's model. The change in parameters from the initial simulation can be expected to make most of the estimated residential shifts larger, while preserving their directions. Table 2 confirms this, though the magnitudes are far less than doubled and not greatly different in many cases. For example, the assumed increase in outer zone land prices is now projected to reduce total residential land area by 2.2 per cent, as against the previous estimate of 1.7 per cent.

Table 1: **Regional effects of a 10 per cent increase in outer residential land prices (elasticity = -0.08)(percentage change)**

	Central	*Inner South*	*Inner East*	*Inner West*	*Inner North*	*Outer South*	*Outer-East*	*Outer West*	*Outer North*	*All regions*
Total residents	7.8	1.8	0.6	4.5	2.2	-5.1	-6.6	-5.6	-7.7	a
Total employment	-0.5	b	-1.5	-3.8	-1.0	3.5	3.7	5.4	3.6	a
Residential land rental prices	4.6	4.3	3.7	5.9	4.8	10.0	10.0	10.0	10.0	5.9
Land area:										
residential	4.5	0.9	0.5	2.6	1.1	-5.3	-6.5	-5.7	-7.6	-1.7
industrial	-5.2	-4.4	-5.3	-9.5	-5.9	3.5	3.6	5.4	3.6	-2.7
other	a	a	a	a	a	0.3	0,6	0.6	0.4	0.4
Number of households living in:										
flats	13.0	9.0	2.8	16,6	11.3	-1.0	-9.3	-3.0	-12.8	8.8
houses	-9.9	-0.2	0.3	b	-0.3	-5.5	-6.5	-5.9	-7.4	-2.2
Proportion of households in flats	4.9	6.8	2.5	11.5	8.6	4.4	-2.0	2,5	-5.0	8.8
Industrial output	-0.8	-0.3	-1.8	-4.2	-1.4	3.5	3.7	5.4	3.6	-0.3
Wages -0.4	-0.3	-0.3	-0.4	-0.4	b	b	b	b	-0.3	
Total transport use	6.7	1.7	1.0	4.2	2.1	-6.1	-8.5	-7.7	-9.3	-1.4
Average transport use per person	-1.0	-0.1	0.4	-0.3	-0.2	-1.2	-2.0	-2.2	-1.8	-1.4

a denotes that variables have been exogenously set equal to zero.
b denotes percentage change between -0.05 and +0.05.
Source: Commission estimates using the Horridge model of Melbourne.

Table 2: **Regional effects of a 10 per cent increase in outer residential land prices (elasticity = -0.16)(percentage change)**

	Central	*Inner South*	*Inner East*	*Inner West*	*Inner North*	*Outer South*	*Outer East*	*Outer West*	*Outer North*	*All regions*
Total residents	8.9	2.2	0.8	5.0	2.7	-5.8	-7.6	-6.8	-8.8	a
Total employment	-0.5	0.6	-0.9	-3.4	-0.7	2.1	1.8	3.7	2.4	a
Residential land rental prices	5.1	4.2	3.6	5.6	4.6	10.0	10.0	10.0	10.0	8.4
Land area:										
residential	4.9	0.8	0.4	2.4	1.0	-6.4	-7.8	-7.3	-8.8	-2.2
industrial	-5.7	-3.7	-4.6	-8.9	-5.4	2.1	1.9	3.7	2.4	-2.9
other	a	a	a	a	a	0.4	0.7	0.9	0.5	0.6
Number of households in:										
flats	15.5	13.1	6.0	21.7	15,9	7.4	-2.1	5.0	-5.7	12.7
houses	-12.9	-0.9	0.0	-1.1	-1.1	-7.1	-7,9	-7.8	-8.9	-3.2
Proportion of households in flats	6.0	10.9	5.0	15.9	12.7	14.4	6,0	12.5	2.5	12.7
Industrial output	-0.9	0.3	-1. 1	-3.8	-1. 1	2.1	1.8	3.7	2.4	-0,3
Wages -0.4	-0.3	-0.3	-0.4	-0.3	b	b	b	b	-0.3	
Total transport use	8.9	1.9	1.0	4.9	2.6	-6.7	-9.1	-8.5	-10.1	-1.5
Average transport use per person	-0.7	-0.3	-0,2	-0.2	-0.1	-1.0	-1.7	-1.9	-1.5	-1.5

a denotes that variables have been exogenously set equal to zero.
b denotes percentage change between -0.05 and +0.05.
Source: Commission estimates using the Horridge model of Melbourne.

APPENDIX D: ASSESSMENT OF WATER AND SEWERAGE CHARGES

This appendix examines charges for providing hydraulic infrastructure to residential lots at the fringe and inner city locations. It considers the total amount paid, whether upfront or over lime, by households living in a number of different locations and compares it with the costs of providing services.

A methodology for assessing upfront and recurrent charges is developed and applied to the case of water and sewerage services provided by the SWB and Melbourne Water.

D1 Introduction

A key issue for this inquiry is whether the provision of infrastructure to developments, particularly at fringe locations, is being subsidised.

There are a number of studies that have shed some light on this question. Many of them have focused on comparisons between developer contributions and capital expenditures on new infrastructure provided to fringe developments. For example, the NHS quoted NCPA estimates of the proportion of capital expenditures of infrastructure recovered by developer contributions for several capital cities. These estimates, which are presented in table 1, show that average developer contributions are more than 40 per cent of the 'full cost' of economic and social infrastructure.

The SWB provided a comparison of developer contributions with capital expenditures on on-site and off-site infrastructure for the proposed Rouse Hill development in Sydney (see table 2). For most infrastructure except main roads, public transport, and some social infrastructure, developer contributions are expected to recover all capital expenditure.

Table 1: **Developer contributions and capital expenditures on economic and social infrastructure provided to fringe land**[a]

City	*Capital expenditure $ per lot*	*Per cent recovered*
Sydney	60 200	54
Melbourne	52 100	44
Brisbane	47 300	40
Adelaide	47 300	40
Perth	45 000 to 50 000	25
Average	50 800	41

a Includes sewer, water, drainage, roads, power, telephone, site preparation, survey and design and community facilities such as sports and recreation facilities, police, education, health, ambulance and fire stations.
Source: Cited in NHS 199 1 d, p. 66.

Table 2: **Developer contributions and capital expenditures on offsite infrastructure for Rouse Hill, 1988 ($ per lot)**

Infrastructure item	*Public agency capital expenditure*	*Developer contributions*
Economic infrastructure		
Water, sewerage, drainage	9 000	9 000
Main roads	14 900	2 200
Public transport	2 000	0
Local government[a]	7 300	7 300
Electricity	800	800
Gas	2 000	2 000
Telecom	2 000	2 000
Total	38 000	23 300
Social infrastructure[b]		
Total	15 300	0
Tot infrastructure	**53 300**	**23 300**

a Estimates include local government on-site costs. Developer contributions relate to section 94 of the *Environment and Planning Assessment Act 1979* and include contributions towards the costs of community facilities, local road and open space.
b Social structure includes police, primary and secondary education, family and community services, and health. Source: Source: SWB, Sub. 70, annexure A.

The WAWA also examined the different sources of finance for capital expenditure on infrastructure in the fringe in Perth (see table 3). The WAWA's estimates show that developer contributions are primarily levied on economic infrastructure. The proportion of developer contribution in capital expenditure varies from 29 per cent for telecommunications to 75 per cent for roads.

Table 3: **Developer contributions and capital expenditures on Infrastructure provided to a 'suburban' development in Perth, 1991 ($ per lot)**

Infrastructure item	*Federal government*	*State government*	*Local government*	*Private source*	*Total*[a]
Roads					
Freeways and expressways	0	626	0	0	626
Urban arterials, primary distributions	0	0	1 022	1 022	2 043
District distributors	0	0	0	587	587
Local roads	0	0	0	2 689	2 659
Traffic control	0	0	0	734	734
Water					
Reticulation [b]	0	0	0	2 104	2 104
Headworks	0	3 764	0	1 882	5 646
Sewerage					
Reticulation	0	0	0	2 811	2 811
Headworks	0	2 100	0	1 050	3 150
Drainage					
Local drainage	0	0	0	1 665	1 665
Arterial drainage	0	205	0	103	309
WAWA drainage headworks	0	720	0	360	1 080
Flood mitigation/rive Maintenance	0	11	21	0	33
Energy					
Electricity reticulation	0	1 454	0	1 039	2 493
Electricity headworks	0	3 947	0	0	3 947
Gas reticulation	0	921	0	0	921
Gas headworks	0	0	0	0	0
Education[c]	205	6 473	0	0	6 678
Recreation and Conservation[d]	0	636	125	0	761
Community health[e]	103	554	205	0	862
Welfare services[f]	21	310	114	0	445
Water resource management	0	21	52	0	74
Public transport[g]	0	1 922	0	0	1 922
Communication					
Telecom	2 649	0	0	1 039	3 688
Post	52	0	0	0	52

a Totals may not add due to rounding.

b Includes long service, that is, pipes that connect development to the other side of a road.

c Education covers primary and secondary schools, and tertiary institutions.

d Recreation and conservation covers regional and public open space, regional sports centres, and local facilities.

e Community health covers health and medical centres, hospitals and mental homes, and nursing homes and aged hostels.

f Welfare services covers prisons, public housing and community halls.

g Public transport covers bus terminals and stock, and railway stations and stock.

Source: WAWA 1991.

D2 A methodology for assessing charges

Comparisons between developer contributions and capital expenditures such as those made by the NCPA, WAWA and SWB demonstrate the significance of developer contributions as a source of financing the provision of infrastructure.

However, comparisons based on developer contributions and capital expenditures alone can give a misleading impression as to the extent of subsidies to fringe developments. This is because recurrent charges and costs of using infrastructure are ignored. As the HIA noted:

> So far as physical infrastructure is concerned, this argument [that fringe development is subsidised if upfront charges fall to cover the costs of providing infrastructure] confuses the distinction between the initial outlays on constructing infrastructure facilities and the adequacy of arrangements to recover this cost, which could occur either through up-front charges at the time of providing the facilities or over time through recovery of capital costs as a component of the charges for use of infrastructure services (Sub. 52, p. vi).

A preferable comparison, therefore, is one based on the difference between total revenues and costs. This takes into account not only revenues and costs that arise at the time the infrastructure is provided, but also those revenues and costs that occur over time when the infrastructure is used. As the New South Wales Department of Housing said:

> An analysis of empirical data showing the contribution to costs of service provision through direct user charges for key infrastructure, costs and contributions over time to financing and provision of urban infrastructure services through rates and taxes, and level of use of such services, would be necessary to determine which groups are being subsidised (Sub. 70, p. 5).

Total cost of providing infrastructure

The total cost to an authority of providing infrastructure to a lot is the addition of upfront costs of providing infrastructure and the present value of the costs which occur over time when the infrastructure is used.

The recurrent costs include: operating costs; administration costs; maintenance costs; and periodic asset replacement costs. The relevant formula for bringing recurrent costs (except periodic asset replacement costs) over an infinite time to a present value is:

$$\text{Present Value} = C/r$$

where C is a perpetual flow of cash and r is the discount rate (less than 1).

The approach taken in selecting the discount rate is to nominate a rate of return that is required to be earned on all capital investment. This may be thought of as the opportunity cost of debt and equity capital used to finance the investment. The costs of capital finance are incorporated in the analysis when the discount rate is used in this way.

However, the costs of interest and equity returns are included only to the extent that they are required to be incurred for the capital investment associated with the projects actually under consideration. No allowance is made for any ‘overhang' of required interest or dividend payments which may exist from investments unrelated to the provision of infrastructure to the locations considered here.

For the purpose of this analysis, a discount rate of 5 per cent is assumed. This is the required rate of return recommended by the Commission in its report on *Water Resources and Waste Water Disposal* (IC 1992). Melbourne Water considered that the discount rate adopted for the model may not be equivalent to an authority's debt servicing and dividend requirements and preferred a discount rate of 6 per cent. The sensitivity of the results to a discount rate of 10 per cent was examined.

An estimate of the present value of periodic asset replacement costs can be obtained by using the following formula:

$$TC = \Sigma_{n=0} K/(1+r)^{nt}$$

where TC is the capitalised cost of infrastructure (that is the cost of infrastructure including all future replacement costs); K represents capital expenditure on infrastructure which is assumed to be constant for all replacement periods; r is the discount rate and is assumed to be 5 per cent; n represents the number of replacement periods from 0 to infinity; and t represents the life of the asset.

If this sum is expanded, the true capitalised cost of infrastructure becomes:

$$TC = K + PVARC$$

where $PVARC = K/(l+r)^{t} + K/(l+r)^{2t} + ... K/(l+r)^{\infty t.}$

Hence, the capitalised cost of infrastructure comprises the upfront capital cost of providing infrastructure (K) and the present value of asset replacement cost of infrastructure (PVARC) with life t and an infinite number of replacement periods.

If the number of replacement periods approaches infinity, PVARC reduces to the following formula:

$$K/[(l+r)^{t-1}]$$

This formula is used to estimate the present value of asset replacement costs associated with the authorities' infrastructure.

Total revenue or payment received for providing infrastructure

The total payment received by an authority for providing infrastructure to a lot is the addition of upfront payments for the provision of infrastructure and the present value of payments that are received over time when the infrastructure is used.

Upfront payments include developer contributions. Recurrent payments received include revenues from rates and usage charges. In the case of the SVY1B, the payment of environmental levies is also included in the estimation of recurrent payments.

Scenarios modelled

Fringe

For fringe locations, two scenarios were modelled. One scenario assesses all upfront and recurrent costs and charges (scenario 1). A second scenario excludes the costs of headworks on the basis of the argument that these costs are uniform across developments and charges for them are not necessary to communicate relative location incentives (scenario 2).

Inner

The two scenarios used for fringe locations were also modelled for a notional inner location in each city.

An additional scenario (scenario 3) was constructed to reflect the argument that charges for redevelopment or infill of inner city areas should be related to the cost of originally providing the infrastructure. Neutze said that in the context of setting developer charges for developments in established areas:

> While it may be inexpensive to add users in some areas where there is spare capacity, there seems no good reason why an authority should vary its charges accordingly. While developers should never be charged at less than incremental cost of providing them, there are often reasons for charges that are above incremental cost. The value of infrastructure services is probably as great, if not greater in established areas than on the fringe. If authorities were to charge only to cover incremental costs in established areas, they would be grossly undercharging for their services (Sub. 12, p. 4).

Scenario 3, therefore, assumes that for inner city areas, developers:

- pay the developer charges required of original developers when the area was newly settled; but
- do not impose a cost on the system for the increased capacity associated with their redevelopment.

D3 Data

Sydney

Upfront costs

The SWB is responsible for three categories of water and sewerage infrastructure. The Board provides 'headworks' (that is, dams, water treatment facilities and aqueducts, major sewage treatment works and sewage outfalls) and 'major works' (that is, water service reservoirs, large water mains and water pumping stations, trunk sewers, main and branch sewers, sewage pumping stations). Although 'reticulation' (that is, water and sewerage reticulation internal to the development) is initially provided by developers, ownership subsequently transfers to the Board.

Table 4 presents the SWB's data on 'typical' upfront costs of providing infrastructure to a lot in the fringe. Table 5 presents data on upfront costs per lot of providing major works to particular locations. Both sets of data were amalgamated by assuming that reticulation and headworks costs were the same in fringe locations with any locational variations in total infrastructure costs being determined by major works costs.

Table 4: **Typical upfront cost of headworks and reticulation for a fringe development in Sydney, July 1991 ($ per lot) [a]**

	Water	*Sewerage*
Headworks[b]	$500	$1 400-3 600
Reticulation	$1 300 (contract)	$1 700 (contract)
Ancillary[c]	$1 257-2 807	$1 257-2 807

a Average lot size of 670 square metres.
b Headworks costs are based on existing system costs where these were designed and installed with a particular development in mind. That is, the investment was undertaken in the expectation of the development, or on best available estimates of future investments where the development is expected to contribute.
c Ancillary costs include the costs of application and investigation, hydraulic system data, design and design cheeks, contract administration, and supervision of construction (quality control).
Source: Derived from SWB data.

Table 5: **Upfront major works costs in fringe areas zoned residential in Sydney, 1992 ($ per lot) [a]**

Local Government Area	*Water*	*Sewerage*
Baulkham Hills	3 544.3	2 398.6
Blacktown	2 472.3	2 934.6
Campbelltown	1 735.3	2 472.3
Camden	2 753.7	1 862.6
Fairfield	1 125.6	3 222.7
Liverpool	2 686.7	2 874.3
Penrith	2 231.1	2 934.6

a Original data was based on hectares. This was transformed into a per lot cost by assuming an average lot size of 670 square metres.
Source: Derived from SWB data.

Recurrent costs

Recurrent costs associated with the use of water and sewerage infrastructure are: operations and services expenditures; provisions for employee entitlements, insurance, doubtful debts, voluntary redundancy payments; and asset replacement costs. Table 6 presents some data on these recurrent costs on a per lot basis. To obtain a recurrent cost per lot for water and sewerage services, the data is divided by the number of residential and non-residential properties connected to the system (1 325 327 for water and 1 256 413 for sewerage as at 30 June 1991).12

Table 6: **Estimated recurrent costs of providing services to a household in Sydney, 1990-91 ($ July 1991)**

Recurrent cost item	*$ '000*	*$ per lot*
Water		
Water operations and service expenditure		
Water catchment, storage, treatment and quality	81 038	
Water distribution and pumping	154 998	
Other operations and services	21 405	
Total	257 441	194.25
Provisions for employee entitlements, insurance, doubtful Debts, voluntary redundancy payments	63 069	47.59
Total water[a]	320 510	241.83
Sewerage		
Waste water operations and service expenditure		
Waste water collection and transfers	67 711	
Waste water treatment and environmental management	102 405	
Other operations and service expenditure	39 631	
Total	209 747	166.94
Provisions for employee entitlements, insurance, doubtful debts, voluntary redundancy payments	59 472	47.33
Total sewerage[a]	269 219	214.28

a Totals may not add up due to rounding.
Source: Derived from SWB 1991a, and from SWB data.

Estimates of asset replacement costs were based on upfront cost data presented in tables 4 and 5 and on data on asset lives contained in the SWB annual report for 199o-91. These estimates are presented in tables 7 and 8. Table 7 presents estimates of asset replacement costs for headworks and reticulation. Table 8 presents asset replacement costs of major works for Baulkham Hills. Estimates for the other fringe locations, Blacktown, Campbelltown, Camden, Fairfield, Liverpool and Penrith were similarly obtained.

Table 7: **Estimated asset replacement costs of reticulation and headworks, July 1991**

Infrastructure component	*Capital expenditure*	*Average asset life*	*Estimated present value of Asset replacement costs*
	($ per lot)	*(years)*	*($ per lot)*
Water			
Reticulation			
Total	1 300	90[b]	16.3
Headworks			
Dams	450[a]	200	0.03
Water treatment plants	50[a]	30	15.05
Aqueducts	-	100	-
Total	500		15.08
Sewerage			
Reticulation			
Total	1700	90[b]	21.32
Headworks			
Sewerage treatment works	1 120 to 2 880	25	469.34 to 1 206.86
Sewerage outfalls	280 to 720	100	2.15 to 5.52
Total	1 400 to 3 600		471.49 to 1 212.38

a Proportions were estimated so that total upfront capital expenditure on headworks could be allocated to particular headworks assets. These proportions were based on gross asset values obtained from the SWB annual report for 1990-91. For water headworks, these proportions were estimated to be 0.9 for dams, 0.1 for water treatment plants, and 0 for aqueducts. For sewerage headworks, the proportions were 0.8 for sewage treatment plants and 0.2 for sewage outfalls.
b This is an average. According to the SWB annual report for 1990-91, water and waste water mains have a life ranging from 80 to 100 years.
c Assumes 5 per cent discount rate.
Source: Derived from SWB 1991a, and from SWB data.

Table 8: **Estimated asset replacement costs of SWB major works, Baulkham Hills, 1992**

	Capital expenditure	*Average asset life*	*Estimated present value of asset replacement costs*
	($ per lot)	*(years)*	*($ per lot)*
Water major works			
Reservoirs	354	150	0.23
Water mains	2 835	90[b]	35.56
Water pumping stations	354	35	78.39
Total	3 544		114.18
Sewerage major works			
Trunk, main and branch sewers	2 159	90 [b]	27.08
sewage pumping stations	240	30	72.25
Total	2 399		99.33

a Proportions were estimated to allocate upfront capital expenditure on major works to particular types of major works assets. These proportions were based on gross asset values obtained from the SWB annual report for 1990-9 1. It was assumed that half of the gross asset value of water and waste water mains was of a major works type with the remainder being reticulation. The ensuing proportions for major water works were, therefore, 0.1 for reservoirs, 0.8 for water mains, and 0.1 for water pumping stations. For major sewerage works the proportions were 0. 1 for sewage pumping stations, and 0.9 for waste water mains.
b This is an average. According to the SWB annual report for 1990-91, water and waste water mains have a life ranging from 80 to 100 years.
c Assumes 5 per cent discount rate.
Source: Derived from SWB 1991 a, and from SWB data.

Upfront revenues or payments

Installation of water and sewerage reticulation is totally paid for by developers. It is assumed that the developers pass these costs on fully to the purchaser of the developed lot.

With regard to major works, the SWB provided information about water and sewerage charges per hectare imposed on developers for lots in the fringe. Table 9 presents these charges. Once again, it is assumed that the developer passes these charges on fully to the purchaser of the lot. It was assumed that developer charges for major works are not levied on inner area developments, although the SWB advises that it is about to introduce them.

Table 9: **Upfront major works charges set by SWB for fringe developments, 1992 ($ per lot) [a]**

Local Government Area	*Water*	*Sewerage*
Baulkham Hills	3 122.2	2 177.5
Blacktown	2 224.4	1 641.5
Campbelltown	1 594.6	1 480.7
Camden	2 613.0	1 541.0
Fairfield	1 340.0	2 847.5
Liverpool	2 760.4	2 800.6
Penrith	1 849.2	1 641.5

a A lot is assumed to be 670 square metres.
Source: Derived from S" data.

The SWB said that, until recently, contributions were not sought from developers for headworks. Hence, it is assumed that no upfront charges are levied for this category of infrastructure.

Developers pay all ancillary costs.

Recurrent revenues 01 Payments

Recurrent payments received from residential properties comprise the payment of:

- usage charges for water consumption;
- access charges for water and sewerage;
- and a proportion of the environment levy.

1991-92 usage charges applying to residential properties were as follows: 0-600 litres per day at 16.4 cents per kilolitre; 600-822 litres per day at 28.9 cents per kilolitre; 822-30 000 litres per day at 58.8 cents per kilolitre; and above 30 000 litres per day at 64.3 cents per kilolitre. The SWB said that a typical household usage payment in 1991-92 for water was $65.08.

In 1991-92, access charges comprised a rate payment based on property values and a base charge. The rate for water was 0.0448 cents per dollar of land value above $33 000 (the unimproved market value of land as at 1 July 1980) and for sewerage was 0. 1148 cents. The SWB said that most households in Sydney do not pay property based charges or, if they do, the payment is insignificant.

Accordingly, it is assumed that a household makes no rate payments for water and sewerage services in 1991-92. Base charges for water distinguish between metered and unmetered water supplies. it was assumed that households at fringe and inner locations are connected to metered water supplies. The annual base charge for 1991-92 for metered water supply was $97.20 and for sewerage services was $241.92. The SWB also has maximum service availability charges

The annual environmental levy in 1991-92 for both water and sewerage services was $80. If only water services were available, $25 of the levy was payable. Accordingly, it is assumed that $55 of the levy was attributable to sewerage services in 1991-92 even though no specific charge is made.

Table 10 below summarises the typical recurrent payments received from a household. A household is estimated to pay $187.28 for water services and $296.92 for sewerage services. If a maximum service availability charge was payable, total recurrent payments received from a household for water would be $253.88 and for sewerage $568.52.

Table 10: **Annual household bill for water and sewerage services in Sydney in 1991-92, ($ per household)**

Charge	*Water*	*Sewerage*
Usage charge	65.08	not applicable
Rate payment	0	0
Base charge	97.20	241.92
Environmental levy	25.00	55.00
Maximum service availability charge		
metered water	163.80	
sewerage	513.52	
Typical household bill	187.28	296.92
Household bill based on maximum service availability charge	253.88	568.52

Source: Derived from SWB 1991a and SWB data.

Summary of data and assumptions

Fringe

Tables 11 and 12 present a summary of the data and assumptions used to compare total costs of and payments received for water and sewerage infrastructure provided to fringe developments in Sydney under scenario 1. Scenario 2 assumes that the upfront costs of headworks is zero. Otherwise, it uses the same data and assumptions as scenario 1. The data was converted into current dollars.

Table 11: **Data and assumptions used in the scenario 1 analysis of water infrastructure provision to the fringe in Sydney, 1992 ($ per lot) a**

	Baulkham Hills	*Black-town*	*Campbell-town*	*Camden*	*Fairfield*	*Liverpool*	*Penrith*
Upfront costs							
Head works							
Major works	484	484	484	484	484	484	484
Reticulation	3 544	2 472	1 735	2 754	1 126	2 687	2 231
Ancillary	1 257	1 257	1 257	1 257	1 257	1 257	1 257
average	1 965	1 965	1 965	1 965	1 965	1 965	1 965
Recurrent costs							
Water operations and services expenditure	188	188	188	188	188	188	188
Provisions	46	46	46	46	46	46	46
PVARC (5 per cent discount rate)	145	110	86	119	67	117	102
PVARC (10 per cent discount rate)	17	13	10	14	8	13	12
Upfront costs							
Payments							
Headworks	0	0	0	0	0	0	0
Major works	3 122	2 224	1 595	2 613	1 340	2 760	1 849
Reticulation	1 257	1 257	1 257	1 257	1 257	1 257	1 257
Ancilary average	1 965	1965	2 965	1966	3 965	1967	4 965
Recurrent payments							
Usage charge	65	65	65	65	65	65	65
Rate payment	0	0	0	0	0	0	0
Base charge	97	97	97	97	97	97	97
Environ-mental levy	25	25	25	25	25	25	25
Maximum Service Availability Charge	164	164	164	164	164	164	164

a The upfront costs of and payments received for headworks, reticulation, and ancillary and the recurrent costs of operations and services expenditure and provisions were adjusted using gross fixed capital expenditure price deflators for public enterprises (ABS, *Australian National Accounts, National Income Expenditure,* cat. No. 5206.0, June Quarter 1992). They were adjusted by 0.967.

Table 12: **Data and assumptions used in the scenario 1 analysis of water infrastructure provision to the fringe in Sydney, 1992 ($ per lot) a**

	Baulkham Hills	*Black-town*	*Campbell-town*	*Camden*	*Fairfield*	*Liverpool*	*Penrith*
Upfront costs							
Head works average	2 418	2 418	2 418	2 418	2 418	2 418	2 418
Major works	2 399	2 935	2 472	1 863	3 223	2 874	2 935
Reticulation	1 644	1 644	1 644	1 644	1 644	1 644	1 644
Ancillary average	1 965	1 965	1 965	1 965	1 965	1 965	1 965
Recurrent costs							
Sewerage operations and services expenditure	161	161	161	161	161	161	161
Provisions	46	46	46	46	46	46	46
PVARC (5 per cent discount rate)	934	956	937	912	968	954	956
PVARC (10 per cent discount rate)	212	215	212	209	217	215	215
Upfront costs							
Payments							
Headworks	0	0	0	0	0	0	0
Major works	2 178	1 642	1 481	1 541	2 848	2 801	1 642
Reticulation	1 644	1 644	1 644	1 644	1 644	1 644	1 644
Ancilary average	1 965	1 965	1 965	1 965	1 965	1 965	1 965
Recurrent payments							
Rate payment	0	0	0	0	0	0	0
Base charge	242	242	242	242	242	242	242
Environ-mental levy	55	55	55	55	55	55	55
Maximum Service availability charge	514	514	514	514	514	514	514

a The upfront costs of and payments received for headworks, reticulation, and ancillary and the recurrent costs 01 Operations and services expenditure and provisions were adjusted using gross fixed capital expenditure price deflators for public enterprises (ABS, *Australian National Accounts, National Income Expenditure*, cat. no. 5206.0, June Quarter 1992). They were adjusted by 0.967.

Inner

The data and assumptions underlying the analysis of water and sewerage infrastructure provision for a notional inner location in Sydney are presented in table 13. Because of lack of data, especially of system-wide costs of major works, some arbitrary assumptions have been made.

Table 13: **Data and assumptions used in the analysis of water and sewerage infrastructure provision to a notional inner location in Sydney**

	Scenario 1	*Scenario 2*	*Scenario 3*
Upfront cost			
Headworks	As for the fringe	0	0
Major works	0 Assumed no system-wide costs, and development-specific major works costs are fully paid for by developers	0	0
Reticulation	As for the fringe	As for the fringe	As for the fringe
Ancilary	As for the fringe	As for the fringe	As for the fringe
Recurrent costs			
Water and sewerage Operations and services Expenditure	As for the fringe	As for the fringe	As for the fringe
Water and sewerage Provisions.	As for the fringe	As for the fringe	As for the fringe
PVARC (5 per cent Discount rate)	As for Baulkham Hills	As for Baulkham Hills	As for Baulkham Hills
Upfront payments			
Headworks	0	0	0
Major works	0 Any development-specific major works costs are fully paid for by developers	0 Any development-specific major works costs are fully paid for by developers	Assume Baulkham Hills developer Charge imposed
Reticulation	As for the fringe	As for the fringe	As for the fringe
Ancilary	As for the fringe	As for the fringe	As for the fringe
Recurrent costs			
Water usage charge	As for the fringe	As for the fringe	As for the fringe
Rate payment	0	0	0
Based charge	As for the fringe	As for the fringe	As for the fringe
Environmental levy	As for the fringe	As for the fringe	As for the fringe
Maximum service Availability charge	As for the fringe	As for the fringe	As for the fringe

Melbourne

Upfront costs

Melbourne Water is responsible for three categories of water and sewerage infrastructure. These are 'category A works' (that is, water supply headworks, major sewerage treatment plants and outfalls), 'category B works' (that is, for sewerage collection sewers, for water supply zone and regional distribution mains), and 'category C works' (that is, local reticulation).

Melbourne Water provided data on the upfront costs of each of these categories of works for fringe developments (see table 14). Melbourne Water said that category A sewerage costs have been differentiated between Melbourne Water's two main treatment facilities, Werribee Farm and South Eastern Purification Plant. Unit costs, therefore, reflect the costs of unused capacity 'in the existing system available for new growth, together with Category A augmentation planned for the next 10 years. These costs have been adjusted to eliminate works and costs associated with service provision to non-domestic customers and augmentation not generated by urban growth.

Melbourne Water said that category A water supply works operate as an integrated network and, hence, differentiation similar to that applied to sewerage is inappropriate. It said that the average cost of these works is based on spare capacity. There are no augmentation works for growth planned over the next 10 years.

With regard to category B works, a distinction is made between existing and new works required for new development. The new works have been further split into works which benefit all new development and works required to serve a specific development corridor.

Table 14: **Upfront costs of providing water and sewerage infrastructure to fringe developments in Melbourne, 1992 ($ per lot)**

Category of works	*Werribee*	*South Eastern*	*Plenty*
Water			
A	936	936	936
B[a]			
new	3221	2417	3295
existing	835	835	835
C	1 500	1 500	1 500
Sewerage			
A	415	815	415
B[a]			
New (including allowance for the north west trunk sewer)	1 659	2 364	3 706
Existing	1 634	1 634	1 634
C	2 500	2 500	2 500

a Category B existing costs were derived from the net written down value of existing infrastructure Plus the value of expected capital works for the next 10 years less the value of capital works already accounted for as part of new category B works. These costs were adjusted for non-domestic flows and divided by the total number of expected properties in 2002.
Source: Melbourne Water.

Recurrent costs

Recurrent costs associated with the use of water and sewerage infrastructure by to domestic properties are labour and associated charges, materials, services and miscellaneous expenditure, provisions for employee entitlements, insurance and redundancy payments, and asset replacement costs.

Melbourne Water provided information about these recurrent costs. The cost of labour and associated charges, materials, services and miscellaneous expenditure was $98.7 million for water, and $78.5 million for sewerage for 1990-91. These recurrent costs were then divided by the number of residential properties connected to the water supply and sewerage system. Melbourne Water said that 942 918 domestic properties were connected to the water supply and 866 334 properties were connected to the sewerage system. Accordingly, the cost per lot for water was $104.67 and for sewerage was $90.61 per lot.

Provision for employee entitlements, insurance and redundancy payments was given by Melbourne Water for 1991-92 as $27 per lot for water and $25 per lot for sewerage.

Melbourne Water expressed justifiable concerns about the use of metropolitan wide averages for recurrent costs. They said that this is inconsistent and defeats the purpose of the model which is to demonstrate relative servicing cost differentials.

The use of average data will be misleading if there is substantial regional variation in recurrent costs. Unfortunately, data has not been made available to the Commission which could isolate these cost differentials. However, to the extent that they exist total cost (that is, upfront and recurrent costs) variations by region will be larger than those shown in the analysis.

Estimates of the present value of asset replacement costs were also obtained using the formula given previously. These estimates were based on Melbourne Water's upfront cost data given mi table 14. It was not possible to accord average asset lives for each category of asset to derive a weighted asset replacement cost as was done for the SWB. Instead, an implicit average asset life, derived from Melbourne Water's annual report for 1990-91, was used for each category (see table 15).

Table 15: **Implicit average life of Melbourne Water's works assets**

Works assets	*Cost at 30 June 1991 (A) ($'000)*	*Depreciation/ Amortisation for 1990-91 (B) ($'000)*	*Implicit average asset life (A/B) (years)*
Water	1 674 996	23 683	71
Sewerage	1 875 574	28 558	66

Source: Derived from Board of Works 1991 a, p. 116.

Estimates of the present value of asset replacement costs are given below in table 16 for Werribee. Estimates for other fringe locations in Melbourne were similarly obtained.

Table 16: **Estimated asset replacement costs for a fringe development in the Werribee catchment, 1992 a**

	Upfront costs *($ per lot)*	*Asset life* *(years)*	*Estimated present value of asset replacement cost* *($ per lot)*
Water			
Category A	936		
Category B			
new	3 221		
existing	835		
Category C	1 500		
Total	6 492	71	209.77
Sewerage			
Category A	415		
Category B			
new	1 659		
existing	1 634		
Category C	2 500		
Total	6 208	66	258.32

a Assumes a 5 per cent discount rate.
Source: Commission estimates.

Upfront revenues or payments

Developers are two types of upfront payments for infrastructure. First, they pay for all the reticulation costs.

Second, developers pay charges levied by Melbourne Water for category B works (that is sewerage collection sewers, zone and regional distribution water mains). Information about current upfront charges for category B works was given by Melbourne Water (see table 17). These developer charges were also levied on developments in inner locations.

It is assumed that developer contributions are passed fully on to households who subsequently purchase the lot.

Developers do not contribute to the cost of category A works.

Table 17: Current developer charges for category B works set by Melbourne Water, 1992 ($ per lot)

	Water	*Sewerage*
Area charge	2 452	2 132
Location specific charge		
Plenty C		1 492
Berwick South	102	

Source: Melbourne Water.

Recurrent revenues or payments

Recurrent charges for water and sewerage services are used to estimate recurrent payments received per lot. The data on charges is drawn from Melbourne Water's pricing schedule for 1991-92 (Board of Works 1991b) and is presented in table 18 below:

Table 18: Recurrent payments by a household in Melbourne in 1991 -92, ($ per household)

	Water	*Sewerage*
Average rate payment	124.34	276.29
@2.54 cents in $ of net annual value for water		
@5.664 cents in $ of net annual value for sewerage		
Median rate payment		
Werribee	87.94	195.41
South Eastern (Berwick)	95.31	209.57
Plenty (Whittlesea)	101.96	226.56
Water consumption payment		
0-150 kilolitres @ 15.0 cents per kilolitre	52.98	
150-350 kilolitres @ 25.4 cents per kilolitre		
over 350 kilolitres @ 57.4 cents per kilolitre		

a Based on average net annual value = $4878
b Derived from data provided by Melbourne Water on net annual values of properties with single detached dwellings in particular areas in Melbourne.
c Based on average annual domestic consumption of 270 kilolitres
Source: Board of Works 199 1 band AWRC 1992.

Summary of data and assumptions

Fringe

Tables 19 and 20 summarise the data and assumptions used to compare total costs of and payments for water and sewerage infrastructure provision under scenario 1. The same data was used for scenario 2, except that headworks upfront costs are assumed to be zero. The data was brought to curTent dollar values.

Table 19: Data and assumptions used in the scenario 1 analysis of water infrastructure provision to the fringe in Melbourne, 1992 ($ per lot) [a]

	Werribee	*South Eastern*	*Plenty*
Upfront costs			
Category A	936	936	936
Category B	3 221	2 417	3 295
New	835	835	935
Existing	1 500	1 500	1 500
Category C			
Recurrent costs			
Labour and associated charges, materials, services and miscellaneous expenditure	101	101	101
Provisions	27	27	27
PVARC (5 per cent discount rate)	210	184	212
PVARC (10 per cent discount rate)	7	7	7
Upfront payments			
Category A	0	0	0
Category B	2 452	2 554	2 452
Category C	1 500	1 500	1 500
Recurrent payments			
Median NAV rate	88	95	102
Water consumption	53	53	53

a Recurrent costs of labour and associated charges, materials, services and miscellaneous expenditure were adjusted using gross fixed capital expenditure price deflators for public enterprises (ABS, *Australian National Accounts*, *National Income Expenditure,* cat. no. 5206.0, June Quarter 1992). The deflator used was 0.967.

Table 20: **Data and assumptions used in the scenario 1 analysis of sewerage infrastructure provision to the fringe in Melbourne, 1992 ($ per lot) a**

	Werribee	*South Eastern*	*Plenty*
Upfront costs			
Category A	415	815	415
Category B			
New	1 659	2 364	3 706
Existing	1 643	1 634	1 634
Category C	2 500	2 500	2 500
Recurrent costs			
Labour and associated charges, materials, services and miscellaneous expenditure	88	88	88
Provisions	25	25	25
PVARC (5 per cent discount rate)	258	203	344
PVARC (10 per cent discount rate)	12	14	15
Upfront payments			
Category A	0	0	0
Category B	2 132	2 132	3 624
Category C	2 500	2 500	2 500
Recurrent payments			
Median NAV rate	195	210	227

a Recurrent costs of labour and associated charges, materials, services and miscellaneous expenditure were adjusted using gross fixed capital expenditure price deflators for public enterprises (ABS, Australian National Accounts, National Income Expenditure, cat no. 5206.0, June Quarter 1992). The deflator used was 0.967.

Inner

The data and assumptions underlying the analysis for a notional inner location in Melbourne for all scenarios are presented in table 2 1.

Table 21: **Data and assumptions underlying analysis of water and sewerage services provision to a notional inner location in Melbourne**

	Scenario 1	*Scenario 2*	*Scenario 3*
Upfront costs			
Category A	As for Werribee fringe	0	0
Category B	$1315 per lot for water, $2749 per lot for sewerage	$1315 per lot for water, $2749 per lot for sewerage	0
Category C	0	0	0
	$330 per lot for water, $350 per lot for sewerage	$330 per lot for water, $350 per lot for sewerage	$330 per lot for water, $350 per lot for sewerage
Recurrent costs			
Labour and associated charges, materials, services and miscellaneous expenditure	As for the fringe	As for the fringe	As for the fringe
PVARC	As for Werribee fringe	As for Werribee fringe	As for Werribee fringe
Upfront payments			
Category A	As for Werribee fringe	0	0
Category B	Developers charges for Werribee	Developers charges for Werribee	Developers charges for Werribee
Category C	0	0	0
Recurrent payments			
Water consumption	As for the fringe	As for the fringe	As for the fringe
Rate payments	Based on average net annual value of $4878	Based on average net annual value of $4878	Based on average net annual value of $4878

D4 Results

The results for Sydney and Melbourne should be treated as illustrative rather than definitive of the pattern of subsidies. This is primarily because there are limitations in the data. While the authorities have some indication of the locational variations in upfront infrastructure costs for the fringe, they have less knowledge as to how recurrent costs vary. Moreover, in relying on the authorities' data for the fringe, the analysis must assume that the authorities have appropriately identified and attributed the costs of providing infrastructure to developments. Data problems are more pronounced for inner locations and the analysis is largely based on arbitrary assumptions about costs.

Caution is also needed in comparing the results for the two cities. This is because of the differing accounting practices used by the SWB and Melbourne Water (for example, the methods of valuing assets differ). Further, the different assumptions used for the inner analysis render comparisons between the two cities as inappropriate.

Sydney

Fringe

Tables 22 and 23 below present estimates of the residual between costs of and payments received for water and sewerage infrastructure provided by the SWB. Residual costs mean that costs exceed the payment of charges.

In table 22, the estimates for water services show that for typical recurrent payments ($187.28 per lot) and a 5 per cent discount rate, the residual cost per lot under scenario 1 varies from about $1300 in Fairfield to $2000 in Baulkharn Hills. Assuming that recurrent payments are based on the maximum service availability charge ($253.88), the difference between costs and charges vary from a residual payment of $65 in Fairfield to a residual cost of $650 in Baulkham Hills.

Table 22: **Residual cost for water infrastructure provided to a fringe location in Sydney, 1992 ($ per lot)**

Location	*Residual costs based on maximum service availability charge*				*Typical residual costs*			
	Scenario 1		*Scenario 2*		*Scenario 1*		*Scenario 2*	
	5%	*10%*	*5%*	*10%*	*5%*	*10%*	*5%*	*10%*
Baulkham Hills	*650*	*722*	*166*	*239*	*1 982*	*1 388*	*1 498*	*905*
Blacktown	441	544	-42	60	1 773	1 210	1 290	726
Campbelltown	310	434	-173	-50	1642	1 100	1 159	626
Camden	343	438	-141	-46	1 675	1 104	1 191	620
Fairfield	-65	76	-548	-407	1 267	742	784	259
Liverpool	126	223	-357	-260	1 458	889	975	406
Penrith	567	377	84	193	1 899	1 363	1 416	859
Average fringe	339	445	-144	-39	1 671	1 111	1 188	627

Source: Commission estimates.

In table 23, the estimates for sewerage services show that under scenario 1 assuming typical recurrent payments ($296.92 per lot) and a 5 per cent discount rate, a lot in the fringe has a residual cost of between $1600 in Liverpool to $2900 in Penrith and Blacktown. Assuming that recurrent payments are based on a maximum service availability charge (that is $568.52 per lot), *residual payments* range from over $2500 in Pennith and Blacktown to $3800 in Liverpool.

Under scenario 2 for both water and sewerage infrastructure, the residual costs either become less or turn into residual payments, and the residual payments become larger.

Table 23: **Residual costs for sewerage infrastructure provided to a fringe location in Sydney, 1992 ($ per lot)**

Location	*Residual costs based on maximum service availability charge*				*Typical residual costs*			
	Scenario 1		*Scenario 2*		*Scenario 1*		*Scenario 2*	
	5%	*10%*	*5%*	*10%*	*5%*	*10%*	*5%*	*10%*
Baulkham Hills	(3 654)	(736)	(6 071)	(3 180)	1 778	1 953	(639)	(464)
Blacktown	(2 560)	313	(4977)	(2 105)	2 872	3 029	455	611
Campbelltown	(2 880)	8	(5 298)	(2 409)	2 552	2 724	134	307
Camden	(3 575)	(665)	(5 993)	(3 083)	1 857	2 051	(561)	(367)
Fairfield	(3 466)	(603)	(5 883)	(3 021)	1 966	2 113	(451)	(305)
Liverpool	(3 781)	(907)	(6 199)	(3 325)	1 651	1 809	(767)	(609)
Penrith	(2 560)	313	(4 977)	(2 105)	2 872	3 029	155	611
Average fringe	(3 211)	(329)	(5 628)	(2 747)	2 221	2 387	(196)	(31)

Source: Commission estimates.

Inner

The results for a notional inner location are presented in table 24 under three scenarios. They suggest that under scenarios 1 and 2 (assuming typical recurrent payments and a 5 per cent discount rate) there are generally lower residual costs in providing water and sewerage infrastructure to a notional inner location compared with fringe locations.

Under scenario 3 (assuming typical recurrent payments), residual costs turn into *residual payments* for both water and sewerage infrastructure.

Table 24: **Residual costs for a notional inner location in Sydney, 1992 ($ per dwelling)**

Infrastructure	*Residual costs based on maximum service availability charge*			*Typical residual costs*		
	Scenario 1	*Scenario 2*	*Scenario 3*	*Scenario 1*	*Scenario 2*	*Scenario 3*
Water						
5 per cent discount rate	228	(256)	(3 378)	1 560	1 076	(2 046)
10 per cent discount rate	300	(183)	(3 306)	966	483	(2 640)
Sewerage						
5 per cent discount rate	(3 875)	(6 292)	(8 470)	1 557	(860)	(3 038)
10 per cent discount rate	(984)	(3 401)	(5 579)	1 732	(685)	(2 863)

Source: Commission estimates.

Melbourne

Fringe

Table 25 presents estimates of residual costs and payments associated with water and sewerage infrastructure provided to a lot in the fringe of Melbourne. The residual costs associated with providing water services, under scenario 1 and assuming a 5 per cent discount rate, range from about $1400 per lot in South Eastern to $2500 per lot in Werribee. The residual costs associated with sewerage services range from $ 18 0 per lot in Werribee to over 5 1000 per lot in South Eastern.

Under scenario 2, residual costs become smaller or turn into residual payments.

Table 25: **Residual costs for water and sewerage infrastructure provided to a fringe location in Melbourne, 1992 ($ per lot)**

Location	*Scenario 1*		*Scenario 2*	
	5%	*10%*	*5%*	*10%*
Water				
Werribee	2 496	2 420	1 560	1 484
South Eastern	1 436	1 450	500	514
Plenty	2 292	2 354	1 356	1 418
Average fringe	2 075	2 075	1 139	1 139
Sewerage				
Werribee	179	760	(236)	345
South Eastern	1 046	1 725	(236)231	910
Plenty	196	1 007	(219)	592
Average fringe	474	1 164	(75)	616

Source: Commission estimates.

Inner

Estimates of residual costs and payments were also obtained for a notional inner location. The estimates suggest that under all scenarios there are *residual payments* for both water and sewerage infrastructure. The residual payments get progressively larger for each of the scenarios.

Table 26: **Residual costs for water and sewerage infrastructure provided to a notional inner city location in Melbourne, 1992 ($ per dwelling)**

	Scenario 1	*Scenario 2*	*Scenario 3*
Water			
5 per cent discount rate	(643)	(1 579)	(2 894)
10 per cent discount rate	(355)	(1 291)	(2 606)
Sewerage			
5 per cent discount rate	(1 633)	(2 048)	(4 797)
10 per cent discount rate	(243)	(658)	(3 407)

Source: Commission estimates

D5 Conclusions

The results show that there are residual costs in providing water and sewerage infrastructure to the fringe of both cities (assuming scenario 1 and a 5 per cent discount rate). For Sydney, average residual costs for the fringe are estimated at about $3900 per lot for both types of infrastructure. For Melbourne, average residual costs are estimated at about $2500 per lot. The residual costs compare to total costs of providing water and sewerage infrastructure of the order of $25 000 in Sydney and $19 000 in Melbourne. It was estimated that total charges (not just developer contributions) for both water and sewerage infrastructure would have to increase by an average of 16 per cent for Sydney and about 14 per., cent for Melbourne to remove the subsidies.

Among fringe locations, there is some variation in residual costs of both water and sewerage infrastructure. Residual costs at the fringe of Sydney vary from $3 100 per lot in Liverpool to almost $4800 per lot in Penrith. In Melbourne, the variation is much smaller with residual costs varying from $2500 per lot in South Eastern and Plenty to $2700 per lot in Werribee.

For a notional inner location (assuming scenario 1 and a 5 per cent discount rate), the results suggest that, there are residual costs of providing water and sewerage infrastructure in Sydney (although less than the average for the fringe) and residual payments in Melbourne (compared with residual costs for the fringe). In Sydney, it is estimated that charges to inner areas would have to increase by about 40 per cent for subsidies to be reduced to zero. In Melbourne, charges would have to decrease by 24 per cent for overpayments to be fully offset.

Data problems, particularly for inner locations, and the differing accounting approaches taken by authorities, preclude any inferences drawn from comparing Sydney with Melbourne and from the absolute estimated levels of residual costs and payments.

Nevertheless, the results are an indication of the pattern of subsidies and overpayments across locations within each city. They suggest that popular notions of massive under-charging at the fringe are not tenable.

The divergences between charges and costs that do occur for different locations in each city reveal that charging practices inadequately reflect location costs of provision.

For the important comparison between inner city and fringe developments, the results indicate differences in cost recovery for each city. This is most pronounced in Melbourne where there appears to be some relative incentive to develop fringe areas relative to inner areas. Some inner city development faces charges that appear to be too high given the costs associated with it. (.Although, Melbourne Water has indicated that its charging arrangements are under review.)

A question arises as to the pattern of cross-subsidies, given that both authorities are obtaining a positive rate of return overall (AWRC 1992, table 1). Melbourne Water suggested that any subsidies to the fringe are being paid by domestic customers in inner areas and by industrial and commercial customers. SWB indicated that the subsidies for all its domestic customers, whether in the fringe or in inner areas, are being paid for by industrial and commercial customers.

APPENDIX E: STATE GOVERNMENT PLANNING FRAMEWORK

This appendix outlines the current situation with respect to institutional frameworks, strategic planning and land assembly processes throughout the States. Each State's residential land supply process is discussed with particular reference to strategic planning and land assembly processes. These issues have been comprehensively covered in recent studies by the Commonwealth Government.[13]

E1 New South Wales

As of mid-1990 there were 12 300 vacant lots on the Urban Development Program (UDP) frontier, and another 53 000 lot equivalents zoned for development and with access to infrastructure (for Sydney). Much of this land is fragmented and therefore difficult to aggregate for subdivision. Forty per cent was estimated to be in parcels of 1-5 hectares. Land on the UDP frontier is currently projected to provide for about 40 per cent of Sydney's housing needs. The other 60 per cent is expected to occur either in redevelopments of built up areas or as infill in outer suburban areas inside the UDP fringe development areas.

The institutional framework

The major coordinating role for residential land supply in New South Wales is undertaken by the Department of Planning. It chairs a number of urban development committees (UDCs), co-ordinates the preparation of urban development programs, undertakes strategic planning, reviews local environmental plans and guides development. The State Treasury is represented on the Sydney UDC and advises the Government of projected costs of urban development.

There are six major organisations responsible for water supply and sewerage in the major urban areas of New South Wales which are responsible for planning, design, financing, construction, operation and maintenance of water and sewerage services. The Department of Housing (which in 1986 took over the functions of the Land Commission of New South Wales and the Housing Commission of New South Wales) performs a range of activities. These include the provision of

[13] Detailed analysis can be found in IPC 1990, 1991 and 1992, and NHS 1991d. this appendix is drawn from such studies and from information supplied by State government land developers.

services and activities for all tenures (for example public housing, private rental and home ownership). It aims to maximise opportunities for people to have access to affordable housing. A major departmental program involves land acquisition and development. This is taken up below.

The Roads and Traffic Authority and the Ministry for Transport are responsible for planning, construction and operation of major public transport facilities and services. In terms of land development, their role is to provide advice and infrastructure. The Department of Local Government prescribes legislative requirements for building works which can have a major impact on housing form and cost. A number of other State authorities are also involved in the residential land supply process. For example, the Department of Lands and the Department of Family and Community Services provide information on various services and facilities. A number of County councils and other State business enterprises are responsible for the provision of electricity in the major urban areas of New South Wales and they play an important role in planning.

Finally, Local Government plays a vital role in the land supply process. There is a local government representative on the main UDC and a further sub-committee to liaise with councils. Local councils are involved in environmental studies, local environmental plans and development control plans. They have certain requirements pertaining to standards of infrastructure provision, building and inspection procedures. Councils also collect funds for servicing development (section 94). The private urban development industry is not represented on the main UDC.

The land supply pipeline

The land supply process in the major urban areas of New South Wales generally follows the sequence outlined in box 1.

The strategic planning stage is usually in the form of a plan such as the *Sydney Regional Outline Plan* or *Sydney into Its Third Century.* These plans, while identifying land for urban growth, do not have the force of law and cannot rezone areas for specified uses. Developers and land owners can also identify land for future residential uses. These groups may undertake their own investigations and report their findings to the Department of Planning or to the relevant local council. If successful in having the land formally recognised, that land would then enter the Urban Development Program.

Box 1: **Residential land supply process in New South Wales**

Strategic Planning: potential urban areas identified

Land assembly: land acquisition by developers

Regional Environmental Plans: prepared for nominated growth areas

Urban Development Program: various areas of land are placed in a staged release program

Major Infrastructure Planned.. trunk water and sewerage services and major transport infrastructure, electricity and telecom services planned/provided

Local Environmental Plans: land is rezoned, Urban Development Control plans prepared: detailed land use arrangements are formulated

Estate Concept Design and Development Application: plan and utilities designs are prepared

Stage/Precinct Design: detailed plans for specific stage of a new estate

Development Assessment and Determination: subdivision plans are assessed and determined by councils

Utilities Design and approval.. assessment by public utilities

Town Clerk's Certificate: basic works are checked and certified by council

Land Titles Office registration: plans are registered, lots now available for sale

Construction

Joint venture arrangements (that is landowner, developer and financier) tend to arise when land is assembled under option or conditional contract and future purchase is subject to consent being given for development. Consortium developments usually involve more than one land owner and several developers and financiers working with local government to press for earlier release of an area and expedite development. The IPC expects this form of development to become more common.

Landcom (Department of Housing, Division of Land Development and Sales)

Landcom, the marketing arm of the Department of Housing, is the New South Wales Government's land authority. It controls 30 to 40 per cent of lot production in Sydney Region UDP areas. It buys and sells at market value and is not required to generate a specific rate of return.

Landcom's activities extend to the four major residential locations of New South Wales (Sydney metropolitan area, Central Coast, Hunter and Illawarra). It also markets some developed lots in selected country locations such as Wagga Wagga, Kiarna, Dubbo and Coffs Harbour where land initially acquired for public housing purposes and in excess of requirements is to be developed and retailed. Landcom currently holds about 35 000 potential lots (split on the basis of non-residentially zoned broadarea, 40 per cent; residentially zoned broadarea, 57 per cent; and developed lots, 3 per cent). Landcom also has responsibility for the residential development of Crown Land equivalent to around 12 000 lots.

Landcom is exempt from stamp duty on acquisition, land tax and local council rates on vacant land in all categories. These exemptions do not apply to private developers. However, Landcom does incur holding costs on its land bank through cost of borrowings and maintenance and water charges. Landcom is currently self-financing and with the merger in 1986 of the former Lands Commission and Housing Commission it acquired stocks on hand and a cash reserve.

Landcom is instituting a new accounting system for its commercial operations and until that system is running it cannot determine its rate of return. Nevertheless, the Department operates on a viable basis for each project (break even or better) -margins are low owing to it concentrating its activity at the low end of the market. Current policy is td produce and market lots in the following price categories:

Low price	($65000)	70 per cent
Middle price	($65 000 - <$ 100 000)	20 per cent
High price	($ 100 000 per lot)	10 per cent

By 1995-96 Landcom is expected to be less involved in the high and middle end of the market.

Table 1: **Landcom lot production in Sydney region UDP areas**

Year	*High*	*Medium*	*Low*	*Total*	*% of total lot product*	*% Low market lot product*
1981-82	683	573	3 324	4 580	52.3	N/A
1982-83	500	32	570	1 102	20.8	N/A
1983-84	412	139	1 909	2 460	44.5	N/A
1984-85	1 067	505	3 040	4 612	63.1	71.2
1985-86	58	7	443	508	7.3	13.4
1986-87	334	230	526	1 090	18.4	22.8
1987-88	390	523	1 632	2 545	34.5	45.8
1988-89	516	174	3 343	4 033	40.5	47.8
1989-90	277	0	1 587	1 864	23.1	26.8
1990-91	232	53	1 727	2 012	31.2	36.9
Total	4 469	2 236	18 354	25 226		
% of Total Landcom Production	18.00%	9.00%	73.00%	100.00%		

a Sydney ffigh includes LGAs of Baulkharn Flills, Homsby, Sutherland and Warringah. b Sydney Medium includes LGAs of Fairfleld and Liverpool. c Sydney Low includes all other UDP LGAs (Blacktown, Camden, Campbelltown, Gosford, Hawkesbury, Penrith and Wyong). d Data may contain some lots produced outside release areas in UDP LGAs. Source: Sub. 95, attachment.

E2 Victoria

The institutional framework

The Ministry for Planning and Environment (MPE) has overall responsibility for the planning process. In conjunction with other agencies it has developed the Metropolitan Services and Co-ordination System (MSCS). The aim of the MSCS is to forecast population growth and development in Melbourne and to co-ordinate the provision of infrastructure. A Land Release Program (1989-2003) and a number of other Bulletins and reports which are updated annually have arisen from the MSCS. The Urban Development Program is prepared by the MPE and it identifies residentially zoned land in outer Melbourne.

The Department of Management and Budget co-ordinates financial management economic and social policy and budgetary requirements of the State government. It participates in the MSCS providing population and household forecasts for Melbourne. The Valuer-General’s Department provides analysis of property transactions for land valuers, planners, lenders, developers, estate agents and the like.

The Roads Corporation of Victoria (Vicroads) acquires land for major public roads and undertakes planning, design and construction. It acquires land in conjunction with BMB and obtains valuations from the Valuer-General. It also consults with the Ministry of Transport and local government authorities. Melbourne Water is responsible for water supply, sewerage and drainage, and industrial waste management.

The State Electricity Commission of Victoria provides power and Telecom and the Gas and Fuel Corporation provide telephone and gas services respectively. The Land Titles Office has a 'Landata' land information service which consolidates statistics on public authorities. Finally, local government authorities have planning and monitoring functions.

The land supply pipeline

The land development process in Victoria is the overall responsibility of the Department of Planning and Housing. With the other agencies involved in the MSCS, it aims to prepare an efficient staging plan for future land release. A 15 year land release program is updated each year.

Box 2: **The land development process in Victoria**

Strategic Planning: identifying urban growth areas at a regional and municipal level, or, private application for rezoning. Development plans containing strategic policy statements with planning schemes detailing land use zones.

Planning Applications: developers submit plans to councils, application is assessed or, if permit not required, developer proceeds to certification stage.

Referral to authorities: plans are assessed by relevant authorities within specified time (whe required).

Council determination: councils permit or refuse applications. Application for certification: plans submitted by councils.

Referral to authorities: further assessment by authorities may be required. Determination: councils either certify or refuse plans.

Assessment of engineering plans; councils assess and approve designs, following which construction commences.

Statement of compliance: developer requests statement of compliance from councils. Registration of plans: Registrar of Titles checks and registers plans, tides are issued.

The Urban Land Authority

The Urban Land Authority (ULA) commenced operations in March 1980 acquiring the land and cash reserves of the former Urban Land Council (a non-statutory body). It is the largest land developer in Melbourne, aiming to provide 'innovative, cost-efficient and environmentally sensitive' residential developments. The authority currently produces about 1800 serviced residential lots a year.

The authority controls about 15 to 20 per cent of all development sites. It sells about 2000 residential allotments each year, out of 14 000 total. It undertakes planning, development and marketing of completed residential lots - thus it operates in the same manner as a private developer. There are about 160 000 lots reserved for housing in Melbourne and the ULA holds 17 000 of them (see table 2).

Table 2: **Major developers' holdings of undeveloped residentially zoned land in Melbourne (end of 1988)**

Developer	*Holdings of zoned land (Ha)*	*Potential lot yield*	*Current annual lot production*	*Number of years' supply*
ULA	1 721	17 200	3 000	5.7
Jennings	400	4 000	1 000	4
Hookers	160	1 600	900	1.8
Wimpey	200	2 000	800	2.5
Ginsborough & Marcus	127	1 270	700	1.8
Stocklands	204	2 040	650	3.1
Esanda	180	1 800	600	3
National Mutual	500	5 000	500	10
Cambridge	110	1 100	400	2.8
Wilbow Peck	160	713	350	2
Bond Corp	230	2 300	350	6.6
Overland Development	23	250	220	1.1
Silverton	30	300	150	2
Others	*260*	*2 430*	*780*	*3.1*
Total for major developers	4 305	42 003	10 400	4 (average)
Metropolitan totals	18 736	159 102	14 192	
Major developers' share of metropolitan total	23%	26%	73%	

a In receivership and trading under a new name. b Bond Corp has now been bought out by Pathstone Developments. c Of the 'others' significant operators include the Dennis Group, the Corteck Group and Orlit Homes. d Metropolitan totals include all undeveloped residentially zoned land, identified in the 1988, Ministry of Planning and Environment Survey of residential land in Melbourne. The metropolitan total for annual lot production is based on NTE data for residential lots released in 1988.

Source: ACIL 1992, p. 54, citing Victorian Department of Planning and Housing Building (1992), *Land Development Industries, p.* 19.

The ULA generally aims at a 20 to 35 per cent rate of return compared with private developers which aim for about 30 per cent, but it may settle for less depending on the objectives involved. About 70 per cent of all ULA land is sold to first home buyers. The ULA seeks to purchase raw land on a large scale well ahead of development to enable it to produce and sell residential land at affordable prices. As the single largest Victorian residential land developer the authority has been active m speeding provision of services and community facilities in the major growth areas. By maintaining adequate land supplies in these areas, the ULA seeks to limit price fluctuations of private land and maintain a steady supply of affordable blocks. The Authority currently has at least six years supply of broadarea residentially zoned land available for future development.

A 'Homestart' scheme was introduced in 1989-90 and applies to first and low income home buyers. In its 1991 report, the ULA noted that 1000 blocks sold at $10 000 discount (this is discussed further in report chapter D2). The scheme has been extended to another 1000 lots in 1991-92. In fact in 1990-91, 70 per cent of ULA land was sold under Homestart. The scheme commenced in response to limited demand. The ULA objectives include: to maintain an adequate supply of serviced residential land to meet the ULA's share for the projected metropolitan demand; to assist State and Commonwealth Governments to dispose of surplus land assets by converting them to residential property and/or selling them on the open market; to supply affordable land and housing opportunities, particularly for first home buyers, and act as a stabilising influence on land prices; and to implement projects and techniques that give effect to State government policy to increase residential densities and assist in consolidating the metropolitan area.

About half of the ULA's product lots are below 500 square metres. In partnership with private builders, the ULA has developed a range of house and land products which can be sold on small blocks from $80 000-$85 000 (house and land). This compares with cheap houses on bigger lots in private sector developments which are often starting at $95 000.

Housing and Construction Victoria (a government agency) has been a major provider of medium density housing over the past five years. In recent years it has focused its activities on achieving urban consolidation through redevelopment of existing stock and inner-urban infill.

E3 Queensland

The Queensland system devolves much more responsibility for decision making on planning and development matters to local government than in other States. Formal metropolitan or regional planning schemes are not usually utilised. Some local authorities have not zoned areas where urban development is expected to occur. In such cases it is left to the developer to negotiate rezoning with the local authority.

A local authority may prepare a planning scheme which is approved by the Department of Housing and Local Government. A person may apply to the local authority to amend the planning scheme for the rezoning of land. Once approved the local authority applies to the State authority for final approval. While the State can also rezone land this is rarely used. A feature of the Queensland system is that rezoning decisions are subject to review by the Planning and Environment Court.

The institutional framework

Aside from electricity supplied by regional electricity boards, and water supplied by the Brisbane and area water board, local authorities are responsible for supplying utility services. Local authorities also set town planning, engineering and building standards. The State government becomes involved when a local authority recommends rezoning approval to the Minister for Housing and Local government. Reference to a State planning authority is not required.

The land supply pipeline

Ninety per cent of land development in Queensland is undertaken by the private sector, consequently there is little public sector land development. However, the Brisbane City Council has been involved in land development for some time. It acquired its land during the Great Depression, principally as a result of default on rates. Pricing policy is to sell fully serviced land at market prices. The land development process is outlined in box 3.

Box 3: **The land development process in Queensland**

Local authority prepares a planning scheme, including a strategic plan: seeks approval from the Department of Housing and Local Government, and upon approval the local authority is responsible for administering the planning scheme.

Developer initiates concept plans: generally in accordance with strategic plan, and if not appropriately zoned, initiates land use and subdivision applications.

Applications for land use and subdivision: made to the local authority in accordance with the planning scheme, and with the exception of rezoning, the local authority makes the final determination of the application.

Environmental assessment: some developments require an site contamination assessment.

Rezoning application: local authority applies to Minister for Housing and Local Government for final determination of a rezoning application.

Local authority seals the plans of subdivision: when conditions are complied with by the developer

Registration: plans submitted to the Division of Titles (Department of Lands).

E4 South Australia

The institutional environment

An Urban Development Coordinating Committee (UDCC) chaired by the Department of Environment and Planning prepares a Metropolitan Development Program for endorsement by Cabinet. This is the basis for State agency planning. Local councils and the South Australian Planning Commission are responsible for co-ordination of the subdivision process. The South Australian Urban Land Trust (SAULT) operates land banking (wholesaling) and planning of social infrastructure requirements. Land information is comprehensive and coordinated by the Lands Department.

Other groups involved in the subdivision process include local councils; Engineering and Water Supply Department; Electricity Trust of South Australia; Telecom; South Gas Company; Social infrastructure and services departments (for example, Education Department and the Health Commission); the Department of Road Transport; the State Transport Authority; and developers.

The land supply pipeline

There are three basic stages for land development. They are: approval under the Planning act; the issue of a Certificate of approval by the council and the South Australian Planning Commission (SAPC) to certify that physical works are completed (for example roads); and acceptance of survey plans of division and issue of Certificates of Title by the Registrar General. The process is outlined in box 4.

Box 4: **The land development process in South Australia**

Strategic planning: potential urban areas identified by DEP, councils or developers.

Statutory planning: control of land division and land use in designated potential urban areas to prevent activities which would jeopardise future residential development.

Acquisition: of selected broadareas by SAULT and others.

Rezoning: of future urban areas for residential and related uses, and preparation of structure plans.

Concept plan prepared.. developer acquires broadareas from SAULT or private owners and prepares a conceptual waste plan and servicing proposal.

Planning approval: SAPC consults relevant authorities and either SAPC or local council determines plans.

Statement o requirements issued.. SAPC and council provide requirements for works and services.

Certificates of approval: certificates issued by SAPC and council when necessary works and services are either provided or bonded.

Plan of division submitted: developer submits final plan to Registrar general.

The South Australian Urban Land Trust

The South Australian Urban Land Trust is required to hold sufficient land to meet the Government's staged release in new areas and to make sufficient land available to assist in the orderly establishment and development of new urban areas. Section 14 (1) of the *Urban Land Trust Act 1981* provides that:

> The functions of the Trust are to hold land and, as prevailing circumstances require, to make land available for and otherwise assist in, the orderly establishment and development of new urban areas.

The Trust purchases land in advance of it being zoned and this is said to reduce speculation. It releases broadarea land consistent with market demands to keep new urban land prices at 'reasonable' levels. The Trust has no development role outside of joint ventures. The joint venture arrangements are discussed in chapter D2. It is a wholesaler of broadarea land to developers and holds about 40 per cent of broadarea stock.

SAULT pays market value for acquired land and has not used its acquisition powers. If an area is zoned urban it will already have some inbuilt capital appreciation. The Trust has a policy of having urban land on hand for immediate residential development, and it has parcels which are zoned urban residential, or commercial, for development in one to five years' time. It also has future urban area holdings which may be required in ten years' time. The trust does not hold land for longer than ten years as it considers this to be too costly. There are 3755 hectares in the land bank (see table 3). The South Australian Housing Trust can buy land and develop it for housing but does not have powers of compulsory acquisition.

Table 3: **Broadarea land bank (hectares)**

			Jun-91		*Jun-90*
Local Government Area		*Residential*	*Rural and Other*	*Total*	*Total*
Enfield:	Northfield (1)	217	2	219	-
	Walkley Heights	49	-	49	-
Salisbury:	Walkley Heights	83	1	84	-
	Other	95	60	155	100
Tea Tree Gully:	Golden Grove	554	37	591	675
	Other	-	56	56	56
Gawler		48	306	354	359
Salisbury:		887	133	1 020	1 018
Noarlunga:	Seaford (2)	312	39	351	319
	Other	40	272	312	327
Willunga		-	555	555	446
Mount Gambier		-	9	9	9
Total		2 285	1 470	3 755	3 309

a Total area of the Northfield land is 246 hectares. However, as the South Australian Housing Trust has a 40 per cent equity in portion of the land (Precinct 1:67 hectares) the area relative only to the Urban Land Trust's equity is included.
b Total balance area of the Seaford joint venture land is 702 hectares at 30 June 1991. The area of 351 hectares included in the tables reflects the Trust's half share of the joint venture land in the ownership of the Trust and the Housing Trust as tenants in conunon.
Source: SAULT 1991, p. 6.

SAULT's objectives are to: maintain an appropriate broadarea land bank sufficient to meet the Government's staged release in new urban areas; assist Government and local government to ensure rezoning and structure planning proceeds ahead of the release of broadarea land for new urban development; assist in the co-ordination of and planning for the timely provision of community facilities, services and programs in new urban areas which may include the acquisition and holding of land for community facilities; promote and assist with the government's urban consolidation objective as appropriate; and assist in furthering the State Government policies in respect of affordable housing, housing choice and mix.

The Trust pursues. an active program of broadarea land banking which it regards as sufficient to ensure an adequate supply for staged release in new urban areas and to maintain housing affordability, especially in the urban fringe new housing sector. To keep land in productive use it is leased for agricultural purposes (around 95 per cent). Leasing arrangements indicating a surplus of receipts over outlays are shown in table 4.

Table 4: Leasing operations

	1989-90	*1990-91*
Gross rent	204 636	270 892
E& WS rates	26 399	37 847
Council rates	112 930	144 917
Surplus	65 307	88 128
Area leased at 30 June (Ha)	3 146	3 693

Source: SAULT 199 1, p. 6.

E5 Western Australia

Statutory planning functions have been delegated to the Metropolitan Planning Council, Committee for Statutory Procedures, and the Department of Planning and Urban Development. The land supply process in Western Australia is distinctive in that environmental assessment is separate from the planning process (it is conducted under the Environmental Protection Act). Perth development is currently structured on the 30 year *Metroplan.* There are several strategies including the Metropolitan Development Program which is a five year rolling program of land release updated each year.

The institutional framework and land supply pipeline

To initiate the land development process, land needs to be zoned as urban land under the Metropolitan Region Scheme which is under the control of the Department of Planning and Urban Development (DPUD). Local authority approval is also required in terms of the local authority town planning or district zoning scheme. Once these issues are resolved a subdivision approval is required from DPLTD, which would also consult with the service providers to obtain approval for the proposed development. The Main Roads Department, the Water Authority of Western Australia, the Environmental Protection Agency and the State Energy Commission would also be part of this process.

Box 5: The land development process in Western Australia

Metropolitan Strategic Planning

Metropolitan Scheme Amendment: SPC initiates amendment; classified as substantial or non substantial transfer from urban deferred to urban.

Structure plan and servicing: developer prepares a concept plan and servicing information for proposal.

Local authority scheme change: local council initiates amendment then requires approval of SPC and Minister for Planning.

Subdivision plan prepared: developer prepares plans and submits to DPUD for determination by CSP Consultation with utilities agencies and EPA: DPUD circulates subdivision plan for comment and conditions.

Preliminary approval: CSP approves plan subject to conditions.

Clearance of conditions: developer obtains individual clearance of conditions from relevant local authority and other agencies.

Subdivision plan approval: SPC gives final approval.

Registration of plans: Offices of Titles gives titles to allotments.

Homeswest

Homeswest is a public housing statutory authority and has the dual role of providing public housing and using its development activities to raise funds. It provides public rental stock and home loans for low income earners. It also plays an important role in land development, specifically in the areas of. providing land for public rental building program; providing affordable land for low income householders; introducing and promoting innovative products and practices in land development; assembling land to meet future housing needs; and generating revenue to enable Homeswest to meet its other social housing obligations.

It competes with the private sector for available land and in the sale of housing. Homeswest is Perth's largest developer and holds 3700 hectares of the available 9750 hectares of land zoned for urban use (as of March 1991). There are 23 130 residential developed lots in stock (representing a ten year pipeline).

Homeswest explicitly focuses its selling on first home buyers. It is a large player in the Perth land market. It provides rental housing and home ownership access for low income families. Borrowings are often private sector financed.

Much of the land for public housing is made available through Homeswest's own land developments which allow it to provide housing in areas where it has historic land holdings.

Homeswest maintains continuous access for buyers at the lower end of the market by directly providing first home buyers with land.

Despite the emphasis on affordability, sales are made at a market rate and above cost to the government. Even though a profit is returned, affordability is possible due to the foresight involved in original acquisitions (Sub. 57, p. 2).

E6 Tasmania

The supply of residential land in Tasmania is not coordinated by a central agency. Land subdivision is generally the responsibility of the Commissioner for Town and Country Planning, local councils or regional planning authorities.

The institutional framework

Tasmania has no framework for State planning policy. Legally developers can only be required to meet within subdivision costs (that is, there are no New South Wales section 94 type provisions). The Department of Environment and Planning informed the Commission that there is no large private sector development industry in Tasmania.

The land supply pipeline

The IPC reports that subdivision procedures are complex and costly. Control of subdivision is through the Commissioner for Town and Country Planning, or by local government which has delegated authority from the Commissioner.

When delegated authority is given, a concept plan is submitted to the relevant council. Following this stage, a detailed plan is assessed by council. When delegated authority is not given, concept plans must be referred to the Commissioner. Tasmanian planning schemes contains provisions which stipulate lot sizes.

Box 6: The land development process in Tasmania

Developer liaises with council.

Developer prepares estate plan.

Council assesses and determines application.

Approval in-principle given by council.

Developer prepares final plans. Plans assessed and determined by council.

Sealed plan to TCPC.

Registration by Recorder of Titles.

E7 Northern Territory

In the Northern Territory residential land planning occurs in two discrete stages. First, the Department of Lands and Housing conducts strategic planning. The second stage involves the Department advising the Joint Planning Group its role is to ensure that planning and delivery of land and infrastructure are undertaken in an efficient manner. The Northern Territory Planning Authority has responsibility for residential development plans.

The institutional framework and land supply pipeline

The institutional and planning framework in the Northern Territory is highly centralised. The Department of Lands and Housing plays a role in strategic planning; is the focus for co-ordination of physical and social infrastructure; and provides technical co-ordination of subdivision.

Councils in Darwin, Alice Springs and Palmerston have no direct planning powers but are represented on the Northern Territory Planning Authority. Once the decision to release land is made, the exercises its statutory planning functions. It considers the application with Authority reference to the Power and Water Authority, the Department of Transport and Works, the Conservation Commission, Health and Community Services and local government authorities.

Box 7: **The land development process in the Northern Territory**

Strategic plans prepared by department of Lands and Housing.

Strategic plans assessed by Joint Planning Group and endorsed by the Minister.

Developer prepares estate and subdivision plans.

Plans assessed and determined by planning authority.

Engineering designs prepared by developer.

Designs approved by utilities authorities.

Completed subdivision works approved by service authorities.

Final plans to Surveyor General.

Titles issued.

All development in the Northern Territory is undertaken by private developers, who may buy leases and are subject to a development plan through the Department of Lands and Housing. After development the individual land parcels are converted to leasehold with the Government retaining a buy back mechanism.

E8 Australian Capital Territory

Prior to 1987 residential land development in the Australian Capital Territory was controlled by the National Capital Development Commission (NCDC). After the 1987 Budget the responsibility for land development was transferred to the private sector, with the Government retaining responsibility for the major aspects of planning, the release of land for development, the provision of major infrastructure and the maintenance of standards. The Territory Government has stated its intention to re-enter land development.

The institutional framework and land supply pipeline

Land development in the Territory occurs within the framework of the Territory Plan. Planning is the responsibility of the National Capital Planning Authority a Commonwealth agency - which prepares and administers the National Capital Plan; and the Australian Capital Territory Planning Authority which is responsible for the Territory Plan which must be consistent with the National Capital Plan.

The Australian Capital Territory differs from other States and Territories in that the Government initiates subdivision, and once land is developed it is held by individual lease. Land is not available as freehold title but is leased from the Commonwealth, usually for 99 years. The residential land development process in the Australian Capital Territory is outlined in box 8.

Box 8: **The land development process in the Australian Capital Territory**

Five-year development program prepared by the Department of the Environment, Land and Planning (DELP).

DELP submits demand projections to ACT Government.

ACT Government determines location and quantity of residential land.

determines appropriate land releases.

ACT Government constructs most major infrastructure.

Developers submit public applications to bid for broadarea packages of land.

Broadarea land offered for development to approved bidders.

Developer submits implementation plans, subdivision plans and detailed engineering designs.

After approval, developer constructs works.

Following completion of works, developer seeks clearances.

Developer prepares detailed deposited plan, submits it to DELP.

Individual long term leases issued for allotments.

APPENDIX F: THIRD PARTY COSTS AFFECTING URBAN SETTLEMENT

This appendix describes the costs of urban settlement which fall on third parties and considers some estimates of their magnitude. Ways of achieving improved outcomes for pollution and other third party effects such as noise, congestion, accidents and heritage preservation issues are examined.

F1 What are third party costs?

Third party costs (and benefits) refer to circumstances where markets fail to reflect the full range of costs (and benefits) associated with production and consumption. Where this arises, the goods and services involved are said to generate 'externalities' -other terms include side-effects; spillovers; and third party costs or benefits. Meade (1973) describes an externality as:

> ... an event which confers an appreciable benefit (inflicts an appreciable damage) on some person or persons who were not fully consenting parties in reaching the decision or decisions which led directly or indirectly to the event in question.

Many activities generate third party effects. The question is whether they justify some form of government intervention, which itself involves costs. Ascribing values to third party costs is difficult (Hufschmidt et al. 1983 contains a useful taxonomy). Some approaches have had to rely on questionable assumptions.

Information on some third party costs, how they arise, and their impacts is shown in table 1.

F2 Environmental concerns about urban settlement

The environmental impact of urban life is a matter of concern in the community. The Department of the Arts, Sport, the Environment and Territories said that urban settlement has ramifications for energy use, waste disposal, water catchments, air pollution and noise (Sub. 62). These issues were raised by many groups in the community.

Table 1: **Some urban externalities**

Externality	*Origins*	*Impacts*
Air pollution	Vehicle emissions, atmospheric factory discharge, combustion stoves, electricity generation	Human health (sickness, stress). Aesthetic impact. Damage to buildings (corrosion, deterioration)
Waterways pollution (costal and inland)	Solid wateleaching from landfills, sewage and stormwater, urban run-off	Health impacts. Aesthetic impacts Reduced leisure
Noise	Transport and industrial activity	Stress, hearing damage, reduced leisure activity
Congestion	Road usage	Increased private transport costs (tyres, brakes) and travel time. Loss Of production stress and accidents
Accidents	Road usage	Death, injury, pain and suffering. Congestion
Reduced biodiversity	Greenfields development.	Loss of amenity, aesthetics, reduced
(loss of flora and fauna)	urban consolidation of open space	Biodiversity - forgone opportunities From medical research
Hertiage loss	Urban renewal and greenfields Development	Loss of amenity, destruction of sites with historical and cultural value
Flooding	Undercapacity in stormwater Disposal; concreted areas (high density); land Degradation	Stress, loss in productivity
Neighbourhood amenity effects	Impacts of dilapidated structures, solar access, noise	Aesthetic impacts and reduced house valuations
Climate change (greenhouse)	Industry, transport, agriculture	Unknown

For example, the DHHCS stated:

> The sprawling form of Australian cities both derives from and has created a profound dependence on private motor vehicles… [and] has significant implications for energy consumption and air and noise pollution (Sub.85, p. 29).

Newman and Kenworthy (1991) said:

> In all Australian cities the problems of sprawl impacting on farmland and bushland has led to one contentious issue after another in recent years.

The Sydney Water Board (199l b) said:

> ... the Hawkesbury-Nepean River catchment has a finite capacity to absorb the activities of a city growing within and around it. It is our responsibility as stewards of this natural resource to ensure that this limit is not exceeded ... (p. 7 1).

At the initial public hearings, Roseth stated that:

> ... the 3.7 or 3.8 million people who now live in Sydney have abused the environmental capacity of the region ... there is not sufficient drainage and there's too much pollution and not enough treatment of sewerage and so on (transcript, p. 478).

Infrastructure issues

Bennett argued that urban infrastructure has been provided by governments on a needs basis with the price often set at zero or well below the long run marginal cost of supply. When the limit of existing facilities is reached, funding is sought for expansion. In effect neither the internal (infrastructure) nor external (third party) costs have been recovered from users - but efficiency in patterns of urban settlement dictates that they should be. Bennett's summary of the effects of these practices on the environment is shown in table 2.

A closer link between infrastructure pricing and provision would contribute to alleviating third party costs. Prices for government services should reflect opportunity cost (the value of resources in the best alternative use). The use of environmental resources likewise involves opportunity costs which should be reflected in prices. Where prices are too low, the demand for urban infrastructure may be excessive and environmental resources overused. For example, underpricing can encourage excessive investment in, and consumption and degradation of, water resources.

Location and density considerations

Some locations are more environmentally sensitive than others:

> Examples are areas where atmospheric inversions, or lack of ventilation, are endemic, and catchments where the receiving waters cannot dilute effluents, or are themselves at critical levels through biological or chemical pollution (Urwin and Searle 1991, p. 5)

Where such locational considerations are not reflected in pricing and charging regimes, the potential for environmental degradation is enhanced. Allied to concerns about the location of urban settlements on the environment are concerns about their density:

> Sydney’s urban structure is such that low density housing has pushed a greater proportion of new development into the Hawkesbury-Nepean basin, where problems of air and water pollutant disposal are higher (Urwin and Searle 199 1, p. 2).

Table 2: Possible environmental consequences of selected government policies

Policy	*Possible environmental consequences*
Provision of public roads at zero marginal cost	Air used for vehicle emissions Air used for noise transmission Land used for roads Water runoff accelerated Expansion of city size with associated increase in resource use The hierarchy of urban centres is affected with reallocation of environmental resources used
Provision of subsidised public transport	Environmental consequences of private transport altered Sized and composition of cities altered with associated effects
Provision of water storage and reticulation systems at subsidised prices	Land used for storage areas Expansion of urban settlement Urban hierarchy effects
Provision of sewerage / drainage systems at subsidised prices (often zero)	Water resource used for liquid waste disposal Land used for treatment facilities Expansion of urban settlement Urban hierarchy effects
Provision of solid waste disposal services and dump sites at subsidised prices	Land used for dump sites Water and air resources affected Expansion of urban settlement Urban hierarchy effects

Source: Sub. 62. pp. 4-5.

Many argue that low density development is responsible for a number of environmentally undesirable effects. Urwin and Searle (199 1) and Newman and Mouritz (199 1) have stated that low density development:

- consumes large tracts of land;
- leads to an increase in built-up and paved areas adding to run-off of rainwater and petroleum products;
- increases energy usage and air pollution by decreasing the viability of public transport;
- increases energy usage costs because single story detached dwellings have poor thermal capacity;
- promotes high water use patterns (for gardens); and

- displays poor recycling rates owing to higher collection costs.

Others have pointed to positive environmental aspects of the existing urban structure. For example, according to Troy:

- more domestic waste can be composted on urban blocks and resource recovery and recycling programs can be more easily managed;
- the traditional house and land development reduces rainfall runoff and associated drainage problems;
- garden and tree plantings associated with traditional urban blocks have positive effects on air pollution and wildlife;
- traditional houses require lower levels of sound insulation and result in lower levels of ambient noise;
- traditional houses increase the scope to utilise solar and wind power; and traditional houses allow a measure of self-sufficiency.

Neutze said that more public open space is needed in higher density housing areas to provide acceptable levels of amenity because of the loss of private space in open back yards. He said that claimed reductions in energy consumption and in air pollution as a result of urban consolidation were simplistic, as they assumed that employees worked in the city centre and lived in the suburbs. Neutze argued that urban consolidation could result in less intra-urban decentralisation of jobs and services with little effect on the total volume of travel.

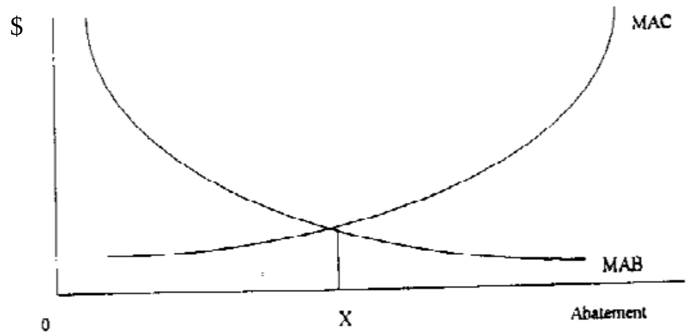
Hensher (1992), like Bennett, emphasises the role of pricing (rather than strategies to shape densities) to achieve better environmental outcomes:

> The issue of the shape and density of urban areas should be an outcome of the pricing process (and associated resultant investment activity) and not a constraint to it. The density and dispersal characteristics of our cities do not have to necessarily change in any major way to create a circumstance more conducive to major social and environmental gains. Society will not benefit by a one-sided strategy to starve the suburbanisation preference any more than starving the consolidation desire.

F3 Environmental pollution: how much is too much?

The existence of an externality does not necessarily imply that it should be eliminated. Mitigation action is not costless. A zero level of air pollution, for example, might entail closing down many industries and banning motor transport. As both costs and benefits of mitigation action need to be considered there is a presumption that there exists an optimal level of pollution. One way of representing the optimal level of pollution is by reference to the costs and benefits of pollution abatement (see box 1).

Box 1: **Optimal level of abatement**



The marginal abatement costs (MAC) curve has a positive slope reflecting the assumption that the more existing levels of pollution are reduced, the more the cost of further abatement increases. For example, a car can be modified to reduce its emissions through the use of unleaded petrol and a catalytic converter. Further reductions in emissions may require much more expensive modifications.

The marginal abatement benefits (MAB) curve has a negative slope on the assumption that as the level of abatement increases, the benefits of fluffier abatement increments decrease. For example, the incremental benefit of reducing the risk of illness from contaminated water from one in ten, to one in 10 000 may be large, whereas reducing the risk from one in 10 000 to one in ten million may confer little observable benefit.

OX represents the optimal level of abatement (MAC=MAB). If abatement exceeded OY, then MAC would exceed MAB indicating that net benefit would be increased by moving back to OX (that is, reducing abatement measures). On the other hand, if abatement were less than OY, MAB would exceed MAC. In this case net benefit would be increased through more abatement.

While the analysis illustrates optimal pollution abatement, diagrammatic representations abstract from the real world. With environmental pollution it is extremely difficult to measure external costs and benefits, largely because there are no observable prices to facilitate valuation. Thus, determining optimal levels of pollution may often be infeasible. In these situations it may be necessary to set feasible target levels of acceptable emissions.

Of course, feasible goals tend to be arbitrary standards for reduction. Thus, rather than being preoccupied with optimality, the emphasis is on choosing the best instrument to attain such standards: it is acknowledged in the literature that 'arbitrary' means that the standard is not necessarily optimal. Meeting a target via this approach may result in a level of pollution different from that which would arise from a full cost-benefit analysis with the target set to equate marginal costs and benefits - were it possible.[14]Instruments for achieving better environmental outcomes

Some market-driven responses to environmental concerns are occurring, for example, labelling of products to indicate their biodegradability. However, achieving better environmental outcomes usually requires some form of government intervention to provide information; regulate activities; change taxes or subsidise some market prices; allocate or alter property rights; or provide some facilities outright. Some policy instruments are outlined in box 2.

Operating within the constraint of achieving a practicable (rather than optimal) standard, the most efficient instrument is one that achieves the target at the lowest resource cost. However, additional factors to consider when a standards based instrument is chosen include:

- *Dependability:* concerns how quickly and effectively the instrument meets the target. This may be crucial where there is a stock rather than a flow pollutant problem.
- *Ease of monitoring and enforcement:* required to ensure that firms do not emit more than their specified emissions levels and to assess compliance.
- *Flexibility:* the instrument should be capable of achieving its goal in changing economic circumstances.

The Commission (IC 1991d) found that only tradeable permits are both dependable and efficient (irrespective of how allocated). Regulation can be dependable but not as cost effective and taxes/subsidies are cost effective but not as dependable (they may require some iteration). Nevertheless, a case by case approach is required to choose the most appropriate instrument. Economic instruments provide greater flexibility, more opportunity to reduce third party costs below prescribed benchmarks and are generally more efficient than command and control measures. There is scope to use them further as an adjunct to regulation in Australia.

[14] These matters are surveyed in IC (1991a) and there is extensive discussion of this issue in the literature - for example, see Baumol and 0ates (1988); Bohm and Russell (1985); Common (1989); and Tictenberg (1990).

Box 2: **Instruments for environmental policy**

1 Education and suasion

- publicly, social pressure against harmful activities
- dissemination of information, research and education

2 Command and control (regulation)

- regulations preventing specified uses of resources
- regulations limiting the permissible levels of pollutants, or the permissible level of use of extraction of resources
- specification of mandatory processes or equipment
- regulations preventing certain activities and sale of certain goods
- specification of the use and/or disposal of certain types of materials

3 economic instruments (price incentive modification)

- taxes and charges based on environmental damage and emissions of pollutants (for example, effluent charges)
- taxes or tax exemptions on goods and services to influence demand (for example, product charges)
- charges to cover costs of provision of services (user charges) and administration
- subsidies and taxation allowance based on reductions in emissions or the use of more environmental friendly equipment
- refundable deposits
- rehabilitation and performance bonds
- tradable permits and licenses

4 Pure market approaches

- (re)allocation of property rights over environmental assets to private hands to provide a proprietary interest in improved environmental quality (for example, private conservation lands)

5 Government provision

- prevention and treatment facilities (for example, sewage)
- regeneration activities (for example, reafforestation)

F4 Some international comparisons

International comparisons of pollution levels offer an opportunity to provide some perspective on the size and significance of environmental problems in Australian cities. Unfortunately the collection of data to facilitate this task has only been undertaken relatively recently. The ministerial meeting of the OECD Environment committee in Paris in 1991 agreed to ensure through appropriate coordination, the development of object, reliable and comparable environmental statistics and information at an international level. The OECD's *Environmental Data Compendium* (1991b) was an initial attempt at this task and has been used together with the ABS publication, *Australia's Environment: Issues and Facts* 1992, which contains data from 1982-87, as the primary sources for these comparisons.

An important caveat is in order. At this relatively early stage of data collection, there are large differences ’m the definitions of emission sources and in the measurement methods used in different countries. Even so, it appears that in general Australian cities do not fare badly when international comparisons are drawn.

Atmosphere

A comparison was undertaken for sulphur dioxide, nitrogen oxides, carbon monoxide, particulates and lead. In the case of sulphur dioxide, concentrations in Australian cities were generally well within the acceptable level and very low by international comparison. For example, the level in Melbourne ’m the period 1982-87, measured either as a one hour or 24 hour average, was less than 50 per cent of the targeted acceptable level.

Oxides of nitrogen, (NO_X), are produced by man-made sources such as fossil fuel combustion, biomass burning and the intensive use of fertilisers. Motor vehicles are the principal source in the production of NO_X ’m most cities, contributing over 80 per cent in Canberra, Melbourne and Sydney. The observed levels (1987 data), of nitrogen dioxide ’m Canberra were within acceptable levels. However the *extreme* of nitrogen dioxide concentrations in Sydney and Melbourne have exceeded the standard during the 1982-87 period while the mean levels remained well within the acceptable levels. Internationally, only the mean levels were given and these almost uniformly exceeded the mean levels in Australian cities.

Carbon monoxide is mainly produced from fossil fuel combustion sources and does not appear to be a major problem in Australian cities. For example, one hour extreme values as well as mean values were well within the acceptable levels in Australian cities in the period 1982-88, with mean levels generally less than 20 per cent of United States Environmental Protection Agency standards.

Particulates, or dust are defined as large particles having relatively short atmospheric residence times. Particulate generators include industry, agricultural and mining activities, transport and construction and demolition activities. The level of particulates depends upon the topography and meteorology of the air basin as well as the nature of specific sources. Data provided by ABS suggest that there was improvement in Brisbane and Sydney in particulate levels over the period 1971-89.

Nevertheless, further data show that the level of fine particle concentrations has exceeded the standard in some Australian locations. For example, the *extreme* values for the airborne particle index for Melbourne were well above the acceptable level between 1982 and 1987. However, breaches of the visibility acceptable level, the most easily observed effect of particles, fell from almost 150 breaches in 1982 to about 60 in 1987. International levels suggest that Sydney, while roughly comparable to Rome and Berlin, exceeded most reporting OECD countries in this category.

Lead is one of the most significant air pollutants owing to its toxic nature. Sources include: petrol engines, refineries, battery manufacture and some recycling activity. In the Australian context, over 90 per cent of lead emissions derive from leaded petrol sources. As the car fleet is replaced, a great improvement in levels of lead pollution is anticipated. In the period 1982 to 1987 there were significant improvements in all Australian cities in the levels of lead pollution. But the maximum three monthly moving average of lead in the Sydney CBI) was still in excess of the State Environment Planning Policy objective in 1987 (1.6 micrograms per cubic metre versus 1.5 micrograms per cubic metre) whereas the Melbourne CBI) had been well below the objective from 1983. If the clearly established trend in the Sydney CBI) data continued after 1987 (with improvements averaging 0.4 micrograms per cubic metre), it should also presently be well below the targeted objective. Figures for lead are not reported in the OECD data.

Land and water

international comparisons are possible for broad land uses such as the extent of forests, wetlands and land given over to national parks. However, data which would enable comparisons of the environmental impact of landfills or other forms of solid waste disposal, in terms of, for example, leaching into waterways, are not available.

Data on water is generally reported in terms of river basins in international studies and so is not directly useful for comparison with Australian cities. However, at this stage, with the possible exception of Adelaide, it seems that pollution of drinking water is not an environmental problem for Australian cities. A more detailed description of water pollution follows in the next section.

F5 Water pollution

A by-product of urban settlement is the production of household and industrial wastes. Households create wastes directly (sewage) and industry creates wastes in producing goods and services. Much of this waste is in liquid form which can impose significant third party costs in terms of the eutrophication of inland waterways and pollution of coastal environments (solid wastes can also leach into waterways). Those who reside near or use the waterways may be adversely affected, but, in the absence of any property rights over the affected areas, they have little recourse for forcing improvement or claiming compensation. This section examines water pollution problems with emphasis on Australia’s largest urban settlement, Sydney.

The problem

It has been claimed that the Parramatta and Cooks Rivers, and the Nepean-Hawkesbury river system which drains most of the area west of Sydney, are showing signs of stress. The latter is the most significant river system for Sydney. Some salient features include:

- it is the major source of drinking water for the Sydney region with eleven storage dams in its catchment;
- over 97 per cent of Sydney's water needs are provided from these dams (in average and above average rainfall years);
- the river receives treated effluent from 23 sewerage treatment plants in the catchment serving about 480 000 people - the Sydney Water Board (SWB) dams tributaries within the catchment and discharges sewage effluent into the river;
- the SWB is to spend about $100 million in improving the quality of the river system and the Blue Mountains streams feeding into it; and
- the catchment is the focus of Sydney's urban development for the next 15 to 20 years.

The last point which relates to the location of urban settlement has been the subject of much recent comment. The SWB (1991b) said:

> Direct sources [of contaminants] include treated and untreated sewage discharges, point source industrial and agricultural wastes, river-bed sand and gravel extraction and various types of tourism and recreational activities. Indirect sources include land clearing, urban development, water storage, animal wastes, irrigation, fertiliser and pesticide use and solid waste disposal (p. 6 1).

Latham, (1992) argues that environmental concerns justify the setting of a maximum population target for Sydney:

> It is undeniably in the interests of Western Sydney to place a moratorium on the development of greenfields estates ... The evidence in Sydney's west now suggests the balance must shift from housing to the environment (pp. 74, 80).

How a 'better' balance could be achieved was noted by the SWB (199lb).

> ... development in western Sydney must consider the entire current and future costs of urban fringe development in terms of natural resource management and environmental protection. The short and long term economic and environmental impacts of particular developments must be considered within the contexts of the river itself... (p. 62).

The Board concluded that in the absence of the 'courage' to make difficult decisions about the river catchment:

> ... then most certainly the river system will not be able to sustain western Sydney's growth ... (p. 7 1).

Some idea of the costs of environmental damage to waterways can be gauged from SWB budgeted expenditures to improve outcomes for the Sydney metropolitan area. The Board plans to spend $600 million over the next ten years to improve the quality of effluent discharged into the Nepean-Hawkesbury system. This is part of the *Clean Waterways Program* which comprises a $6.25 billion program over 20 years to clean up beaches, harbours and Sydney waterways. The *Special Environmental Program* funded by an environmental levy, estimated to raise $440 million over five years, is a major component of the *Clean Waterways Program.*

Current practice

Regulated discharge limits

Under current arrangements, sewage other than some trade wastes is generally unmetered so it is difficult for operators to introduce volume charges which could encourage lower levels of waste. Therefore authorities have little scope to transmit to users the costs of changing quantities of waste - let alone environmental impacts. In contrast, private waste disposal arrangements rely on measurement. For the provider, such information is vital for profitability and for the user it is a way of assessing that services paid for are delivered. Decisions about sewer provision and extensions m the absence of this information exacerbate environmental problems.

Sewage, at various stages of treatment, is dispersed into oceans and rivers affecting users such as fishermen and bathers. The usual response is for an Environmental Protection Agency (EPA) to assess damage, and constrain discharges accordingly. Ideally an EPA should permit discharges such that the total cost to those affected from the last unit of discharge equals the benefit to generators of being allowed to discharge it (as outlined in box 1). But, this information will in many cases not be discoverable (for example, owing to freerider and valuation problems). In practice, an EPA cannot, except fortuitously, set the optimal discharge limit.

Trade waste charges

The ABS reported that in 1984 over 33 000 gL of industrial wastes were discharged into sewers and drains in Australia *(Australia's Environment: Issues and Facts, 1992).* In Sydney, charges are levied on broad pollutant categories where quantities are limited by trade waste agreements which licence allowable quantities. Sewerage operators may also be required to obtain a licence. The SWB reports that total agreements now exceeded 2500 (SWB 1991a). Daily mass limits for non-domestic pollutants have also been introduced.

A general environmental levy

Where environmental damage costs cannot be recouped from polluters owing to diffuse sources of pollution or damage caused by previous generations (sunk costs), beneficiaries of environmental enhancement may be required to contribute. The Commission's water report considered that a general environmental levy applied to Sydney households is appropriate:

> ... households pay an environmental levy of $80 a year (for five years), to upgrade sewage treatment plants, clean up beaches and renovate stormwater systems. This is an appropriate way to finance such works. Specific purpose levies inform the community of the cost to individuals of environmental enhancement as well as the use to which their contribution is applied (IC 1992, p. 172).

However, this should not preclude more area-specific charges being levied where appropriate.

Urban run-off

Urban run-off is seldom regulated, even though it can contain heavy metals, nutrients, grease and suspended solids which pose a significant environmental problem. The SWB is investigating charging local councils for the discharges into the drainage system from their jurisdictions. Concerns about debris in stormwater drains led the New South Wales Government to approve progressive differential stormwater management charges as individual drainage area enhancements occur and the concurrent elimination of property-based taxes (SWB 1991a). The form and funding will be negotiated through Catchment Advisory Committees.

Local council stormwater drainage boundaries do not align with natural catchment areas, making it difficult to identify responsibility for adverse environmental effects. The SWB contends that its efforts to improve waterways through improved sewage treatment are impaired by the effects of drainage. It is considering charging local councils for discharges into hunk systems; integrating sewerage and drainage systems; and redressing local council fragmentation though a regional waste management strategy.

The Board is also considering a strategy under which drainage infrastructure in new areas becomes its property, allowing better siting in the catchment - local councils are normally constrained to sites within their administrative areas. The New South Wales Government has required the treatment of storm water and tertiary level sewage processing at Rouse Hill (within the Hawkesbury Basin).

Scope for improvement

Reform charging and pricing

Bolton et al. (1971) report that sewage comprises 99.9 per cent water. This suggests that user charges for water, as opposed to relying on fixed entitlements and property-based charges as some utilities do, would reduce the total quantity of sewage. Such action would presumably result in higher use charges which, in combination with the removal of 'free ' water' allocations, should encourage water re-use and the use of treated effluent (for example, golf course watering, industrial use of treated effluent).

In terms of trade waste user charges, Niland (1991) states that:

> The Water Board's Trade Waste Policy was revised in early 1990 to provide for a progressive increase in charges, in essence as a pollution tax on the creation of trade waste. The increased charge provides an incentive for firms discharging trade waste to the sewer to examine their processes and find more cost effective ways to reduce, reuse or recover materials from their trade waste. The pricing strategy incorporates mass and concentration and differentiates between industrial waste of domestic strength, and the discharge of non-domestic substances such as heavy metals, and provides an incentive for dischargers to bring effluent concentrations down to set standards (p. 142).

However, as not all local authorities have a trade waste policy this is an area for further work.

Ensure locational impacts are reflected in charges

it is technically feasible to achieve sewage and stormwater treatment standards at any level for ocean outfall and river emissions. What level is appropriate depends on the costs and benefits. At present it appears that inland dumping is about ten times more expensive than ocean outfall. While recognising that there are problems with both forms of effluent disposal, these numbers suggest, however, that if these treatment costs are masked by uniform charging practices, there is likely to be over development in areas using river disposal (such as the Nepean-Hawkesbury basin).

Thus, there is a need to ensure that locational impacts are reflected in charges. If a particular development has a more serious environmental impact or requires more expensive mitigation measures than an alternative, this should be reflected in charges. Whereas a differential pricing approach could lead to the abandonment or modification of an environmentally damaging development, uniform charges may mask environmental costs thus encouraging a development which may not have proceeded had clear price signals, that included potential environmental impacts, been transmitted.

The SWB has been frustrated in its attempts to introduce location-related charges. For example, new developments at Freeman's Reach were to have involved SWB-funded improvements with residents paying higher rates. This caused an outcry and the residents now pay the Sydney-wide uniform charge. The Board also sought to upgrade drainage around Cabrarnatta Creek with benefiting residents around Hoxton Park to pay a supplementary charge. Following a public outcry, it appears that the work will not go ahead. Provision of sewerage infrastructure at Palm Beach will cost residents $300 to $500, compared to its true cost of around $1500 per dwelling, reflecting that it is at the end of the system, encompasses difficult terrain and requires a lot of pumping.

Topography is a vital determinant of locational costs. Water run-off from Bargo (south) and Govett's Leap (Blue Mountains) runs into the Nepean-Hawkesbury. Effluent released into that system requires tertiary treatment and nutrient scrubbing with operating costs between $0.80 and $3.00 per kL. In comparison, current costs of primary treatment of effluent for dumping through ocean outfalls (coastal plants are planned to be upgraded to secondary treatment) are about $0. 11 to $0.15 per kL. The current Sydney-wide charge is $12 per year.

The scope for economic instruments

Problems with waterways pollution that affect mitigation options include:

- *Numerous sources:* waste dischargers consist of many hundreds of firms and households making monitoring difficult.
- *Diffuse sources:* although untreated stormwater and urban run-off (the biggest source of pollution in the lower Yarra River in Melbourne) can be environmentally damaging, it may not be possible to trace the sources of contaminants.
- *A myriad of contaminants:* the small quantities of different waste products dumped into sewers could number in the thousands and may not be significant enough to support permit trading. Moreover, these chemicals could react within the sewer to form other hazardous compounds.
- *Sunk costs:* There may be cases where past pollution is a sunk cost (for example, damage caused by previous generations).
- *Jurisdictional impediments:* Local council drainage boundaries do not align with natural catchment areas.
- *Monopoly provision:* Sewage treatment by a monopoly provider can mask cost and benefit signals and reduce incentives to seek information on quantity usage which could improve overall efficiency.

Many of the instruments noted in box 2 could be applied to a small number of firms, emitting a relatively small number of prescribed effluents from a fixed point amenable to 'end-of-pipe' monitoring. But many pollution processes do not fit this model. A mix of market measures in tandem with regulation is appropriate to control damaging water use. The OECD (1991a) has stated that water pollution can be addressed using emission, user and product charges. It saw a role for marketable permits and an indirect role for deposit refund systems for pollutant containers to recover residues contained in them.

Preventing eutrophication of waterways depends on controlling nutrient phosphorus loads from point sources such as sewage plants, and diffuse sources such as the injudicious use of fertilisers, and urban run off. Where nutrient problems can be traced to farm run-off, transferable water rights, changes in pricing for irrigation and taxes on fertilisers should be explored. Such source specific approaches may be more effective (and equitable) than charging all metropolitan users for clean-up costs.

Pollution taxes could be applied to discharges affecting water quality. However, the administrative costs of assessing taxes and liability across polluters (or the efficiency tradeoffs associated with a uniform tax rate) led the Commission, in the Water report, to consider that they were useful in limited circumstances.

The scope for using tradeable discharge permits is limited to relatively homogenous point source discharges. However, while the application of permits for diffuse sources of pollution will remain a problem for some time, the 'homogeneity' consideration may not be a strong constraint. Kimberley Clark informed the Commission's water inquiry that discharge entitlements could be specified in terms of toxicology. Indeed, biological oxygen demand is already used by some authorities as a charging basis for effluent treatment.

Halm and Hester (1989) report some success with tradeable discharge permits adopted by the Colorado State Government on phosphorus discharged into the Dillion Reservoir. The Commission's water report notes the Salinity and Drainage Strategy of the Murray-Darling Basin Commission may provide a foundation for future trading in salinity credits (IC 1992, p. 163).

Tradeable permits would complement rather than replace regulation. The allocation and establishment of standards to complement the permits needs to be resoled. Some recommendations of the Water report are listed in box 3. If implemented together with the recommendations on infrastructure provision and charging for services discussed in this report, they would ensure that environmental considerations form part of investment and planning decisions.

Box 3: **Water report recommendations:**

1. Except where subsidisation of costs is an explicit government policy, investment in new urban WSD infrastructure should be premised on full cost recovery, including the designated rate of return on capital. The authority concerned should consider whether the willingness to pay of customers who will benefit would be sufficient to permit full cost recovery, if differential charges could be set for those customers.

2. Urban authorities should pursue full cost recovery on the provision of water through a two part tariff, comprising an access charge plus a usage charge for each kL of water supplied. The usage charge should be set to cover the costs of making additional water available plus a loading to ration supply when capacity in the system is scarce. The access charge should be set so that, in total, the desired revenue yield is achieved over the life of an asset system.

4. WSD authorities should consider charging for sewerage services according to the percentage of water returned to the sewerage system.

5. WSD authorities which are faced with significant trade waste discharges should have in place charges based on the quantity and strength of the waste discharged.

25. State Governments should ensure that Local Governments are accountable for stormwater and other run-off leaving their boundaries.

31. The States should formalise water entitlements for environmental purposes. Where systems are fully, or close to fully committed, water for the environment should be purchased from licence holders.

32. Governments should investigate the application of tradeable discharge permits.

33. Regulators, before setting standards, should undertake an assessment of benefits and costs, including an assessment of alternative technologies. The process should explicitly canvass consumer’s willingness to pay for improved environmental outcomes. Such analysis would be one input into a decision-making process which would also embrace issues of sustainability and intergenerational equity.

34. Environmental monitoring by an agency or authority other than the service provider is necessary to ensure that failures to meet standards are made public. Summary results of monitoring should be released in a form readily accessible to the media.

Source: IC 1992, pp. 11, 16, 18.

The first national guidelines on water quality were released at a meeting of the Australia and New Zealand Environment Conservation Council in November 1992. As part of the National Water Quality Management Strategy, the guidelines set down scientific levels for pollutants and other substances such as pesticides, heavy metals, algae, faecal bacteria, natural toxins and industrial pollutants. The guidelines also recommend limits for water quality factors such as colour, taste, odour, turbidity, salinity, hardness and chemical treatment.

F6 Air pollution

Air pollution can impact on human health in a variety of ways (table 3). It also damages buildings, as well as being aesthetically unpleasing.

Table 3: Health and ecological effects of some common air pollutants

Pollutant	*Major effects*
Carbon monoxide	Affects cardio-vascular systems and central nervous system
Nitrogen dioxide	Causes bronchitis, lowers resistance to ailments, component of photochemical smog, increases soil nitrogen levels
Sulphur dioxide	Obstructs breathing, irritates eye tissues, important factor in acid deposition
Lead	Contributes to Parkinson's disease exposure
Fluoride	Causes necrosis of vegetation
Ozone	Irritates eye tissues, aggravates asthma, inhibits plant growth

Source: *ABS 1992, Australia's Environment: Issues and Facts,* cat. no. *4140.0,* (based on data from the South Australian Environmental Protection Agency *1988).*

Measurement issues

Atmospheric pollution costs may be estimated by determining the costs of mitigation action (as in box 1) or by examining the costs of related health services. The latter faces problems in excluding non-human health impacts and in establishing causation between health and pollution. The Inter-State Commission (ISC) has undertaken analysis of the costs of air pollution attributable to the transport sector (table 4).

Table 4: Estimates of aggregate annual atmospheric pollution costs, Australia, 1989-90 ($ million)

	Automobiles	*Heavy duty petrol-engined vehicles*	*Heavy duty diesel-engined vehicles*
Interstate and rural	3.1	0.2	0.7
Urban	670.5	28.1	84.0
TOTAL	673.6	28.3	84.7

Source: *ISC 1990, vol. 2, p. 204.*

The ISC estimated the total cost, over all passenger kilometres, of atmospheric pollution at $673.6 million for automobiles and $113 million for heavy vehicles (petrol and diesel) in 1989-90. These estimates are based on United States estimates of emission damage costs per gram and emission levels per kilometre and the ISC advises that the estimates should be treated with caution.

The Commission strongly endorses this caveat. The relationship between emission levels and damage is non-linear - damage costs may grow slowly (or remain virtually constant) until the absorptive capacity of the receiving environment is reached, at which point damage costs may grow exponentially. Thus, applying damage costs per gram from the United States, where pollution levels differ from those in Australia, could be very misleading.

Locational and density issues

Setting aside concerns about greenhouse gas emissions (to which Australia is a minor contributor globally), if all of Australia's atmospheric pollution sources were evenly dispersed across the continent, pollution would not generally be regarded as a problem. This observation emphasises that the location, density and topography of polluter and receptor regions affect the severity of atmospheric pollution. The ISC (1990) noted that:

> Climatic factors also affect concentrations: high winds promote the dispersion of exhaust gases and high solar intensity assists the formation of secondary pollutants, known generally as photochemical smog (vol. 2, p. 20 1).

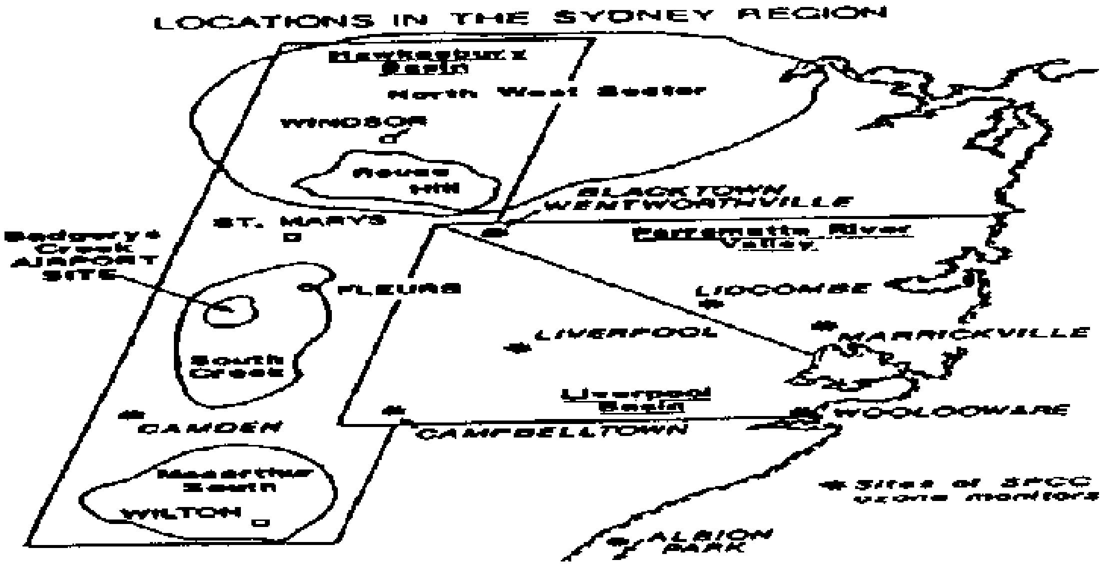
Although not well understood, the Hawkesbury Basin is an example of air pollution linked to weather and topographical and locational factors. The CSIRO (Johnson 1991) reports that the Basin can import pollution from other regions in Sydney when certain weather patterns arise:

> These streams of polluted air flow a little way out to sea but with the commencement of the sea breeze the pollution can be brought inland again, picking up a second dose of emissions as it makes its way across the city back towards the Hawkesbury Basin. Thus the Hawkesbury Basin is both a source and receptor region for airflows in the Sydney airshed and the quality of the air in the Hawkesbury region is influenced by the pollutant emissions from the rest of Sydney (p. 49).

At present the basin is relatively lightly populated but this could change if projected urban development (including that at Rouse Hill) is realised. More importantly, the Basin is reputed to frequently have calm weather, suggesting that new emissions *within* the basin will have poor dispersion. Figures 1 and 2 indicate location and airflow respectively.

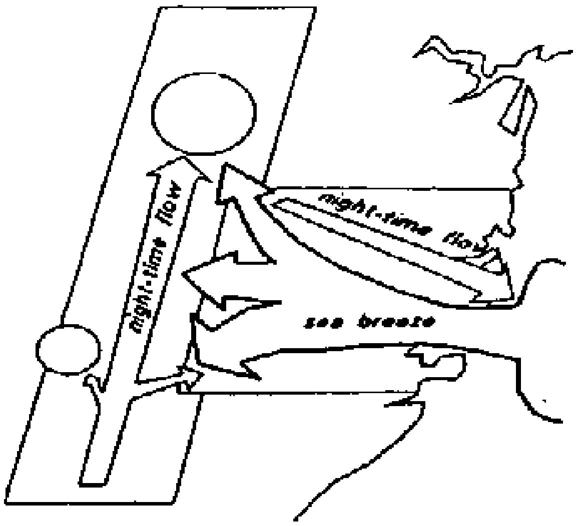
In terms of patterns of urban settlement, substitution away from the Hawkesbury Basin to say, increasing urban development (or density) in south or east Sydney will still create pollution problems for Basin residents when weather patterns are conducive to a 'pollution episode'.

Figure 1: **Locations in the Sydney region**



Source: Johnson 1991, p. 48.

Figure 2: **Some wind flows typical of the Sydney region on days with weather conducive to petrochemical smog episodes**



Source: Johnson 1991, p. 50.

Current practice

Instruments and regulatory approaches currently used to mitigate atmospheric pollution include mandatory pollution standards applying to new motor vehicles (catalytic converters); the introduction of unleaded petrol; and source specific command and control measures (pollution control licenses) backed by fines.

There is also a range of policies which have an incidental effect on atmospheric pollution. They include road user charging; subsidised public transport; tariff policies and sales taxes which increase the price of motor vehicle ’ s; fuel excises which may discourage use of motor vehicles; and urban form. If greater recourse to product charges (fuel taxes) were adopted, the elasticity of demand for fuel may be such that the tax would need to be inordinately large to have an impact.

Scope for improvement

In some cases, mitigation strategies could be location specific. For example, recognising that the Hawkesbury Basin suffers from poor air dispersion might suggest that there should be a lower permissible level of point source emissions in the region. This could be achieved, for example, through measures such as pollution taxes, controls on emissions and specifying certain types of wood heaters.

However, location-specific strategies may have relatively little effect owing to the mobility of pollution. Indeed, location specific charges could create incentives for air-polluting activity to relocate in areas where their pollution will migrate to the Basin. This suggests that more general charging and regulatory regimes may need to be examined. For example, mandatory pollution testing of vehicles and higher standards for new cars may be an option. Bennett notes that:

> Payment for the use of the air for vehicle emission disposal is also technically feasible (at the yearly registration check, a device fitted to the exhaust system is monitored much in the same way as tachographs are now monitored in heavy vehicles) (Sub. 62, p. 11).

Fixed sources of industrial air pollution are amenable to tradeable discharge permits which can be relatively easily monitored and enforced. The OECD (1991 a) suggested that air pollution be addressed through emission charges as a complement to, or a substitute for, regulation. It saw merit in deposit refund schemes to abate CFC emissions, for example, on refrigerators and airconditioners. The OECD also saw scope for applying marketable permits.

A study by Hahn and Hester (1989) reported that the United States EPA emission trading policy achieved cost savings exceeding US$1 billion. Tietenberg concurs that emissions trading has led to better outcomes than the command and control measures which preceded it. A description of the major components of the policy is listed in box 4.

Box 4: **EPA emissions trading terminology**

EPA emissions trading involves four different activities that firms can use: offsets, bubbles, banking and netting. Briefly, these activities are:

- Offsets are used when a major new emission source seeks to locate in a non-attainment area. The new emissions may be offset with emission reductions of an equal required credits may be obtained through internal or external trades.
- A bubble enables a firm to treat an existing plant with multiple emission sources as if it were a single source. Derived from the concept of a bubble enclosing an entire facility with emissions escaping through a single opening, a bubble allows a firm to adjust the mix of controls on individual sources to meet the total emission limit for the facility in a more cost-effective manner.
- Banking enables a firm to hold emission reduction credits as assets for future use or sale. Each State regulatory agency must develop its own administrative procedures in banking program. Details of these programs differ significantly across markets.
- By using netting, a firm seeking to increase emissions at one source in a plant can avoid classification as a major source by reducing emissions elsewhere within its facility. The reduction in emissions must be enough so that the net increase in emissions is below the level at which a new source would be considered a major source. Since the reduction used for netting need not be as great as the emissions increase that will be caused by the modification, a netting transaction can result in a small increase in emission levels.

Source: Hahn and Hester 1989.

Although Halin and Hester (1989) found significant savings, they also noted that some elements of the program had been little used:

> The emissions trading program. has yielded a mixed bag of successes and failures. The activity given the most attention - EPA-approved bubbles - has been least used. Nevertheless, the cost savings from emissions trading have been impressive, amounting to over a billion dollars. Netting and offsets have been the most successful aspects of the program, having been used by thousands of firms. Banking has been the least used emissions trading activity. In fact, the general failure of active markets in emission reduction credits to develop is the greatest disappointment of emissions trading. Until such markets exist, the full potential of emissions trading to reduce pollution control costs will go unrealised.

Bennett (1991) reports that the costs of pollution control in the Lower Delaware Valley geographical regions (bubbles) under permit trading are about five per cent of those which would arise under a command and control approach.

While emissions trading is an improvement on command it may not be applicable to all sources of atmospheric pollution:

> It appears that much of the trading activity in the United States has involved large corporations. Emissions trading is probably not equally applicable to large and small pollution sources. The transaction costs are sufficiently high that only large trades can absorb them without jeopardising the

gains from trade. For this reason charges seem a more appropriate instrument when sources are individually small, but numerous (such as residences or automobiles). Charges also work well as a device for increasing the rate of adoption of new technologies and for raising revenue to subsidise environmentally benign projects (Tietenberg 1990, p. 30.)

EPAs in Australia should investigate the use of permit trading regimes and the application of charges. Such measures are preferable to command and control which leaves little scope to reduce emissions below regulated levels or to adopt improved technologies. Process-oriented regulation can frustrate attempts to seek more efficient ways of meeting targets. Nevertheless, tradeable permits could be implemented under existing process-oriented regulatory standards:

Emissions trading integrates particularly smoothly into any policy structure which is based either directly (through emission standards) or indirectly (through mandated technology or input limitations) on regulating emissions. In this case emission limitations embedded in the operating licences can serve as the trading benchmark if grandfathering is adopted (Tietenberg 1990, p. 30).

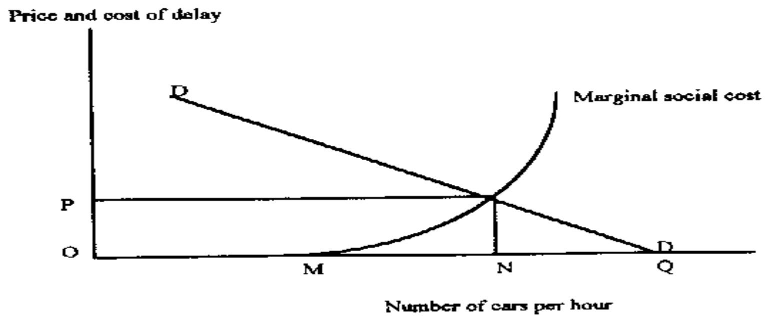
F7 Other transport-related third party costs

This section looks at some other third party costs including congestion, noise and accidents which are mainly associated with road use.

Congestion

A highly simplified urban road congestion situation is shown in figure 3. The curve DD indicates the demand for use of an urban motorway. The marginal social cost curve shows only the costs of congestion: that is, time delays that an additional user imposes on other motorists. When the number of cars per hour is less than OM there is no congestion (marginal social cost is zero).

Figure 3: **Urban road congestion**



Source: George and Shorey 1984.

As the volume of traffic increases beyond OM each extra car causes some congestion which increases journey times for existing users. Marginal social costs increase. As traffic volume increases, so too does congestion - at an increasing rate. If no attempt were made to restrict demand, traffic volume would increase to OQ and congestion would be considerable. The optimal traffic volume is ON, where the benefit to the marginal user of the road equals the marginal social cost.

Measurement issues

Transport costs essentially fall into costs on individuals (for example, oil, fuel, wear and tear, fuel tax, registration and licence fees); and costs borne by society but not (fully) by the individuals who generate them (for example, congestion, accidents, pollution and noise). A study in the United States (Lindley 1987) estimated urban freeway congestion as giving rise to over 1.2 billion vehicle-hours of delay, over 1.3 billion gallons of wasted fuel and over US$ 9 billion in user costs.

One estimate of congestion costs for Australia was made by the BTCE (Luck et al. 1988). It was based on the assumption that because the main benefit derived from new capital expenditure on urban arterial roads is reduced travel time, whatever benefit-cost ratios are used to justify such projects will give an indication of the cost of congestion. Assuming a level of expenditure on urban arterial roads of $900 million and an average benefit-cost ratio of 2 to 1, total congestion costs of $2 billion were estimated.

This assumption is open to question. It is difficult to envisage any accurate assessment of congestion costs which failed to estimate directly the value of time delays. A theoretical estimation procedure to incorporate time delays is discussed below.

Current practice

Individual drivers take account of congestion problems by factoring in the expected increase in trip duration and making choices about whether to drive, use public transport, change journey departure times or routes or not travel at all. This behaviour is more about adjusting to congestion problems than internalising third party costs because all motorists on congested roads and making closely substitutable (identical) journeys spend the same amount of time in traffic, irrespective of the value they place on time. Possible pricing approaches to congestion problems are considered in the following section.

The amount of congestion is dependent on the level of roads provision. Just as it would be inefficient to plan for and construct a one lane road to the CBI) and allow those journeying there to adjust accordingly, it would be equally inappropriate to provide roads on a needs basis without taking costs into account. This is the point raised by Bennett in table 2.

According to Hensher (1992), Houston, Texas, ameliorated its congestion problems through vigorous road building:

> [Houston] combined a 43 per cent increase in freeway capacity and a 32 per cent increase in arterial capacity with a commitment to allocate five per cent of the new capacity to transit ways for buses, car-pools and van-pools. Congestion peaked in 1984 and has steadily declined since then until in 1990 it was back to the levels experienced in 1979.

Vigorous road building could impact on other externalities such as air pollution. Public or private (BOOT) provision of tollways are other options. However, tollways, while reducing travel times between the source and destination fringes, may do little to ameliorate congestion at the source and destination.

Other (regulatory) approaches commonly adopted in urban centres include one way roads, bus-only lanes, traffic lights, pedestrian only zones and parking restrictions (or charges). However, as with many forms of regulation there is a need to be aware of consequences. For example, while parking restrictions might deter some users from driving cars into congested areas, they may also worsen congestion problems if motorists spend longer searching for a parking space. Through traffic would not respond to parking restrictions. Similarly, car free zones can only be usefully adopted in relatively small areas. Extending them across large areas of urban centres would be inequitable to those people residing in them.

Scope for improvement

There are a number of factors, other than regulation or price incentive modification, which can influence congestion problems. They include the location and density of residential areas and major work place s/opportunities; increases in intra-suburban work travel, and the numbers of people working from home; the information and communication 'revolution' which reduces the need for physical interaction; technological developments such as traveller information systems that allow individuals to make better choices about routes to avoid congestion; and the public transport system.

Most of these considerations reflect technological change and people's lifestyle patterns. However, an efficient outcome to congestion problems requires a mechanism which differentiates those who value time (or particular time slots) for road travel more than others.

A congestion tax

Referring to figure 3, a congestion tax set at OP would achieve optimal road use. In principle, OP can be estimated - a road authority could monitor a road and determine that traffic volume is around 5000 vehicles per hour at an average speed of 20 kph. By determining how much an additional vehicle reduces the average speed, an estimate of time lost per kilometre can be arrived at, say 0. 0 1 of a minute per kilometre per vehicle. Thus, total time lost is 5 000 times 0.01 which comes to 50 minutes delay per kilometre.[15]

For this estimate to be meaningful requires translation into a monetary benchmark, say $2 per hour. Therefore, a delay of 50 minutes per kilometre means a cost on other road users of $1.67 per kilometre ($2 per hour times 50-60 hour). The use of similar calculations for different volumes of traffic makes it possible to trace out a marginal cost of congestion curve. In tandem with appropriate information on the demand side, it would be possible to apply a congestion charge approximating OP.

Of course, information problems can be formidable. In this indicative exercise, $2 per hour was arbitrarily chosen. In reality how should that monetary benchmark be derived (wage rates, survey results)? Other problems include:

- how to estimate a meaningful and accurate profile of demand for an urban
- motorway;
- congestion varies according to the time of day (for example, peak hours) and the day of the week, suggesting multiple charges should be used. This adds to the problem of obtaining information;
- congestion is often related to the type of vehicle, suggesting differential charges for cars, buses and trucks; and
- whether aspects such as noise, danger to life and limb should be included in this tax or in other ways.

Finally, as noted in chapter B4, the relationship between road funding and user charges is an issue that has not been fully resolved.

A tax (OP) is one way of achieving the desired volume of traffic (ON). At some stage, the technology will be available at such a cost as to make it practicable for cars to be monitored for location specific road use by time with charges made accordingly. These types of measures are feasible in certain high volume areas such as Singapore where electronic monitoring is used to determine road user charges. Indeed, Bennett said that:

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[15] In this indicative example, the time delays are quite small. The 50 minute per kilometre total time delay comprises many small increments which not be significant to those individuals affected. Thus, some judgement about what minimum individual delay time should be aggregated to obtain an overall delay estimate may be required.

Road use pricing is now a technically feasible possibility (sensors in the roadway detect the electronic signal emitted by a car specific device and a computer calculates the running tally of journeys for which a fee is charged - eg the Sydney Harbour Tunnel) (Sub. 62, p. 11).

There it is infeasible to bring costs and benefits into line through pricing measures, an alternative approach may be to lower the price of public transport through subsidies. The drawback is that if public and private transport are not close substitutes the extent of subsidy may have to be very large with implications for the efficiency of the operator. These issues will be discussed in the Commission inquiry on urban public transport.

Density issues

Achieving urban consolidation is said to offer reductions in city size and a reduction in the role of the car and car related problems such as congestion, pollution noise and accidents. Proponents of urban consolidation often see higher densities as one part of a package including increased use of public transport and less reliance on private car use.

Many proponents of higher density living concentrate on cost minimisation believing that this somehow equates to welfare maximisation. This will not be the case if cost minimisation results in changes that people do not want. For example, in developed counties it seems that the highest order of living ’m an urban environment includes the benefits in terms of flexibility that a private car gives.

More important, however, is the lack of evidence that consolidation policies, without stringent limits on car use, would moderate third party effects such as congestion and pollution. Claimed reductions in car use from urban consolidation are often based on an assumption that people drive from their suburban homes to workplaces in the city. As noted in part A, there is much intra-suburban commuting occurring.

Noise pollution

Costs falling on third parties from noise pollution depend on the location and the timing of the activity. Noise may be more disturbing - and therefore costly - at night and noise generated in remote locations is likely to be less costly than noise generated in an urban environment. The subjectivity and varying sensitivity to noise of different individuals were noted by the ISC (1990):

> The main losses or costs resulting from heavy road vehicle noise pollution are generally regarded as being speech interference, loss of sleep, annoyance, dissatisfaction, and interference with other activities such as learning and task performance. Actual physiological damage to the auditory system is not an issue ... annoyance is dependent on the type of activity being conducted and the time of day.

Similarly, many people become accustomed to high levels of noise, even to the extent that they do not perceive a problem (vol. 2, pp. 197-9).

Measurement issues

The most common method of estimating the costs of noise pollution is to examine changes in property values between comparable housing (and amenity) stock 'm noise-affected and quiet locations. An alternative approach is to examine the costs of mitigation measures and to use these costs as a proxy for the costs generated by noise - however, this approach may reflect the political power of certain areas, especially in relation to public expenditures on noise mitigation. Table 5 presents estimates of noise costs associated with urban and interstate and rural transport. Predictably, heavy trucks in urban environments are most costly.

The ISC estimates are based on a United States Federal Highway Administration Cost Allocation Study applied to Australia. It is not clear what estimation procedure was adopted by the United States study. Thus, the estimates should be treated with caution.

Table 5: **Estimates of aggregate noise costs for vehicles, Australia, 1989-90 ($ million)**

	Automobiles	*Medium trucks*	*Heavy trucks*
Urban	128.9	68.6	191.5
Interstate and rural	31.8	12.5	100.7
TOTAL	160.7	81.1	292.2

Source: ISC 1990, vol. 2, p. 200.

Current practice

As with most third party cost situations, some people are less affected than others and some trade off reduced amenity for cheaper houses. Individuals who are less affected by noise may choose to reside in noisier and cheaper locations. Indeed, the cost of private noise mitigation (for example, double glazing and insulation) may be offset by lower house prices. This is important where people decide to locate under say, an existing flight path, rather than having already located and then being affected by a new flight path. In the former case, one could argue that the externality has become internalised.

Current approaches to noise pollution are essentially regulatory in nature. For example, outdoor rock concerts may be banned in certain areas, neighbourhood noise may be subject to police intervention after a certain time and airport curfews may disallow aircraft movements during certain hours. Freeways often have noise buffering. Decibel limits and curfews are imposed on aircraft movements.

Scope for improvement

The OECD (1991a) suggested that noise pollution mitigation could be pursued through charges on noise originating from roads, aircraft and industrial sources. This proposal has merit. Rather than banning noisier transport modes or productive techniques which gives an infinite value to low noise levels, charges affect the behaviour of noise generators. For example, options include paying the charges; phasing out noisier equipment; and confining the use of noisier equipment to certami times if differential charges are used. The most efficient mix can be chosen. The transitory nature of much noise pollution may make it difficult to apply instruments such as tradeable permits.

Road accidents

Estimates of accident costs are large. However, it is important to note that only some involve third party costs not taken into account by those responsible for accidents. The operation of insurance markets, which can take account of property and personal damage and medical expenses, clearly influences the extent to which costs are external.

Measurement issues

Attempting to determine the cost to society from road accidents is difficult. A range of techniques have been used including:

- estimating in present value terms the future earnings of an individual (incapacitated or killed), excluding returns on capital;
- discounting the present value of losses to others from the death of an individual (multiplying the probability of the person being alive in a future year by the difference between their expected gross earnings and expected future personal expenditure);
- deriving the value of life from social investments that increase or reduce the number of deaths or injuries;
- deriving a value from the size of the insurance premium a person is willing to pay and the probability of their death;
- deriving a value from empirical observation on court settlements (which may use the above technique(s) to obtain an estimate); and observing willingness to pay for increased risk (occupation data).

These measures have flaws. Valuing lives, pain and suffering and intangible elements such as people's feelings is difficult. Nevertheless, table 6 presents ISC estimates of *total* crash costs of around $5 billion in Australia in 1985. It argued that most of the cost for production losses ($1570 million); material damage ($1725 million); and pain and suffering ($965 million) are internalised by road users.

Current practice

Many regulatory measures are aimed at improving traffic flows and reducing accidents (for example, road signs, registration inspections, defect notices, drink driving laws and testing, and infringement notices and fines). Improved roads (dual carriageways, fewer bends, improved surfaces) are also important. Improving driving skill testing for granting licences or mandating car safety features are other avenues used to varying degrees.

Table 6: **Estimated socio-economic cost of road crashes (millions)**

Cost category	*United Kingdom 1985 (pounds)*	*United States 1980 (US$)*	*Australia 1985 (A $)*
Production losses and lost output	800	na	1 570
Medical care and ambulance	140	na	194
Material damage	1 100	na	1 725a
Road policing	b	na	105
Insurance administration	150	na	278
Pain and suffering	630	na	965
Legal costs	c	na	150
Total	**2 820**	**57 200**	**4 987**
GNP	351 150	2 630 000	209 775
Percentage of GNP	0.8	2.2	2

na. Not available.
a Includes losses due to other vehicle damage and traffic delay.
b Amount included in insurance administration.
c Included in other cost categories.
Source: ISC 1990, vol. 1, p. 92.

Scope for improvement

Given the high private costs associated with involvement in accidents it is unlikely that price incentive modification will be particularly useful. The absence of any personal health insurance would be unlikely to make a significant difference to a person's driving behaviour, given that the private cost could be death, irrespective of one's insurance status. Regulatory measures are probably the more appropriate response.

Nevertheless, policies aimed at reducing congestion (for example, subsidised public transport) will impact on accident rates in urban environments. These issues need to be considered in relation to road user charges for all vehicles and public transport policies including all substitute modes.

Relative prices of road, rail, sea and air are also important. A shift in relative prices which leads to substitution from road to rail freight may have positive benefits for accidents.

Similarly, the abolition of the two airline agreement may have had positive road safety benefits.

F8 Neighbourhood amenity and heritage conservation issues

Many people are made worse off from spending time in congested traffic conditions or when they are exposed to smog and polluted rivers. This section examines other third party costs associated with urban settlements that are less serious but which can nonetheless have a significant impact on people's welfare.

Neighbourhood amenity issues

When groups of people work and reside in a confined urban environment the activities of some have the potential to inflict inconvenience through to material damage upon others who did not consent to the decision which led to that damage. The range of adverse effects at the neighbourhood level is varied from barking dogs which affect people's sleep through to a neighbour's aesthetically intrusive shed which reduces access to sunlight and lowers adjacent house values.

There is some private negotiation between neighbours - for ' example, asking people to: keep down noise levels; hold dogs in confined areas; and not to bum off when washing is out. Neighbours may also combine their efforts in mutually advantageous projects such as common fencing. However, as the number of affected parties ('victims' and/or 'cost imposers') increases this type of bargaining becomes more difficult. Thus, there is an array of regulatory measures in place to account for third party costs at the neighbourhood level. Some examples include:

- animal control regulations: to control vicious and/or noisy dogs and to control livestock in urban environments (for example, cockerels and horses);
- noise guidelines and regulations: which may involve police intervention should noise be at or above a specific level at certain times;
- fire control regulations: for safety reasons, pollution mitigation reasons or to protect those affected by backyard burning.

- land use planning and building codes: to maintain certain construction standards. Adjacent properties or whole neighbourhoods can be affected by unsightly construction, and constructions which reduce solar access to others. First party safety issues are also rationales.

While proponents of pure market approaches might argue that an economy in which every asset is owned would internalise all externalities, this approach has problems where bargaining is difficult and property rights are difficult to define (for example, sunlight). Bargaining and property rights approaches may work more effectively where urban densities are very low - such as farming communities. Higher density environments imply that more people are affected, which makes bargaining difficult.

The regulatory measures noted above can also impose costs (see chapter D3) but there are few other alternatives, although cities which do not rely heavily on land use planning, and zoning do exist. For example, Houston, Texas does not have zoning laws. Incompatible land use problems are accounted for In private contracts (covenants) whereby land owners contract with others not to use land for certain purposes. Over two thirds of the city is covered by such covenants. Of course, a legal framework is still required and some have argued that the cost of litigation can make such systems inequitable.

Heritage issues: consolidation and the fringe

Heritage conservation (destruction) can confer benefits (impose costs) on others. For example, a restoration project can contribute to neighbourhood amenity although the beneficiaries cannot be made to pay for it. The Australian Heritage Commission raised concerns that these types of costs and benefits may not be fully accounted for 'm planning and (re)development. It stated that a cost benefit approach to urban development could concentrate on marketable goods which would systematically underestimate the value of goods such as the character' of established areas:

> Inadequate assessment of public goods risks giving rise to a future where urban consolidation is pushed for its economies of infrastructure, but the character of established areas is inadequately recognised ... (Sub. 62, p. 2).

Heritage issues are not confined to urban consolidation. Greenfields development may be detrimental to historic farmhouses and villages, Aboriginal sites and natural areas (for example, areas of remnant vegetation and animal habitat). Heritage impacts from urban consolidation are related more to man-made structures such as buildings but can also include remnant vegetation areas within the city limits.

A problem with determining what buildings or features have heritage value, where there are no indicative price data, is that tastes change. The Heritage Commission noted that:

> Statistics on the number of present heritage listings obscure the fact that heritage lists grow and change as community perceptions of heritage change; long term planning must make some allowance for the new interests of the next generation. Statistics obscure the fact that the types of places affected under each scenario are very different - farms, villages, natural areas and aboriginal sites in the case of continued sprawl; mostly between wars suburbs in the case of urban consolidation (Sub. 62, p. 4).

The Heritage Commission has a preference for urban consolidation over greenfields development because the former is thought to provide greater opportunities for saving heritage sites. It views regulation through planning controls as the appropriate policy instrument. However, as noted in chapter D1, development controls can, by banning a redevelopment implicitly ascribe an infinite value to the status quo. This is recognised by the Heritage Commission:

> To what degree should policies for heritage areas be more prescriptive than policies for other areas? These are important issues involving tradeoffs between control, flexibility, the developer's rights, the community's rights, and the expense of administration (Sub. 62. p. 6).

Heritage concerns can involve rejecting or modifying a form of redevelopment. Given the highly subjective nature of heritage conservation 'm urban areas, (for some, restoration provides benefits; for others it maintains an eye-sore and denies access to redevelopment benefits), these issues may be more properly accounted for through the democratic process.

Residents, rather than using 'dollar votes', can (and do) apply pressure on local councils on these matters.

F9 Concluding comments

There is a need to ensure that prices, charges and investment decisions are efficient. That is, they should reflect a user charging discipline (for access, usage, augmentation), any locational variations and a return on capital. This process in itself, while not eliminating third party costs, will generally ensure that they are not as large as they would otherwise be.

It would be desirable if third party effects were included in infrastructure prices and accounted for during the planning phase (as opposed to requiring corrective action). For example, where urban settlement in a particular region impacts on the environment (sewage in a river system) the cost of ensuring low-impact discharge should be reflected in charging. In some cases, experience will mean that standards are known - but this will not always be the case.

Identification and quantification of third party impacts may require input from 'victims', scientists, social researchers, economists and 'polluters'. In some cases, scientific research will reveal target standards - for example, safe levels of contamination for lead, sulphur, particulates, and dioxins. In other cases, standards may need to be inferred from a variety of measurement techniques.

This process should examine costs and benefits and involve victims and polluters. A zero level of pollution may not be achievable, or it may imply dramatic reductions in living standards. Standards derived for one application may be inappropriate for another. For example, variables such as climate, topography, tides, location and residential density may require different standards for pollution control measures.

Choosing appropriate mitigation instruments is a complex process requiring examination of.

- *Source type:* does the pollution problem stem from point-sources (factories) or is it mobile (cars), or from diffuse (urban run-off) sources?
- *Source quantity:* are there many or few sources? What does this imply for transactions costs?
- *Type(s) of pollution:* is the pollution homogenous (lead in petrol) or heterogeneous (a myriad of water borne discharges)?
- *Intertemporal considerations:* is the pollution a sunk cost (contaminated sites) or current (air pollution)?
- *Irreversibility and uncertainty: Is* the pollution problem at the stage where irreversible damage may result? Is there pervasive uncertainty?
- *The regulatory framework: Is* there a sufficient regulatory framework in place? The success of any approach will be constrained if sanctions cannot be imposed, if there are insufficient resources to implement a trading permit regime and if monitoring and enforcement are weak. Where monitoring is sporadic, sanctions should be harsher. If the ’goalposts’ are moved, certainty is reduced as is the effectiveness of the any environmental protection scheme.

Answers to these questions may present decision makers with a fait accompli in terms of instrument choice. Nevertheless, least cost abatement strategies should be followed and where possible economic instruments should be used. Some problems require a package. For example, public transport policies will impact on air pollution, noise pollution, congestion and accidents. This suggests the need for coordination between the relevant authorities and the EPA.

APPENDIX G: DEFINITION OF HOUSING AND LOCATIONAL CHOICE SURVEY ZONES

G1 Definition of zones in Sydney and Melbourne

To use the information gathered in its Housing and Locational. Choice Survey the National Housing Strategy classified Local Government Areas (LGAs) in Sydney and Melbourne into five broadly concentric zones. They were termed the core, inner, middle, outer and fringe zones. The zones were defined as follows:

Fringe zone: the developing LGAs on the fringes of the cities (more than 20 kilometres from the CBD), with population densities of less than 500 persons per square kilometre, and population growth rates of over 30 per cent between 1976 and 1986.

Outer zone: the more established areas on the outskirts of Sydney and Melbourne (the majority over 20 kilometres from the CBD), with population densities between 500 and 2000 persons per square kilometre and positive population growth rates between 1976 and 1986.

Middle zone: LGAs between 10 and 30 kilometres from the CBD, with zero or negative growth rates and densities over 2000 persons per square kilometre.

Inner zone: LGAs between six and 10 kilometres from the CBD.

Core zone: LGAs less than six kilometres from the C131).

The National Housing Strategy estimated the number of households in each zone in Sydney and Melbourne as follows:

Table 1: **Number of households in each zone, Sydney and Melbourne**

Zone	*Sydney*	*Melbourne*	*Total*
Core	139 980	164 460	304 450
Inner	76 260	147 850	224 110
Middle	415 410	319 840	735 250
Outer	354 680	273 930	628 610
Fringe	274 300	197 800	472 100
Total	**1 260 630**	**1 103 880**	**2 364 510**

Source: NHS 1992a.

Table 2: **A list of the LGAs in Sydney and Melbourne and the characteristics used to differentiate zones**

SYDNEY	*Pop density per/sq. km*	*Pop change 1976-1986 (5)*	*Distance CBD km*	*zones*
Syndey	3402	56	2	Core
North Sydney	4752	3	4	Core
Wollahra	1489	-4	4	Core
Leichhardt	4577	-10	6	Core
Marrickville	4945	-7	6	Core
Mosman	5966	-4	6	Core
Lane cove	5798	-1	7	Inner
Waverley	6644	-3	8	Inner
Ashfield	4867	-4	9	Inner
Drummoyne	3778	-3	9	Inner
Hunters Hill	2158	-6	9	Inner
Willoughby	2338	1	9	Inner
Botany	1281	-4	10	Middle
Manly	2349	-3	11	Middle
Randwick	3458	-3	11	Middle
Burwood	3891	-2	13	Middle
Concord	2127	-5	13	Middle
Rockdale	2846	-1	14	Middle
Ryde	2221	0	15	Middle
Strathfield	1816	-2	15	Middle
Canterbury	3847	0	17	Middle
Auburn	1476	-1	20	Middle
Kogarah	2354	-2	20	Middle
Hurstville	2548	-5	22	Middle
Bankstown	1947	-3	23	Middle
Parramatta	2176	-1	27	Middle
Holroyd	1990	-2	32	Outer
Ku-ring-gai	1223	0	22	Outer
Warringal	659	2	26	Outer
Sutherland	569	12	27	Outer
Fairfield	1498	34	34	Outer
Liverpool	297	4	35	Outer
Blacktown	798	20	38	Outer
Hornsby	233	13	39	Outer
Baulkham hills	270	36	30	Fringe
Campbelltown	389	132	45	Fringe
Camden	91	29	50	Fringe
Hawkebury	16	na	55	Fringe
Penrith	333	71	56	Fringe
Wollondilly	10	69	64	Fringe
Blue Mtns	45	39	72	Fringe
Gosford	106	49	75	Fringe
Wyong	82	74	90	Fringe

MELBOURNE	*Pop density per/sq. km*	*Pop change 1976-1986 (5)*	*Distance CBD km*	*zones*
Melbourne	1912	-5	0	Core
Fitzory	4550	-11	2	Core
South Melbourne	2056	-13	2	Core
Richmond	3698	-11	3	Core
Collingwood	2714	-20	4	Core
Port Melbourne	764	-14	4	Core
Footscray	2613	9	4	Core
Prahran	4490	-11	5	Core
Saint Kilda	5216	-12	5	Core
Brunswick	3824	-10	6	Inner
Kew	1938	-5	6	Inner
Cobour	2814	-9	8	Inner
Essendon	2432	6	8	Inner
Hawthorn	3020	-9	8	Inner
Malvern	2596	-8	8	Inner
Northcote	2756	-12	8	Inner
Camberwell	2354	-7	10	Middle
Preston	2193	-9	10	Middle
Williamstown	1585	-12	10	Middle
Caulfield	3063	-8	11	Middle
Heidelbery	1887	-6	12	Middle
Brighton	2423	-7	13	Middle
Box Hill	2130	-9	14	Middle
Broadmeadows	1551	-7	14	Middle
Moorabbin	1795	-8	15	Middle
Oakleigh	1812	2	15	Middle
Sandringham	2027	-7	15	Middle
Nunawading	2210	-1	19	Middle
Waverly	2059	5	19	Middle
Mordialloc	2215	-7	24	Middle
Sunshine	1173	7	12	Outer
Altona	826	8	16	Outer
Keilor	960	32	16	Outer
Doncaster/T	1096	21	17	Outer
Springvale	847	15	23	Outer
Ringwood	1752	9	25	Outer
Diamond Valley	746	21	26	Outer
Know	920	40	26	Outer
Croydon	1190	20	29	Outer
Dandenong	1450	17	29	Outer
Chelsea	2048	-2	30	Outer
Frankston	1174	17	42	Fringe
Eltham	144	39	20	Fringe
Bulla	67	111	26	Fringe
Werribee	80	65	28	Fringe
Cranbourne	109	105	30	Fringe
Berwick	386	90	25	Fringe
Lillydale	178	41	25	Fringe
Melton	63	108	37	Fringe

MELBOURNE	Pop density per/sq. km	Pop change 1976-1986 (5)	Distance CBD km	zones
Sherbrooke	179	36	37	Fringe
Whittlesea	132	65	38	Fringe
Hastings	79	77	45	Fringe
Healesville	33	51	50	Fringe
Mornington	295	36	55	Fringe
Packenham	43	57	56	Fringe
Flinders	101	55	70	Fringe

2 Definition of zones in Adelaide

Hassan (1992) developed zonal systems in Adelaide broadly similar to those used by the HALCS for Melbourne and Sydney. In Adelaide, Local Government Areas were classified into three broad concentric zones, namely Inner Metro, Middle Metro and Outer Metro. But in Adelaide the Outer Metro zone was further divided into two zones, North Metro and South Metro, in order to examine and analyse the dynamics of growth in the two parts of the outer zone which have historically developed under different public policy frameworks.

The four zones used in Adelaide were defined as follows:

Inner Zone - This zone consists of all but one LGAs less than 6 kilometres from the CBI). The population density of this zone in 1986 was 1,964 persons per square kilometre.

Middle Zone - This zone consists of LGAs between 6 and 13 kilometres from the CBI) with a population density in 1986 of 1,631 persons per square kilometre.

North Metro - This zone represents all LGAs in the north between 14 and 30 kilometres from the CBI).

South Metro - This zone represents all LGAs in the south which are between 14 and 30 kilometres from the CBI).

The overall density for the two outer metro zones was 408 persons per square kilometre.

A list of the LGAs in Adelaide and their characteristics is shown in Table 3.

Table 3: **A list of the LGAs in Adelaide and the characteristics used to differentiate zones**

Area	*Pop density per/sq.km*	*Pop change 1976-1986 (5)*	*Distance CBD km*	*zones*
Adelaide	888	3	1	1
Unley	2586	-2	3	1
Norwood/ Kensington	2 226	-7	3	1
St Peters	2 050	-11	3	1
Thebarton	2 125	-17	3	1
Walkerville	1 700	-5	4	1
Hindmarsh	1 560	-10	4	1
Prospect	2 288	-6	5	1
Payneham	2 257	-10	6	1
West Torrens	1 321	-9	6	2
Burnside	1 431	-3	6	2
Enfield	1 549	-14	8	2
Mitcham	805	2	8	2
Campbelltown	1 804	5	9	2
Marion	1 245	4	10	2
Glenely	2 640	-8	10	2
Henley Beach and Grange	2 100	-11	10	2
Woodville	1 858	6	10	2
Brington	2 100	-12	11	2
Pt Adelaide	1 097	4	13	2
Salisbury	593	25	20	3
Munna Para	85	24	20	3
Tea Tress Gully	777	32	13	3
Elizabeth	1 535	-9	25	3
Gawler	305	101	29	3
East Torrens	48	20	13	4
Stirling	142	42	15	4
Happy Valley	168	133	20	4
Noarlunga	406	47	21	4
Willunga	35	137	29	4

Notes: Zones
Inner Metro = 1
Middle Metro = 2
North Metro = 3
South Metro = 4

Source: Hassan 1992.

APPENDIX H: COMMONWEALTH-STATE FINANCIAL ARRANGEMENTS

H1 Introduction

In Australia, the government sector comprises the Commonwealth and State governments (including two federal Territories which now have self-governing status and are treated much like States in most fiscal and other intergovernmental respects), and over 900 local government authorities.

The Constitution gives the Commonwealth relatively few exclusive powers. The States have exclusive legislative responsibilities in areas such as education, health and hospitals, land, housing and urban development, rail and road transport, provision of water, gas and electricity, and control of local government.

However, section 96 of the Constitution gives the Commonwealth the power to make grants of assistance to the States (through specific purpose payments) on such terms and conditions as it sees fit. In this way, the Commonwealth can influence policy-making in areas of State responsibility. It can also influence State infrastructure spending through the provision of general purpose capital funds (although the amounts are relatively small and the States are not obliged to spend those funds on capital works) and through the setting of Loan Council 'global limits' on borrowings by government trading enterprises.

Local governments are subject to legislative direction by State governments. In recent times local government has expanded its role in human services provision, but remains primarily the supplier of local infrastructure (such as parks, local roads and drainage) and services to residents (such as garbage collection).

The role of local government in infrastructure provision varies substantially between (and even within) States. For example, water and sewerage undertakings are exclusively local government responsibilities in Queensland, are shared between State and local government in Tasmania and parts of New South Wales, and are exclusively the province of the States elsewhere.

H2 The imbalance between outlays and revenues

The 'vertical fiscal imbalance' among the three levels of government is illustrated in table 1, which shows that the Commonwealth accounts for about 70 per cent of public sector revenue, but is responsible for only half of public sector outlays. As a result, the States rely on Commonwealth funding, and the way that funding occurs can have a number of effects.

Table 1: **Public sector outlays and revenues, 1990-91**

	Share of total public sector			*Total public sector as a share of national aggregate*
	Commonwealth %	*State* %	*Local* %	%
Own-purpose outlays				
Current	54	42	4	
Capital	24	62	14	
Total	**51**	**44**	**5**	**39** [a]
Own-source revenues				
Taxation	78	18	4	31 [a]
Total	**72**	**24**	**4**	**36** [a]
Net debt [d]	30	66	4	28 [a]
Capital stock [d]	17	--83--		34 [c]
Employment [d]	23	67	9	22 [e]

a Ratio to GDR
b As at 30 June 1990.
c Share of total net capital stock (excluding public financial enterprises).
d For 1989-90.
e Share of total employment
Sources: Walsh and Thomson 1992, p. 17, citing Budget Statements 1991-92, Budget Paper No. 1, Statement 6 and Budget Paper No. 4; ABS, *Government Financial Statistics, Australia* (cat. no. 5512.0); ABS, *Government Financial Estimates, Australia,* cat. no. 5501.0; ABS, *Australian National Accounts: Estimates of Capital Stock,* cat. no. 5221.0 plus unpublished data on Commonwealth State/local proportions.

'Own-purpose' outlays

The Commonwealth's 'own-purpose' outlays (that is, excluding grants to other levels of government) comprise about half of total public sector outlays (see table 1), and are concentrated primarily in social security, welfare and health benefits, and defence.

The Commonwealth is responsible for about one-quarter of total public sector capital outlays. It provides much communications and aviation infrastructure, and, while providing little social infrastructure directly, it makes capital grants to the States for urban infrastructure such as roads, public housing, schools and TAFE colleges, and hospitals and nursing homes.[1]

State government own-purpose outlays, representing about 44 per cent of total outlays, are predominantly for education, hospitals, transport, housing and community amenities, and public order and safety. Local government outlays (5 per cent) are principally for road construction and maintenance, and for sewerage, drainage and sanitation services to households.

State and local governments have the biggest role in the provision of physical and social infrastructure. They are responsible for about 76 per cent of annual public sector capital outlays, and control about 83 per cent of the total value of public sector infrastructure, comprising schools and hospitals; public housing; rail, road and port facilities; water supply and sewerage systems and electricity generation and distribution. Walsh and Thornson'estimated that this represents a little over one-third of Australia's capital stock.

'Own-source' revenues

The Commonwealth dominates total revenue collection, accounting for about 78 per cent of tax revenues and 72 per cent of total revenues (see table 1). It has predominant control over taxation of both income and goods and services.

This dominance arose during World War 11, when the Commonwealth acquired a monopoly over personal and company income tax. Subsequently, it retained this monopoly by providing grants to the States on the condition that they not reintroduce income taxes. Thus while the States have the power to reintroduce income taxation, there are political and fiscal constraints which would first need to be addressed. Moreover, the High Court's wide interpretation of tile Commonwealth's power over 'excise' has effectively prevented the States from taxing the production and sale of goods.

As a result the States raise tax revenues through a range of other taxes such as payroll tax, stamp duties on financial transactions and conveyancing, taxes on motor vehicles and licence fees on the sellers of alcohol, tobacco and petroleum products. Municipal rates based on land values are an important revenue source for local government.

[1] In 1991-92, total specific purpose capital grants amounted to $3.2 billion, of which $1.6 billion was for roads, $0.8 billion for public housing and $0.7 billion for education.

Borrowings

Several participants expressed concern about the restrictions placed on borrowings by local governments. The Municipal Association of Victoria said that the Victorian Government had reduced each council's 'as of right' borrowing limit to $1 million, with no variation according to the creditworthiness or revenue raising capacity of individual councils. It argued that many worthwhile infrastructure projects have been forgone as a result, noting that the imposition of fight restrictions on borrowing:

> ... has unnecessarily and inequitably penalised many metropolitan councils and provincial cities, particularly those with growing population numbers (Sub. 15, p. 8).

The Brisbane City Council said that it:

> ... has ample evidence of unnecessary delays to works which were economically viable but suffered Loan Council restrictions. These restrictions do not ensure that borrowing by individual authorities is prudent. It would be far preferable to expose each authority to the disciplines of the capital market as ' occurs in the United States of America and other advanced countries and remove Loan Council restrictions (Sub. 45, p. 27).

The City of Werribee, an expanding municipality, said that the restriction is 'onerous', and it is well-placed to service higher levels of borrowings. Its needs are for infrastructure funding, as the City has grown from a rural shire to a rapidly expanding city within the last two decades, but with a road network which remains essentially rural.

Walsh and Thomson noted that, since 1985-86, aggregate net borrowings in most States remained below the set limits eleven while borrowing limits were cumulatively cut by over 40 per cent in nominal terms. High real interest rates were said to be a factor.

More broadly, they also noted that one consequence of the fiscal restraint imposed on the States by the Commonwealth has been that State governments have increasingly required their public agencies to contribute to general revenues, and have begun to sell off assets deemed to be surplus to requirements.

H3 Grants to the States

Because of the vertical fiscal imbalance, State and local governments are highly dependent on financial assistance from the Commonwealth to fund their outlays. This assistance can be for specific purposes, or to supplement general revenues.

Specific purpose payments

Over half of the Commonwealth's assistance to the States is in the form of 'tied' grants - specific purpose grants to assist the States in meeting expenditures on purposes designated by the Commonwealth. They are provided on the condition that the States provide particular services or undertake particular projects. In 1992-93, specific purpose grants are expected to total $17.6 billion or about 54 per cent of total Commonwealth payments to the States.

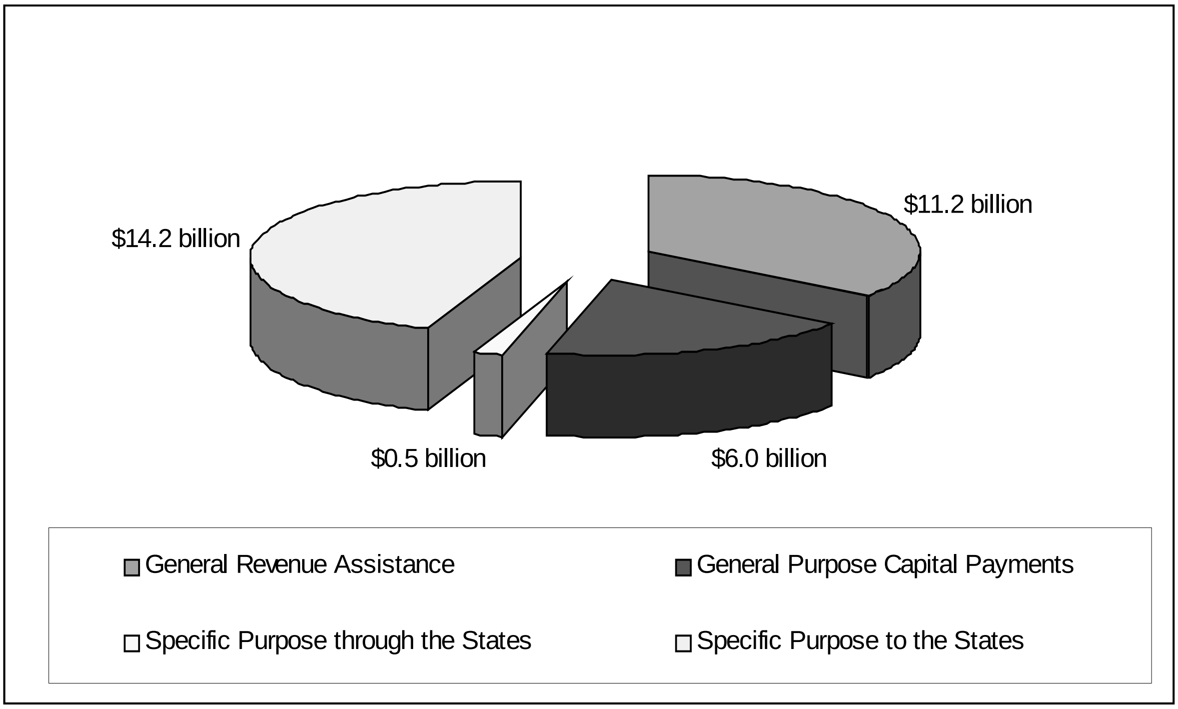
Specific purpose payments may be classified as payments either 'to' State governments, or as payments which are made 'through' them - that is, amounts which they are required to pass directly to other bodies such local governments or to service providers. For example, higher education payments are passed on to the relevant educational institutions.

Specific purpose payments to the States are expected to total $11.2 billion (chart 1) in 1992-93. Payments for education, health, housing, roads and financial assistance to local governments are expected to account for about 86 per cent of this (Commonwealth Government 1992b, p. 72). Specific purpose payments through the States are expected to amount to $6 billion.

Funds provided to local government for general revenue purposes are classified as specific purpose payments through the States in chart 1. For 1992-93, these are estimated to total $748 million, and will be distributed among the States on an equal per capita basis. Within States the funds are distributed according to criteria developed by the State Local Government Grants Commissions and approved by the Minister responsible for local government.[2] A further $332 million is to be paid as 'funding 'm lieu of tied grants for local roads' (Commonwealth Government 1992a, 1992, p. 3.259). These funds need not be spent on roads. For the present, distribution of these funds between States will be as under the Land Transport Development Program.

[2] The Australian Capital Temitory receives assistance for its municipal budget under comparable funding arrangements.

Figure 1: **Composition of payments to the State/ local sector in 1992-1993**



Note: Payments made direct to local government are included in general revenue assistance.
Source: Commonwealth Government 1992b, p. 5.

General revenue assistance

General revenue assistance (mainly financial assistance grants) is expected to amount to $14.2 billion in 1992-93 (see chart 1). These funds are untied - that is, available to be used by the States in accordance with their own budgetary priorities.

The Commonwealth Grants Commission recommends how the total pool of general revenue assistance is to be allocated among the States. This is done with the objective that each State has the capacity to provide an average level of services, without being required to levy above average taxes and charges. This matter is taken up in the next section.

Some Commonwealth-funded urban infrastructure programs

A list of Commonwealth programs impinging on urban development can be found in attachment B of the submission by the DHHCS (Sub. 85, pp. 97-108). The following notes the features of some of a selection of programs which have implications for infrastructure provision and pricing.

Building Better Cities

The Building Better Cities program was announced in the 1991-92 Budget. The objectives of the program are: 0 to reduce urban development costs;

- to improve urban land use, including use of Commonwealth land;
- to reduce the costs associated with traffic congestion and pollution;
- improve urban planning; and
- increase housing choice and affordability (Howe 1991, p. 2853).

The Government will provide up to $816 million to the States over five years. The funds are provided as additions to general purpose capital payments. In 1991-92, $41.5 million was provided under the program; $182 million will be provided in 1992-93. Distribution of these funds will be determined on the basis of an assessment of relative needs following consultation with the States (Commonwealth Government, 1992b, p. 42).

While many saw benefits arising from this program, some participants had concerns. The Australian Federation of Construction Contractors said:

> Last year the government introduced the Better Cities Program in an endeavour to combat the growing problem of urban sprawl by encouraging 'urban consolidation' ... However, the likely success of the Program in containing urban sprawl may have been overestimated. A recent study [McLouglin 19911 analysed the relationship between urban densities and land demand, and concluded that even with a highly successful urban consolidation program, its impact on the pace of growth in fringe areas would be minimal (Sub. 53, p. 8).

This point is discussed in part A.

Delfin Property Group said:

> A serious danger of the Better Cities Program is that it could lead to subsidisation of inefficient projects through lack of complete feasibility analysis of the real costs of projects (Sub. 59, p. 3).

The DHM said that the program is one component of a broad strategy of urban reform, and will help demonstrate the effectiveness of new approaches to urban development, including cooperative planning between governments, integrated urban developments and higher density housing developments (Sub. 85, p. 99).

Green Street Joint Venture

The DHHCS said:

> The objective of the Green Street program is to reduce the cost of housing, increase the range of housing choices and to enhance urban amenity and environmental quality through the encouragement of best planning and engineering practice in the development of residential land (Sub. 85, p. 102).

Established in 1983, Green Street is a joint venture between the Commonwealth, State and local governments and the housing and land development industry. A notional allocation of about $2 million was made to the Green Street program from the 1991-92 Australian Housing Industry Development Council (Sub. 85, p. 102).

Road grants

Until recently, Commonwealth funding for roads was provided in the form of specific purpose (tied) grants to the States, or through the States to local government. Funding was distributed according to a formula which looked at road responsibilities or needs of councils in terms of length, type and other physical characteristics of the road network.

• *Local roads*

Most *local road* funding from the Commonwealth is paid to local government, although some is paid to the States for local road expenditures in areas not covered by local government.

Funding for local roads has been 'untied' since 1990-91 and paid as general purpose funds to local government. These funds, amounting to $332 million in 1992-93, continue to be identified as road grants but are no longer required to be spent for that purpose.

At this stage, their interstate distribution is to continue to reflect the 'needs' criteria established under the *Australian Land Transport Development Act* 1988, but their distribution within States will be determined by the States under fiscal equalisation criteria (see next section). If the funds allocated for local roads are fully absorbed into the financial assistance grants allocation and therefore distributed according to fiscal equalisation criteria, there will be a shift in funding from rural to metropolitan councils (Walsh and Thomson 1992).

Moreover, the OLG (1992) and Pensabene (1990) argue that the current distribution of financial assistance grants favours local government areas which have growing populations, suggesting that changing the distribution of road funding would further favour metropolitan councils in newly-developing areas relative to those in established areas.

- *Arterial roads*

Funding for *arterial roads* is paid to the States. In 1992-93, the Commonwealth expects to provide grants to the States of $882 million for national highways and $573 million for arterial roads.

As part of a rationalisation of the roles of each level of government, the Commonwealth's post-1993 road program will cover the existing National Highway System, some other major interstate routes, and urban roads linking the current points of termination of the national highway system in Sydney, Melbourne, Brisbane, Perth and Adelaide.

This rationalisation of responsibility will also result in the untying of $350 million of funds which were previously provided to the States as specific purpose payments for arterial roads, funded from the Australian Land Transport Fund. As in the case of local roads, these funds will continue to be identified as road grants but will not be subject to any formal conditions. These funds will be untied from the second half of 1993-94 and converted to financial assistance grants over four years, thereby changing the interstate distribution of those funds (Commonwealth, Government, 1992b, p. 39). Walsh and Thomson (1992) consider it likely that there will be a significant redistribution of the $350 million to be treated this way:

> A shift in distribution from one based on needs assessment (in which SA, in particular, receives a comparatively low share even on a simple population basis) to one based on the CGC's overall relativity assessments would appear likely to especially favour SA, NT and Tas on *present* relativities (p. 10).

Education

The Commonwealth provides current and capital assistance to the States to support the operations of their TAFE systems. In 1992-93 total payments amounted to $517 million. It also meets about 73 per cent of the costs of higher education institutions (the remaining funding comes from such sources as fees, investment income and donations).

For government schools the Commonwealth meets approximately 11 per cent of costs, with the balance coming from State and Territory governments. The Commonwealth meets on average 35 per cent of costs for non-government schools (with the balance being met by other governments - 19 per cent - and private sources - 46 per cent). For TAFE colleges, the Commonwealth provided grants to the States in 1991-92 of approximately 9 per cent of total recurrent funding and 65 per cent of total capital funding (Commonwealth Government, 1992a, p. 3.43).

The Commonwealth contributes to the general operating costs and capital expenditure of government and non-government schools and provides further funding for a range of specific purpose programs aimed at identified areas of need.

Commonwealth-State Housing Agreement

The main objectives of the 1989 Commonwealth-State Housing Agreement are:

> ... to ensure that every person in Australia has access to secure, adequate, affordable and appropriate housing by seeking to alleviate housing-related poverty and ensuring that housing assistance is, as far as possible delivered equitably to persons in different forms of housing tenure. Housing assistance under the CSHA is to be provided in accordance with need (DHHCS, Sub. 85, p. 107).

Under the agreement, a minimum of about $1 billion in Commonwealth housing assistance grants is to be provided to the States in each year from 1989-90 to 1992-93. The States are required to match a proportion of these grants with their own funds and with home loans to low income earners (Sub. 85, p. 107).

The Commonwealth outlays are also used to fund the expansion and maintenance of the public rental housing stock by State governments. Assistance is targeted to low income people and groups disadvantaged in funding suitable accommodation.

Other developments include a new Community Housing Program, with funding of about $24 million in 1992-93. This is expected to add significantly to the community sector housing stock over the next four years. The Private Rental Housing Subsidy program is to be abolished and a new program, the Social Housing Subsidy Program, will from 1992-53 assist State government to borrow funds to cover the cost of public equity portion of shared home ownership arrangements for some low and moderate income households. The Commonwealth contribution will be a maximum of $8 million in 1993-94, rising to $24 million in 1995-96.

Local Capital Works Program

The Commonwealth is to provide about $245 million in 1992-93 on a ’ new Local Capital Works Program to be undertaken in partnership with local government. Funds will be available for social and economic infrastructure projects in areas experiencing higher than average rates of employment (Commonwealth Government, 1992a, pp. 87, 3.12 1).

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