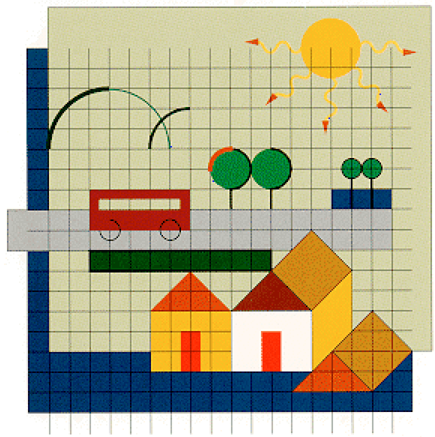
AMCORD

A national resource document for residential development

Practice Notes



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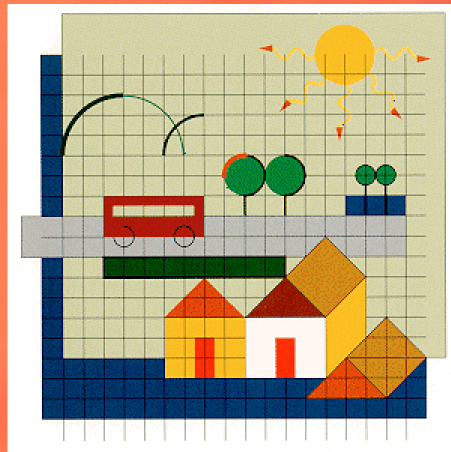

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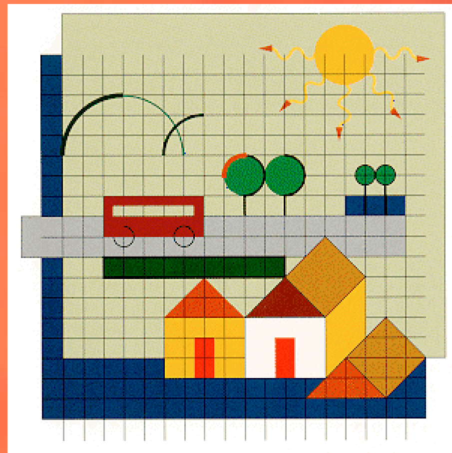

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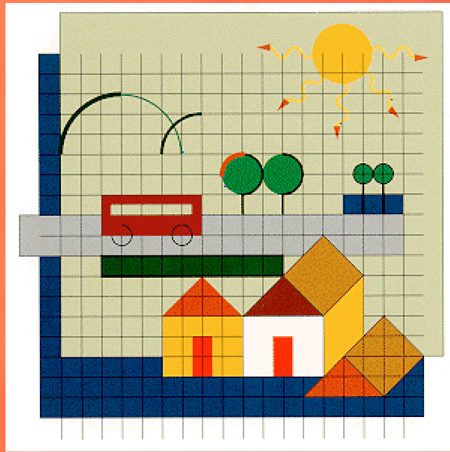


Introduction

Purpose

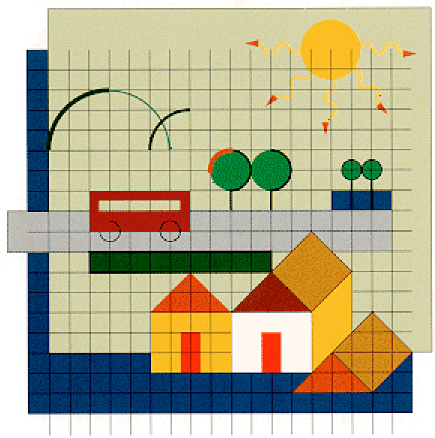
Parts 1 and 2 or AMCORD contain material relating to both upfront planning (including strategic and development planning) and elements of design. During the course of preparation of AMCORD Edition 2 and AMCORD URBAN, there were many requests for AMCORD to provide more detailed guidance on particular matters relating to housing development.

The material contained in this companion document provides this additional information, and is directed to those more closely involved in the housing and development industry.

Planning Practice Notes

Planning Practice Notes provide additional material relating to Part 1 of AMCORD. While some of the Practice Notes include practical material and case studies, they largely provide additional theoretical material based on recent research.

Design and Development Practice Notes



Design and Development Practice Notes have been developed incorporating additional practical advice and case studies relating to Part 2 of AMCORD. Primarily they are an elaboration of many of the Design Elements in Part 2, and are targeted to designers of housing projects.

Reference Material and Acknowledgements

References used in the preparation of the Practice Notes are either contained within each Practice Note or in the References section of the main AMCORD document.

Full acknowledgements are also included in the main AMCORD document.

Further Development

Considerable scope exists to further develop the Practice Notes in terms of updating the existing material and by preparing additional Practice Notes covering new topics. Depending on the level of support by practitioners for the development of new material (which includes the provision of new case study material), the Practice Notes can be updated and expanded over time.

Please forward material to:

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AMCORD

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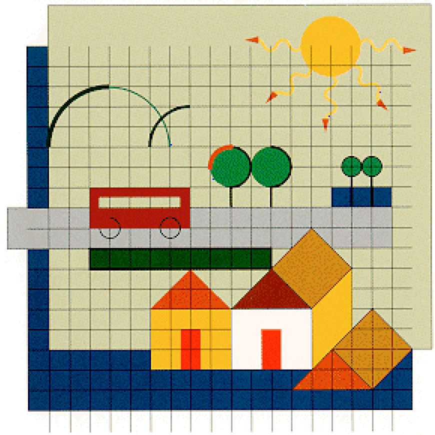


Practice Note PNP 1

Integrated Local Area Planning (ILAP)

Scope

The concept of Integrated Local Area Planning (ILAP) was jointly developed by the Australian Local Government Association (ALGA) and the Commonwealth to promote a 'whole of government, whole of community' approach to strategic planning and program management at the local/ regional level. Previous research by ALGA revealed considerable duplication in government administration, which highlighted the necessity for cooperative, needs-based planning and improved inter-governmental relations centred on partnership approaches and program agreements.

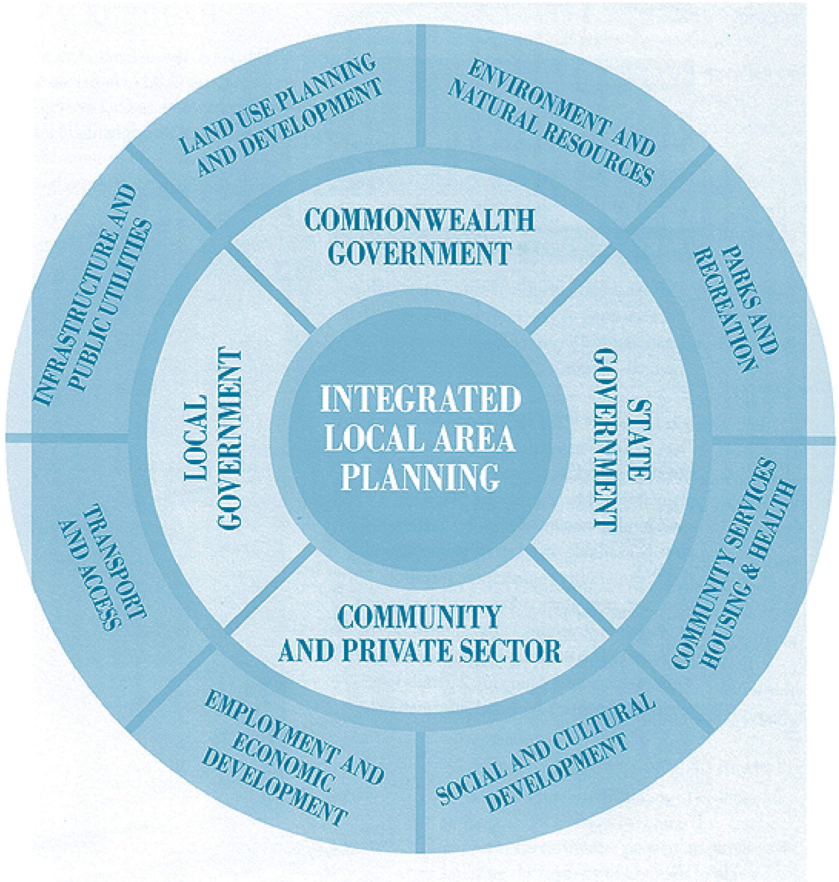


Figure 1: The Elements of ILAP

An Integrated Approach

The concept of ILAP promotes three major themes:

- the need for partnership between the three spheres of government, local communities and the private sector to work towards establishing and achieving shared objectives for enhancing local well-being;
- the need for the public sector to improve its performance by ensuring that its various activities are effectively integrated and directed towards enhancing the overall well-being of local communities and their environments;
- the need for local government to play a leadership role in bringing about more effective strategic planning and integration at the local or regional level.

These themes apply equally in areas undergoing significant new urban development or redevelopment, as they do in other situations. *A Guide to Integrated Local Area Planning*, published by the Australian Local Government Association, sets out the major principles underlying the concept of ILAP:

- Local areas and communities differ, and more emphasis should be placed on devising appropriate responses to distinctive local circumstances and needs.
- Local areas should be viewed holistically, linking related physical, environmental, economic, social and cultural issues, rather than treating them separately.
- A shared understanding of key issues is needed among all those concerned with the well-being of local communities and, as far as possible, a shared vision of desired futures.

- Related activities of different departments within councils, organisations and spheres of government should be coordinated in order to address key issues and achieve desired futures.

- More efficient and effective use of available resources is essential, and unnecessary gaps or duplication between government activities and programs should be eliminated.

- Community involvement in planning and management processes should be increased.

- Local government has a mandate to play a leading role in implementing these principles.

ALGA thus makes it clear that ILAP, despite its name, is not just about planning in the traditional sense. It also embraces ongoing management of activities and resources. ILAP is a ‘whole of government, whole of community’ approach to planning and management. Compared with many existing forms of planning, its distinguishing characteristics are its:

- holistic view;

- emphasis on the composite needs of different localities;

- promotion of partnership;

- focus on coordination;

- orientation towards long-term processes.

Central to the ILAP approach is the proposition that local councils should canvass the full range of significant issues facing their locality, and actively set out to explore the linkages between different issues, functions, expenditure programs, agencies, and spheres of government relating to the efficient and effective planning, development and management of a locality.

A Flexible Model

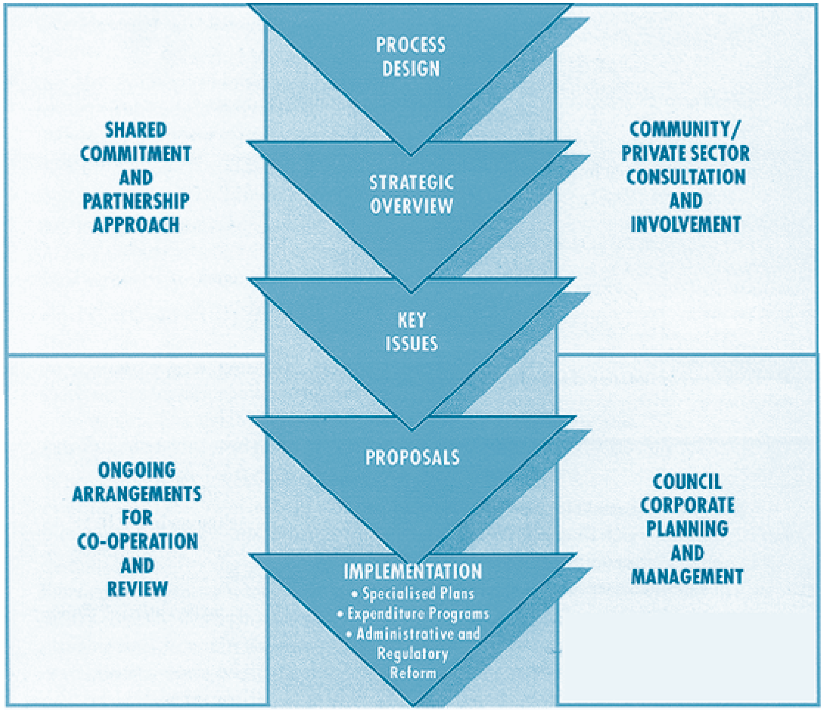


Figure 2: A model for Integrated Local Area Planning

The following methodology has been developed jointly by the Commonwealth and the ALGA to assist councils, agencies and other organisations to implement the principles.

Figure 2 illustrates a generalised model which can be adapted as circumstances require. It has two major components:

- a planning process;
- a number of support mechanisms to facilitate the planning process and implementation of outcomes.

The model shows all the elements that make up the complete ILAP package, but it is not essential to include every element in order to implement the principles. The content of an ILAP process will differ significantly according to the nature of the local issues and needs. The area base will also vary.

ALGA's Guide suggests that the local government area provides a convenient unit for planning because councils need to integrate activities and balance resource allocation at that scale. However, some ILAP processes may need to focus in detail on issues in a particular part of a local government area, and others may need to span two or more adjoining local government areas in order to address issues of subregional or regional significance. Clearly, when it comes to planning for residential development or redevelopment, much smaller areas may be appropriate.

Support Mechanisms

Four mechanisms have been identified to provide a supportive framework for Integrated Local Area Planning and thus facilitate the achievement of desired results. These are:

Shared commitment and partnership among key stakeholders
Any local area planning process must begin with political and/or corporate commitment on the part of key stakeholders, and particularly the council. Such commitment needs to be based on:

- a sufficient understanding of the concepts and processes involved;

- a willingness to invest the necessary resources in the process, and to respond appropriately to the outcomes of that process;

- an appreciation of the benefits that will flow.

One of the central thrusts of ILAP is to ask whether the existing activities of councils and other agencies are appropriate to meeting priority local needs. If the issues are pursued rigorously and with a genuinely open mind, then the answers to that question may require significant changes to existing arrangements. This may need to be acknowledged at the outset.

It is normally a council's task to identify and engage other stakeholders and to seek their partnership.

Establishment of a reference group which brings key stakeholders together is often useful to establish and maintain regular liaison during the process. Such arrangements can evolve into longer-term arrangements for longer- term implementations.

Adequate processes for community consultation and involvement, including the private sector
Accurate identification of key local issues and priorities demands effective community and private sector involvement. Such involvement must go well beyond the limited consultation commonly associated with statutory planning processes. ILAP should be informed by community views and expertise from the outset, and significant community/private sector organisations will usually figure among the stakeholders.

Consultation techniques need to be diverse and will vary according to local circumstances. These are explored in more detail in Planning Practice Note 2: Consultation.

Effective corporate planning and management within the responsible council
Since councils are seen as the lead agencies for integrating planning activities at the local scale, it is vital that their own activities are effectively linked and directed towards desired outcomes. This requires management and decision-making structures that avoid internal bureaucratic empires, and facilitate the formulation and pursuit of a broad strategic vision for the local area.

Ongoing arrangements for inter-agency cooperation and review of outcomes
Implementation needs to respond to changing circumstances, needs and priorities. It also depends on maintaining shared commitment and responsibility for the achievement of shared objectives.

Effective implementation thus requires ongoing arrangements for inter-government cooperation, community consultation, monitoring of change, and evaluation of outcomes. Such arrangements might include continued regular meetings of a reference group, working parties dealing with particular areas of activity, or annual seminars to review progress. Suitable performance indicators should also be devised to determine whether the various activities are producing the desired outcomes and benefits and, if not, to suggest ways and means of refining the process.

The Planning Process

At the core of an Integrated Local Area Planning process is the combination of a holistic assessment of the relevant local area with subsequent focusing upon a limited number of key issues. This facilitates a strategic approach and identification of significant linkages between different areas of activity, but also allows later stages of the process to be kept within manageable limits.

ILAP may thus be divided into five steps:

1. Process design
2. Strategic overview
3. Identification of key issues
4. formulation of proposals and principals for integrated action
5. Implementation.

Step 1: Process design
It is important to begin by determining how integrated local area planning can be conducted. In particular, a council needs to consider the resources and expertise at its disposal, as well as others involved (eg Commonwealth and State agencies, adjoining councils, non-government agencies, local business and community groups). A workshop or series of workshops could be

held to canvass potential issues and the likely extent of cooperation and support from other agencies and organisations. This could lead to the formation of a reference group or joint steering committee.

Process design should thus help to generate shared commitment, to set practical limits to the scope of the exercise, and to reach broad agreement on objectives and desired outcomes.

Definition of the geographical area to be examined should be condsidered. As noted previously, for the purposes of focusing on residential development outcomes, it may be appropriate to select part of a local government area that is undergoing development or redevelopment.

Step 2: Strategic overview
This is a crucial phase. The fourfold purpose of the strategic overview is to:

- set out all the significant issues facing the local community and environment (as far as available information, time and resources allow);
- establish an agreed basis of facts and attitudes from which the balance of the planning process can proceed;
- identify the various organisations, departments and spheres of government involved;
- facilitate the selection of key issues.

The strategic overview is not intended to provide a complete picture of all facets of the local community and environment. Compilation of the strategic overview will involve extensive consultation and analysis of information relevant to the intended scope of the ILAP process. Broadly, such information will fall into four categories:

- a description of the local community and environment, focused on significant characteristics and trends likely to require action by government during the planning period;

- assessment of existing infrastructure, services and programs, similarly highlighting those elements or areas of expenditure apparently in need of review;

- documentation of all relevant existing policies, strategies, instruments and regulatory practices which are likely to significantly influence the outcomes;

- Identification of opportunities to improve the existing situation or influence likely outcomes, together with associated challenges and constraints which must be addressed.

A broad range of areas could be explored, but a selective approach may be essential to avoid excessive expenditure of time and effort. Some limits may be imposed at an early stage and the actual gathering of information and continuing consultation with other parties will also help to pinpoint major areas requiring further examination.

Step 3: Identification of key issues

Selection of a limited number of key issues for detailed attention is essential to keep the ILAP process within manageable proportions. Subsequent implementation measures will concentrate on those issues.

The following criteria are suggested as a basis for selecting key issues:

- dominant areas of concern identified in the strategic overview;

- critical linkages between different activities, agencies or spheres of government which require coordinated action;

- the resources and time available to undertake the remainder of the planning process and achieve tangible outcomes.

Key issues may take a number of different forms, for example:

- a part of the council's area undergoing rapid development or redevelopment requiring coordinated planning and capital expenditure programs;

- a group of programs requiring improved coordination or adjustment to the current pattern of service delivery;

- an aspect of regulation (such as residential development codes) requiring updating and better coordination between the council and State agencies in order to better reflect community needs;

- design and construction of a major multipurpose community facility, where a successful outcome will require cooperation between several agencies and pooled funding;

- an environmental problem (such as land degradation), which may involve several government agencies, the private sector and voluntary community efforts.

Where the number of key issues is beyond manageable limits for a one-off exercise, Steps 3–5 of the planning process can be repeated for successive packages.

It need not be the local council's task to address all key issues at the one time. ILAP is about partnership, and it follows that the workload involved should be shared. Wherever possible, those agencies directly responsible for the major elements of key issues should undertake necessary follow-up investigations and actions. It will usually be necessary, however, for the council to act as facilitator and coordinator of this work.

Step 4: Formulation of proposals

For each key issue, the following points could be documented:

- the various programs, departments, organisations and spheres of government involved and the linkages/interactions between their activities;
- the nature of the problems/needs to be addressed;
- objectives for improvements to the current situation;
- action required to achieve those objectives (see Step 5);
- targets for outcomes (time frame, proposed expenditure, performance indicators etc).

It may be helpful to prepare a matrix for some key issues to highlight complex linkages and interactions, especially when it comes to coordinating the provision of several elements of infrastructure necessary to support residential development.

It is basic to the concept of ILAP that, wherever necessary, proposals spell out the expected roles and responsibilities of the different parties, and the principles which would govern their future working relationships. Unless these expectations are made clear, and a basis established for future integration of activities, the effectiveness of implementation will be substantially reduced.

Step 5: Implementation
Implementation of ILAP proposals will usually proceed in one or more of three ways: through more detailed, specialised plans; through expenditure programs; and through administrative or regulatory reforms.

Specialised Plans

Key issues will often be of such complexity or magnitude as to require preparation of specialised plans. These could include, for example, a structure plan for a newly developing area; a local conservation strategy; an economic development program; a public health plan; a community services and facilities plan; an open space and recreation plan.

Many councils have already prepared a range of specialised plans for such issues, but often without the benefit of an overall strategic framework or adequate arrangements for inter-agency and intergovernment cooperation. The ILAP process provides an opportunity to review existing plans to ensure they relate appropriately to each other, and to overall community needs and priorities. The same applies to plans prepared by other spheres of government.

Expenditure Programs

A fundamental tenet of ILAP is that expenditure programs be properly attuned to local needs and should make efficient use of scarce resources. Many proposals emerging from an ILAP process will necessitate a review of current patterns of expenditure with a view to:

- addressing areas of currently unmet need;
- switching resources to areas of higher priority;
- overcoming unnecessary gaps or duplication between activities or programs.

Wherever appropriate, the relevant expenditure programs of all three spheres of government and the community/private sector should be reviewed as a package. Clearly such reviews ought to be undertaken on a cooperative basis by the different agencies concerned.

Administrative and Regulatory Reforms

Resolution of some key issues may require adjustments or major changes to administrative arrangements or regulatory practices and processes rather than just expenditure programs and service delivery. For example, a great deal of attention has already been given to streamlining approvals processes through the Local Approvals Review Program (LARP). Similarly, AMCORD promotes greater flexibility in controls governing residential development to allow a greater range of choice in type and density.

ALGA advocates that an important aim of conducting an ILAP process is to ensure that approaches to administrative and regulatory reform promoted at State and national levels are appropriately tailored to local circumstances and consistent with local priorities. Such reforms will then complement other aspects of implementing the outcomes of an integrated approach to development planning.

Conclusion

ILAP is not the sole preserve of local government. Councils which embark on the ILAP process ought to receive the full cooperation and backing of the other parties involved. All spheres of government have to accept the challenge of responding to the particular needs of different localities, tailoring their programs accordingly, and properly coordinating their activities to address issues of concern to local communities. Indeed, ILAP is a continuing process and not a one-off exercise. It seeks some fundamental changes to the way governments work together in developing better communities.

Acknowledgement

The above material has been adapted from ALGA's *A Guide to Integrated Local Area Planning*, published in 1993. Copies of the Guide are available from the Australian Local Government Association,
8 Geils Court, Deakin ACT 2600.

Case Study:
Planning for the
Maryland–Minmi Corridor, Newcastle.

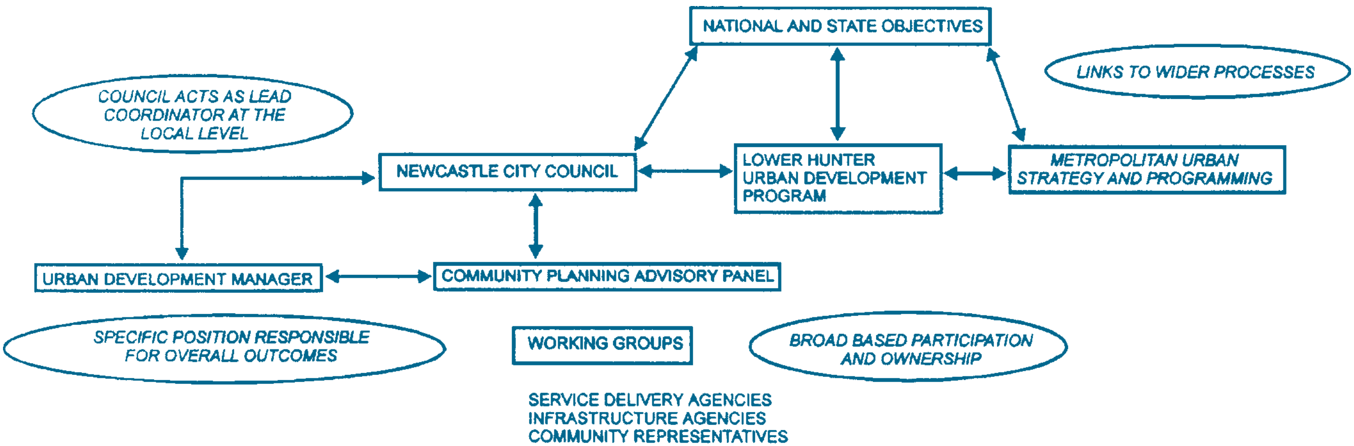


Figure 3: Maryland–Minmi Corridor integrated planning structure.

Context and background

The Newcastle City Council has identified the Maryland–Minmi corridor as suitable for urban development and has prepared the Maryland–Minmi Corridor Structure Plan. The plan predicts that the corridor is likely to accommodate up to 25,000 people over the next 20 years.

Support mechanisms

Newcastle City Council has set in train a series of consultative and planning mechanisms aimed at:

- developing a shared commitment among key stakeholders to the achievement of desired outcomes for the corridor;
- developing partnerships based on trust and a common understanding of the issues and the tasks to be carried out in developing the corridor;
- establishing participatory and consultative processes between council, the community, State and Commonwealth Governments and the private sector through a series of committees to ensure adequate opportunity for involvement at all stages;
- linking these processes to existing formal planning and coordination processes such as Newcastle City Council's Steering Comittee for the Corridor and the NSW Department of Planning's Urban Development Program and State Government coordination mechanisms. This includes developing links with the budgetary processes of government;
- developing longer-term working arrangements to ensure continued cooperation and review of progress at regular intervals.

An integrated planning and development process

The central aim of the planning and development process for the corridor is to effectively link related physical, social, economic, environmental and cultural aspects and to develop and implement a coordinated strategy for the delivery of infrastructure, services and access to employment. Other objectives include early access to community services, retail outlets and employment for residents within the corridor.

The essential elements include:

- identification of the outcomes intrinsic to 'best' practice planning, development and management of the corridor;
- identification of desired outcomes and strategies for achieving those outcomes, including:
  - examination of the contribution of all stakeholders to achieve the desired outcomes and investigation of collective strategies to maximise their contribution;
  - development of partnerships across the public, private and community sectors;
  - effective linkage with planning and development in neighbouring local government areas, particularly Lake Macquarie.
- implementation of a coordinated strategy for the staged planning, development, provision/delivery, funding and management of facilities and services to achieve the desired outcomes, including identification of alternative capital and recurrent funding regimes.

Benefits

The benefits include:

- better participatory and consultative processes between council, the community, State and Commonwealth Governments and the private sector;
- enhanced capacity of council to service the local community;
- innovative methods of infrastructure provision through such approaches as the joint use of facilities, increased private sector involvement, and application of alternative funding techniques;
- more cost-effective development;
- progress towards greater alignment of Commonwealth, State and local policies and programs to more effectively address needs and the overall well-being of the new community.

ILAP is of particular relevance to the situation facing the Maryland–Minmi Corridor. The ILAP principles offer an approach which ensures the development is well planned; environments are properly managed; services are appropriately designed and targeted; and duplication gaps are avoided. It provides a framework for the evolution of council's role as a lead agency for strategic planning in the corridor. Application of the principles throughout the planning and development process will produce more efficient and effective use of available resources; this is essential if quality urban development is to be achieved.

Practice Note PNP 2
Consultation

Scope

Community involvement is a critical factor in shaping the quality, equity and efficiency of the built environment. It can bring about a range of specific benefits such as:

- providing the community with the opportunity to express its views on the strategies and policies for residential development and housing in their area;
- enabling identification of potential problems arising from proposed development before development approval is given;
- providing an opportunity for feedback to councils on planning and development policies;
- enhancing public awareness of the background to local planning and residential development decisions.

Figure 1: Consultation can lead to better decisions.

A systematic approach
There are advantages in adopting a systematic approach to such consultation and in choosing the most relevant consultative technique. By adopting a more methodical approach, planning staff are more readily able to recognise the benefits and disadvantages of consultative strategies. Furthermore, a systematic approach can help to make the approval process more efficient and cost-effective.

Consultation processes must relate to the framework created by the relevant planning system. At the State and local level, decisions are made as to the extent of formal consultation required. For example, the legislation, regulations or policies may prescribe the extent to which some types of residential uses will be permitted as-of-right, or require town planning permits as part of a development application approval system. Such matters are likely to be the subject of some degree of consultation.

In the absence of a formal process (where consultation is required or carried out as a matter of course), it is often not easy to predict which issues in residential development will be seen to be significant and warrant consultation. However, this is not an argument for an *ad hoc* approach. A thoughtful and systematic consultative approach can provide a much better understanding of community concerns and ensure that residents are also better informed.

Consultation for upfront planning

Consultation can be seen as a logical part of the corporate and strategic planning activities of a municipality. It can provide a valuable two-way learning opportunity for exploring issues and options, and for deciding on strategies, policies and priorities.

Consultation is essential in the preparation of strategic and development plans and involves sharing of information of needs, establishing design and environmental performance conditions and developing improvement programs.

Approaches Towards Consultation

Consultation in a residential context

In the context of residential development, the emphasis is on consultation as opposed to participation. Participation implies a measure of sharing of power in the decision-making process; consultation is based on sharing information with the community, listening to community concerns, but with the planning authority reserving ultimate decision-making responsibility.

Conflicting views within a residential community are inevitable. Local communities are inclined to resist change, often in the face of policies that have the 'greater community interest' at heart. Consultation, therefore, does not necessarily produce solutions acceptable to all parties.

However, if consultation is conducted in a way that makes its purpose explicit, and appropriate techniques are used it should enhance the likelihood of informed discussion and increase the possibility of acceptance of a strategy, plan or proposal.

Consultation and the approval process

Consultation can help prevent a proposed development being judged poorly, simply because there might have been a lack of information available to the community. It can serve to improve the approval process for general residential development by:

- improving the quality of decision making and helping to achieve intelligent design;
- making decision making more accountable;
- increasing the certainty of decision making;
- reducing the time taken to deal with the consultation aspects of applications;
- making the assessment of residential development more comprehensive;
- reducing approval costs to councils, industry and the community;
- making the decision-making process simpler and easier to understand.

Principles for Consultation

In developing new or improved consultative methods in residential development, the following principles should be considered:

- people/groups with an interest in the outcome, ie stakeholders should be consulted;
- the process should begin as early as possible, in particular before entrenched positions have been taken by any party;
- the process should be based on the needs of the particular community involved;
- the process should recognise the need for balance — there are costs involved in prolonged consultation which may increase the cost of housing;
- the process should be solution-oriented rather than problem-oriented;
- adequate resources (eg time, money, staff, information) should be made available;
- the consultation program should be flexible and capable of responding to different situations;
- it should be understood and accepted that solutions devised by experts are not necessarily the best from a community's viewpoint;
- there should be a clear demonstration of how community views have been incorporated.

Designing a Consultation Process

Major factors

In general, the major factors influencing the consultation process include:

- the kind of issue (eg strategic planning, development planning, development proposal);
- the degree of delegation planning officers are given by council in situations where there is conflict;
- developments that reflect State policies but are not understood or accepted by the local community;
- complex issues, developments or impacts.

Strategic and local area planning

People will respond most effectively to an issue or development proposal where they perceive a strong, tangible benefit, and where the issue is immediate, close at hand and specific. Consultation on proposals that are remote in time or vague in detail attract less general interest.

Consultation on strategic planning issues is important; however, it requires different techniques than those required for evaluating specific development proposals. Techniques for strategic and local planning are discussed at the end of this Practice Note under ‘Applications’.

Consultation programs must be designed to take account of the preferences of both decision-makers and the community, as well as the way in which people will be able to identify with the final decision.

In order to reduce the length and uncertainty of the approval process, the focus of public consultation should, in the first instance, be on setting the context for residential development. Once the development parameters are clearly established (with community involvement), greater certainty is created and further consultation on specific proposals at the application stage may not be necessary or may be limited to specific aspects (this is the case with certain categories of development in some States).

AMCORD has been designed to facilitate consultation upfront by emphasising the importance of planning (eg development plans) in advance of development proposals, and by suggesting appropriate techniques for plan and policy preparation with community involvement.

Development proposals

The design of the consultation process for dealing with development proposals should consider:

- the likely impacts;
- those who may be significally affected;
- those with an interest in the proposal;
- how information is to be presented and shared;
- how controversial aspects may be addressed;
- how opportunities for negotiation, compromise or modification can be created;
- what happens when agreement is reached;
- what happens if agreement is not reached.

Some Consultation Techniques

A range of techniques

A variety of techniques are available to involve and consult with the community on strategic and development planning and residential development proposals.

There is no 'best' technique. The practice of consultation for residential development has not been extensively documented and varies considerably in the way that methodology is applied. Planning authorities are encouraged to develop a range of consultation methods and to test and evaluate them.

In so doing, consideration should be given to:

- providing training for elected members and staff in consultation techniques;
- ensuring that information regarding the application is accurate and complete;
- providing training in the conduct of meetings convened for the purpose of community consultation.

Figure 2: A design workshop is used for consultation.

Internal meetings and advertising

Council officers often use internal meetings as the first stage of negotiation (whether 'over the counter' or in the more formal sense). They are one of the most widely used, effective and probably efficient means of starting a community consultation program.

Officers may provide advice on how the proposal relates to current council plans and policies and on likely community reaction. The advantages of this technique are that it allows proposals to be tailored to existing policies and local conditions, and facilitates the efficient processing of development/permit applications.

The effectiveness of the technique depends on the skills of the officer(s) involved in providing information and responding to objector and applicant views, also in engendering trust.

Advertising a development application is a more formal process of consultation at this preliminary stage. This process varies between the States and is not described further in this Note.

Pre-planning advisory committees

The purpose of pre-planning advisory committees is to provide early information on council policy and to highlight possible problems or objections for the applicants. This saves time and costs, compared with having to amend plans once the formal processing has begun.

These committees usually comprise elected representatives, senior planning officers and, occasionally, representatives of outside authorities. They can also include community representatives and/or adjoining owners. The committees can meet at the request of an applicant, but councils can encourage and guide applicants as to the appropriateness of such a meeting.

Pre-planning committees are most relevant for larger, unique or more controversial development proposals. Research suggests that they play an important role in information sharing, in highlighting the nature and detail of critical issues and in helping to define more appropriate design solutions.

Site meetings

Site meetings involving objectors, applicant and council officers (and sometimes elected representatives) are often the means by which councils address objections to a proposed development. Their purpose is to discuss fully the implications of the proposal and to attempt to resolve the objections.

Council officers find these meetings effective in sharing information and views, and they often reveal information not previously known. They are successful in resolving objections in some cases, but not all (probably less than half). Where the differences are more fundamental, they serve a largely information sharing and/or educational function.

Public meetings

Public meetings are not often suitable for resolving disputes over residential development proposals. Entrenched views are common in such forums, making a managed negotiation virtually impossible. However, public meetings are useful as a means of enabling objectors to express their views as a democratic right. Hence they are often initiated by members of the public or elected representatives who wish to gauge or demonstrate public concerns (ie a reactive use of public meetings).

Public meetings are also used by councils to present information to the community on residential plans or strategies (ie a pro-active use). In this case, they are usually part of a wider program of consultation.

Workshops

Workshops are meetings in which attendees are divided into small groups. Individuals are expected to participate by contributing ideas or by assisting in the development of strategies and plans or in the design of parts of major residential sites. If used appropriately and properly managed, workshops can be a very effective means of involving the community. They can also be time-consuming and expensive to organise, but can often lead to better outcomes.

Charettes

Charettes are workshops where all shareholders ‘work through’ a specific problem. Charettes generally continue over several days, and a preferred solution is the expected result.

Precinct committees

Precinct committees are usually geographically-based advisory committees. They can be an important means of community access to a council’s decision-making process.

The most notable and indeed the first example of this concept is in North Sydney, where it was first applied in 1978. North Sydney has 25 precincts, each of approximately 2000 people, and most are served by a precinct committee. All development applications and rezoning proposals are referred to the precinct committee for comment.

The objective in North Sydney is to provide open government, broadening the democratic base by enabling residents to actively participate in council’s decision-making processes.

Development forum

A development forum is designed to facilitate communication and education between the council and people directly involved in development.

The Great Lakes Council (NSW), for instance, has set up an informal planning consultative forum which consists of senior council officers (attending as individuals), consultants, developers, and representatives from the real estate industry. It provides an opportunity to discuss development issues and impacts before proposals have been prepared and applications lodged.

Selecting appropriate techniques

The appropriateness of the consultation procedure depends on the context of any residential development project, its development category and scale, and the nature and extent of existing planning controls over residential development.

The consultative technique should be within a reasonable time frame. If consultation leads to unacceptable delays in processing a development application, there may be resistance to including it in future development approvals processes. Additionally, increased costs incurred by the housing development industry are likely to lead to higher costs for the housing consumer.

Consultation forms a legitimate and important part of the approvals process. However, it should be carefully managed so that the risk of uncertainty to the housing development industry is decreased not increased. A point may be reached where consultation to minimise risk to the community unreasonably increases the costs to an industry that is expected to provide affordable housing.

The most effective form of consultation is that which;

- directs community views into an expression of rational planning-related considerations and away from emotive and/or prejudiced ‘feelings’;
- clarifies upfront the scope for housing, so that there is predictability for both the community and the housing development industry.

APPLICATIONS

Strategic planning
As discussed, there are many techniques of community consultation. It is important to regard them as an integral part of the planning process and to use them as progressive and collective learning experiences.

This can be achieved through a series of workshops, attended by the range of stakeholders. The workshops should be spaced to provide an interactive framework for arriving at a preferred position, and to allow for technical work to proceed in the intervening periods. For example:

- Workshop 1: Issues, constraints, opportunities
- Workshop 2: Review of preliminary options and assessment criteria
- Workshop 3: Review of options and consequences, setting priorities and expression of preferences.

Such a process assumes that the local authority commits sufficient resources to undertake the necessary technical work between the workshops.

A similar process was implemented by the Great Lakes Council, which established community liaison groups in each of its local centres. Their task was to develop a vision for their area. One of the issues discussed was how to deal with development pressures along the coast. These included to continue with coastal sprawl or create small, clearly defined, coastal villages which protected the natural assets. An important outcome of this process was a change in community perceptions.

Local area planning

A staged process of community consultation is also appropriate in addressing development planning. This particularly applies to established residential areas where there are often concerns of preserving existing values. These concerns can be addressed through workshops, charettes and other techniques; however, the best results are achieved with a carefully prepared and implemented program of community consultation.

Practice Note PNP 3

Sustainable Residential Development

Scope

There is a growing interest in creating a sustainable urban environment, ie one in which there is a balance between what the community needs, can afford and can sustain, and the long-term preservation of the environment. Residential development is a major component of the urban environment. Housing location, type, density and design, and the infrastructure it needs, have a major effect on the sustainability of the urban environment.

What is Meant by Sustainable Residential Development?

The Commonwealth Government's Strategy for Ecologically Sustainable Development (ESD) is endorsed by all Governments in Australia. The core objectives are to:

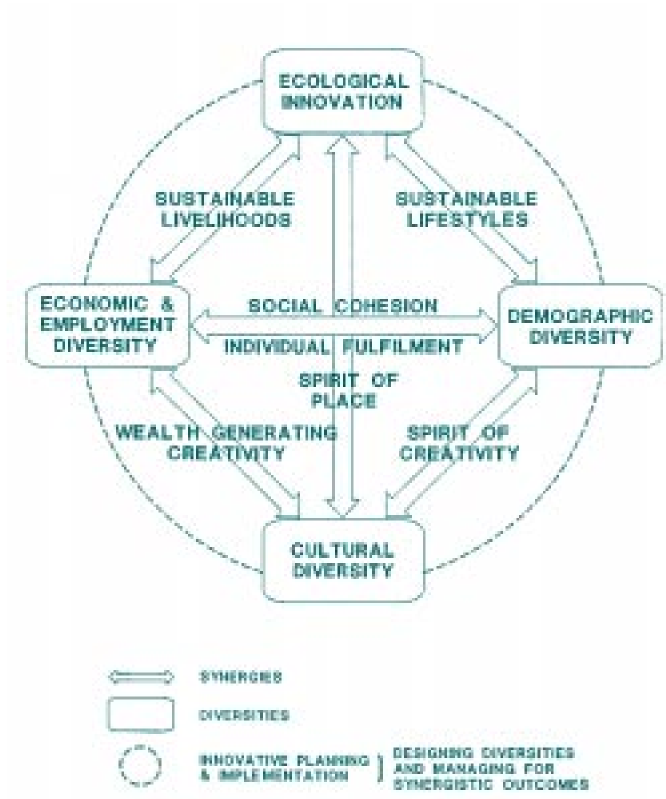


Figure 1: A system of diversities for sustainable urban living in the 21st Century Jerrabomberra National Ideas Competition (Synetics).

- enhance individual and community well-being by following a path of economic development that safeguards the welfare of future generations;

- provide for equity within and between generations;

- protect biological diversity and maintain essential ecological processes and life-support systems.

While these objectives are clear, it is not immediately obvious what they mean in practice or how they can be applied in achieving a sustainable urban environment.

Options for Increasing Sustainability

Sustainability in the urban environment can be addressed in several ways.

Ecologically sustainable development
Australian cities are characterised by relatively low population densities, the dominance of the motor car and high emissions of greenhouse gasses. Cities consume substantial land, water and energy resources, produce high levels of pollution and waste, and are not ecologically self- sustaining.

The challenge is to create urban forms that can do better in terms of environmental impact and use of natural resources. The guiding principle for improved performance has been summarised by the catchcry:

'think globally, act locally, respond personally'.

In planning for greater sustainability, there must be a response to the global issues of energy consumption, air and water quality, and species conservation. The local issues are likely to include avoiding unnecessary urbanisation of rural lands, introducing low impact infrastructure and reducing transport demands. Opportunities for personal responses to ESD objectives include application of energy saving devices, domestic recycling of wastes, domestic water harvesting, water reuse and conservation, and approaches to landscaping.

Economically sustainable development

Australian cities are not financially self-sustaining. Low urban densities and segregated land uses have dislocated communities from their economic base. Full-cost pricing of conventional infrastructure (including headworks) on the fringe of urban areas would result in housing no longer being affordable for many sections of the housing market. The financial burden on future generations of maintaining and upgrading infrastructure, and the long–term costs of environmental repair and management, are often not considered in urban planning.

Economic sustainability applies not only to the costs of services but also to the creation of wealth, giving people the capacity to pay for these services. It is generally applied to local communities. It can be promoted by:

- assessing the potential for local resources (physical resources and the labour market) to support economic development;
- identifying local waste streams and by-products as economic resources;
- reducing resources ‘imported’ from outside the local area, and applying recycling and value adding to local production;
- providing opportunities for individual participation in economic production;
- effectively tapping into local skills and creativity.

Socially sustainable development

Questions have been raised about whether Australian cities are socially self-sustaining. The current low-density form of development offers affordable but poorly serviced housing on the fringes. It favours access to services by those with resources and cars, and penalises those without either (NHS, 1992a). It also denies people access to many of the resources that would enable them to meet their own needs as an alternative to dependence on the State.

Planning for socially sustainable development includes establishing communities where residents have ready access to the resources that support their well-being. Communities need to be more self contained and equitable in relation to the opportunities for local work, learning and play. It may also be appropriate to promote greater sharing of amenities, thus requiring innovation in household tenure and community management.

Focusing on sustainable development gives increased understanding of the long-term interrelatedness of actions and impacts. This need for an integrated approach applies to urban environments as a whole, and to residential development in particular. Sustainable development, in particular therefore, is a key feature of AMCORD and has been considered in all its provisions.

Strategic Directions

Several important principles must be considered in planning for sustainable development.

Assess available resources

A resource inventory is an important starting point for ecological, economic and social sustainability. This can be combined with state-of-the-environment reporting to establish a baseline from which the effectiveness of strategies can be measured. It will often be appropriate to do this with water catchments as appropriate planning units, even if these extend beyond the area of immediate planning concern.

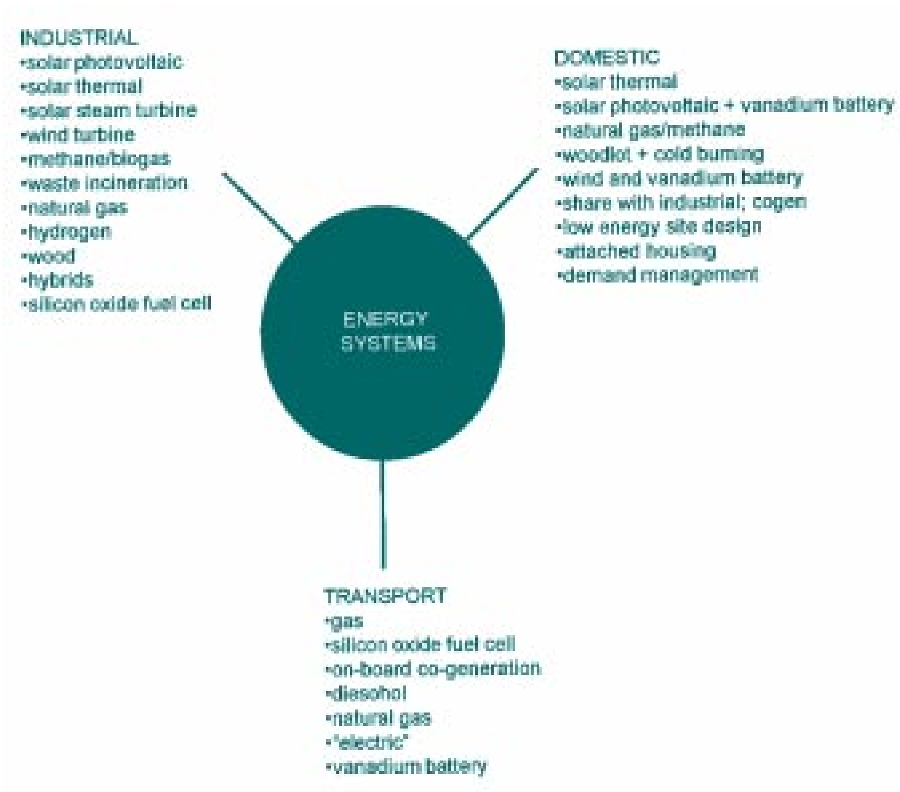
Identify productive rural–urban interrelationships

Several critical issues need innovation in planning for successful rural–urban interrelationships. Planning for the urban–rural edge must not squander land resources, as has often been the case in the past. Rural residential development needs to allow specific involvement in conservation or agricultural production, and clustering of dwellings within areas of common management is appropriate for some environments. There may be opportunities to link rural areas of production with urban areas of consumption. This would include networking of food production and processing activities with consumers, as well as production of building materials (earth, clay, plantation timbers) and other consumables. There may also be planned opportunities for involving urban residents in rural activities, including work in rural production, information and research, voluntary participation in environmental management, and recreation.

Minimise use of resources
The relationship between urban form, housing density and type, transport systems and street design on the one hand, and the use of non–renewable resources, energy and the subsequent greenhouse impacts on the other hand, is a fundamental aspect of sustainable development. Another catchcry of sustainable development is:

‘reduce, reuse, recycle, repair.’

Australian communities consume very high levels of resources, and this cannot be maintained over time without significant environmental degradation. Planning will need to become considerably more conscious of


INDUSTRIAL
•solar photovoltaic
•solar thermal
•solar steam turbine
•wind turbine
•methane/biogas
•waste incineration
•natural gas
•hydrogen
•wood
•hybrids
•silicon oxide fuel cell
DOMESTIC
•solar thermal
•solar photovoltaic + vanadium battery
•natural gas/methane
•woodlot + cold burning
•wind and vanadium battery
•share with industrial; cogen
•low energy site design
•attached housing
•demand management
ENERGY SYSTEMS
TRANSPORT
•gas
•silicon oxide fuel cell
•on-board co-generation
•diesohol
•natural gas
•"electric"
•vanadium battery


RECYCLE GREY WATER
DEMAND MANAGEMENT
DONT WASTE
INFRASTRUCTURE REQUIREMENT
•on site management
•no pipes in & out
•absorptive surfaces
RAIN WATER TANKS
AUDITS
REVEGETATE CREEKS
•plants
•habitat
•erosion control
•replant trees
•reeds
EFFICIENT APPLIANCES
USER PAYS
SWAMPS SETTLE POLLUTION
WATER MANAGEMENT

resource use, with energy auditing and real cost pricing increasingly being applied. The new field of environmental economics may allow for environmental impacts to be more accurately costed as part of any assessments, with provisions being made for appropriate monitoring, management and repair of the environment.

Sustainable development also requires careful consideration of both capital and operating costs. The capital cost is only part of the total cost; operating cost over the life of the facility usually exceeds the capital cost substantially. Total life cycle costing should be part of financial planning for urban development.

Provide infrastructure that the community needs and can afford

The provision of housing cannot be divorced from the provision of the physical and social infrastructure of the community at the time of settlement. Residential development creates a resource that needs to be maintained and updated to meet new standards and requirements. Life cycle affordability is rarely considered, but strategic and operational asset management is likely to become a significant factor in future sustainable development. The tools for assessing infrastructure, asset creation and management must be improved, as part of a sustainable residential development process.

A focus on environmental performance

Greater emphasis on environmental performance, together with demand for greater mix of uses within urban communities, may require the development of new planning techniques. Traditional zoning systems may well be inappropriate in meeting future needs. Rather, the planning frame work will be driven by the identification of performance thresholds, the determination of carrying capacities for different environments, the establishment of sustainable levels of resource use, and the specification of long-term management requirements. Conditions imposed on development will require greater measurement of long-term impacts, as well as corrective management strategies.

Performance standards, which are already being broadly applied in planning systems, point to desired outcomes and offer greater scope for more flexible and innovative planning and design. A performance-based zoning approach aims for greater equity, diversity and choice in residential environments than can be achieved by a prescriptive and rigid land-use planning system.

Community involvement

Sustainability is a matter of balance. There will always be conflicting views about the relative weights to be given to ecologically, economically and socially sustainable approaches. These views will differ between communities and evolve over time. Community involvement in setting priorities is, therefore, of considerable importance. Essential for success is a high level of community participation in determining local strategies, monitoring their effectiveness and reviewing targets over time.

ESD as an ongoing process

Sustainability is an evolving concept; what it means in practice will change as knowledge is gained, needs are understood and there is an acceptance of the consequences of any action. 'Sustainability is to be seen not as an end point, but rather as a direction accompanied by a set of guiding principles. It is a carefully chosen journey rather than a destination' (Rodgar et al, 1994).

Source of information spiders: Dr V. Rounsefell.

Case Study: New Haven Village, Osborne, Adelaide

Introduction

New Haven Village is the result of a national design competition, sponsored by MFP Australia and BHP, to design an innovative and sustainable residential development on 2 ha of land at Osborne 16 km from the Adelaide CBD. The winning entry comprises 65 medium-density dwellings on Torrens Title allotments varying in size from 123 to 348 m² (average 196 m²) resulting in a site density of approximately 33 dwellings per ha.

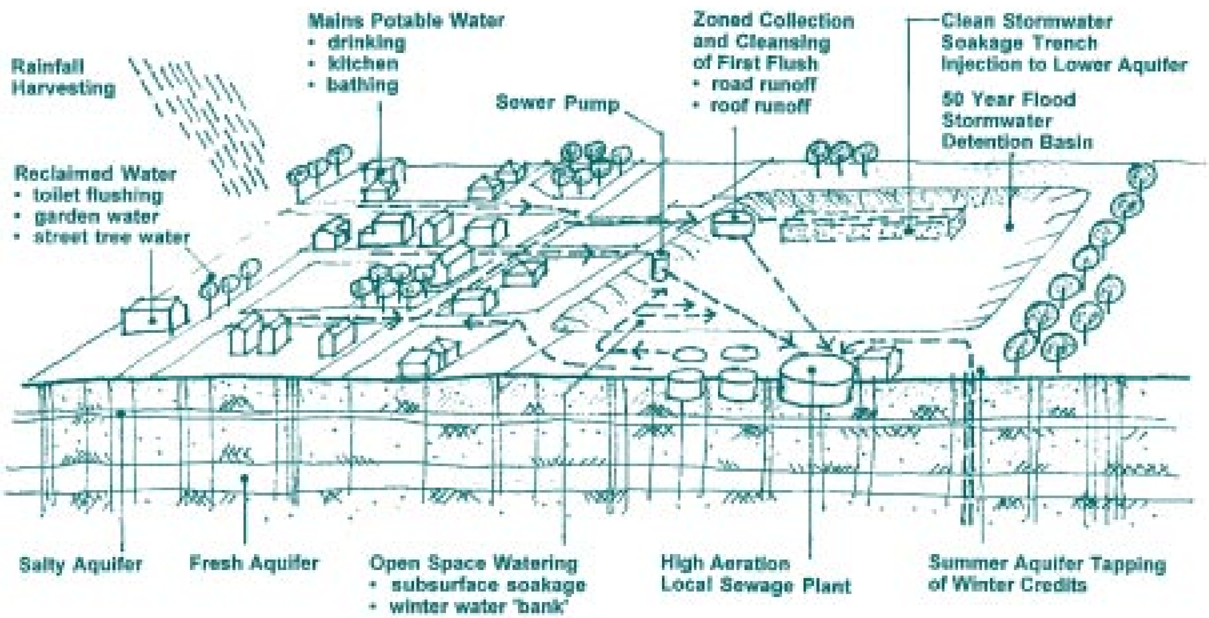


Figure 2: On site water/wastewater management at New HavenVillage, Osborne, South Australia.

Construction of the Village has begun, and it showcases a number of innovations in urban design, water and wastewater management, energy management and engineering which are applicable to other housing projects throughout Australia.

Urban Design

The site of the New Haven Village was chosen primarily because of its proximity to existing infrastructure such as public transport, a shopping centre, schools, community services and recreational facilities. This allowed for housing of significantly higher densities than that of the surrounding areas.

For the first time in South Australia, a shared zone for vehicles, pedestrians and cyclists has been created. Priority is given to pedestrians and cyclists through reduced street width, and the use of bollards, landscaping, street furniture and materials and a maximum speed limit of 10 km/ph. Proximity to public transport and other facilities, and the pedestrian and cyclist friendly public environment, are anticipated to result in a reduction in the number of cars per dwelling and an increase in the number of daily trips on foot or bicycle.

Dwelling and allotments are orientated to ensure north-facing living rooms which are directly linked to private open space. Each house is designed to the highest energy efficient standards, incorporating the latest passive energy construction features.

A ‘town square’ is located within the Village and includes each household’s mail box within the Village Tower to encourage greater communal interaction. The design of the Village Tower and the upgrade of the adjacent Osborne Railway Station have both included local artist and community involvement.

Water and Waste Water Management

The treatment and reuse of wastewater, stormwater and sewage within the Village will result in virtually no wastewater leaving the site. It is anticipated that this will result in a reduction of average household water consumption by 30%.

All household wastewater is treated through a local treatment plant (located beneath the adjoining reserve) and ultimately reused in toilet cisterns and for irrigating gardens, road verges and reserves. The treatment plant will be maintained and operated by the local council.

The stormwater system has been designed as a traditional system based on a one in five-year storm for underground flows and a one-in-100 year storm for overland flows. The adjoining reserve has been modified to act as a stormwater retention basin for peak flows.

The underground stormwater pipe system is placed centrally in the services corridor under a spoon drain with grated sump inlets which act as gross pollutant traps. The road pavement profile is V-shaped to ensure maximum surface flows and capacity for peak events. A 40,000 litre underground tank collects the 'first flush' stormwater which is used in the wastewater treatment plant.

Water supply innovations include the use of 'Titon-Loc' joints on the pipework to enable other services to be installed in close proximity to the water main in a narrower street service corridor. The Village is also trialling an automatic remote metering system for electricity and water, with conventional water metres replaced by underground cast-iron meter boxes.

Energy Management

As well as dwelling and allotment orientation to maximise passive energy opportunities, each dwelling includes high levels of insulation, and incorporates window shading devices to reduce heat loads. Alternative energy systems, such as geothermal, solar and reverse cycle, will be incorporated into all dwellings. These energy systems are made accessible through a 'green mortgage' scheme whereby purchasers can extend their loans to cover upfront capital costs.

Environmentally friendly, less obtrusive street lighting have also been used in the Village. The new OL lamps are low in energy consumption, have a long life and are low in filament coatings.

Other Engineering Innovations

The Village includes narrower than conventional public utility street services corridors for the installation of underground service mains. This allows for a significantly reduced road reserve width (from a previously minimum 12.4 m to 6.8 m) which in turn allows for a more efficient road and allotment layout.

Other engineering innovations include:

- The development of new electricity service pits which can supply four houses instead of two, thus reducing the number of pits required. The use of an enclosed, in-line fuse holder has allowed installation of service fuses in this pit rather than in an above ground pillar.
- The location of electrical and telecommunication pits in garden areas rather than roads, allowing lighter-duty service pit covers.
- In-ground boxes for water mains meters which allow meters to be located in the driveway of narrow frontage allotments.

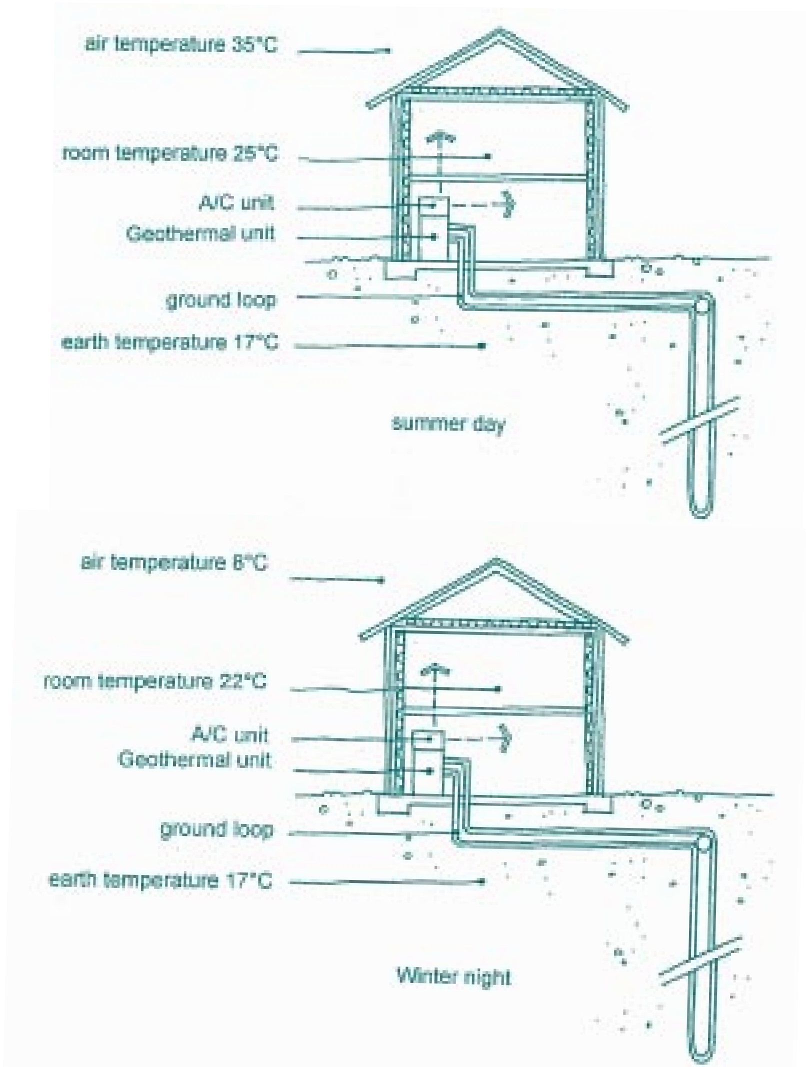


Figure 3: Geothermal in-ground heat exchange provides for winter heat, summer cooling and hot water

- A sealed telephone system requiring fewer pits and no future maintenance accommodates two lines to each household for telephones, computer links, facsimiles and other communication technology. Conduits have been increased in diameter to allow for future installation of new technology.

- An innovative flood gully replacement is installed at the front of each dwelling, preventing overflow from a blocked sewer being trapped in rear courtyards.

- A sub-surface drip irrigation system enables the Village's reserves and household gardens to be irrigated while in use.

A Practice Note outlines the changing demand in housing needs and outlines methods of planning for this change.

Practice Note PNP 4

Housing Needs

Scope

Housing demand and change

Housing preferences have helped to shape Australian cities and will continue to do so. However, housing demand is not static. There are changes in demographic characteristics, community attitudes and financial constraints, among other factors. As a result, changes in housing type, location and density may occur and affect the urban environment.

There are significant changes in the demographic character of the population that have implications for housing:

- household size is declining (from about 3.5 persons per household in 1961 to under 3 in 1991), as is the proportion of households with dependent children;

Figure 1: A variety of housing to respond to changing housing needs.

- just over 50% of households are now composed of only one or two people;
- with the decline in household size, the number of households has increased. Household formation has been occurring at a rate greater than population growth, as indicated by every census conducted since 1961;
- by 2006 almost half of all income units will consist of single persons or childless couples aged over 35 (compared with only around 40% at present — NHS, 1991);
- the trend of increased female labour force participation is likely to continue, creating a growing need for housing which is well located in relation to employment and employment-related services such as training and child care (NHS, 1991).

The changing demand is therefore not only a matter of type and quantity, but also one of location.

Many people, as they grow older, want less space and more care. Some are content simply to move to an area where these needs can be met. However, others who value their network of friends and relatives and the familiarity of their local environment want to stay in their local area, but cannot always find appropriate accommodation. As a result, dwellings remain occupied by small and ageing households, instead of being adapted or redeveloped, or occupied by a larger household.

Housing affordability has become a critical issue for a growing proportion of the population. Home ownership continues to be highly valued in Australian society, but the increasing cost of traditional housing and a diminishing ability to pay has forced the housing development industry to find more cost-effective solutions and provide for increased choice.

Meeting changing needs
Several innovations pioneered by the Green Street Joint Venture are now beginning to be applied in practice (eg small-lot subdivision, narrower and safer streets, and different housing types).

AMCORD aims to extend this choice further.

Location, affordability and choice in housing must be linked with the need for increased sustainability of the urban environment.

Thus options should be offered to help make existing low-density suburban areas more sustainable. Affordable housing should also be offered in locations that support the needs of a changing population, while recognising the needs of established communities.

Housing Strategies

Changes in housing demand are likely to occur in all towns and cities. The implications may be more profound in larger cities than in smaller centres because of the costs of affordable housing in desired locations. However, in all centres these implications must be addressed and housing strategies formulated.

The primary aim of a housing strategy in the context of AMCORD is to create the conditions that facilitate the provision of appropriate, sustainable residential development for a changing society, and ensure there is affordable and diverse forms of housing with all necessary facilities and services.

There are several components in preparing a housing strategy (adapted from *Local Housing Action*, 1992):

Research

- existing housing stock and occupancy characteristics and recent changes in such characteristics;

- market conditions and needs;

Figure 2: A housing complex for the elderly to meet different housing needs.

- community structure;
- longer-term changes in housing needs;
- facilities and services;
- environmental performance;
- infrastructure.

Policy issues

- objectives;
- housing location in relation to facilities and services;
- sustainable development performance criteria;
- review of infrastructure needs and provision;
- review of current zoning and development control provisions;
- development application procedures and trade-offs;
- housing initiatives.

Existing housing demand and supply

Analysis of the number of households by type

Households can be grouped by size and type of occupancy. The information is readily available (census data for collector districts).

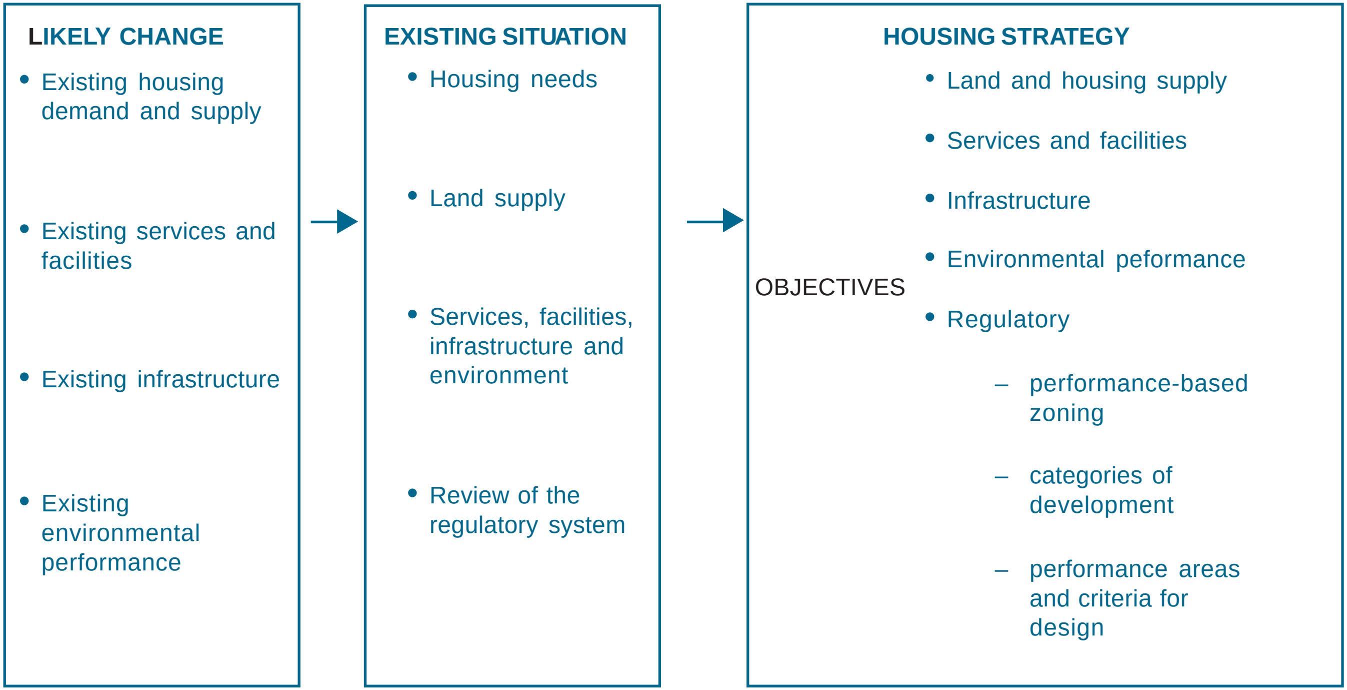


Figure 3: Indicative process for developing a housing strategy

Analysis of household

The National Housing Strategy considered eight key consumer groups, some of which were based upon their stage of the life cycle, and others on the basis of identified special needs (Housing Information Study, 1992).

The groups based upon the life cycle were:

• young separators;

• first home buyers;

• traders-up;

• older home owners;

• older private renters.

The groups with special needs were:

• sole parents;

• recently arrived migrants;

• caravan park residents.

Although information may not be readily available, it is useful to obtain it, as there are clear planning implications in housing provision and services for these groups.

Analysis of housing stock

Information on housing stock is available from the census and recent changes can be measured through an analysis of building approvals, alterations and additions. Housing condition surveys may also be warranted.

Existing infrastructure and services

Social infrastructure

The existing services and facilities should be analysed and related to the housing areas and household groups served. Deficiencies should be identified.

Physical infrastructure

The condition of the existing physical infrastructure, the need for up-grading and its capacity for further demands should be assessed. This particularly applies to stormwater drainage, as increased densities may lead to increased runoff.

Environmental quality

In established areas, an analysis of existing environmental conditions should be undertaken and any need for improvement identified.

Housing needs

Market outcomes

Analysis of recent transactions and discussions with real estate agents will indicate the interaction between supply and demand.

Non-market conditions

The operation of the market does not ensure that all needs are met. The appropriate matching of housing stock should be checked. For instance, there may be a demand for smaller dwellings by older residents who want to remain in the area where they live, but the supply is impeded by existing zoning provisions.

Household projections

Changes in household size and type should be analysed and forecasts made of likely housing demand for a period of up to 20 years. In larger towns and cities, forecasts of population growth and household formation will probably exist. In communities where they do not exist, assumptions of high and low population and households should be made.

Household groups

It is desirable to relate the household projections to the likely changes in household groups as this influences the approach towards development planning (such as accessibility, infrastructure provision and environmental management).

Land supply

Vacant land

The availability and suitability of vacant land for housing should be assessed. Matters requiring investigation include the land's sustainability for development, accessibility, and ability to economically provide services, and the size and fragmentation of property holdings.

Infill and redevelopment sites

The availability and suitability of infill and redevelopment sites may be more difficult to assess. Where land is not affected by constraints associated with neighbouring developments, there may be potential for housing. However, the potential of sites for redevelopment within many established residential areas will depend on the provisions of existing planning instruments and the attitudes of existing residents. Neither of these conditions need prevent further development, but there must be a careful exploration of the options in consultation with the local community and the development industry.

Council-owned property

Local authorities should review existing council-owned properties to assess their possible redevelopment for housing.

Services, facilities, infrastructure and environment

The impact of further population and housing development on the existing services, facilities, infrastructure and the quality of the environment should be assessed in broad terms. A detailed assessment is required only when there are specific proposals for local areas.

The regulatory system

Review

There is a need to review the regulatory aspects of planning policies that affect housing outcomes, such as:

- current planning objectives;
- zoning and whether it restricts the scope for particular housing forms and types, generally or in specific areas;
- codes and regulations, whether they prescribe minimum standards instead of Performance Criteria, and whether the standards are still appropriate;
- approval systems and how they perform in relation to different housing categories and for particular areas;
- community involvement.

Consultation with the housing and development industry is strongly recommended.

Objectives

Setting objectives is important in developing housing strategies. The following objectives may be pursued by local authorities (adapted from *Local Housing Action*, 1992):

Housing affordability

To facilitate the provision of housing for a range of income levels, especially for first home buyers.

Housing choice

To ensure that current and future residents have access to housing appropriate to their needs.

Market efficiency

To facilitate the provision of land and housing at a rate consistent with demand and without creating inflationary pressures.

Public housing

To facilitate the provision of affordable public housing or other forms of housing not provided by the market.

Cost-effectiveness

To facilitate the provision of housing in a way that it makes the most efficient and cost-effective use of the land, the infrastructure thereon and building techniques.

Facilities and services

To ensure that housing and the provision of facilities and services are integrated in space and in time.

Housing amenity

To encourage a standard of residential development and housing design that not only ensures adequate daylight, open space and privacy, but also promotes development sympathetic to the local streetscape and environmental and historical characteristics.

Community participation

To actively encourage local resident, community group and industry participation in the development and implementation of a local housing strategy.

Security of tenure

To increase security of tenure for people in rental accommodation and to ensure information and advice are available to people whose housing opportunities are affected by public and private sector activities.

Crisis accommodation

To facilitate the provision of emergency short and medium-term crisis accommodation.

Matching future needs with supply

To satisfy such objectives, matching needs with supply is not simply a matter of numbers. There must be careful consideration of the different needs, and the constraints and opportunities in different parts of the local area.

Linkages

The provision of housing must be related to density and urban form (see PNP 5 and PNP 6), accessibility (see PNP 7), physical and social infrastructure (see PNP 8) and environmental quality (see PNP 3 and PNP10). The links vary depending on housing categories and groups. Housing strategies, therefore, should be considered in the context of an overall planning strategy.

Ongoing process

Housing strategies, like any planning strategy, chart directions for the short to medium term future (ie often 5-10 years hence). They need to be revised and updated in the light of new information and perceptions. A data base of housing provision and household characteristics, infrastructure, facilities and services is an important tool in such a process.

References

Office of Local Government, Department of Housing and Regional Development (1992) *Local Housing Action: An Overview and Guide to Good Practices.*

North Sydney Council (1994)*Affordable Housing: Housing Strategy.*

Sutherland Shire Council (1994)Draft Housing Strategy.

Practice Note PNP 5
Housing and Urban Form

Scope

The growing understanding and acceptance of the concept of ecologically sustainable development (together with other factors such as changes in technology) is progressively changing the management of towns and cities. This, in the long term, may change the way we live, work, move and interact.

The location, density and type of housing are central to these changes. There is a need for options that help to make existing low-density suburban areas more sustainable and to offer affordable housing in locations that support the needs of a changing population. A range of options can be considered: more compact cities, high-rise or low-rise development, fringe development or urban consolidation, and large or small-scale urban reform.

The emphasis on options is deliberate. A pivotal feature of AMCORD is to increase choice; hence the focus on performance instead of prescription. This applies at all levels of housing, from the design of individual development proposals to housing in an overall urban context.

However, cities are large collective enterprises with considerable inertia to major change. Accordingly, a shift towards more sustainable development will be a slow process.

In a report to the New South Wales Parliament, the Standing Committee for Long-Term Strategies commented that urban consolidation has its merits, but will not prevent continuing urban sprawl (Standing Committee for Long-Term Strategies, 1992).

The extent to which change towards more compact and varied housing is achievable and appropriate will vary from city-to-city and from time-to-time. There are many facets and, as indicated in Sections 1.3 and 1.4 in Part 1, these can best be addressed through longer term regional and local strategies.

New Urbanism

An international approach to urban design which seeks to redefine the best elements of late nineteenth and early twentieth century design (of integrated, mixed-use communities oriented to public transport) and re-interpret it to fit late twentieth century conditions has gained momentum in the last decade. Termed 'New Urbanism' by its proponents, the principles are as follows (Duany, Calthorpe et al, 1991).

Community Principles
All planning is in the form of complete and integrated communities containing housing, shops, work places, schools, parks and civic facilities essential to the daily lives of residents.

The size of communities is designed so that housing, jobs, daily needs and other activities are within easy walking distance of each other.

As many activities as possible are located within easy walking distance of transit stops.

Communities contain a diversity of housing types to enable citizens form a wide range of economic levels and age groups to live within their boundaries.

Businesses within a community provide a range of job types for local residents.

The location and character of a community is consistent with a larger transit network.

A community has a centre that combines commercial, civic, cultural and recreational uses.

A community contains an ample supply of specialised open space in the form of squares, greens and parks of which frequent use is encouraged through placement, design, and housing densities.

Public spaces are designed to encourage the attention and presence of people at all hours of day and night.

Each community or cluster of communities has a well designed edge so that agricultural greenbelts or wildlife corridors are permanently protected from development.

Streets, paths and cycleways form a fully connected system of interesting routes to all destinations, their design encouraging pedestrian and cycle use by being small and spatially defined by buildings, trees, and lighting, and discouraging high-speed traffic.

The community's natural terrain, drainage and vegetation are preserved wherever possible, with superior examples contained in greenbelts or parks.

The design of the community helps to conserve resources and minimise waste.

The efficient use of water is encouraged by natural drainage, water harvesting, drought tolerant landscaping and recycling.

Street orientation, the placement of buildings and shading contribute to the energy efficiency of the community.

Regional Principles

The regional land-use planning structure is integrated within a larger transportation network built around transit rather than freeways.

Regions are bounded by continuous systems of greenbelt/wildlife corridors as determined by natural conditions.

Regional institutions and services (eg, government, stadia, museums) are located in the urban core. Materials and methods of construction are specific to the region, exhibiting continuity of history and compatibility with climate, to encourage the strengthening of local character and community identity.

Source: Local Government Commission, Land Use Strategies for More Livable Places, 1992, Sacramento, CA

More Compact Cities

One of the options is to create more compact cities or develop higher density nodes or centres within existing cities.

There are alternatives to the car oriented city: linear and radial cities developed along major transport corridors. The two sets of alternatives can be combined into different urban forms (such as urban 'nodes', 'urban villages', and transit-oriented developments) which may be more sustainable than current forms and structures.

There is no single model

No single urban form can achieve all environmental, social justice, economic and lifestyle requirements, however there are indicators.

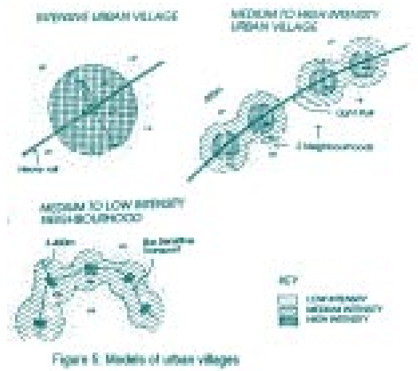


Figure 1: Models of urban villages.

A recent study of urban form and development strategies examined equity, environmental and economic implications and concluded that 'the most acceptable approach seems to be:

- selectively making cities more compact, to increase housing variety, access and (with government support) more affordable housing in the inner, middle and outer parts of existing cities;
- developing district centres in favoured locations to make employment, leisure and educational opportunities more widely available (as well as reducing pressures on central business areas);
- developing selected regional cities' (NHS, 1992b).

Compact urban forms can be created through a variety of planning provisions, which can either be applied 'across the board' or to specific areas.

Accessibility and density are linked

Accessibility and density are key aspects; these are also linked. Accessibility should be a matter of choice between using public transport, pedestrian and cycleways, or car. That choice is constrained when public transport routes cannot be economically provided because densities are low and the origin and destination of trips are dispersed.

Accessibility is essential in all areas

In established inner and intermediate residential areas, acceptable levels of accessibility often exist. However, in many outer areas, established during the 1970s, access to community facilities and employment is often poor because densities were low and insufficient attention was given during the development stage to the provision of public transport and routes for pedestrians and cyclists.

Greater choice in accessibility is now being built into the planning of most new urban areas, but it may have limited effect as densities are still relatively low and there is little coordination in the location of land-use and transport.

There are trade-offs

Increased residential densities is not the only factor influencing urban form. The relationship between sustainability, urban form and residential densities is not simple. Residential land represents only a portion of total urban land and higher environmental standards may require more land.

Although residential land is the largest single land-use category in urban areas, the proportion of the total urban land area used for purely residential purposes is typically about 30–35%. There is a need to examine the potential for reducing the proportion of non-residential land, but with higher residential densities this may be difficult to achieve. Indeed, the proportion of non-residential land may actually need to be increased.

Higher environmental standards may lead to conflicting objectives. For instance, the demand for improved air quality and energy conservation through reduced reliance on private transport suggest more compact cities, but there are other environmental factors which may offset some of the savings in land. These factors include the need to improve water quality, reduce stormwater runoff, protect dwellings from traffic noise and provide additional open space.

Selective increases in density

A solution to this dilemma is to more selectively increase residential density. This can offer more compact and varied forms of housing than that currently available, and may reduce development costs, particularly for the public sector.

With strategically located higher densities, many of the objectives of compact cities can be achieved. For example, better forms of public transport and increased accessibility to public transport services can be provided. Increased use of public transport and decreased use of cars can contribute to a more sustainable environment because of a reduction in vehicle emissions, use of non-renewable resources and in traffic accidents.

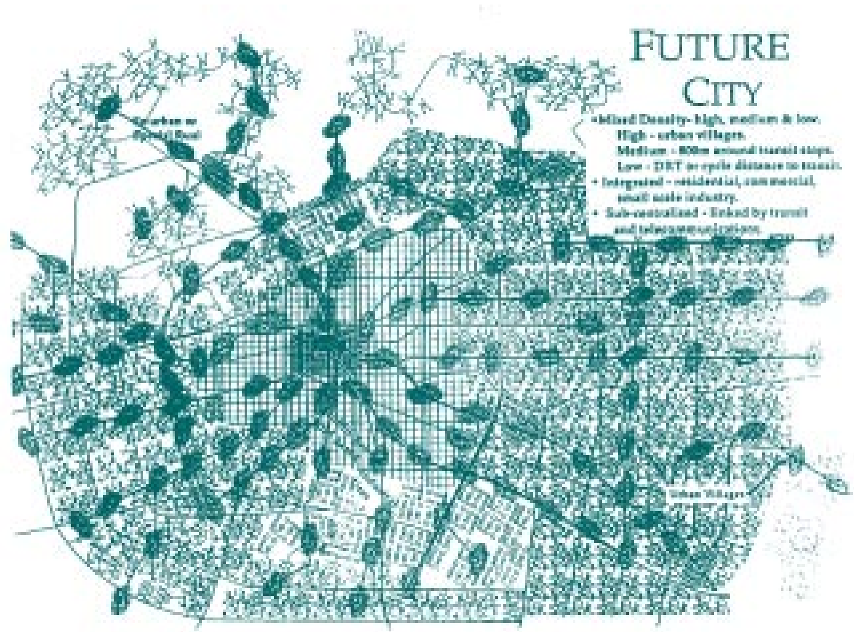


Figure 2: Illustration of an urban form with a number of smaller sub-centres.

(Source: NHS (1992) *Housing, Transport and Urban Form*, Stategy Paper No. 15, AGPS, Canberra).

In aiming for selective increases in density, it should be possible to achieve an urban form similar to that shown in Figure 2. It illustrates a form comprising many smaller sub-centres, which have access — by walking, cycling or transit — with all sub-centres well serviced by telecommunications. According to NHS (1992), this form with its telecommunications, integrated mixed developments, and lower car dependence, has the opportunity to lead to more efficient and environmentally sustainable urban environments.

High-Rise or Low-Rise Urban Form?

More compact cities often conjure up visions of high-rise development, and raise issues about the appropriateness of this form of development in an Australian context. In considring these issues, there are relevant social and economic aspects.

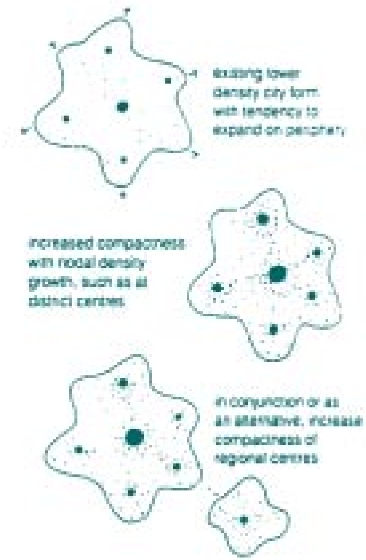


Figure 3: Urban form and some options for city growth

Social aspects

Housing density is often held responsible when evidence of social problems in higher density housing is present. However, this may not be justified.

There has been found to be no simple relationship between housing density and the extent to which residents are satisfied with their environments, itself a measure of social malaise (Marcus and Sarkissian, 1986). Other important variables combine with density to influence resident satisfaction and the way in which density is perceived.

Perceived housing density is likely to be less if visual and acoustic privacy are protected by design. For example, a lower density is more likely to be perceived if a development is subdivided into clusters of units, with only a small number of units sharing an entrance. This is in contrast to the same number of units situated in one large mass having one or only a few entrances (Marcus and Sarkissian, 1986).

In a major (largely British) study of the relationship between design and other variables, and social conditions (Coleman, 1986), it was found that child density was the only socio-economic variable that was more strongly correlated with social problems than certain design variables. This confirmed earlier American research (Jacobs, 1961; Newman, 1972), which also postulated the connection between a low adult-to-child ratio and social problems.

High-rise housing may have its place in certain locations; however sufficient densities can usually be obtained in low (two-to-three storey) to medium rise (five-to-six storey) buildings.

Although there are many examples world-wide where high-rise housing has been shown to be acceptable for family living, lifestyle expectations in countries such as Australia have generally led to this form of housing not being recommended for families.

TYPE OF BUILDING CONSTRUCTION	$/SQ.M
Single storey villa (project home	480 – 580
2 storey townhouses	730 – 810
2 to 3 storey apartments (no lifts)	750 – 950
4 to 7 storey apartments (lift and stair access)	890 – 950
8 to 12 storey (lifts, stair pressurisation)	1,300 – 1,400
13 storey	1,600 – 1,800

* Basic standard residential developments for level suburban sites in Sydney. Figures exclude site Preparation, car parking, essential works and external services, landscaping, furniture, carpets, equipment, and air-conditioning.

Source: Scott Carver, 1992

Table 1: Construction Costs by BuildingType (1992)

Aspects of development economics

A further reason for continued low-rise urban form in Australian towns and cities in the foreseeable future is cost: high-rise housing is more expensive than low-rise (Table 1).

In research for CORD URBAN, a case study feasibility analysis revealed that, in one instance, a shift from a four-storey scheme (walk-up access) with 63 dwellings to one with a nine-storey tower (with lifts) and 77 dwellings resulted in a substantial increase in cost per dwelling. Even though the number of dwellings on the site increased (from 63 to 77) and the land cost per dwelling fell, the effect of the additional construction cost per metre2 (a rise from $750 to $1245) meant that the average cost of an identically sized two-bedroom dwelling rose by 17% (Scott Carver, 1992).

Market conditions favouring high-rise development are likely to be confined to some inner areas, to sites converted from non-residential use and to special locations.

There is a place for low-rise medium density housing in all areas
In greenfield situations, housing at medium densities can generally be introduced as part of the initial development.

The introduction of predominantly low-rise development in established areas is less controversial than high-rise development because of existing community expectations. However, care is required to ensure that the proposed development is appropriate to the existing environment.

Large or Small Scale Urban Development?

There are differences in the processes for urban expansion on the fringe and urban change in established areas.

Areas of urban expansion are normally identified in strategic plans and urban land release programs. Development plans, including infrastructure programs, are prepared. Land is then developed through subdivision and subsequent housing provision or through *integrated development* where land and housing are planned and developed together.

There are advantages in integrated development
In recent times, there has been an increasing interest in integrated development by the private sector, and some large greenfield or infill developments have been completed while others are being planned.

Integrated development offers opportunities to innovate and to incorporate principles of sustainable development.

Joint ventures and community title developments
Forms of joint ventures with or without the existing property owners and community title developments may offer new opportunities.

Because of difficulties in site amalgamation over several ownerships the pattern of land holdings has often precluded these more integrated approaches. At times larger parcels of land have become available (eg institutional or government owned land that is no longer needed for its original purpose).

Most development will continue to be small in scale
Much new development will probably continue as small-scale subdivisions and housing developments in outer areas, and individual lot redevelopments in established areas.

Lots are generally individually titled and subdivided at an earlier date. The vast majority were intended for a single, detached house.

Lot frontages in inner and middle suburban areas are generally narrow, relative to the depths. This pattern of subdivision has design implications when considering an increase in dwelling densities in established housing areas. The size and shape of lots, together with the existence of established housing on adjoining lots, frequently constrain design choices.

Streets were also designed to serve the pattern of detached housing, and were generally not intended to accommodate significant numbers of permanent additional parking.

This pattern of small-lot land holdings has resulted in changes in density being incremental, directed at the micro rather than the macro level.

The unit of land being considered for more intensive residential development is generally the individual house lot. Urban change with higher densities on individual lots (such as dual occupancy) needs to be addressed with care.

Community Attitudes

A number of studies into attitudes to different densities have been undertaken since the late 1980s. They reveal that people had no real understanding of the concept of density, with wide differences of opinion as to the meaning of 'high density' (Woolcott Research, 1991).

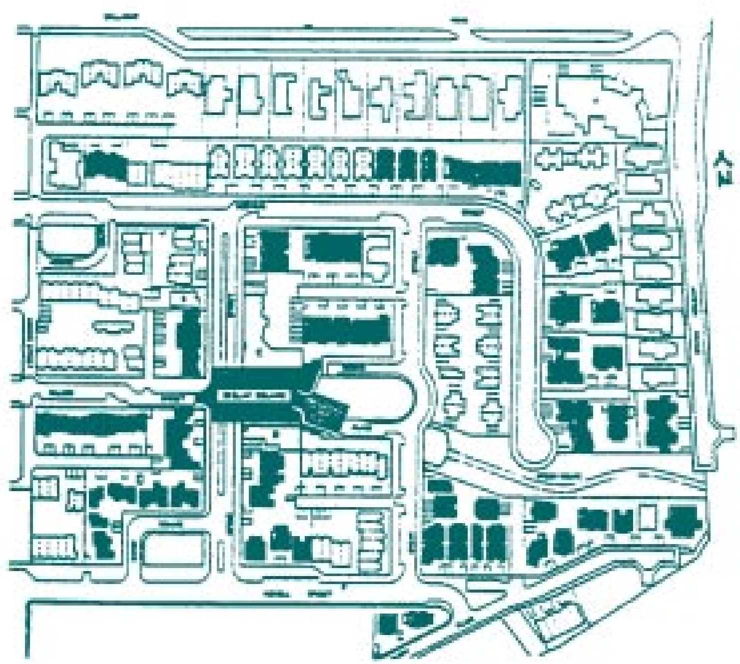


Figure 4: An example of a joint venture development, William Angliss Project at Footscray, Victoria.

In the study 'Perceptions of Residential Planning in the City of Melville, Western Australia', the majority of the 583 respondents within the study area objected to all types of group housing being developed 'next to their property'. 'The most important determinants of objections to the development of higher density housing on neighbouring properties were specific individual characteristics such as community attachment and belief systems. For instance, those with a high level of community attachment tended to object more to all forms of higher density housing than those with low community attachment' (City of Melville, 1991).

A Wollongong City Council survey of residential flats tested resident opinion about existing multi-unit or flat developments. ‘The intensity of urban development in the immediate street tended to influence the reasons given why appearance was unacceptable rather than the overall acceptability of appearance. People living in the lowest density single dwelling areas were more inclined to argue that multi-unit development was out of character with their area’ (Wollongong City Council and Masterplan Consultants, 1988).

A study investigating objections to medium-density housing in Adelaide (Orr, 1989) found that people had major concerns when developments were proposed, but these concerns did not eventuate after the development had occurred.

Major community concerns

The major concerns with medium-density developments are often that :

- the development is ‘out of character’ with the area;
- the density of the development is too high;
- there will be too much traffic.

A medium-density housing study in Melbourne included a survey of the degree of satisfaction with their housing of residents living in medium-density dwellings. This survey showed that a similar level of satisfaction with housing appeared to exist for those in both medium-density and detached dwellings (Tract Consultants et al, 1990).

The issue, therefore, is not the provision of medium-density housing, but its relationship to existing lower- density forms of housing.

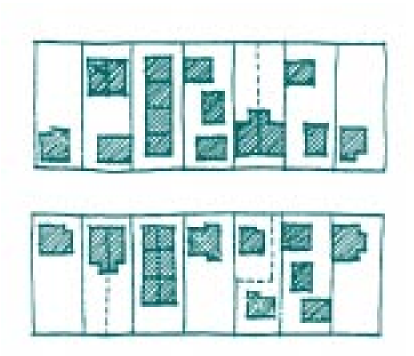


Figure 5: Incremental development of single house lots is likely to continue, with constraints on design options.

One solution: more upfront planning

The need to undertake upfront development planning involving stakeholders in the process is a central feature of AMCORD. In this way, understanding is increased, any ancillary actions identified and design requirements determined. With such a process, the major concerns can be addressed and the parameters for new housing can be established in advance of the receipt of development applications.

Strategic Directions

Some of the significant strategic directions arising from this overview include the following.

Consider residential density in a broad urban context

Residential density may not simply be a matter of responding to housing demand. It may also be a function of the broader demand for sustainable urban living and the provision of accessible, affordable, equitable and environmentally responsible urban development. There may be regional as well as local responsibilities in determining densities.

Create higher density urban nodes

Planning for housing should include the creation of urban nodes or centres in selected areas. Such nodes should have an overall density and size sufficient for the operation of both a viable form of public transport and off-peak private transport, and for a mixture of housing types.

Facilitate choice in transport mode

Housing densities, especially in many fringe areas of larger Australian cities, may need to reflect the social and economic costs and benefits of providing each of the three major transport systems and of providing new infrastructure (Industry Commission Report on Urban Transport, 1993). This aspect is further explored in PNP 7.

Permit diversity in housing types

Efforts should be made to provide more compact and varied housing not only in established areas but also in areas yet to be urbanised. Zoning should focus on performance criteria and not discriminate against particular housing types.

Encourage housing and mixed development

Projects comprising housing and associated services and facilities improve the opportunity for social interaction, local employment and reduced dependence on the car. In order to assist such projects, planning controls should simplify the provision of a range of housing types and the introduction of environmentally acceptable non-residential uses at the neighbourhood level.

Influence the location of mixed-use development

Higher-density mixed-use developments should be encouraged in the following locations:

- around key public transport nodes and shopping/employment centres;

- in new developments at the fringe of cities.

Opportunities to increase dwelling densities in existing suburbs should also be pursued. This form of development is likely to occur where:

- the cost of inner urban development relative to returns is more competitive than in fringe areas;

- planning and development controls permit higher densities and, in key locations, direct that higher densities are to be achieved.

High-rise development requires special conditions

High-rise development is likely to be confined to some inner areas, to sites converted from non-residential use and to special locations. AMCORD does not offer specific guidelines as they will vary depending on local circumstances. However, development plans are essential in order to establish the development parameters.

Facilitate multiple-lot development and redevelopment
A more sustainable urban environment is possible when lots are assembled first so that a small-scale integrated form of development can take place. Integrated housing, achieved through joint ventures, cooperatives, community titles or other mechanisms, can make a significant contribution to improving the environment.

Encourage sustainable subdivision design
Subdivision of large sites involves laying out and developing allotments; roads; street lighting; water, sewers, electricity, gas and telecommunications connections; parks; and community facilities. To achieve a sustainable urban form it is important that the following issues are fully considered and incorporated into subdivision design:

- assess flora and fauna values, and direct development away from sensitive areas;
- retain and expand areas of natural habitat;
- ensure that significant vegetation and watercourses are retained;
- orientate allotments to facilitate passive solar access to living areas of houses;
- design interconnected street layouts while maintaining low vehicle speeds and volumes;
- investigate opportunities to incorporate stormwater retention onsite.

Single-lot development requires design guidelines
Single-lot development and redevelopment are likely to continue as the most common form of urban expansion and consolidation. The design guidelines in Part 2 are intended to provide the basis for the local regulation of this development.

A Practice Note which outlines the definition of density, and provides categories to different housing forms available.

Practice Note PNP 6

Density Definitions and Dwelling Categories

Scope

The term 'density' is widely used in Australian planning practice, yet there are no standards for measuring it, nor are there generally accepted definitions of what constitutes low medium or high density housing.

The concept of density is important for planners, designers, developer and valuers.

Density is a measure of population or of the number of dwellings per unit of area. Together with other factors it determines the physical and social infrastructure required.

Need

The concept of density is significant for strategic planning where long-term investment decisions on major infrastructure have to be made. It is

Site Density

Represents the ratio of dwellings to the area of the site they occupy

Lot Area = 500m²

Site Density = $\frac{\text{1 dwelling}}{\text{0.05 (hectare)}}$

= 20 dwellings / hectare

Note 1: *For any housing estate site density is calculated by dividing the number of dwellings by the total area of residential land (ie exclusive of roads, parks etc).*

Note 2: *It is not considered appropriate to distinguish between site density for lots in different forms of title. For group/cluster/apartment housing developments site density includes all of the land area, including shared access/parking/open space etc.*

The 'site density' definition is considered the most useful for comparison between projects as it excludes all land other than that used for house.

also relevant for development planning so that areas for housing at higher densities can be related to the infrastructure capacity and any contribution towards augmentation can be assessed.

Density is, together with other types of control, a measure of both the form of the built environment and the development potential.

The measure is also important to designers of housing projects who use density to determine how built up an area is likely to become (ie the ratio between the space occupied by buildings and the area of the site, the combination of the height of buildings and the space between them).

The measure is also relevant in the valuation of land and in the preparation of feasibility studies Developers need to have some degree of certainty about the number of dwellings that can be built on a site in order to decide whether to purchase the site and proceed with a project .

Density controls are often put in place to restrict higher-density housing by zoning areas exclusively for low-density housing and by limiting the areas where higher-density forms of housing can occur. Concerns about sustainable communities, together with the need for greater choice in housing and more cost-effective development, suggest that restrictive zoning be changed to permit higher-density and more varied forms of housing.

Density may also affect housing affordability. An increase in net residential density can reduce the cost of producing dwellings. A case study showed that a 20% increase in site density (with land price constant) resulted in a cost saving of around 10% per dwelling (Scott Carver, 1992). In addition, it may make an otherwise unviable project feasible and lead to more housing opportunities.

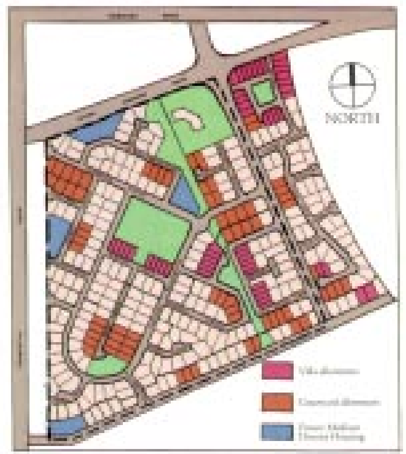
Residential Density Definitions

Density of dwellings is a common measure used in planning. It is particularly useful in assessing land demands arising from increases in the numbers of households in a particular area, and the extent to which this will be satisfied by different patterns of development. It can best be used as a scale within which different household sizes are likely to be accommodated, providing for some averaging out of these differences.

It may be misleading to apply measures of dwelling density to developments where household size is smaller than average. For example, inner city developments often result in an increase in the number of dwellings, but not necessarily any increase in occupation levels (and sometimes the reverse).

Many ways of defining dwelling densities have been used in the past, and some consistency is encouraged so that comparisons between areas can be correctly made. The following definitions are adopted in AMCORD as current best practice and are recommended for use by all planning and development agencies throughout Australia.

Site density
Represents the ratio of dwellings to the area of the site they occupy. It can be applied to:



- individual houses on their own lot;

- multi-dwelling developments on their development site.

Site density is the preferred definition for density comparisons between projects.

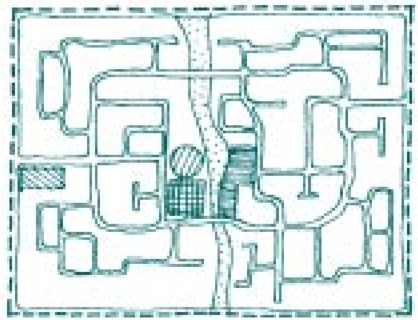
Net residential density
Represents the ratio of the number of dwellings to the area of land they occupy including internal public streets, plus half the width of adjoining access roads that provide vehicular access, to dwellings.

Note: The exclusion of public reserve areas from 'the land' enables comparisons to be made between areas and States where different open space requirements exist. In addition, many projects make financial contributions to councils in lieu of providing public open space.

While it is recognised that road reserve widths and the extent of road reserve area vary from project to project, 'net residential density' is still considered useful for comparison, as all housing estates include roads.

Neighbourhood density

Represents the ratio of the number of dwellings to the area of land (including associated neighbourhood or local facilities) they occupy. The area includes internal public streets, all areas of public open space, local or neighbourhood shops, primary and secondary schools, local community services, local employment areas, and half the width of adjoining arterial roads.



This definition is most relevant for servicing authorities (physical and human) in broadacre development at the urban fringe or on large infill sites. Comparisons between areas are difficult to make due to inclusion of significant variables.

Urban centre dwelling density

Represents the ratio of total dwellings in an urban centre to the area occupied by the urban centre. This category has only limited use, mainly as a means of broad comparison between regions within cities, and between towns and cities in Australia, and in international comparisons. The area of an urban centre is defined by the Australian Bureau of Statistics.

Population density

Population density is the other form of density measure and is used for planning services, both 'physical infrastructure' (eg water supply, sewerage, power and roads) and 'social infrastructure' (eg health, education and community services). If population levels cannot be projected directly from a development proposal, certain assumptions are made about the average occupancy of different types of dwellings. The number of bedrooms in a house its total floorspace or site density are the usual indicators.

There is a problem in using any dwelling characteristic (eg number of bedrooms, floorspace, type of structure) as an indicator of population. Given changes in household size, increasing diversity of household type and lifestyle choice, the conventional assumptions may no longer hold good. In particular, designations such as 'bedroom' may no longer reflect the actual use of a room and its implications for occupancy levels. There is a need for new empirical research to find out what features of a dwelling and its location, if any, do provide a good correlation with household size.

Until such research can provide a more reliable basis for population estimates, the following may be used as a guide. It is based on the number of rooms, or floor area, whichever is most convenient.

- 1–2 roomed dwellings, or 'small' dwellings on sites of less than<R>200 m2<D>: 1 person per dwelling;

- 2–4 roomed dwellings, or 'medium' sized dwellings on sites of <R>200– 500 m2<D>: 2 persons per dwelling;

- dwellings of 5 rooms or more, or 'large' dwellings on sites over <R>551 m2<D>: 2.5 persons per dwelling.

For these definitions, a kitchen, toilet cubicle or laundry is excluded from the assessed number of rooms.

Dwelling categories

Definitions of dwelling type have often been used in planning regulations, with certain categories of dwelling being permitted in different circumstances. This is no longer considered appropriate. AMCORD provides a more rational basis for promoting the residential amenity of a given area, whatever the dwelling types and mix.

However, it is sometimes of interest to describe the forms of housing that exist, to assess whether the development industry is providing a range of options for consumers, and to examine market demand for different types of houses. Provided that these terms are not used beyond their descriptive intent, AMCORD recommends that the following terms be consistently applied, to allow for comparison between areas:

Detached dwelling.
A separate house on an individual lot (no shared land/facilities).

Semi-detached dwelling.
Two attached houses (a single common wall) on their own individual lots (no shared land/facilities).

Row or terrace house.
Three or more attached houses (common walls) each on their own individual lots (no shared land/ facilities).

Group or cluster housing, including townhouses, villas etc.
Two or more dwellings on a site sharing part of the site for access and/or open space/site facilities. (Thus a dual occupancy comprising two detached houses on a site. with no sharing of facilities, would be classified as two detached dwellings. If they shared a driveway they would then be classified as group/cluster housing).

Flat or apartment (including attached to a shop, office etc)
One of more of the following:

- units constructed over the top of each other;
- shared parking/access arrangements;
- shared communal open space in lieu of or as well as private open space;
- attached to a detached dwelling (with shared access/site facilities).

A Practice Note outlining the impacts of transport and methods of planning for traffic and access in the local area.

Practice Note PNP 7

Transport, Accessibility and the Local Environment

Scope

Urban growth has resulted in an increased demand for a wider range of housing. People living in towns and cities must have access to the necessary facilities and services. However, continuing dependence on the motor vehicle has led to rising levels of traffic congestion, air and noise pollution, and fuel consumption. Questions have therefore been asked about the relationship between transport, accessibility and environmental protection.

There are several dimensions to this relationship that apply to the planning of residential development, including:

- reducing the dependence on the motor car;

- protecting the local environment and the environmental traffic capacity;

- assessing the transport impact of development proposals.

Reducing Dependence on the Motor Car

'The car is used for 75% of urban trips in Australia. Its use reflects the preference of most Australian households for suburban living while catering to their complex, cross-city travel which such living increasingly requires' (Industry Commission, 1993).

There are strong environmental, social and economic arguments for reducing dependence on the car and making walking, cycling and public transport as attractive as possible:

• The environmental, social and economic consequences of air pollution, traffic noise, consumption of non-renewable energy, deaths and accidents are well documented and many cities are considering ways in which these impacts can be reduced (eg Integrated Transport Strategy for Greater Sydney, 1993).

• Studies of the social consequences of urban forms relying largely on access by car reveal the accessibility and equity problems that can arise from low-density, suburban development. A study of access difficulties undertaken for the National Housing Strategy outlines the problems certain community groups have with transport (NHS, 1992).

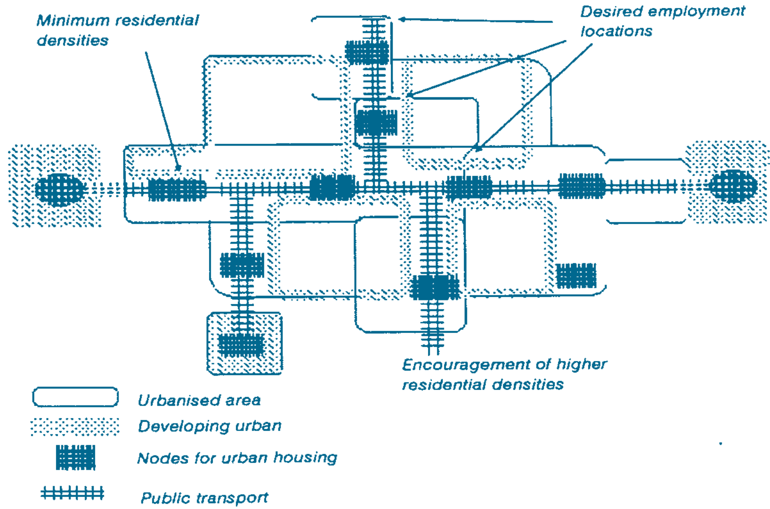


Figure 1: An integrated approach towards housing, transport and employment location is needed.

• A summary of recent research (Tranter, 1994) demonstrates that the independent mobility of primary school children has declined dramatically in the last 20 years. This can partly be attributed to traffic congestion, pollution and safety concerns about using local streets. Yet the importance of independent mobility for children's personal, intellectual and psychological development has been widely recognised. Traffic calming, improved public transport and urban containment can assist in the creation of more friendly environments.

• There are high costs in providing and operating urban transport facilities; operating deficits of public transport services alone cost taxpayers more than $500 for each household in Australia (Industry Commission, 1993). There are community costs arising from road congestion; the cost of road congestion in Sydney and Melbourne is estimated at $4 billion a year (Industry Commission, 1993). Furthermore, funds for transport improvements have become scarce, and more efficient pricing and demand management have become matters of public debate.

Accessibility, mobility and activity

There is a need to understand the importance of and difference between accessibility and mobility, and how they are linked to land-use.

Accessibility can be defined as the possibility of reaching a location within an acceptable amount of time, money and effort (Hilbers and Verroen, 1993). Accessibility is determined by transport networks, their capacities and operating characteristics, and the costs and convenience of travel. Many factors influence cost and convenience, such as travel time, the location of stops and stations, parking provision at the destination, and the requirement to change transport mode between origin and destination. Although widely used, the term ‘accessibility’ is often misunderstood. Simply, accessibility represents the transport supply.

Mobility reflects the ability of individuals, households and businesses to satisfy their needs for movement and represents the demand for travel. Each household has its own characteristics which are dependent on car ownership; car use; household composition, age and income; and activity patterns of members of the household. Businesses, too, have their individual needs and mobility profiles.

Both accessibility and mobility are influenced by the type and location of land-use activities, and vice versa. Activities, such as employment, shops, facilities, services and dwellings, generate (ie attract and produce) trips by households and businesses. Collectively, these activities represent the transport demand. The distribution (or location) of these activities must be related to the mobility profiles of households and businesses, and be accessible to them. The policies for the location of activities, and the provisions for accessibility, should therefore be linked to the mobility profiles of the community served.

All these variables can be influenced by policy. Activities can be concentrated or dispersed. Accessibility to activity locations can be provided, selectively provided (eg by giving preference to public transport) or constrained (eg by traffic calming). Mobility profiles can be influenced by policies about the location of activity and the kind and level of accessibility provided. For example, parking policies at major regional centres can be directed at discouraging commuter travel, or vice versa.

In developing strategies it is important to appreciate these relationships. In terms of policy it is also necessary to be more explicit, (eg accessibility from where, to where, by whom, when and by what mode). An accessibility policy may (Hilbers and Verroen, 1993):

- influence mode choice: eg the selection of housing, employment and services location and density, based on the (potential) reduction of car use, for environmental reasons or to reduce congestion;

- safeguard conditions for personal development: eg where non-car owners have poor access to public transport, people have to combine housekeeping with a paid job, or the reach of people in urban areas needs to be increased;

- stimulate economic growth: a key argument for new infrastructure and for promotion of regions and locations.

In the planning, design and management of residential areas, the first two accessibility objectives are the most important. There is then a need to understand existing and likely future mobility profiles of the different households and local businesses. This includes analysis of the types of trip (eg commuters, visitors, business travel, goods, social traffic), target groups (eg car owners, non-car owners, the elderly, school children) and the scale of interaction within and outside the neighbourhood. It is also necessary to appreciate how residential density affects travel patterns (Steiner, 1994). It may not be possible to satisfy the objectives equally and there may have to be trade-offs.

Strategic Directions

Car travel is greatly influenced by the distribution of activities, the quality of public transport, and the opportunities for walking and cycling. Walking is a surprisingly important mode for many trips, including the journey to work.

There are five performance areas where considering the interaction of transport, accessibility and housing should benefit both housing and transport:

Relate housing and employment activities to public transport infrastructure
As residential and employment densities increase, the number of public transport passengers per route kilometre increases, and a higher level of service can be provided cost-effectively. Walking distances between trip origins or destinations and public transport services are important for public transport users, as they are usually pedestrians at both ends of the trip. Higher development densities should be concentrated along trunk public transport routes and transfer points, to ensure that the maximum number of potential users are located within close walking distance.

All development within walking distance of public transport, including higher-density housing, must also have direct and attractive pedestrian links to public transport stops. ‘Transit-oriented developments’, ‘urban villages’ or ‘urban nodes’ (Figures 2 and 3) are forms of development where higher-density housing is integrated with high-capacity public transport systems (Mondon, 1990).

Set densities at a level where public transport can be effective

Neighbourhood residential densities should be set at a level where good-quality and cost-effective public transport can be provided.

Opportunities to provide cost-effective and convenient public transport are increased when neighbourhood densities are at least 20 dwellings per ha (Pushkarev and Zupan, 1977). Where large-scale urban renewal is considered, high densities may make it possible to incorporate light-rail public transport. Densities should be graded according to accessibility to public transport.

Plan movement networks for people not cars

Planning for pedestrians, cyclists and public transport is just as important as planning for the motor vehicle. Discouraging through-traffic should not also discourage walking to local centres, facilities and public transport stops. An integrated approach will ensure that all transport modes

Figure 3: Development should focus on the rapid transit stop

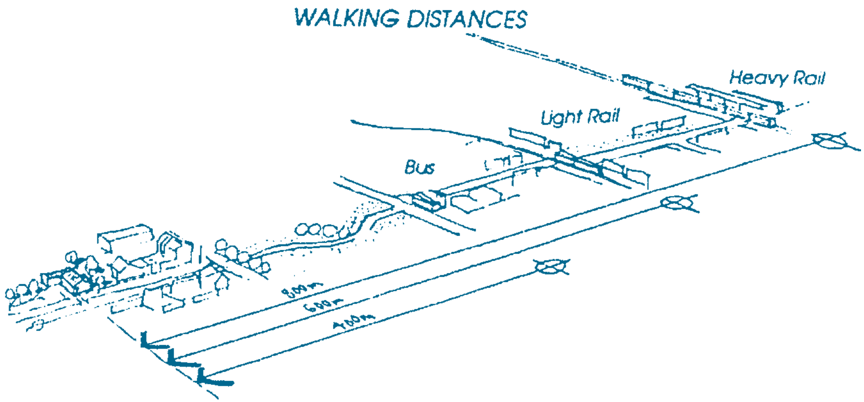


Figure 2: Centres of activity should be related to public transport networks which are within walking distance.

Source: Hocking Planning and Architecture (1993) *Urban villages for Perth.*

support themselves and each other in the most cost-effective way.

Actions to be considered include:

- footpaths along main public transport routes;
- a street pattern providing direct access from housing to public transport stops;
- bicycle storage at major public transport stops and stations;
- a clear bicycle network with appropriate use of bicycle lanes and cycleways;
- use of bus-only links between neighbourhoods;
- special attention to the needs of the aged, people with disabilities and children.

Mix uses at accessible activity centres

When housing is located near the services and activities people need, dependence on the motor car may be reduced. Similarly, housing can be linked efficiently by public transport to activity centres some distance away .

Mixed-use zoning, multiple-use sites and the location of housing close to activity centres will support walking, cycling and public transport. Public transport is more attractive if a wide variety of uses are located along a public transport route. Conversely, large, single-use areas in isolated locations will require public transport passengers to travel longer distances at higher cost, or to transfer between a number of routes, making car travel more attractive.

Mixed uses can also promote more uniform and balanced levels of consumption of public transport, allowing more frequent services to be provided. A concentration of a variety of land uses in activity centres encourages multi-purpose trips.

Reduce the impact of transport on the residential environment
Improving the accessibility and connectivity of urban areas must be balanced with the need to mitigate the adverse impacts of transport on the residential environment, such as traffic noise, air pollution and danger to pedestrians. Residential planning and dwelling design should recognise these impacts.

The creation of residential precincts or neighbourhoods where car traffic is subservient and traffic calming measures are introduced is a pre-requisite for environmental protection. However, when residential areas are protected from traffic, viable routes for walking, cycling and buses should be preserved. Too often, subdivisions designed to minimise through-traffic also exclude viable bus services and produce long, circuitous walks to nearby facilities.

Along transport corridors where movement (including public transport) is facilitated, both the road and adjacent housing should be carefully designed to minimise the adverse impacts of that movement. If possible, housing and other development should face the street to maximise pedestrian access and streetlife. This requires careful building design (eg room location, double glazing) and traffic management.

Transport and Factors Affecting the Local Environment

In the planning, design and management of residential areas, several transport-related performance issues should be considered:

- accessibility and choice in mode of transport;
- circulation within and between residential areas;
- environmental protection;
- cost-effectiveness and operational efficiency.

Accessibility and choice in transport mode

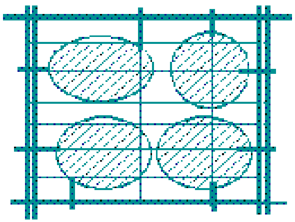
Three transport modes must be provided for:

- private vehicle transport, including service and emergency vehicles;
- public transport;
- walking and cycling.

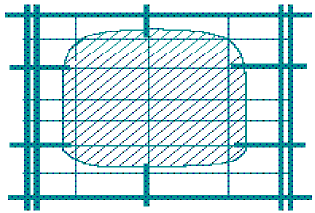
In the past, there has been a preoccupation with accessibility for private transport. However, the growing interest in sustainable urban environments requires greater attention to alternative transport modes, the integration of the three transport modes, and their relationship to land use and the local environment.

Circulation

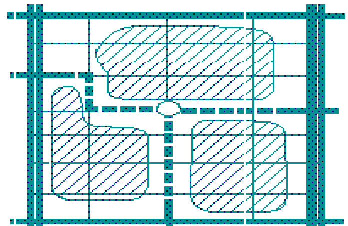
There should be adequate opportunities for pedestrians and cyclists to reach their destinations as directly and safely as possible. Bus routes should be able to penetrate without creating routes for



Absence of internal street connections removes all through-traffic, but forces all local traffic on to adjoining corridors.



Internal connections are maintained. Traffic calming deters through-traffic, but the many outlets affect the traffic performance of the corridors.



A hierarchy of internal streets provides for bus access and few external connections, but measures are required to avoid high speeds and volumes on collector streets. There is also a need to connect adjoining precincts.

Figure 4: Traffic calming vs regional transport efficiency.

through-traffic. Streets can be structured to reflect a simple hierarchy consisting of access streets and places and collector streets. The degree of 'permeability' for vehicles is open to debate; the need for enclosure, security and defensible space may conflict with the need for freedom of choice in route (see Figure 4).

Environmental protection
Residential areas should not be exposed to traffic noise and air pollution and should be safe for all street users. Pedestrians and cyclists should be able to safely cross residential streets without delay. Residential areas should be connected to public transport stops, schools, employment uses, shops and playing areas by safe and direct pedestrian and cycle routes. Links with adjoining areas should not be severed by major transport barriers.

Cost-effectiveness and operational efficiency
Cost-effectiveness and operational efficiency can be measured in terms of public transport and street length or area.

One measure of cost-effectiveness in residential development is the number of dwellings that can be served by a public transport route. More dwellings can be served with higher net densities near such routes, than with conventional densities, and a higher quality of service can be provided.

Another measure of cost- effectiveness is the number of lots per unit of street (or carriageway) length or area. The ratio should be sufficiently high as the development and maintenance costs are directly related to the length and width of streets. While frontage access should be maximised for cost-effectiveness, this should be balanced with other considerations, such as safety, legibility, variety and urban form.

Finding an acceptable balance
It is not always easy to achieve an acceptable balance between these objectives. There is more scope in newly developing areas, but much depends on the development plan for an area the

extent of large-scale integrated development, and timing in the provision of public transport. It is more difficult to achieve an acceptable balance in established areas. Existing levels of environmental protection may not be adequate and there may be community concerns that any further development will aggravate the situation.

Environmental Traffic Capacity and Traffic Calming

Definition

The notion of environmental capacity was first proposed in Buchanan et al, (1963) *Traffic in Towns.* Residential streets should not provide relief routes for the main traffic system, and priority should be given to environmental protection by defining 'environmental areas' and setting limits on the amount and performance of traffic within them (see Figure 5).

The term 'environmental capacity' has since been widened to include a range of other matters, unrelated to traffic. For this reason, the term 'environmental traffic' capacity is used here. It can be defined as:

'the maximum number of vehicles that should be permitted to pass through a given environmental situation over time and under prevailing environmental conditions. The capacity should not normally be exceeded without changing one or more conditions that prevail' (Sharpe and Maxman, 1972).

There have been several studies to determine what criteria dominate for transport-related environmental problems in such an environment (Sharpe and Maxman, 1972; Appleyard, 1981; Holdsworth and Singleton, 1979; Coady, 1982; Department of Transport, UK, 1983; Singleton and Twiney, 1985; Song, Black and Dunne, 1993; Stapleton and Hallam, 1993).

The general consensus is that the principal impact (and hence 'performance') criteria for residential areas are:

- noise;
- air pollution;
- crossing delay;
- pedestrian safety.

The above impacts are determined by:

- street characteristics: width of reservation and carriageway, number of lanes, gradient, road surface conditions;
- traffic characteristics: traffic volume, traffic composition (in particular, the proportion of heavy vehicles), vehicle speed;
- built environment: distance from carriageway, nature of intervening surfaces, type and design of building, type of occupation (eg relative sensitivity to traffic impact).

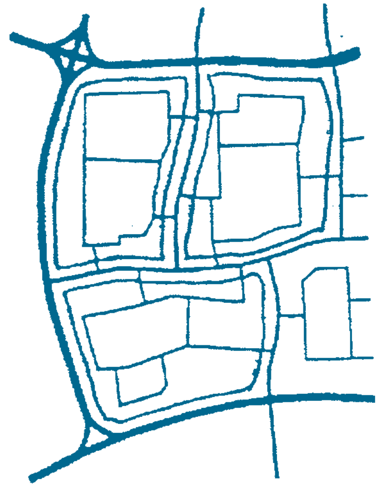


Figure 5: The concept of 'environmental areas'. (Source: Traffic in Towns, 1993)

As these factors can be modified and perceptions of what constitutes an acceptable balance vary, the environmental traffic capacity of a residential area depends on local conditions.

The environmental traffic capacity can be increased with traffic calming. Traffic calming may be defined in broad or local terms (Brindle, 1991). In local terms it is 'the results of actions to restrain traffic speed and lessen traffic impacts at the local level, where traffic volumes, levels of service and network capacity are not an issue' (FORS, 1993). In broad terms, it can encompass a wide range of measures, including those designed to reduce the need for car travel and encourage the use of other transport modes.

In the context of AMCORD, traffic calming represents those measures related to street design and construction as well as traffic management which can be used to achieve, or progress, the environmental traffic capacity of a local street system. There are other tools to increase the environmental traffic capacity, such as street design, building location and design, and (at this stage, more in theory than in practice) land-use and travel-demand management.

Needs

In the past, very little attention has been given to the concept of environmental capacity. Australian cities have been moulded to a large degree by the opportunities and constraints relating to such influences as economics, land capability, market demand and infrastructure capacity. More recently, however, attention has been increasingly directed towards creating more sustainable environments, including reducing the impact of traffic.

The question of acceptable levels of traffic in residential areas has become a matter of community interest. This can be observed when development applications in established residential areas are opposed because people are concerned about the impact of such proposals on their streets.

With the continuing growth of Australian cities and the prospect of more development and redevelopment in established areas, there is a pressing need to develop a consistent process for determining and enhancing the environmental traffic capacity.

As AMCORD shows, there is considerable scope for modifying the street and traffic characteristics and the built environment so that the impact of traffic can be reduced. With such modifications, the environmental traffic capacity of established residential areas may be increased. In addition, it may be possible eventually to reduce the proportion of vehicle trips in the total travel demand as densities increase and the use of other transport modes is facilitated (see Figure 6).

It follows that proposals to increase urban densities are not necessarily constrained by traffic impacts. The way these impacts are managed, and whether they can be contained within acceptable limits, are what matter.

Environmental capacity analysis can also be used when proposals are made to change the arterial road system and there are impacts on the local street system.

Critical performance areas

The critical performance areas are noise, air pollution, crossing delay and pedestrian safety. Of these, pedestrian safety is regarded as the most important criterion. The ratio of the social cost from traffic accidents to that from air pollution, and to that from noise, is about 25:3:1 (Himanen and Nijkamp, 1992; Dess et al, 1992).

Most of these performance areas are linked to vehicle speed.

Increased residential densities may not lead to proportional increases in vehicle trips and reduced environmental traffic capacity. However, traffic management and traffic calming, together with design and siting measures, are needed.

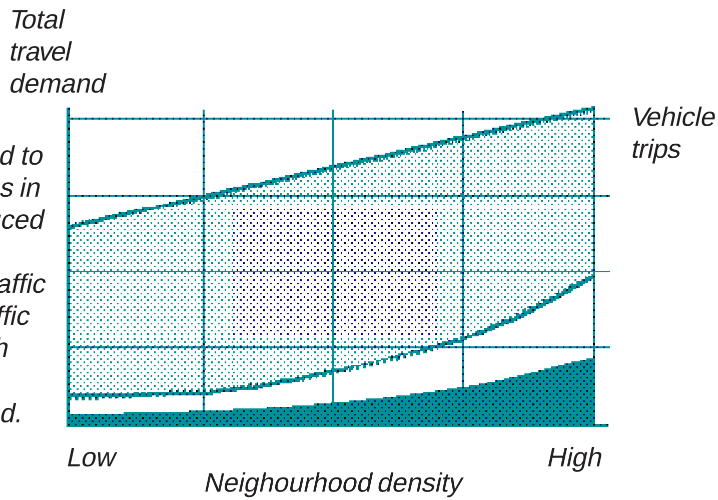


Figure 6: Environmental traffic capacity and neighbourhood densities.

Noise

In residential areas, the generally accepted environmental limit is Leq(24h) 55 dB(A) at the facade of a dwelling. With an average distance from the noise source of 10 m, 5% heavy vehicles, and no corrections for terrain or road surface, the number of vehicles that can be carried by the street is 2080 veh/pd at 40 km/h and 1750 veh/pd at 50 km/h.

In suburban areas, the distance between the facade and noise source is typically 12–15 m. In urban streets, the distance may be less than 10 m. Many residential streets carry traffic volumes of 2000 veh/pd or less and their environmental capacity is not exceeded if speeds and the percentage of heavy vehicles are kept low.

In residential streets with higher traffic volumes and/or speeds, the environmental capacity does not need to be a constraint, provided the design of the dwellings takes account of the need for noise attenuation. AMCORD suggests acoustic analysis in such an event (Figure 7).

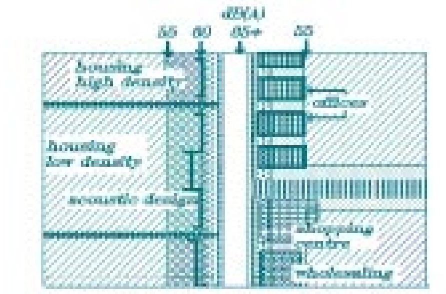


Figure 7: Relating land use and housing in existing corridors to achieve acceptable emmission levels.

Air pollution

Air pollution may be a concern along busy roads, but is not a pervasive problem in low-volume residential streets. Acceptable levels of exposure on footpaths along roads are set (overseas) at 12,000 veh/pd for CO and 5000 veh/pd for NOx.<D>

Pedestrian delay

Pedestrian delay is a function of carriageway width, traffic volumes, gaps in the traffic stream, vehicle speed and pedestrian vulnerability (the crossing speed of many aged persons and people with disabilities is less than half that of younger and fit persons). An acceptable delay to all pedestrians in residential streets is often set at 2.0 seconds.

It is clear that traffic calming and carriageway narrowing on local streets or at pedestrian crossings on collector streets can greatly increase the environmental capacity of residential streets. With a carriageway width of 5.5 m, crossability for vulnerable pedestrians and non-vulnerable pedestrians is within acceptable limits if traffic volumes do not exceed about 200 and 370 veh/ph respectively. With a carriageway width of 7.5 m, the values are 110 and 270 veh/ph respectively. It follows that, at points where pedestrians cross collector streets, carriageway narrowing increases the environmental capacity of the street system.

Pedestrian safety
Pedestrian safety in residential streets is correlated with vehicle speed. Overseas studies suggest that at speeds of less than 24km/h there are only slight injuries to pedestrians or cyclists in an accident. Injuries are moderate where speeds are between 24km/h and 39km/h, and serious between 39km/h and 52km/h. Fatalities are more likely with speeds in excess of 52km/h (Oei, 1988).

It is difficult to establish an acceptable level of risk. A significant proportion of pedestrian accidents involve children who have an undeveloped perception of risk (Black, 1994). Another vulnerable group are older people who are often uncomfortable with speeds greater than 25 km/h. Keeping speeds below 40 km/h in most residential streets reduces the risk, but in streets where children are likely to play, lower speeds should be set (Brown and Lam, 1994, *Can I Play on the Road, Mum?)*. The same situation arises where there are developments with a large proportion of aged people.

Other factors
There are other factors, such as community severance and visual impact. Community severance is an issue where communities are severed by high-capacity traffic routes. The visual impact of traffic and parked cars is a general design problem and is location-specific.

Determining environmental capacity
Determining an acceptable environmental capacity in an established residential area often involves trade-off decisions, as constraints imposed on traffic may benefit some residents but disadvantage others. It is also subjective because an interpretation of what is acceptable will vary with location, time and community attitudes. An important aspect in the process, therefore, is the definition of acceptable performance standards.

There are three ways of determining the environmental traffic capacity:

- quantification

- community survey

• a combination of the two.

Quantification

Once acceptable performance standards have been determined, it is possible to quantify the environmental capacity. The performance standards may be:

• traffic noise exposure <55 dB(A);

• vehicle speed of 40 km/h or less in low-volume streets (<<2000 veh/d) with narrow carriageway (<<6 m);

• vehicle speed of 25 km/h in streets with more than 2000 veh/d at points where pedestrians cross and the carriageway is narrowed;

• vehicle speed of 50 km/h or less in streets with more than 2000 veh/d.

Assuming that there is no heavy vehicle traffic and there are no special conditions (eg steep gradients), the process is as follows:

• Streets are described as links.

• Carriageway widths and street reservation widths are recorded for each link.

• Traffic volumes on the links are recorded.

• Vehicle speeds on links are estimated or observed.

• Street links with more than 2000 veh/d and/or speeds greater than 40 km/h are identified.

• For those street links, pedestrian and noise-sensitive land uses are identified and building setbacks are recorded.

- An acoustic analysis is then made for the above links, the number of dwellings exposed to noise in excess of 55 dB(A) is determined, and the scope for measures to reduce any deficiency is assessed.

- Pedestrian crossability is analysed for the above links, taking into account traffic volume, vehicle speed, carriageway width and visibility, and the number of links with deficiencies is recorded.

- An assessment is made of the scope for removing deficiencies in crossability.

The environmental traffic capacity is considered acceptable if the analysis shows that the standards are not exceeded or measures can be introduced to achieve them.

There are more comprehensive approaches to quantification. One such approach quantifies risk by linking pedestrian safety to crossability and delay (Song, Black and Dunne, 1993).

Community survey
Another method is to conduct a social survey using of the following three questions (Sharpe and Maxman, 1972):

(1) How would you describe the noise caused by traffic on your street?

Quiet -------------- [0]
Acceptable ------------- [1]
Bothersome ------------ [2]
Bad -------------- [3]
Terrible -------------- [4]

(2) How would you describe the air pollution caused by traffic on your street?

Not noticeable --------- [0]
Acceptable ------------- [1]
Bothersome ------------ [2]
Bad -------------- [3]
Terrible -------------- [4]

(3) How much of a problem does the traffic on your street represent to you (or your family) as pedestrians (if a business, use ‘or your customers’)?

No problem ------------- [0]
Acceptable ------------- [1]
Bothersome ------------ [2]
Bad -------------- [3]
Terrible -------------- [4]

Responses should be weighted numerically from 0 to 4 in four equal intervals, with 4 implying ‘terrible’. It is then possible to:

- calculate a mean annoyance value for these three criteria;
- correlate the average daily traffic against each mean annoyance value and discard non-statistically significant relationships;
- use the lowest environmental capacity if more than one criterion produced a significant curve;
- produce a table that lists environmental capacities, controlling environmental factors (eg air pollution, noise or safety) and land use/road prototypes;
- test the impact of alternative transport plans and predicted traffic levels on environmental capacity.

Combination

The community survey can be combined with the quantification approach. The critical performance standards are then used as preliminary indicators and verified (or modified) in the light of the results of the community survey.

Application

The principles of environmental traffic capacity and traffic calming (or 'LATM: Local Area Traffic Management) can be combined to enhance the quality of established residential areas (Figures 6 and 8). Existing through-traffic can be discouraged, pedestrian and cycle routes defined, pedestrian safety increased, opportunities for noise protection introduced, and street speeds established. With appropriate measures, these can reduce the impact of traffic on the environment (Figures 9 and 10).

In most cases, there will be a redistribution of traffic and the consequences must be assessed carefully (Figure 11).

EXAMPLE: Planning for Traffic and the Local Environment

NORTH SYDNEY TRAFFIC STRATEGY 1993

A Vision for North Sydney Traffic

Acknowledging its location on the traffic approaches of Sydney's Central Business District. North Sydney should manage major traffic flows on designated routes and minimises the intrusion of through-traffic into residential areas.

North Sydney should have a vibrant commercial area surrounded by a series of 'village' communities of varying sizes, each developing its own character. Centres should be linked by a network of shaded, safe and easily accessible footpaths.

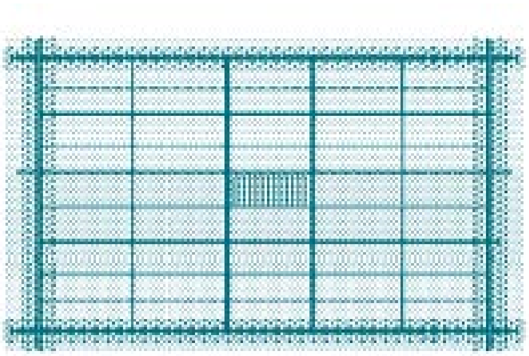
Local bus routes should give complete intra-municipal access throughout the day and be planned to help old people and those without an available car.

Local streets should be quiet and safe with low traffic speeds, with busier roads being streetscaped to be calmer and safer and more appropriate to surrounding activities.

Commuters to North Sydney are to be encouraged to use public transport or cycle or walk to work.

The design of all schemes should meet the needs of mobility impaired people.

The traffic strategy should be reviewed at regular intervals, moving towards more of a community feeling at street level with emphasis on public transport and non-care movement.



Many suburbs in established areas are exposed to traffic noise, through-traffic, inappropriate speeds and a lack of pedestrian safety.

Figure 8: Typical problems in established residential areas.

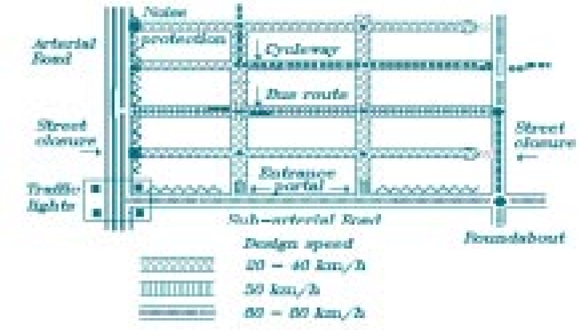
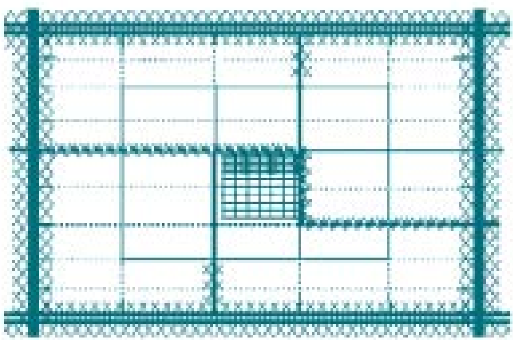


Figure 10: Illustration of some principles of traffic calming.



Many of these problems can be ameliorated with careful management of land use, street categorisation, traffic calming and building siting and design. Thus the environmental traffic capacity can be increased.

Figure 9: Environmental improvement through a range of measures.

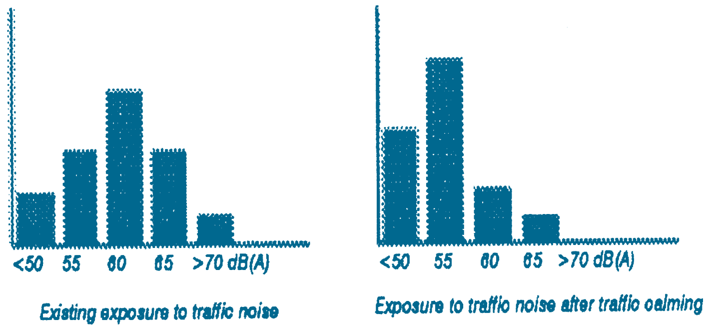


Figure 11: The impact of alternative measures requires testing.

Community involvement

There are well-established procedures for preparing LATM proposals (AUSTROADS, 1988), but the determination of acceptable environmental traffic capacities depends on local circumstances.

Community involvement is essential here. The North Sydney Traffic Strategy was prepared through extensive involvement of the community in each of the local precincts (North Sydney, 1993).

Principles

Safety

People should be safe from traffic danger, whether as pedestrians, motorists, cyclists or children at play. Traffic danger spots should be diminished.

Access

All people should be able to access different parts of North Sydney. Those with disabilities should have their special needs addressed through specific design consideration in all new works.

Public transport should have comprehensive coverage through appropriate routes and strategies.

Equity

Vehicle users should pay the costs of works associated with making their journeys compatible with these principles.

Environment

The environmental effects of vehicle trips should be minimised by encouraging people to make fewer trips and use their cars less.

Participation

The community should be involved in determining plans, works and priorities for action on a continuing basis, with emphasis on the precinct system.

Amenity
A consistent visual image based on design themes should be applied to road-related works in order to enhance a sense of community and influence motorist behaviour.

Strategies
There are five strategies, supported by Action Plans:

- Commuter Strategy
- Through-Traffic Strategy
- Villaging Strategy
- 'Movement without Cars' Strategy
- Residential Amenity Strategy.

Transport Impact of Development Proposals

Strategic assessment
It is possible to undertake a strategic environmental traffic capacity assessment to identify areas or sites for new housing. The technical outline of an assessment procedure undertaken by a planning authority might include:

- identifying locational factors that support housing at higher densities, based on market survey, user preference or developer experience (these may vary from city to city), and distinguishing any market segments within each local government area;
- using this information to undertake a spatial search (Massam, 1980) to define the spaces that satisfy the locational factors;

- undertaking an analysis of spare capacity (assuming that proximity to good public transport is identified as a positive locational attribute, ie potentially likely to lead to substitution of private transport by public transport for trips to and from work and for travel to other major activities);

- undertaking an analysis of the degree of access residential areas have to community facilities (assuming that ready access to such areas is also identified as a positive locational attribute, ie, potentially likely to lead to substitution of private transport by walking and cycling for private transport as a means of access);

- combining analyses undertaken, such as those above, to produce strategic plans that identify both definite and possible locations for medium-density housing development. The plans may be stratified to indicate different market segments.

The technical process described above requires analyses of spare capacity of infrastructure, the degree of access to land uses, and the impact of additional traffic in noise exposure.

Development assessment

There are two situations where a transport impact analysis may be needed:

- In large subdivisions and integrated developments, access streets may be created and the carriageway widths and design will be influenced by the number of vehicles that use them.

- In some established areas, the services and transport infrastructure will have spare capacity to absorb a new demand for services without significant effect. However, in other areas the proposed development may result in the need for change in existing services and transport infrastructure to cater for the new demand.

Appropriately located medium-density housing may in fact generate less vehicle traffic than that from lower-density housing because its residents choose to walk or use public transport and because household sizes tend to be smaller. Small clusters of ten dwellings are unlikely to have much local impact and a transport impact analysis would not be warranted.

If the location of such small developments on subarterial or arterial roads (eg close to major intersections) causes a council concern, or if the scale of the proposed development exceeds 20 dwellings, then a transport impact analysis should be conducted.

A transport impact analysis for any new substantial development usually follows a five-step procedure (Traffic Authority of New South Wales, 1984).

Determine the current status of the transportation system surrounding the site
This investigation involves surveys of existing traffic flows (private and public transport vehicles) in the surrounding street system, including turning movements at intersections. An inventory of existing street and intersection capacities, parking facilities, pedestrian accessways and public transport facilities should be undertaken.

Determine the likely transport demand generated by the proposed new development
Trips by private cars, public transport trips and pedestrians will be determined from:

- a survey of similar development in adjacent or similar environments;

- trip generation rates and modal splits (ie the proportion of the total trips that are made by different transport modes) previously determined by road and traffic authorities. An example of private car trip generation rates per dwelling type is shown in Table 1.

Determine the impacts of increased demand on existing transport system
New trips likely to be generated as a result of the proposed development are assigned to the existing road network. Analysis is conducted for impact on:

- street and intersection capacities, and delays to vehicles entering or exiting the properties;

• public transport capacities;

• pedestrian pathways and cycleways;

• parking;

In new urban areas, the results will help determine the street reservation and carriageway widths and the types of intersections needed.

In established urban areas, the transport impacts may require action, either to provide additional facilities to meet the extra demand or to modify existing facilities. The identified impacts should then be presented by showing the changes in the levels of service relative to the capacity rating for each mode of the transport system.

Identify possible system improvements
System improvements may be needed in one or several of the transport system components.

For road and street network operations, suitable traffic management measures, such as signal timing, parking restrictions, turn restrictions and traffic calming devices, should be considered together with construction measures, such as mini-roundabouts. The *Guide to Traffic Engineering Practice* (AUSTROADS, 1988) explains how to conduct Local Area Traffic Management studies.

For public transport, improvements may be made to vehicle capacities, locations of bus stops and routes, access to the service and service frequencies.

For pedestrian and cyclist facilities, matters to be considered include footpath widths, designated pedestrian crossings, separate walkways, provisions for the aged and people with disabilities, and cycleways.

Recommended actions
Having assessed the impacts of the development proposal, the developer should recommend actions in terms of:

- improvement to site access and circulation;
- improvement to the transport network by reducing congestion levels and traffic calming;
- improvement to pedestrian facilities;
- the effect on the operation of adjacent developments;
- the effect on public transport services, including bus routes, bus stops and access thereto.

Alternatively, changes should be made to the size or design of the proposed development.

Presentation

A transport impact analysis is usually presented in a study report to satisfy the requirements of the legislation or regulations that apply in the States and Territories (eg Section 90 of the *Environmental Planning and Assessment Act, 1979* [NSW]).

Table 1: WEEKDAY AVERAGE VEHICLE TRIP ENDS PER DWELLING UNIT

	Average (mean)	Range	Number of Cases
Family detached	9.6	4.3–21.9	348
Apartment rental (pre-1973)	6.5	2.0–11.9	109
Apartment rental (post-1973)	6.3	2.0–11.9	33
Low-rise	6.6	5.1–9.2	22
Townhouse/Condominium (owner occupied)	5.9	1.8–11.8	53
High-rise	4.2	30.–6.5	9

(Source: Adapted from Institute of Transportation Engineers, 1991)

A Practice Note which outlines the infrastructure requirements in residential development, and the coordination of its provision.

Practice Note PNP 8

Infrastructure

Scope

Residential development and infrastructure

The infrastructure is the framework that supports economic and social activity within neighbourhoods. There are two categories of infrastructure that relate to residential development:

- physical infrastructure (eg utility, drainage and transport systems);
- social infrastructure (eg schools, hospitals and community facilities).

In this Practice Note, only those infrastructure components that are relevant in a strategic context will be referred to.

The provision of local infrastructure and funding are considered in PNP 11: Development Standards and Funding.

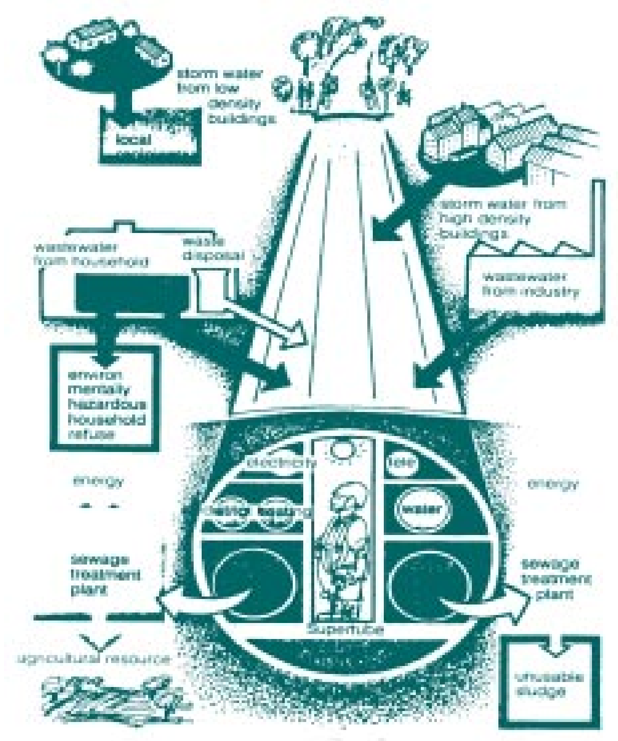


Figure 1: Example of innovative Swedish approach to infrastructure provision.

The approach to the relationship between housing and infrastructure differs for new urban areas and established areas.

In new urban areas, the primary focus is on cost-effective, timely and environmentally sustainable provision. In established areas, infrastructure already exists and the issues to be considered are:

- the extent to which it can sustain new development;
- what is needed to maintain it;
- how any augmentation or modification to it can be funded.

Infrastructure in New Urban Areas

What may be needed
A large proportion of dwelling commencements occur in areas of urban expansion. The proportion varies from city to city, but appears to be less than 60% of dwelling commencements (Cardew, 1993).

In planning the infrastructure for these new urban areas questions arise as to what services are to be provided and when, what Performance Criteria are to be used, how the services are to be provided and maintained, and how they are to be funded.

Functioning communities
As a general principle, new residential developments should be provided with all the infrastructure needed for them to function as communities.

There is general acceptance of the basic physical and social infrastructure components for new areas (eg water, sewerage, drainage, utilities, open space, shops, schools, recreation, health and community facilities) and the timing of their provision. Recent research demonstrates that the provision of gas (or liquefied petroleum gas) is important in reducing greenhouse emissions from household energy use (GNP, 1993). Some infrastructure components perceived as desirable may not be practicable at the initial stages of development. They must be planned for, although they may not be developed until later.

Financial and equity aspects have a bearing on the early provision of infrastructure components. It is not possible to provide a specific list of infrastructure components and the timings of their provision, as this depends on the type of development and its occupants, rate of growth and socio-cultural factors. However, the aim should be to provide sufficient infrastructure to enable communities to function at an early stage and ensure there are no groups disadvantaged by lack of access to facilities and services they need (PNP 11).

The need to define Performance Criteria

The criteria and standards to be used in the provision of infrastructure have become important issues for environmental, social and economic reasons and should be defined.

Concern about water as a resource, and the environmental impact of sewerage and drainage on the natural and built environment, has led to new approaches which are likely to be incorporated in current practice (PNP 3 and PNP 10). Integrated catchment management is a key feature of these approaches (Part 2, Element 3).

Facilitating the development of sustainable communities requires guidelines to determine what community facilities and human services are to be provided, and the timing of their provision (PNP 11).

The focus has shifted from land subdivision and subsequent construction of dwellings to a process aimed at producing complete, and potentially more sustainable, residential environments (Nielson, 1993).

Coordination in the provision of infrastructure

The timing of physical and social infrastructure in greenfield development sites can be of concern. Often inadequate social infrastructure provision occurs immediately following the establishment of such sites.

It is apparent that this lag is not only due to the limited capacity of public utility providers to deliver services at an ideal time (ie economic constraints), but also due to greater weighting being attributed to the physical needs as against the socio-cultural needs of new communities.

Coordination in the provision of infrastructure is important as many stakeholders and agencies are involved in the process. The key tool is the urban land release system, which has two objectives:

- maximising cost-effectiveness of urban growth;
- timely delivery of services to new communities.

The urban land release system provides an integrated and coordinated vehicle for different service delivery agencies and can, in its advanced form, result in an effective partnership between the public and private sectors. The key to a successful urban land release system is efficient management. This requires leadership, adequate planning, effective organisation, financial planning, budgeting and control.

Preparation of an urban land release program

The preparation of an urban land release program consists of a number of steps (Infrastructure Coordination and Urban Land Release Systems, 1993):

- Information on demand and land supply
- Physical services study

- Land release program (which may lead to a rezoning program)
- Human services study
- Infrastructure program
- Forward estimates review
- Budget submission and urban development program.

Land ownership and land assembly
An important aspect in the design and implementation of any urban release program is that of land ownership and land assembly.

In order to realise the maximum development potential for the major infrastructure, fragmentation of property into many small holdings can be an impediment and is unattractive to large-scale developers. However, there are many developers who work with 20–50 lot subdivisions or housing estates and only need land parcels of about 3–5 ha.

There may also be scope for joint ventures with existing property owners (such as the land pooling schemes in WA). A consortium of land owners and public and private sector organisations may be another model (eg Rouse Hill Infrastructure Consortium, North-West Sydney).

Urban land release programs must be related to strategic plans (Part 1.3) but strategic plans must take account of the potential for cost-effective provision of major infrastructure.

There are thresholds, particularly in the provision of sewerage, drainage and water supply systems, which influence the location and staging of potential development areas.

Efficiency in the provision of infrastructure can be gained through the land use planning process (AURDR,1995a). Land-use decisions could be made in conjunction with infrastructure management. In financial and economic management terms, land use plans could be adjusted according to the economic viability of service provision. This is illustrated in Figure 2.

The effectiveness of this scenario is, however, dependent on the level of local government responsibility and concern for the financial viability of infrastructure provision.

Funding

Aspects of infrastructure funding are considered in PNP 11.

Infrastructure in Established Areas

The context

In established areas, there is a nexus between the scope for, and the impact of, infill housing and redevelopment and the existing urban infrastructure. Urban consolidation may help to offset declining populations, thus utilising existing infrastructure more efficiently and making the replacement of ageing infrastructure more cost-effective (Meeske, 1992). It may also accelerate the need for replacement, involving an opportunity cost.

Putting aside environmental or amenity costs, the direct infrastructure

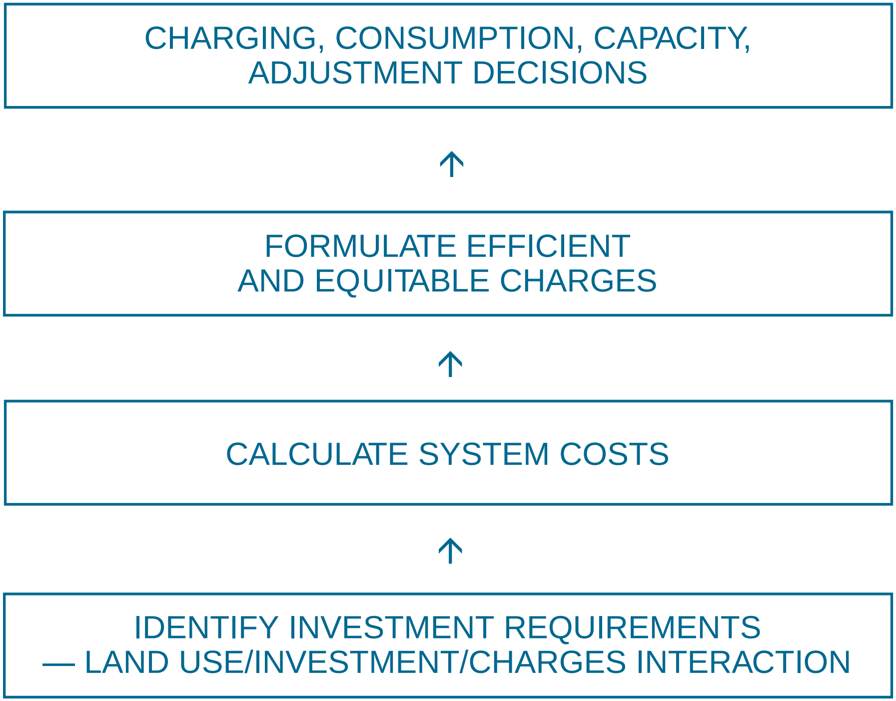


Figure 2: Integrated land use planning and infrastructure provision.
(Source: AURDR (1995a) *Financing the Fringe*).

costs of infill rather than fringe development hinge on the extent of excess capacity (Industry Commission, 1992).

There is a general perception that urban consolidation is less costly than urban expansion because existing infrastructure, which was designed for a population that has since declined, will have available capacity. Some studies confirm that there are cost savings in providing water, sewerage and drainage facilities in established areas compared with areas being urbanised (Hughes et al, 1991). However, these studies do not take account of the ageing infrastructure, the demands for higher standards and the limited scope for introducing new technologies.

Asset management

Generally little information is available on the need for replacing existing infrastructure, although there is growing interest in asset management. Asset management, or the renewal and rehabilitation of ageing systems, is one of the major issues facing utility and local authorities today. In many areas there has been a lack of investment in upgrading existing infrastructure and the costs of catching up may be considerable (Figure 3).

While additional infill housing may not in itself accelerate the need for renewal, the environmental and financial consequences of failure of existing systems will become greater as urban consolidation proceeds. For many cities, an adequate inventory of existing infrastructure services does not exist. Such a

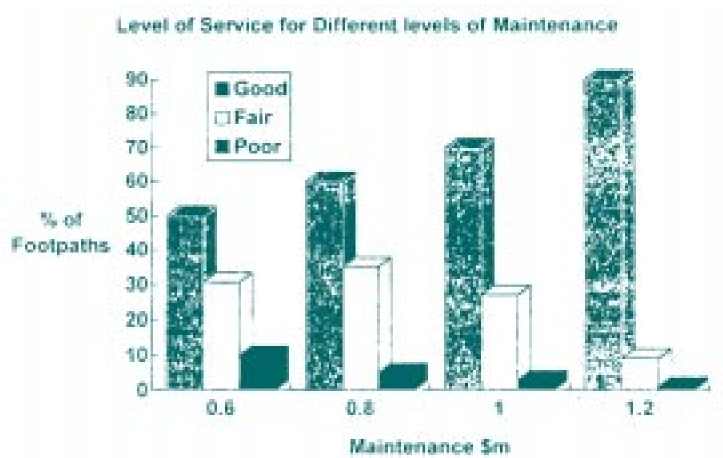


Figure 3: Asset management throws the issue of infrastructure standards into a sharp perspective.
(Source: North Sydney Council, 1994)

database must be established so that the impact of infill housing on the physical infrastructure can be accurately assessed.

Some of the critical issues related to major infrastructure in established areas are considered below.

Water supply

Water supply headworks (dams and treatment) and trunk distribution systems are sized to meet peak instantaneous demands and to ensure minimum head conditions within the reticulation systems. When the reticulation system is sized to meet the peak instantaneous flow requirements, it often results in 100 mm minimum-size pipes which will usually allow an increase in densities within reticulation systems. The key factors for infill housing, therefore, are the capacity of headworks and reservoirs, and the trunk distribution system (Pinzone, 1991).

Sewerage

Sewerage consists of collection and treatment/disposal systems. Collection systems involve reticulation, which is generally draining to a low-level pumping station. The sizing of reticulation systems is directly proportional to population served, but some variation may occur because of the design criteria adopted. With increased housing density, population density may not increase significantly, which will often mean that there may be spare capacity for infill housing. However, the age and condition of the infrastructure may be a problem. Stormwater infiltration may occur in older areas, leading to overflow during even minor rainfall events.

There is also a growing demand for higher standards from primary to tertiary treatment (where phosphate and nitrogen nutrients are removed). Upgrading of sewerage systems may be required irrespective of whether infill housing occurs, especially in older areas.

Drainage

Drainage systems must be provided to cater for both major and minor stormwater flows. Many existing drainage systems in established areas are below standard and no provision is made for water quality control. There is usually very limited scope for adapting major stormwater flows to cope with additional demands caused by increased run-off from higher-density development, but there may be scope for reducing the impact of urban run-off (see Part 2, Element 3).

Other utility services

In most urban areas, the problems of adapting major infrastructure of electricity, gas and telecommunication services to increases in gross dwelling densities are not of the same magnitude as those involving the abovementioned utility services.

Transport

As outlined in PNP 7, road-based transport systems in established areas are often struggling to cope with the demands placed upon them. With limited funds to improve such systems, there is a growing interest in demand management. The impact of traffic must also be reduced through 'traffic calming'.

Illustration of Integrated Infrastructure Provision:

Rouse Hill Infrastructure Consortium

The Consortium is a coalition of landowners, including both public and private sector organisations. It is a non-profit organisation, established as a Trust, with a Chief Executive and small administrative staff. Its role is to:

- finance the provision of the trunk servicing infrastructure for water supply, sewerage and stormwater drainage in the Rouse Hill Development Area (RHDA);
- undertake design, construction and commissioning of the works necessary;
- liaise with the planning authorities on the rezoning and development planning of the land within the RHDA;
- liaise with other service providers to ensure that all the necessary and desired physical services are available to the proposed development as and when required;
- continually review the servicing strategies for the RHDA and prepare and negotiate changes to those strategies, and improve the efficiency and reduce costs of the strategies;
- undertake and complete the project works within time and cost constraints to ensure the most efficient and earliest servicing of land for development.

Practice Note PNP 9

Social Impact Assessment

Scope

The term ‘social impact assessment’ or ‘social impact analysis’ refers to the process whereby the likely or possible social effects of a development proposal are considered and the need for social facilities and services generated by the proposal is established.

The term ‘social impact’ may cover various possible impacts associated with new residential development or increased population densities in established urban areas. It may refer to many of the considerations already addressed in AMCORD, such as traffic or urban design impacts.

There are, however, some social impacts associated with new housing in established areas that do not fall within the scope of AMCORD. They may be classified as follows:

- effects on the amenity or character of the local area arising from the number and/or characteristics of the incoming population;
- effects on the incoming residents themselves;
- displacement effects, that is, the direct effects on residents and other activities occupying a site that is being considered for redevelopment for diverse housing forms.

‘Social impact assessment’ also usually implies a concern with the equity implications of a proposal. Attention is generally given to the likely effect of a proposal on groups disadvantaged in some respect. In the case of new infill housing or in redevelopment/rejuvenation areas, this may involve, for example, an assessment of the likely effect of a proposal on the availability of housing for lower income groups, or of the effects of relocation for former residents.

When May a Social Impact Assessment be Needed?

The normal process of project assessment often deals effectively with social impacts without the need for a separate social impact assessment. This is usually the case when the likely social impacts concern issues such as traffic noise, loss of parking, overlooking, overshadowing or visual impact.

There are some circumstances when a specific social impact assessment may be called for. These circumstances may occur where the proposal is likely to have one or more of the following:

- a distinct (adverse or positive) effect on a particular social group either resident on or in the vicinity of the site;
- an identifiable effect on the social composition and/or character of the locality in which it is situated;
- an identifiable effect on the availability and use of existing community services and facilities and/or may require the provision of such services and facilities.

A social impact assessment may overlap with what is considered in the normal assessment process. There may be a need to consider whether some impacts assessed as part of the conventional approval process have a particular social effect. An example of this may be where traffic noise or possible parking problems have different effects on various social groups.

How is a Social Impact Assessment Undertaken?

Each social impact assessment will be different depending on the particular circumstances, but there are some general guidelines. These are outlined below.

Identification of community
In established areas, there is likely to be an existing social infrastructure and community. In developing areas, a community can be expected to evolve with its own characteristics and needs. In these areas the existing adjoining community can be identified.

Develop a consultation process
Social impact assessment goes hand in hand with public consultation. Where the assessment of social impacts involves an understanding of the perceptions or attitudes of various groups that have an interest in the project, consultation is indispensable. Consultation may also be important to understand the way in which different groups are likely to be affected by a proposed development and to elicit ideas and information about possible ameliorating measures.

Understand the existing situation
In order to understand the likely social effect of a proposal it is necessary to have a good understanding of what exists at present. This may involve, for example, understanding the existing demographic situation, existing traffic patterns and impacts, existing urban design conditions, or social infrastructure.

Understand the likely future situation without the proposal
This is sometimes called the ‘baseline projection’. It involves understanding what would probably occur in a particular environment if the proposal did not proceed. This is necessary to appreciate the likely effect of the proposal in the future.

Understand the proposal
This involves developing an appreciation of the proposal itself so that its likely impacts may be properly assessed.

Assess the impacts
This involves establishing the likely nature and extent of impacts. In some cases, the impacts

may be quantifiable, while in others judgements will be required as to their nature and extent.

An important aspect is the ‘benchmark’ against which any impacts are to be assessed. In general terms, a benchmark can be described as: the minimum level of service per person, community or catchment which is considered adequate to meet needs.

This is difficult to establish in general terms as it depends on local objectives, spatial patterns and characteristics of the community, time-frame and available resources. The development plan provides a mechanism for determining the benchmarks. However, there is often little understanding of the range of facilities and services, and the population levels needed to support them.

Assess the implications

Following the analysis of social impacts, it is often necessary to consider the measures required to address adverse impacts. These are often termed ‘mitigating’ or ‘ameliorating’ measures.

It may also be necessary to assess the estimated costs of any facilities and services that may be required. This is certainly the case where development contributions are to be charged and the nexus between development and the level of contributions must be established.

Monitor the effect

Monitoring the expected effect is often neglected, but it is useful as a way of ensuring that management measures proposed to ameliorate adverse impacts are appropriate and are being adhered to. It is also useful to inform future social impact assessments.

There is a large amount of literature available on social impact assessment methods and on social impact assessment generally. Some helpful sources are listed in the Selected References.

Trade-Offs and Limitations

As with impact assessment generally, there are trade-offs to be made among competing interests in the assessment of social impacts. A proposal may be recognised to have an adverse social effect which cannot be resolved by ameliorating measures but, in the light of other circumstances, the proposal may still be justifiable.

Social impact assessment provides no guarantee that adverse social effects will be entirely avoided. Social impact assessment does, however, allow the social effects of a proposal to be identified and judgements to be made about their relative importance.

There are other possible limitations to the social impact assessment process deriving from the particular nature of effects being examined. In the case of community services and facilities, for example, it is sometimes difficult to predict the type of population that will occupy a development and therefore its need for social infrastructure. Furthermore, it may be difficult to assess the capacity of an existing service because of one or more of the following:

- the absence of a generally accepted standard for the service;
- the difficulties in defining a catchment area for the service;
- the fact that the service is life cycle related and therefore its capacity may change over time.

Problems of this type may also hamper the assessment of social impacts in other areas.

Thus there are clearly limitations to a social impact assessment's ability to achieve a completely desirable outcome in new housing projects. However, such an assessment does allow impacts of particular social importance to be examined and, where there are adverse impacts expected, to be ameliorated. To that extent, social impact assessment is an important part of the planning process.

A Practice Note which promotes development strategies which take account of environmental factors, and outlines the type of factors to be considered.

Practice Note PNP 10

Environmental Management

Scope

The preparation of a development plan in both greenfield and urban situations should ensure that there is adequate recognition of the natural and man-made characteristics of the area, and that sustainable environments are created or maintained. Environmental management in the context of AMCORD involves:

- taking maximum advantage of the natural resources, such as land form, landscape, climate, water and energy resources;
- protecting residential areas and housing developments from traffic noise, air, water and soil pollution, flooding and bushfires, and from natural or industrial hazards;
- minimising environmental problems, such as polluted urban runoff and the disposal of domestic waste, associated with new residential development.

Landform and Landscape

The slope and orientation of land, and the existence of any potential foundation difficulties such as rock outcrops, highly reactive clays, landslip-prone areas, wetlands and natural drainage, have a profound influence on the form and type of residential development.

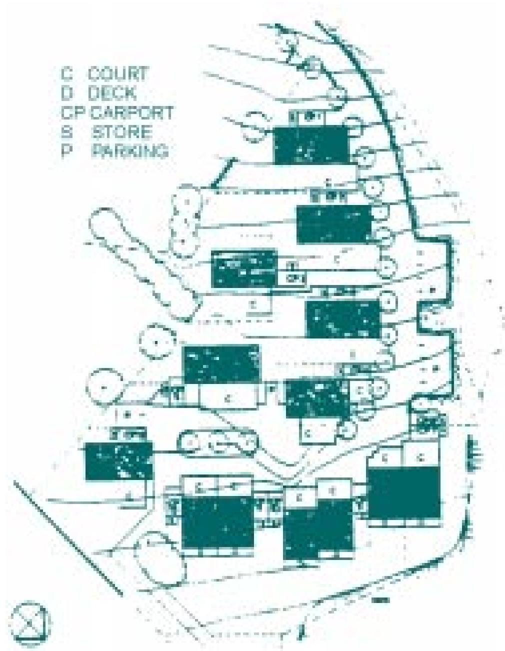


Figure 1: Physical site characteristics can shape the form of development, as in this Hobart scheme for a steep site.

Small lot development, for instance, is generally more appropriate on land with a slope of 10% or less than on land with steeper gradients.

The desirability of retaining special landscape qualities or features such as trees and views should also be taken into account in the preparation of the development plan.

Landscape qualities may establish important parameters that will influence precinct design and site layout.

Figure 2: Siting for solar access and breezes can maximise comfort.

Design for Climate

Design for climate includes matters such as using the sun, shade and cooling breezes and reducing exposure to wind to ensure a level of comfort in the dwelling.

The need to utilise the sun, shade and cooling breezes will vary with climatic and topographic conditions, but the principle of comfort applies universally. The issue is to determine under what conditions regulation is essential and how it can be expressed in a form that can be easily understood and administered.

Figure 3: Designing for energy conservation.

Comfort can be achieved through the ability of householders to manage solar access and breezes within their dwelling. This means that, in temperate climates, the sun should be able to penetrate the dwelling in winter, while in hot climates it should be able to be excluded and the dwelling should be able to catch the prevailing breezes. In all climates, the ability to manage solar access and breezes is strongly correlated with the orientation of the dwelling and the location of the living areas. These, in turn, are influenced by land form, lot size and orientation.

Narrow frontages are more cost-effective than wider frontages. However, an east–west lot orientation may, depending on the latitude and slope of the land, cause the northern facade of the dwelling to be in shadow, while lots with attached housing would only receive the morning and afternoon sun. The land form and street layout, therefore, are important, especially in the case of lots with an area of less than 450 m2 or a frontage of less than 15 metres

Solar access is governed not only by orientation and slope, but also by latitude and the shadow cast from buildings and walls along the northern boundary.

In all areas, the lot shape, size and orientation can be varied to attain particular objectives.

Skewed or oblique lots can offer some advantages in special situations. For instance, skewed lots can combine desired orientation with exposure to breezes from the prevailing direction, as in Darwin. Skewed lots may also permit the retention of views on sloping land.

Areas that need special attention to climatic factors should be identified in the preparation of the development plan.

Element 5, Part 2 of AMCORD contains relevant provisions for land development proposals and for building, siting and design.

Design for Energy Conservation

Utilisation of sun, shade and breezes is also important for energy conservation and reduction of greenhouse emissions. The objective of energy conservation can be expressed as the ability to heat/cool the dwelling with minimum use of energy and to make the most efficient use of energy for other household appliances and services. The important criteria that apply to achieving comfort also apply here, but there are some additional requirements.

Solar access to north-facing living area windows offers greatest energy benefits in temperate and cooler climates. This passive heating can reduce demand for winter heating and, together with window shading, reduce summer cooling needs.

Solar access is also important for roof-mounted solar collectors. These may be used for hot water or generating electricity for household uses. Orientation and pitch of collectors are important, as is good sunlight exposure. Roof form is important to allow for future installation, preferably with a north-facing roof located away from the front of the house so that collectors are less visible from the street.

It must also be recognised that there are many locations, particularly for infil developments, where it is difficult to obtain solar access.

There will also be locations where people place a higher priority on other aspects, such as views. Also, development economics may make it difficult to satisfy a universally applied requirement for solar access. In these situations, attention may focus on other techniques for conserving energy.

Protection from Traffic Noise

Traffic noise can be a matter of major community concern and is not confined to noise generated by road-based vehicles. Railway and aircraft noise are other important causes of concern, but are not considered here as they are not as pervasive as traffic noise.

Attitudes towards noise exposure diverge widely. Some people are affected by relatively low levels of traffic noise while others appear to tolerate relatively high levels. Annoyance also varies with transport mode and time of exposure. A few trucks at night can be more annoying than a heavy flow of traffic during the day.

Noise is conventionally measured in decibels of the A-scale [dB(A)].

The A-scale is a set frequency weighting allowing for lack of sensitivity of the ear to sound at very high and low frequencies. Traffic noise normally fluctuates over a given period. There are different ways of assessing traffic noise, but the two most common descriptors are L10 and Leq. L10 is the sound level that is exceeded 10% of a given time. Leq is the equivalent energy level which, over a period of time, contains the same amount (equivalent amount) of sound energy as the varying levels of the traffic noise. In practice, Leq is approximately 3 dB(A) less than the L10 for the same condition.

Figure 4: An example of a house along a major road designed to minimise traffic noise exposure.

Research has shown that a Leq of 55 dB(A) or less at the facade of a dwelling during the day is generally acceptable.

Annoyance increases with greater exposure and a Leq of 70 dB(A) or more is considered a serious annoyance. Experience of traffic noise during the night is comparable with an exposure during the day that is 10 dB(A) higher. Day and night periods are defined as 7.00–19.00 and 23.00–7.00 respectively.

Noise levels at any location near a roadway are principally a function of traffic volume, speed, proportion of heavy vehicles, road gradients, distance from the source of noise, topography, the extent and type of obstructions that may shield the location from noise, and the hardness of the ground surface.

A technique for predicting traffic noise levels that takes account of these factors is the CORTN method (Calculation of Road Traffic Noise, Department of Environment, UK, 1975). The method is widely used and is relatively simple to apply.

Traffic noise in residential streets should not be a problem if the provisions in AMCORD are observed.

Where traffic volumes in residential areas do not exceed 3000 vehicles per day, and the verge widths and setbacks proposed in Element 2.1, Part 2 are observed, traffic noise should normally not be a problem. The development plan should maximise the length of streets where such volumes are not exceeded.

However, there will be roads where higher traffic volumes and speeds cannot be avoided and traffic noise impact must be considered.

There are several ways by which noise exposure can be reduced. Separation by distance means a greater setback and/or a wider verge. This is only practicable where space is not at a premium and exposure levels are moderate. Mounds, half-mounds or screens can achieve a reduction of between 7 dB(A) and 10 dB(A) but are limited in height and effective only where housing is low-rise. Barriers screen views and can become an urban design problem unless carefully landscaped. Landscaped earth mounds can be attractive but need space.

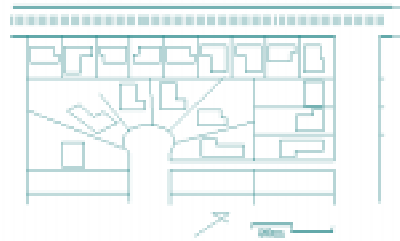


Figure 5: Typical situation.

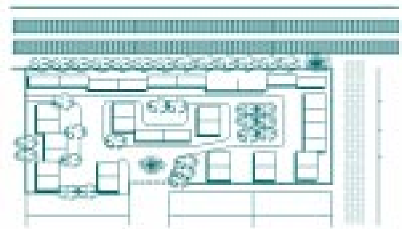


Figure 6: Integrated redevelopment with noise protection.

Building design can be effective by locating quiet areas away from the noise source and by using solid walls and insulation material on exposed facades.

In buildings designed for multiple occupancy, opportunities exist for screening by design and use of building materials. Single dwellings, however, are often framed and have large windows. This endows them with poor attenuation properties. Accordingly, such dwellings should not be sited in exposed situations.

Attention to traffic noise is essential in the preparation of a development plan and in site planning near major traffic routes.

In established areas, studies should be undertaken to show the number of dwellings exposed to different levels of traffic noise and the impact of traffic calming on the number of dwellings affected. More information is provided in PNP 7 and in Element 5.13, Part 2.

Air Quality

Air pollution has regional and local dimensions. At the local level the principal concern is with carbon monoxide (CO), nitrogen oxide (NO) and lead levels. High concentrations of CO in blood cause lethargy, reduced ability to react and may, after longer exposure, lead to heart and lung failure. Nitrogen oxide can cause damage to lung tissue and contribute to an increase in acidity in the environment.

Standards for exposure on footpaths along roads have been determined. These are related to traffic intensity, current vehicle emission performance, and expected improvements in emission performance. In the Netherlands, current limits are 12000 vpd for CO and 5000 vpd for NO.

In developing urban areas, dwellings should be set back from traffic routes where these volumes are likely to be exceeded.

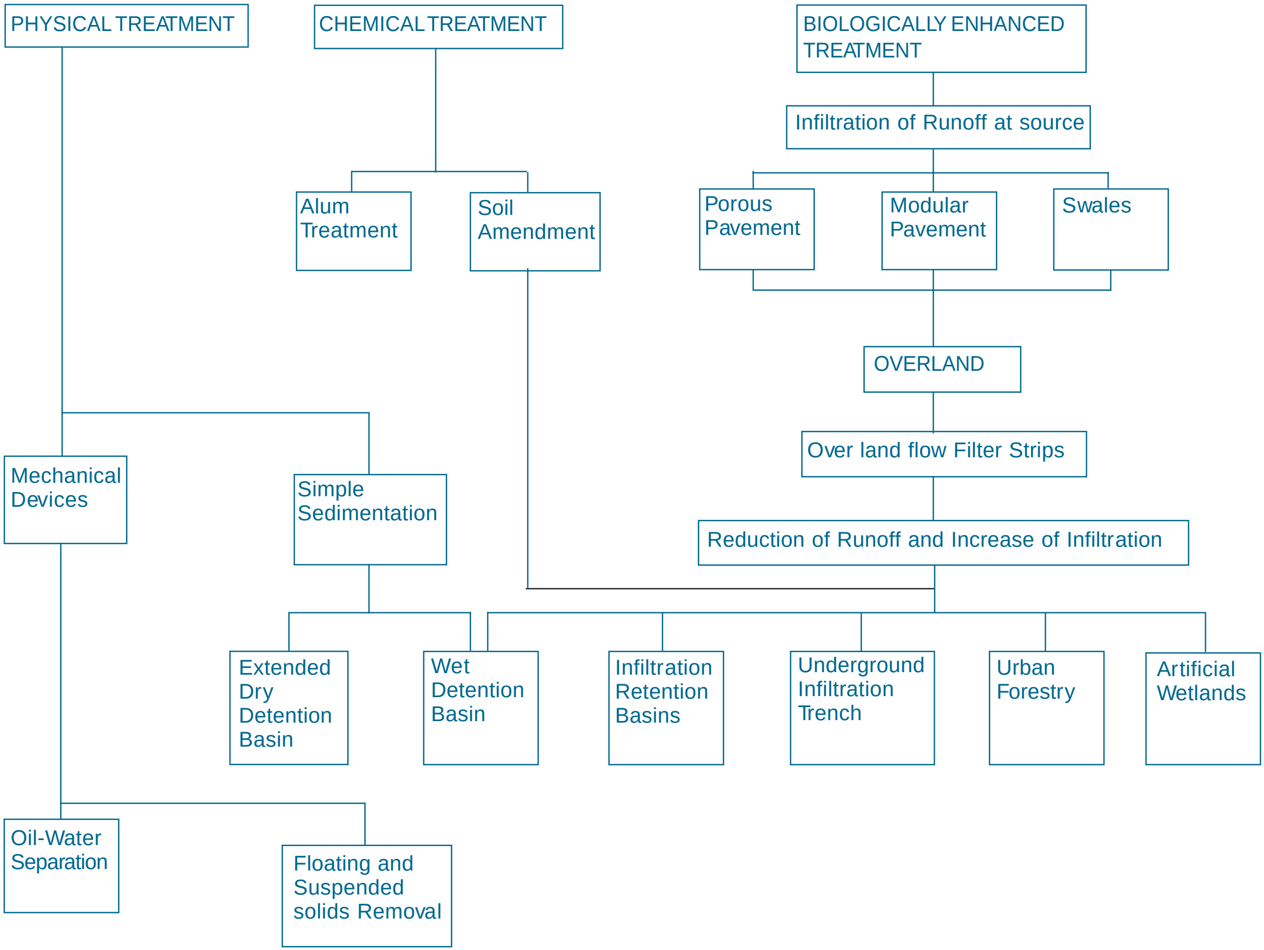


Figure 7: Best management practices: measures to control stormwater runoff pollution.

Practice Note PNP 11
Development Standards and Funding

Scope

There has been an evolution from the ‘Sewerage, Shops and Schools’ mentality of the 1960s. Both the public and private sectors are more aware of the need to develop residential areas as physical and human environments at an early stage. However, there is debate on what infrastructure should be provided as part of the initial development stage and how it should be funded. The central questions concern costs and benefits and who should pay for the costs (Industry Commission, 1992).

There is a strong link between development standards and the ability to pay for them.

The link is very significant in the context of AMCORD as it affects environmental quality and design, development economics, housing affordability, market choice and equity. Most local authorities determine infrastructure development standards as part of a development plan (or its equivalent), but standards range widely and are still evolving. There are also different mechanisms for cost recovery, although some common principles have been established.

The link is established clearly in New South Wales, where the preparation of a Development Contributions Plan is now mandatory for local authorities seeking to recover the infrastructure costs associated with new development. Part of this process is the determination of the infrastructure needs of new fringe development areas and the upgrading of existing infrastructure as a result of infill and redevelopment in established urban areas.

Defining Standards

Development standards are commonly used as the basis for determining needs, but questions arise about how they were derived, whether they have general applicability, and whether there is flexibility to adapt to changing circumstances. Standards are reflections of values, characteristics and understandings of need at a particular point in time. In addition, the characteristics of communities vary and the spatial patterns of communities differ considerably (Reynolds, 1990).

Accordingly, standards should not be seen as immutable and monolithic.

A distinction is often made between physical and social infrastructure, where the physical infrastructure includes water, sewerage, drainage, utility and transport systems, and the social infrastructure includes open space, schools, hospitals and community facilities.

There are differences between physical and most social infrastructure. Much social infrastructure is strongly correlated with population characteristics, but the physical infrastructure has to serve for a long time during which development changes will occur. This difference affects the definition of standards and the timing of provision.

The physical infrastructure should be seen as less time-dependent than the social infrastructure, which is strongly related to the characteristics of the population at a particular point in time. The characteristics of the population may change over time, but once initial development has occurred, the opportunity for adapting the physical infrastructure to changing needs is constrained.

This constraint to adaptation applies to all infrastructure elements requiring significant areas of land or amounts of expenditure. For instance, land should be reserved for public purposes (eg open space, roads and streets, major drainage and utilities, and major community uses) not solely on the basis of short-term need but also in the expectation of changes in needs in the long term.

A preferred approach in providing most social infrastructure provision is to use standards as guidelines and to base them on locally derived needs (Briggs, 1992). Some infrastructure can be regarded as essential ('baseline' items, such as open space, school, public telephone, local shops and a community building). Others can be regarded as community dependent ('threshold' items, such as youth or aged persons' facilities and community transport).

Questions which need to be addressed in developing a community facilities and services plan are set out in Table 1. The questions should be answered at both neighbourhood and district levels, and the answers will be specific for each location. The development standards are, therefore, location and time-specific. Information on common standards of community facility or service provision, for use as a preliminary guideline only, is summarised in Table 2. Reference should also be made to the Human Services Planning Kit, SA Urban Land Trust, 1994.

Costs and Benefits

The costs of providing infrastructure represent a large proportion of the house and land package. The higher the development standards and performance expected, the greater the costs and potential benefits. However, funds must be generated to pay for them and the responsibility for payment must be defined .

There is a philosophical basis for shared responsibility: costs should be borne by those who stand to benefit from development, and the cost should be proportionate to the benefit. However, while developers' contributions are seen increasingly as a source of alternative financing, this poses questions about equity, availability of 'top-up' and recurrent funds, and the difficulty of justifying contributions for small-scale incremental development.

The costs and benefits of infrastructure vary with the particular type and standard, and with the community served. Difficult policy issues arise when:

- Community expectations change but are often not directly related to the ability to pay.
- The distribution of the benefits and costs of creating sustainable urban environments is not a simple equation.
- Which costs should be charged directly to a proposed development and which costs should be borne by the wider community through rates and taxes.

Whatever policy decision is made on these issues, there is a need for transparency so that the market and the community are aware of the consequences.

The Industry Commission inquired into and reported on some of these issues and concluded that the community, through the market mechanism, should decide the preferences, provided there was transparency in costs. The Commission concluded that the infrastructure costs should be included in the costs of dwellings, and made explicit so that people can decide what they purchase, in what combinations of provision, and where (Industry Commission, 1992).

Issues of affordability and equity are also of considerable importance.
On the matter of affordability and equity, the Commission expressed the view that people should be subsidised, not the places where they live or work. It acknowledged that environmental costs are difficult to incorporate in current pricing arrangements as some are not location-specific. The Commission discussed the balance between upfront (developer) charges and access (user) charges, but did not make a recommendation.

Decisions on these issues and how they are implemented will vary from State-to-State. However, the debate about what the community needs and wants, who should pay and how it should be paid for, will continue and will influence development standards and cost recovery in future.

Efficiency and Equity

The method or approach adopted to finance infrastructure provision has equity implications.

In terms of infrastructure, equity means:

- ensuring that those who benefit from the supply of infrastructure bear an equivalent share of the costs;
- making it possible for those without adequate means to gain access at least to the socially desirable minimum infrastructure.

The level of equity or inequity is dependent on the type or level of need, and relates to the availability of infrastructure, and the price associated with its use.

Availability

The availability of infrastructure is dependent on the investment and operational decisions of infrastructure suppliers. In Australia, access to infrastructure services such as water, sewerage and electricity are mandatory.

Table 1: Developing a Community Facilities and Services Plan

Step 1: Identify existing community

- What is the community being planned for?
- What is the nature of the existing community?

Step 2: Identify existing community facilities and services

- What facilities and services exist to serve the community now?
- Do these facilities and services have any space capacity now?

Step 3: Identify new community

- What will the new community be like?
- How quickly will the community grow?

Step 4: Identify community facilities and services needs in new community

- What additional community facilities services will be required to serve this new community?

Step 5: Identify appropriate facilities and services plan

- How can these facilities and services best be provided?
- Where should new facilities best be located and what should they be like?
- When should facilities and services be provided?
- How will they be monitored to ensure their ongoing relevance, effectiveness and efficiency?

Step 6: Identify funding and management structures

- How much will they cost?
- How will they be funded for both capital and recurrent costs?
- How will their provision be managed?

(Source: adapted from Briggs, 1992)

Social infrastructure services such as schools are generally available to serve residential areas; however, access may involve long journeys. Public transport, on the other hand, is not always available, and, where it is, it may not be easily accessible.

If availability of infrastructure is to be equitable, access must be considered at an early stage of development.

Price

The price of infrastructure relates to the cost of provision and the cost of use. The cost of provision may entail a direct cost to the individual or the household, and the cost of use is generally imposed as a user charge.

Where individual or household access to infrastructure is constrained by price, issues such as subsidy provision, or determining how costs are met, need to be considered.

Location

In addition to availability and price, location impacts on access to infrastructure.

In most established urban centres, infrastructure is generally readily available. However, in newly developed or developing areas, or in areas where there is an apparently inadequate demand to support the provision of services, access to infrastructure is compromised.

According to a National Housing Strategy report (NHS, 1991): ‘The availability of the full range of infrastructure services itself affects the price of housing (or residential land). In this way the supply of infrastructure directly influences the distribution of access to it.’ This has further implications which relate to the equity of infrastructure provision.

To minimise the levels of inequity that may result through infrastructure provision, service providers and local authorities must adequately plan, in terms of both the type and extent of infrastructure provision and the funding mechanisms in place, to meet the demand that is likely to arise in new and existing areas. This is an area where development plans can be used to manage outcomes.

Development Contributions

There are several methods of funding infrastructure. The use of development contributions is only one such mechanism.

Traditionally, local government in Australia has obtained the necessary finance from a variety of sources, including rates, fees and fines, borrowings and grants (Lang, 1991). Development contributions have also featured and there is every indication that reliance on this form of funding will increase (Lang, 1991).

The responsibilities for, and the principles of, exacting contributions from developers are reasonably well established, but there is no uniform system of development contributions in Australia.

There are wide variations in the level and extent to which development contributions are levied, but there are common principles, outlined as follows:

- It must be clearly demonstrated that a development is likely to create a need for particular public amenities or services.
- The contributions sought must be for the purpose of satisfying that need and only that need.
- A direct nexus must be shown between the need created and the measures adopted to satisfy that need.
- The contribution amount must be fair and reasonable, and directly proportional to the share of the need created by the development.

- The contribution must be spent within a reasonable period of time, or be refunded.

- The approval authority must be accountable for the manner in which contributions are spent to satisfy the need created (Briggs, 1990).

For established urban areas, there may be land and monetary contributions or a facility in kind. The general principle is that the level of contribution should ensure that the current amenity of the area does not diminish.

Councils should base this level of contribution on this principle and on what is considered reasonable and appropriate for the local area. However, as explained later, an appropriate contribution is not always easily established.

What Mechanisms are Used?

There are several methods of exacting fees and contributions and charging developers for infrastructure provision (Briggs, 1992). They can be compulsory, or negotiated between the developer, the approval authority and/or a government agency selling land to a developer.

It is not always easy to distinguish between compulsion and negotiation. There is, however, an increasing move toward compulsory levies. These provide the developer and recipient community with greater predictability about the kind and level of contribution required.

The most common methods of calculating development contributions include the following:

- *impact fees:* levied as upfront capital contributions;

- *linkage exactions:* similar to impact fees except that the principle of nexus is applied more broadly;

- *mitigations:* requirements to limit negative impacts on surrounding neighbourhoods or the environment;

- *inclusionary zoning:* a form of housing exaction to encourage developers to provide affordable housing;

- *betterment tax:* based on the increased value of land as a result of planning permission .

Of the mechanisms listed above, impact fees are the most widely used form of levy in Australia.

Cost Recovery in Practice

There should be sufficient evidence to indicate the scope for cost recovery, provided the nexus between the need created and the measures adopted to satisfy that need can be clearly demonstrated.

However, whether full cost recovery, as the Industry Commission recommends, is practical at present is debatable.

The first reason is that the information on the 'base case' may be incomplete. This applies in many established areas where there is no consistent record of services and facilities and their condition. Databases, together with asset management, are an important precondition for determining costs attributable to new development (Insite Consultants, 1992).

Secondly, considerable difficulty exists in determining the potential and likely timing of development in established areas (both infill and redevelopment) and the nature of the incoming population (Briggs, 1992).

Thirdly, it may be difficult to determine marginal costs in headworks, networks and local on-site reticulation or distribution where the infrastructure needs renovation and where past pricing policies have not generated replacement funds (National Capital Planning Authority, 1993).

Finally, there is a question of affordability. Often, the user is unable to pay the required amount. In this event, development does not occur unless there is some subsidy or provision of infrastructure is deferred, thus incrementally contributing to the provision of particular infrastructure as part of an overly slow process.

The objective of full cost recovery may, therefore, conflict with an objective to provide housing of a particular type and price in a given location.

In some cases, a levy less than the full amount may have to be applied if there is to be new development. Where this results in new development that would not otherwise occur, a relaxation of the levy requirement is considered a suitable trade-off. In these circumstances, it is important to consider the availability of the balance of needed funds and the impact of this on a council's budget priorities.

A Sydney case study undertaken for AMCORD URBAN revealed that removal of the development contribution reduced the cost of producing a two-bedroom dwelling by around $23,000, even though the levy per dwelling was $14,600. In other words, the amount of levy paid was $14,600 but the cost of the dwelling was $8400 more than this. The extra cost occurs because the timing of the payment (upfront), plus the many additional costs including charges and profits effectively results in a loading to this initial charge. Deferring payment of the levy until the dwelling's settlement date produced a cost saving of $2800 for the same dwelling (Scott Carver, 1992).

There are other situations where trade-offs and bonus provisions may be considered to make development viable, but this requires careful study.

Development Plans as Urban Management Tools

Contribution rates should be set in advance so that they can be built into developers' feasibility studies.

In New South Wales, there is now a requirement that councils prepare contribution plans for both developing and established areas as the basis for determining development contributions.

If development contributions are to be charged, sufficient planning will have to be undertaken to establish the base case against which the nature and level of contributions can be determined. The remainder of capital funds and recurrent needs also must be considered.

The absence of such planning could mean that there is a lack of clarity for the housing development industry, that opportunities for maintaining the quality of the existing environment may be lost, or that unforeseen budget difficulties occur.

The addition of a plan for development contributions and programs of public expenditure adds further strength to the development plans, making them more than planning tools: they become tools for urban management as well.

Further Information

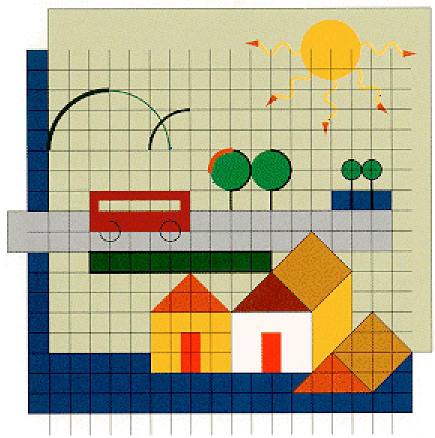
A number of recent studies have been undertaken in relation to this subject. Following is a list of references which detail practice and theory relating to infrastructure funding.

Australian Urban and Regional Development Review (1995a) *Financing the Fringe: Efficient and Equitable Charging for Urban Infrastructure,* Discussion Paper No. 4, Canberra.

AMCORD

A national resource document for residential development

Design and Development Practice Notes



Practice Note PND 1

Adapting and Using Design Elements

Scope

This Practice Note provides advice to different users of the AMCORD documentation. It is intended to assist individuals in identifying those sections that are relevant to their needs at any particular time, and in using the documentation correctly.

Advice is provided on:

- how different categories of users (eg developers, professionals, council administrators) may identify which parts of the document are relevant;
- how different sections of AMCORD relate to different categories of development (eg land subdivision, detached housing, dual occupancy, unit development);
- how the various elements within AMCORD can be weighted, so that some are given greater priority than others, and there is a framework for trade-offs between different elements;
- how the reference documentation which is AMCORD can be adapted as a local code to suit particular circumstances, so as to retain the benefits of the research behind the main document, while also reflecting local needs.

Amcord for Different Users

AMCORD can be used in different ways by different categories of users. It can be a code of practice for professionals, a guideline on product performance for developers, and the basis for a regulatory code or design guidelines introduced by local government.

Table 1 shows those design elements that will be of most interest to each of these user groups. However, this should not in any way discourage any users from gaining familiarity with the whole of the documentation. Such broader knowledge and collaboration between professional groups is required to assist all parties in understanding the total process of residential development, and the ways in which they can contribute to a good quality product.

The different user groups identified, and the parts of AMCORD which will be of most relevance to them, are summarised as follows.

Strategic Planners
Councils often have officers with responsibility for strategic planning, including planners and infrastructure engineers. In addition, councils often employ consultants to assist in this function. These people will have particular interest in Part 1, as well as those Design Elements in Part 2 which relate to considerations beyond the individual site (1.1, 1.2, 1.4, 2.3, 3.1, 3.2, 5.13, 5.14).

Regulators
State/Territory administrations as well as councils have a regulatory function.

Officers concerned with regulation will be particularly interested in the key components of AMCORD that can be applied to local regulatory systems. There will be some variation in the extent of regulation, and in the areas of particular concern in a specific locality. However, all regulators should be concerned with Part 1, as it provides a context for drafting and interpreting local regulations. The Design Elements then likely to be reflected in local regulations are 1.3, 2.1–2.3, 4.1–4.3 and 5.1–5.14.

Developers and Investors
Developers, builders and investors will be particularly concerned with those parts of AMCORD that impact on the development brief, and the marketability of the development. It is important that there is a good appreciation of both site constraints and opportunities arising from site characteristics and the nature of local regulations.

Developers of larger-scale projects will be interested in Design Element 1.1, while all developers and investors will be interested in 5.1 and 5.2 as this affects lot yield. Elements 1.3, 1.4, 2.1 and 2.2 will impact on marketability to different users.

Elements 4.1, 4.2 and 4.3 will also affect marketability through visual presentation. Elements 5.4–5.14 are also specifically relevant to the marketability of the development product, as well as its end-cost.

Developers' Specialist Engineers
Any larger development projects are likely to involve engineering specialists.

Engineers will have a general interest in Elements 5.1 and 5.2 as these relate to the layout of the development. Traffic engineers employed on larger developments will have an interest in Elements 1.1–1.6, 2.1, 4.1, 5.1, 5.6 and 5.13. Drainage engineers will be concerned with 3.1, 3.2 and 3.3. A range of specialists will have an interest in 5.10, 5.13 and 5.14, depending on the nature of the site.

Developers' Planning and Urban Design Consultants
Planners can be expected to be concerned with all the Elements that have regulatory implications. In addition, those Elements which establish the site context for the development will be relevant, including 1.1, 1.2, 1.3, and 5.1.

Building Designers

Building design may be carried out by architects, but in many cases it is done by building designers, drafters, builders, developers or future occupants. Whoever is doing the design work, the Elements that will be most helpful are 1.1, 3.3, 4.1– 4.3, and 5.1–5.14.

Landscape Designers

Many developments may involve a landscape architect, but otherwise the landscape design may be carried out by the building designer or a landscape designer/contractor. Whichever is the case, it is important that landscape design and building design go hand in hand, to develop integrated solutions.

Landscape architects and designers will be concerned with all the same Elements as building designers, with the addition of Elements 1.4, 1.6, 2.1–2.3, 3.1, and 3.2.

Applying AMCORD to Different Categories of Development

Use of AMCORD can be further simplified by identifying which sections apply to which particular categories of development. For example, if a development consists of land subdivision, it may not be necessary to consider all the Elements concerned with building design. To some extent, if a building is of a certain type, there can be a further streamlining of the use of the documentation.

Table 2 identifies the key linkages between different sections of AMCORD and the type of development under consideration at a particular time. The different categories of development used in this table can be diagrammatically described as follows:

Subdivisions

As can be seen from Table 2, development for subdivision purposes will be most assisted by consideration of Elements 1.1–1.6, 2.1, 2.3, 3.1–3.3, 5.9, 5.10, 5.13 and 5.14. Elements 5.1–5.8 are not directly relevant, though a good appreciation of eventual design considerations will obviously be of assistance in achieving a desirable end-product.

Building Design

When it comes to building design, all types of development require consideration of all of Elements 3.3, 4.1–4.3 and 5.1–5.14. Here there is some difference between development types, as consideration of communal open space is irrelevant to single-dwelling design, and consideration of public open space is mainly an issue for larger developments involving land division. Larger developments also need to take account of Elements 1.1, 1.4, 1.6, 2.1–2.3, 3.1 and 3.2.

Within each Element, of course, there will be some provisions which apply to particular development types and which are not relevant in all cases. The location of a development will also determine the relevance of particular elements, eg Elements 5.13 (Housing on Traffic Routes) and Element 5.14 (Bushfire Protection) will only be a consideration in specific circumstances.

Weighting to be Applied to Different Elements

In order to use AMCORD effectively, it is necessary to recognise that not all Elements are of equal importance in all circumstances. Some Elements are generally of greater importance, or weight, than others, while some may assume greater importance in particular locations.

In order to achieve the best possible design solution for a specific site, it may be necessary to allow for some provisions to be sacrificed, so that excellence is achieved in other areas of design.

As a general rule, the appropriate weighting to be applied to the different Design Elements of AMCORD is suggested as those (refer Table 3):

1. relating to community safety and wellbeing;

2. relating to safety and comfort of the development's occupants;

3. dealing with the relationship of a development to its surroundings;

4. dealing with the internal arrangements on site.

It is unlikely that this weighting will vary between local areas, though the priority given to different Elements within these categories may differ.

It will often be appropriate to trade-off compliance with provisions in any one category if this achieves an increased benefit in a higher category, and this increased benefit could not be achieved in any other way.

Within some Design Elements there may be possibilities for trade-offs between provisions. The aim here should be to seek the best solution for the site in terms of meeting the *Intent* of the Design Element.

Trading-off between Elements obviously requires a willingness to negotiate between the regulator and the developer/designer, to achieve the best possible results for everyone. It is more time consuming, and requires more skill than simply putting ticks against the Elements for compliance. There may well be a concern among some councils and developers that this will make the approval process more expensive to administer, and more time consuming.

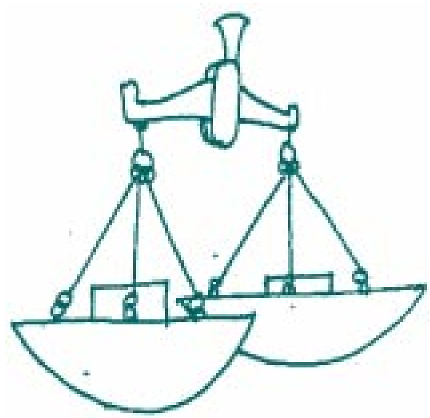
This may be true, but it needs to be recognised that the process of residential development is becoming more complex, in response to community demands for improved performance.

Given that it is more complex, it should be expected that design trade-offs be part of the design and approval process, taking into account the need to provide good quality, affordable, safe, environmentally appropriate and marketable housing.

Provided that councils adjust their procedures to the new regulatory environment (rather than adding new regulations to their existing systems) the costs of better development may be contained. For example, adoption of simplified zoning systems may save administrative costs and approval times in one area, to compensate for more attention being given to good planning and design. Streamlining planning and building approvals will also assist in achieving a more efficient system.

Adapting Performance Criteria to Suit Local Conditions

It is not expected that the Performance Criteria within AMCORD will need to be reworded to suit local conditions. However, the process of adaptation into a local code might include:



- describing the characteristics of the local area, and the council's (or other administration's) strategic planning objectives for the area (see Part 1 of AMCORD);
- considering which provisions apply to the particular locality, or to specific areas within the locality, and those which are not relevant because of local characteristics;
- considering the weighting that should be given to different elements arising from local characteristics and the council's objectives;

- adding new provisions where this is necessary to ensure that development meets local objectives.

However, it is recognised that changes may be required for some Performance Criteria, and some additional Performance Criteria may be necessary. It can be expected that a different weighting system, and additional provisions, will be appropriate in areas of high environmental sensitivity (including coastal areas) and areas of high heritage and conservation value.

In areas where high-rise housing is considered appropriate, it will be possible to use AMCORD as a resource document in relation to this type of development.

Adapting Acceptable Solutions to Suit Local Conditions

In developing a locally appropriate code, there may be a greater need to consider adaptation of the Acceptable Solutions which apply to the Performance Criteria in AMCORD. However, in making such adaptations, it is highly desirable that they be well justified, so that the integrity of the documentation (and its legal resilience if challenged) is not devalued.

Once again, the process of adaptation should start with establishing what it is about the local area which justifies some change from the source document. This includes the characteristics of the local area, and the strategic objectives that have been established for it.

From that point, the process of adapting the Acceptable Solutions should involve:

- where AMCORD does not include an Acceptable Solution for a particular Performance Criterion, developing a locally appropriate solution;

- where AMCORD suggests a range of alternative Acceptable Solutions for a particular Performance Criterion, deleting those that are inappropriate to the local area;

- where AMCORD does suggest locally appropriate Acceptable Solutions, adding other Acceptable Solutions which have been identified locally;

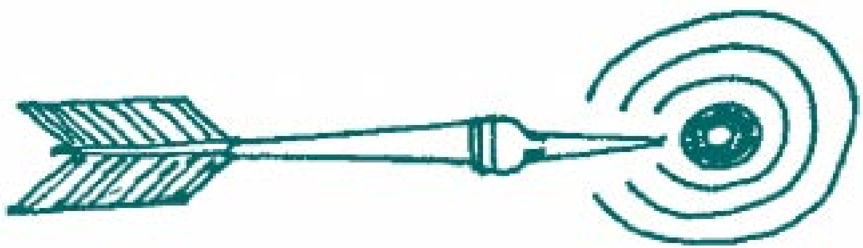
- providing documentation for each locally adopted Acceptable Solution which differs from those proposed in AMCORD. This documentation should include clear identification of the features of the Acceptable Solution which relate to the satisfaction of the Performance Criteria, and any local examples of where the particular solution is in place.

There is a danger in devising locally Acceptable Solutions which either do not meet the Performance Criteria of AMCORD, or which go well beyond these criteria. The test to be applied to the Acceptable Solutions is accountability for:

- Performance Criteria that relate to the Acceptable Solution;

- the local inapropriateness of AMCORD solutions in terms of meeting the Performance Criteria where a provision has been replaced;

- the new solution meeting the relevant Performance Criteria, perhaps with some qualification.



Making Best Use of Performance-Based Regulation

Where a council is moving from using a conventional prescriptive set of regulations to using an adaptation of AMCORD, there will need to be some changes made to its administrative processes. Without this adaptation, the considerable benefits of the performance-based approach will be lost, and the end-result may be counterproductive.

Drafting regulations

Performance-based regulation is weak if the drafting of regulations is not tightly disciplined. It can be confusing and ambiguous, expensive to administer, and decisions based on it may be vulnerable to legal challenge. It is essential that any local adaptations to AMCORD retain a clear and unambiguous approach, clearly stating what is required, and what solutions will be considered satisfactory.

This may require a much sharper style of documentation than councils have traditionally been used to. Council staff may need to develop their skills in this area.

The legal profession and developers are concerned that performance- based regulation should not create ambiguity and uncertainty. Poorly drafted models have this potential.

However the courts have also been increasingly critical of prescriptive regulation which is not backed up by appropriate objectives, and are inclined to disregard them if they are not clearly accountable. Well-drafted performance-based regulation provides much better accountability than prescriptive regulation can offer.

Administering the regulations

To make best use of the performance- based approach, it is important to understand the following:

- The Intent of each Element is the main reference point in interpreting the Performance Criteria and the Acceptable Solutions.

- The Performance Criteria are clearly defined statements of the desired results of the development. They focus on the ends of the development process, rather than the means.

- Ideally, the Performance Criteria should be so clearly stated that it is self-evident whether a development meets the Performance Criteria or not. While it is not yet possible to be so clear in all cases, there should be no doubt about interpreting the Performance Criteria for a particular development. Acceptable Solutions assist in this interpretation by providing examples.

- The Acceptable Solutions should never be regarded as any more than just examples of how the Performance Criteria can be met, and they should not preclude other solutions if the required performance can be demonstrated. They should not be used as de facto prescriptive regulation.

This is essential if the advantages of performance regulation are to be achieved, through encouraging technical innovation and appropriate responses to changing community needs.

Performance-based regulation is different from prescriptive regulation, in that good solutions can be sought rather than minimum tolerable standards. In the presentation of Acceptable Solutions, it should be remembered that they can aim at a good standard rather than a minimum standard, because they do not preclude other options.

Evaluation

Because performance-based regulation is focused on the end-results of development, it will be practical and useful to evaluate:

- whether the Acceptable Solutions are proving successful in meeting the Performance Criteria,

- whether the Performance Criteria are successfully meeting the essential objectives of the code.

Periodic evaluation of existing development should enable regulators to assess the impact of regulation on improved residential design, and to make appropriate adjustments.

Practice Note PND 2
Development Application Information

Scope

The type and detail of information to be provided with a development application will depend upon such factors as the scale and intensity of development as well as the complexity and location of the site. In all cases, the aim should be to provide clear and comprehensive information that will assist the responsible authority in assessing the proposal. Demonstration of how the design criteria are met, particularly where the Performance Criteria are used, will usually speed up the application.

Consultation Prior to Submission

Applicants are encouraged to discuss their proposal with council officers at the early concept stage. Where appropriate, consultation with neighbours and, in some instances, the wider community may be required.

Development Information

The Design Elements in AMCORD provide for the submission of certain types of information as part of the development application. The notes that follow are an indication of the content and level of detail that councils may consider in determining the submission requirements related to:

- Site analysis;
- Site development plan;
- Landscape plan.

Site analysis

While not all authorities currently require submission of a site analysis, it is an important step in the design process for a successful development. A site analysis enables assessors to appreciate the site and the designer's intent more clearly. It also assists in identifying the relationship of the site to adjacent properties and in testing whether the proposed development recognises any constraints that may apply.

It is recommended that additional information be provided where new developments are proposed in established streets. Much of this information would normally already be included as part of the site analysis.

Site development plan

The site development plan conveys the design concept for the site. While the emphasis is on new public streets, it should be remembered that shared driveways internal to the site are regarded as communal streets that also create a streetscape. AMCORD provides for greater design flexibility for communal streetscapes where other parties also have an interest in the design outcome.

Landscape plan

AMCORD encourages the submission of a preliminary landscape plan at the planning approval stage and a detailed landscape plan at the building approval stage. This recognises the critical relationship between the siting and design of buildings, and the location, definition, spatial quality and usability of open space and landscape. A better quality open space may result when consideration is given at the design stage to its function and intended character.

Where criteria in the Elements call for a landscape plan, the information may be presented on the streetscape plan or on the site development plan.

The Site Analysis Plan

The intent of this plan is to require the applicant to demonstrate an appreciation of the site and its context, and to identify opportunities and constraints on the layout and design of the site.

Plan details
- scale of plan 1:100 or 1:200;
- title, site boundaries and dimensions;
- contours or Australian Height Datum at ground levels;
- north point on plan.

Topography and services
- direction of fall of the site;
- natural drainage lines or watercourses;
- soil conditions;
- existing services, connection points and easements;
- existing pedestrian and vehicle access points.

Orientation
- aspect to sun;
- prevailing winds;
- overshadowing from adjoining buildings and dense planting.

Existing buildings on site
- location of any existing buildings;
- buildings to be retained;
- heritage value (if any).

Vegetation on site
- existing trees—species, condition, height and spread, evergreen or deciduous;
- trees to be retained;
- location of trees, shrubberies and other significant vegetation.

Adjoining property conditions
- land use, and the location of buildings that abut the site (with boundary setbacks noted);
- height of adjacent buildings;
- location of windows within 15 m of the site boundary;
- use of rooms where windows are located;
- location of areas of private open space within 15 m of the site boundary;
- any special features, such as swimming pools or large trees;
- type, height and condition of boundary fences.

Views
- preferred views and site viewpoints;
- significant views by neighbours.

Noise sources
- external major (or potentially annoying) noise sources, eg external air-conditioning plant.

Street character and context
- local transport and parking conditions in the street reserve, including pavement and verge widths;
- location of garage and driveway accesses in the street vicinity;
- major planting in both street reserve and front gardens in the immediate vicinity-location, species, height and spread;
- type and height of fencing to street;
- dominant patterns of building type, scale, form, height, roof pitch, front and side setbacks in the vicinity.

Additional Information for Infill Sites in Established Areas

The intent of this additional information is to demonstrate the visual and functional impact that an infill development will have on an established streetscape.

Streetscape elevations

Coloured sketch elevation or photomontage of the streetscape(s) centred around the proposal, extending for at least two properties on either side of the development site at a preferred minimum scale of 1:100; properties opposite the development; or photographs of character and appearance of the street in the vicinity of the site if a photomontage is not provided.

Frontage details

The siting of the proposed building(s) in relation to the street and any proposed changes in the public street reserve should be provided as part of the streetscape impact information. The streetscape impact plan should include details of how the zone between the building and the carriageway will be treated. The plan should cover at least the same length of the street as shown in the streetscape elevations and be at a preferred minimum scale of 1:200.

Site Development Plan

The intent of this plan is to convey the design concept for the site and how it relates to new public or communal streets.

Layout

- minimum scale of 1:200;
- all buildings and the internal layout of ground-floor dwellings, including window locations;
- the private open space of each dwelling and the designated principal area of such open space;
- the external storage for each dwelling;

- car parking spaces and their allocation to dwellings;
- any shared facilities.

Elevations

- minimum scale of 1:200;
- all elevations to streets;
- relationship of elevations to natural ground level, showing any cut or fill;
- details of proposed fencing abutting public streets and adjacent properties;
- schedule of finishes and colours to main external surfaces, including roofs, walls, fences and garages.

Streetscape details

Statement of character and spatial quality

- role(s) of any internal street(s);
- desired spatial and visual qualities;
- design controls on individual dwellings where individual development on small defined sites/lots is proposed;
- plan of street(s), showing levels or contours and site and dwelling lot boundaries;
- typical building alignments to the street;
- typical street cross-section between buildings, including proposed landscaping.

Landscaping and fencing

- planting concept for street reserve, including location, type and size of major tree planting;
- location, type and size of existing trees to be retained;

- any landscape planting in front of the dwellings;
- proposed fencing details along abutting street(s).

Vehicle movement and parking

- street reservation dimensions;
- location of kerb or carriageway edge, widths of medians, verges and footpaths and cycleways;
- location and width of driveways and crossovers;
- design, colour and finish of all street pavements, parking bays, bus stops, kerbs, paths, crossovers, medians and verges;
- location and quantity of on-street parking;
- location and design of any traffic calming devices.

Street furniture

- design and location of all proposed street furniture (eg seats, bins, signs) and lighting.

Services

- location of proposed services and whether overhead or underground;
- drainage treatments;
- details of garbage bin storage areas and mail boxes where these are visible from the street.

Landscape Plan

The intent of this plan is to define the character, structure and treatment of proposed landscape development to the site.

Plan details
- preferred plan scale 1:100 or 1:200;
- existing and proposed levels;
- site and dwelling boundaries;
- outline of buildings, showing windows, doors and ground-floor levels;
- location and canopy of existing trees, adjacent streets and trees, noting any trees that overhang the site.

Landscape design

Statement of landscape intent

- purpose and function of landscape;
- desired character and theme.

Landscape structure

- any connection to open space networks;
- intended location of all open space (eg communal areas, service and storage);
- delineation of the principal area of private open space for each dwelling;
- identification of major tree planting;
- scale of trees relative to buildings.

Soft landscape

- planting concept, showing lawn areas, graded areas, trees and planting themes, and ultimate tree canopy, with botanical and common names;
- planting proposed for privacy screening;
- overland drainage proposals.

Hard landscape surfaces

- outline of all hard paved areas (including communal streets, driveways and paths) and identification of purpose;
- paving materials and drainage treatment.

Hard landscape structures

- details of all fencing and walls;
- any proposed privacy screens;
- location of gates, seating, play equipment;
- materials and levels of steps and ramps.

Site facilities

- details of landscaping to garbage bin storage or standing areas;
- location and details of mail boxes;
- details of any proposed signs;
- concept details of additional facilities, such as barbecues and swimming pools.

Services

- lighting for vehicle areas, cycle and pedestrian paths, and security;
- location of underground services;
- location and treatment of substations and meters.

Management statement
It is recommended that a management statement accompany the preliminary landscape plan in situations where other than private open space is provided.

This will help to:

- clarify responsibility between the private and public sectors;
- clarify responsibility between the body corporate and individual residents;
- indicate the intended management and maintenance principles for non-private open space including such matters as:
  - grass areas
  - ornamental and native planting
  - water features
  - play equipment
  - outdoor furniture
  - other facilities.

Practice Note PND 3

Neighbourhood Design

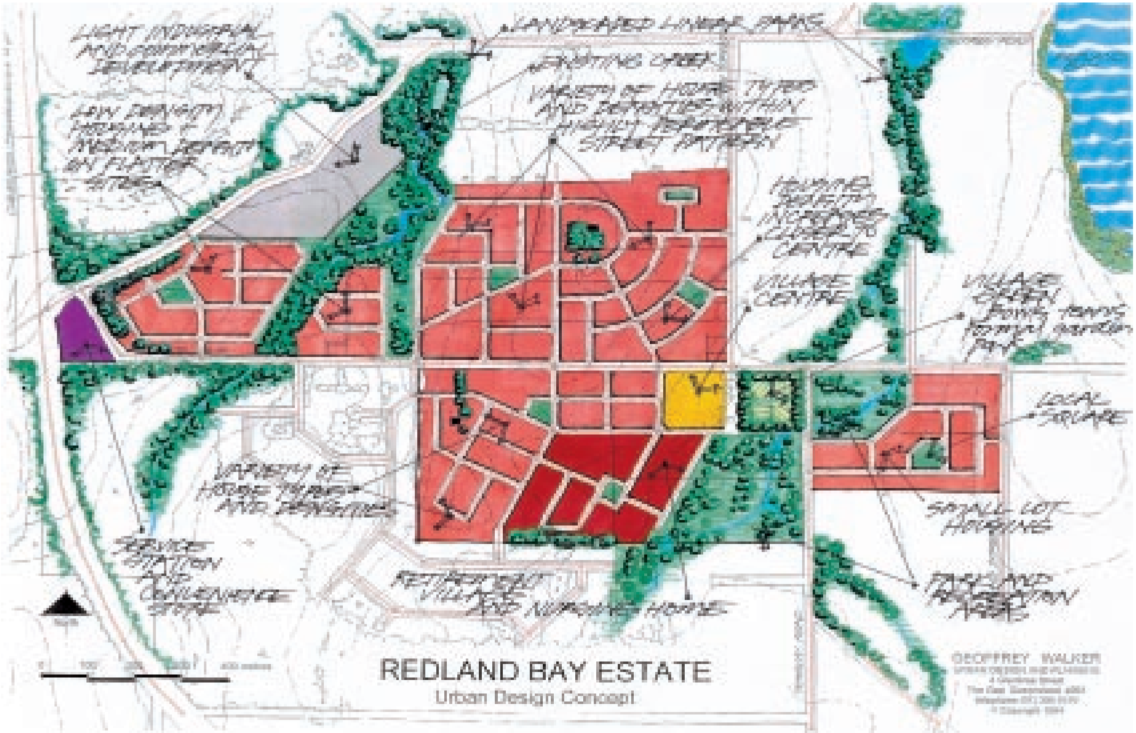


Figure 1: Design Concept for Redland Bay Estate.
Source: Geoffery Walker

Introduction

This practice note provides information on the range of issues, techniques and neighbourhood development principles to be considered during the neighbourhood design process. The process which is favoured by AMCORD is an integrated and holistic approach to neighbourhood design which:

- involves a range of stakeholders including the developers, service providers, design professions and community and local government representatives;
- considers the relationship between the proposed and existing neighbourhoods, including the degree of integration or separation (containment), linkages and opportunities for shared use of facilities and services;
- considers housing within the broader needs of the eventual community (eg recreation, education, retail and service, employment and social needs);
- considers ecological sustainability issues as affected by urban form (eg energy conservation, reducing greenhouse emissions, preserving environmental attributes, integrated catchment management, protection of valuable agricultural land etc);
- results in the creation of attractive and safe living environments that promote and encourage social interaction, participation and a sense of community identity.

The neighbourhood design process should not take place in a policy vacuum; it should occur within the context of a wider planning framework which has established such factors as the direction of growth, the location of regional and district facilities and broad transport and other physical infrastructure needs (eg transit facilities, arterial roads, catchment and waste management).

Neighbourhood Design Approaches of the Past

The suburban neighbourhoods which occurred throughout the latter part of the twentieth century in Australia consisted primarily of single-storey detached houses on generously sized allotments, intended to accommodate conventional family households. For the most part, little consideration was given to issues such as the housing needs of diverse households or energy efficiency.

The resultant suburban pattern was dominated by houses at low densities, with private vehicles required for access to distant work places and shopping centres. Primary schools and possibly a corner delicatessen were usually the only non-residential facilities conveniently located within walking distance. It was invariably assumed that suburban expansion should take precedence to agricultural land uses and, consequently, much of the productive agricultural land close to urban areas was lost.

The removal of stormwater from the neighbourhood, usually by underground pipes or open concrete-lined drains which followed the course of previously natural drainage and creek lines, was a common engineering imperative. Street patterns tended to vary from conventional and modified grid patterns to curvilinear street layouts with a strong hierarchy of roads (including often busy and divisive major collector roads with quiet, relatively safe culs-de-sac). Segregation of non-residential activities such as industry and commerce was high on the planning agenda.

As suburban areas have expanded (maintaining relatively low densities) distances to non-residential facilities have increased. In part this has been a result of a tendency for some industries to aggregate within certain areas (eg close to ports or areas accessible to road or rail transport); the trend towards larger and concentrated retail and service outlets, and the corresponding decline in smaller centres; and the inability of the public sector to finance social infrastructure such as schools, health and welfare services and public transport.

The resultant neighbourhoods have been described as ‘dormitory suburbs’, and have often isolated those that do not have access to private transport and compelled others that do to use it regularly. It is now recognised that such a neighbourhood form has a number of social and environmental shortcomings, and it is not sustainable in the long term.

Figure 2: Neighbourhood Layout at Wattle Grove, Sydney.

Source: New South Wales Department of Urban Affairs and Planning.

Figure 3: Regent Gardens—Precinct 1 of the Northfield housing project, Adelaide.

Source: Regent Gardens Precinct One Joint Venture

Alternative Neighbourhood Design Approaches

In more recent times a more integrated and holistic approach to neighbourhood design has evolved, mainly in response to the shortcomings of the previously prevailing neighbourhood form. However, it is also in response to some of Australia's international obligations to reduce greenhouse emissions, and the escalating costs of providing and maintaining physical infrastructure. Notwithstanding titles such as Urban Villages, Traditional Neighbourhood Design, Transit Oriented Development, Pedestrian Pockets given to a number of these design approaches, they all encompass common objectives. These are to create defined, self contained, sociable environments which reduce (as far as possible) the need for private vehicles for day-to-day activities.

This is largely achieved by designing a compact neighbourhood unit based on the majority of the neighbourhood being within comfortable walking distance (usually considered to be around 400–600 m) of a neighbourhood focal point (eg a transit stop, primary school, convenience store, post office, child-care centre, bank, open space etc). The level and range of non-residential facilities able to be accommodated within a neighbourhood will be directly influenced by the residential densities achieved. The greater the population in close proximity to the focal point, the more potential for patronage of services and facilities. Housing densities will, in turn, be influenced by locational and marketing considerations.

In addition to increased dwelling densities, the new neighbourhood design approaches tend to promote a number of common characteristics, including:

- An interconnected road network (while ensuring low traffic volumes and safe conditions) which is intended to facilitate pedestrian and cyclist movements and disperse vehicle traffic among the streets.

- A strong neighbourhood focal point which can consist of a transit stop (for commuters to distant locations) and a range of retail, service, civic and community facilities. The neighbourhood focus plays an important role in community identity and development and therefore particular attention is paid to achieving a high quality and functional design. Flexibility needs to be retained to allow the community focus to develop as the population grows.

- A diversity of housing types ranging from detached housing on individual allotments to apartment housing at higher densities. Higher-density housing is usually located in close proximity to the neighbourhood focus. A range of household types are considered and catered for to encourage a diverse community.

- Mixed use is encouraged at both horizontal and vertical levels. For example, shop-top housing is promoted as one means of achieving diverse and affordable housing and improving accessibility to non-residential facilities.

- A range of urban design principles are employed to achieve distinct identity, human scale and a high level of amenity. This includes consideration of design elements such as paths, nodes, landmarks, edges, legibility, flexibility and variety.

- The need to achieve social and environmental sustainability (which can extend into methods of local governance).

- An emphasis on defining and achieving a high standard of design of the public domain, including streets, open space and civic buildings, which is intended to encourage more intensive use.

- Containment of the neighbourhood within well-defined edges. These can comprise arterial roads, agricultural land, and natural borders such as rivers or forests etc.

- A sequential arrangement of defined neighbourhoods in linear or nodal form (depending on the type of public transport service/s to be provided) which logically relate to a larger district focus containing higher-order facilities and services.

- Until now, conventional neighbourhoods within Australia have achieved neighbourhood densities of around 8–10 dwellings per ha. Many fringe suburban neighbourhoods are currently achieving densities of around 15 dwellings per ha. In order to achieve the diversity of land use as promoted by the new neighbourhood design approaches (and therefore minimise the need to use private transport to satisfy daily needs) and justify the provision of services such as a transit stop, new neighbourhoods should be attempting to achieve higher densities of the order of 20–30 dwellings per ha.

Design Considerations

Rather than promote a particular design approach, it is considered more beneficial to highlight some of the design elements and principles which should be considered and adopted while designing new neighbourhoods. The following ‘checklist’ is intended to assist those involved in the design process. However, it is by no means comprehensive and designers must consider the unique circumstances and characteristics of the area for which they are planning.

Design process

- Adopt a model which is inclusive and involves all stakeholders.
- Ensure that urban design, community participation and marketing advice is incorporated throughout the process.
- Adopt innovative techniques to explore different potential outcomes (eg three dimensional models, computer imaging, graphic representation in plan and elevation form).
- Consider the use of charrettes or design workshops to assist in the design process.
- Ensure opportunities for the continuing involvement of the community and service providers.

Social imperatives

- Plan for a mix of eventual inhabitants (eg different household sizes, types and market segments, rental as well as private housing, affordable housing).
- Provide a community focus which caters for daily needs (eg convenience store, day-care centre, bank, post office) as well as provide opportunities for interaction (eg public park with facilities,

neighbourhood house, child-care facilities, community hall) preferably within walking distance of the majority of households.

- Create a distinctive community identity (eg through a common architectural theme for facilities located within the neighbourhood focus or a particular landscape theme building on existing environmental characteristics)

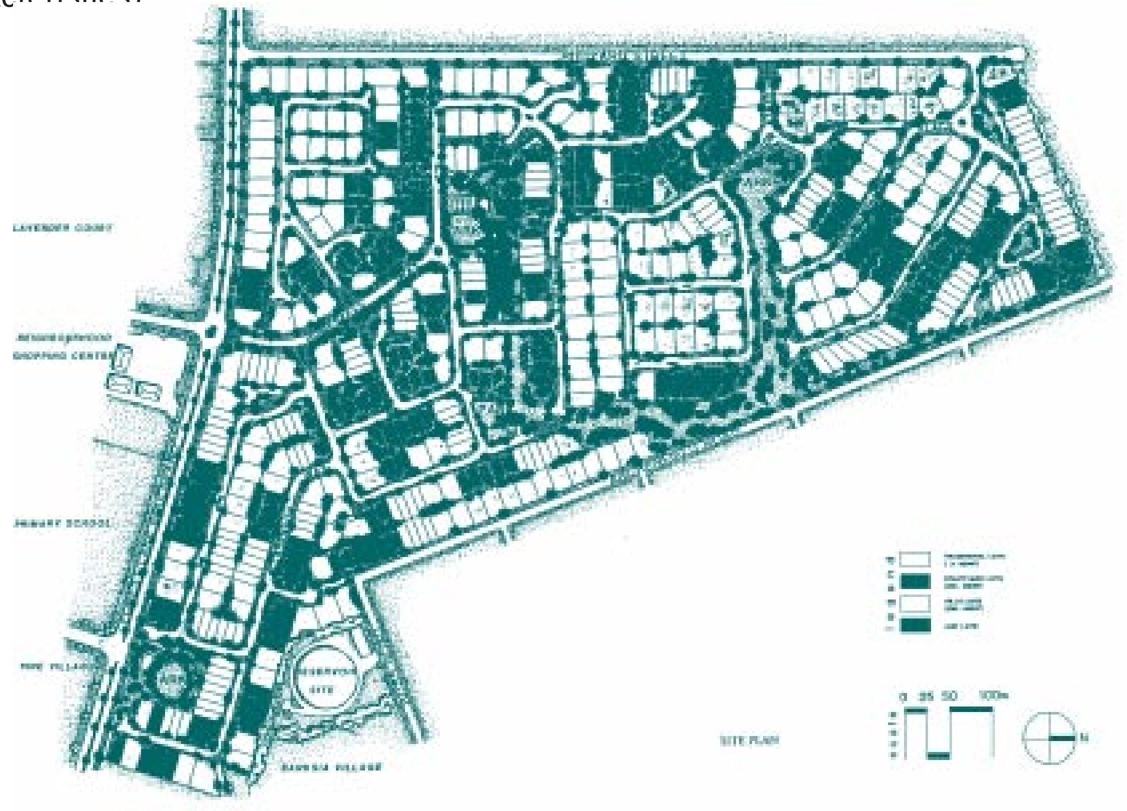


Figure 4: Homestead Village—Stage 1 of the Forest Lake development, Brisbane.

Source: Queensland Department of Housing, Local Government and Planning.

- Ensure that public spaces (eg roads and open space) are designed as secure and safe places with a high level of pedestrian amenity.

Environmental imperatives

- Preserve and enhance any environmental attributes of the area and take advantage of distant views and vistas and orientation ‘landmarks’.
- Adopt integrated water management techniques for managing stormwater generated within and through the neighbourhood.
- Consider energy efficiency and greenhouse emissions at a number of levels including use of resources (eg minimise road widths, choice of building materials), road and allotment orientation, dwelling type and orientation, designing to encourage use of public transport, walking and cycling, and providing local employment opportunities.
- Consider opportunities for a neighbourhood effluent treatment and re-use system.
- Ensure opportunities for and implementation of tree planting, habitat creation and extension along road reserves; within public car parking areas, within public reserves and on private land.
- Recognise and design for environmental constraints (eg reducing the number of roads with high traffic volumes and potential speeds).

Other Design imperatives

- Ensure that the whole design process is integrated and no one element is considered in isolation (eg allotment size and orientation must be in response to the dwelling type to be located on the allotment).
- Adopt urban design motifs to guide the design process (eg paths, nodes, landmarks, edges) and achieve distinctive and legible living environments.

Accessibility imperatives

- Design road layouts which provide for convenient and safe movement of vehicles while ensuring that through traffic is minimised and pedestrians and cyclists can move conveniently and safely throughout the neighbourhood, between neighbourhoods, and between a range of community facilities (eg linking schools, centres, recreation areas etc).
- Design road layouts and pedestrian/cyclist networks to encouarge access to public transport stops and provide for viable bus routes through the neighbourhood (refer to PNP 7: Transport, Accessibility and the Local Environment).
- Consider the wider needs of the community (eg district or regional shopping, employment) and the most effective and sustainable means of access.
- Incorporate a degree of flexibility into the design of buildings, spaces and the neighbourhood to allow future adaptation with changing circumstances.

References

Katz, P. (1994) *The New Urbanism: Toward an Architecture of Community.* McGraw Hill Inc. New York.

Hocking Planning and Architecture Pty Ltd (undated) *Urban Villages for Perth.* A Report prepared for the West Australian State Planning Commission and Homewest, Perth.

Foulsham & Munday Pty Ltd and Ecoweb (1994) *Jerrabomberra Valley – National Ideas Competition: A case study for ecologically sustainable urban development..* A report to the OECD and Australian Governments, Canberra.

Loder and Bayly Consulting Group et al (1993) *The Low Energy Suburb-Greenhouse Neighbourhood Project: Technical Report.* A Report prepared for the Victorian Department of Planning and Development, Environment Protection Authority and Energy Victoria, Melbourne.

Practice Note PND 4
Responsive Urban Design

Scope

This Practice Note outlines one approach to developing sensitive and contextual design responses for sites, based principally on the ‘responsive environments’ methodology which was developed in England and has received wide coverage in the urban design profession over recent years (Bentley et al, 1985). Most of the accompanying illustrations are drawn and adapted from two Hobart studies, the Sullivans Cove Planning Review (1991) and the Wapping Neighbourhood Development Outline Plan (1993).

Following are issues that need to be considered when developing design responses for sites.

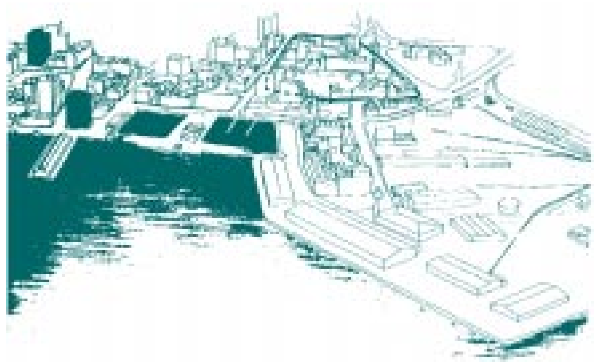


Figure 1: Wapping is a historic neighbourhood in the city of Hobart which is to be redeveloped as an inner-city residential neighbourhood, with a mixture of uses, and taking advantage of its location on the edge of the city and the historic waterfront.

Satisfy the Three Ss

Quality urban design should provide environments satisfying the three Ss:

- safe;
- stimulating;
- sustainable.

To achieve this, new development, whether infill or greenfields, must respond to the existing context of the local area and to any future visions for the area identified by the local authority and the community as part of the planning process. It must also respond to design principles that can provide safe, stimulating and sustainable places, together with requirements of the Design Elements.

Qualities of Responsive Environments

The 'responsive environments' approach defines seven key qualities of urban design that affect people's ability to interact with and respond to their environment, with a high degree of responsiveness seen as desirable.

These qualities can be used to formulate responsive design solutions at virtually any scale of development.

Variety—an example from Wapping
The site as a whole is divided into 'development parcels', each of which aims to create attractive inner-city housing. Diversity and affordability are two of the key objectives for Wapping. Accordingly there is preference for particular forms or types of development for each parcel. All dwellings should be designed to accommodate a variety of occupants including

The seven qualities of responsive environments

Permeability: the degree of physical and visual accessibility; more specifically, maximising connections with surrounding streets and activities and making their role clear to potential users.

Variety: the provision of a range of experiences, in both spatial and activity terms, including a variety of land uses within close proximity.

Legibility: the extent to which people can understand the layout and find their way, including cues from three-dimentional forms.

Robustness: the ability to be used for more than one purpose, in both the short and long terms.

Visual appropriateness: the way that the appearance of places and buildings allow people to understand their context and function

Richness: the amount of visual and non-visual richness of sensory experiences provided by the fine-grained details for users to enjoy.

Personalisation: the design of places so that users can personalise their own space..

How to Achieve Permeability

Analyse the surrounding streets and activities and establish the relative importance of all access points to the site:

- Consider sonnections to the immediate environs and the wider area.
- Include visually significant connections, eg special vistas.
- Aim for direct connections to most popular activities to encourage walking and cycling.
- Locate new routes through the site, making sure that they:
  - adequately connect important external access points to the site;
  - are clearly visible and their function is understandable;
  - respond to the site topography, setting, heritage, and patterns of development;
  - enable building orientation for solar access;
  - satisfy traffic engineering requirements;
  - provide a choice of routes for users, depending on the scale of development.

Where the development is large in scale and new street blocks are defined by streets (whether public or private), ensure that:

- street block sizes are no larger than those of the surrunding area to maintain a similar grain;
- the blocks enable buildings to be sited to front the streets, with backs kept more private.

Legibility analysis

One techniques for a legibility analysis is to use the Lynch approach and identify the following components (Lynch, 1975):

paths: movement routes and connections between nodes;

nodes: focal places and clusters of activity, often defined by different land uses and located at the intersection of paths;

landmarks: notable built form or landscape items that help people orientate themselves and provide special character to local areas;

edges: the limits of the area that define its extent, usually natural (eg river) or some form of barrier or boundary (eg freeway, distinct changes of land uses);

districts: precincts or areas having some unifying quality, which may even be its less distinctive character relative to the other key physical elements.

To these may be added:

gateways: entries to the defined area, that may have or require special qualities;

vistas: controlled visual links terminating at a focal point;

views: more generalised outlooks.

rental and home owners. Those dwellings which do not have an individual address are generally not favoured.

Parcels 1,2,3,4 and the Roberts' site.

These lend themselves to apartment style dwellings. Such development would have:

- a limited number of entry points from the street;
- grouped carparking;
- discretionary private open space.

Parcel 5

Recycling of the Transport Building for apartments or hostel style dwelling is favoured, together with walk-up dwellings with multiple frontages to streets, with grouped carparking.

Parcel 6

This parcel is to include a high proportion of individual allotments sold to owner/builders, with frontages to streets.

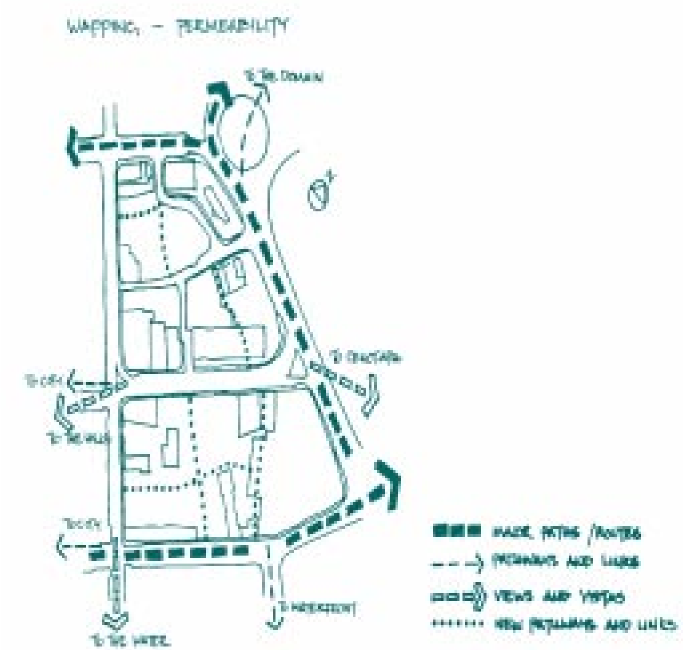


Figure 2: Wapping—an illustration of the interconnections within the site, its permeability and links in the adjoining locality.

How to Achieve Variety

Seek a variety of users within the site, depending on the scale of development:

- Look at local patterns of land uses and activities and consider demand of other uses.
- Aim for mutually supportive uses, with scope for a variety of opening times to generate activity and vibrancy.
- Mix both horizontally across the site and vertically within buildings.
- Minimise potential negative interactions between users through siting and design.
- Avoid public intrusion into private residential areas on the site.
- Ensure functional and economic feasability.
- Encourage variety in spatial qualities and appearance while maintaining a degree of cohesiveness:

  - vary street design and proportions through changes in reserve width and building height and massing;
  - vary open space and landscape design to give distinctive character to identifiable areas;
  - vary building forms and finishes to provide visual and spatial interest.

- Design outdoor and indoor spaces concurrentlly to maximise the quality of usable open spaces.

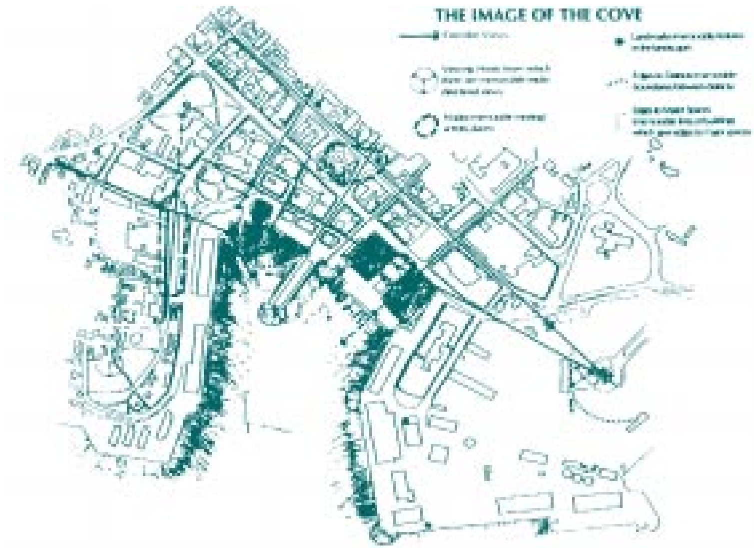


Figure 3: Legibility in Sullivans Cove is clearly defined through clarity of zones and places.

How to Achieve Robustness

Aim for building forms that can accomodate changes in use, with key factors being:

- shallow building depth for natural light and ventilation;
- direct access points to individual units/dwellings;
- limited building height to avoid lifts and the consequent restrictions on uses;
- design for energy efficiency and comfort;
- location of ground-level active uses adjacent to public streets or spaces in mixed-use schemems.

Provide choice and flexibility in detailed building design, with key factors being:

- room shape and size to enable different activities;
- more equivalience in bedroom sizes to suit a greater variety of household types;
- layout of living and eating areas to enable concurrent private use by household members;
- location and design of windows, doors, power points, lights ets for flexibility in furniture arrangement;
- scope for future alteration.

Where private housing abuts active public streets, design for coexistence with attention to:

- protection of privacy;
- scope for comfortable watching of the street activity;
- vehicle and pedestrian movement.

Design a flexible, variable-use street and open space framework where:

- street reserves accomodate cars, cyclists and pedestrians, with options for managing movement ranging from no cars to car dominance;
- shape and spatial qualities of spaces support many activities;
- the interface between open space and buildings is treated as a transition zone.
- Aim for private open space that has:
- reasonable shape and area to suit a range of activities;
- adequate privacy from neighbours;
- external access from the front, side or rear for a proportion of gardens.

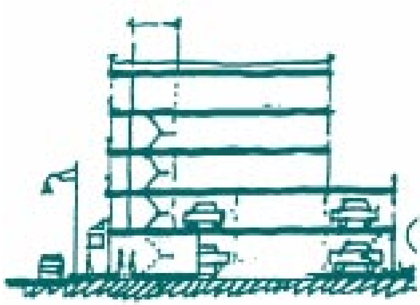
Robustness—an example from Sullivans Cove.

Three key factors support-long term robustness:
Height

In taller buildings the upper floors have restricted links to the outside and are therefore less suited to a wide range of uses.
Depth

A building which is not too deep will allow the penetration of natural light and solar energy.
Access

The number of access points is a key factor governing how easily a building can adapt to a variety of uses.



Where multi-storey parking structures front on to streets with a potential for commercial and pedestrian use, then people-orientated activities should be accomodated at the street front.

Buildings should present their public entrances to the street.

Buildings should have elevations which show variation and hierarchy according to the spaces they face: major-minor, public-private.

How to Achieve Visual Appropriateness

Design the detailed appearance of the buildings to suit their role and site context:

- Enhance the existing or desired sense of place.
- Where desired future urban character has been defined, aim to satisfy the objectives.
- Use local precinct design guidelines where available.
- If it is a greenfields development, consider setting (or satisfying) design guidelines to achieve a distinctive urban environment.
- If it is an infill development, adopt neighbourly design strategies, whether the intent is to reinforce or contrast with existing development.
- Look for contextual visual cues from the adjacent area.
- Ensure that housing looks like housing and is percieved as such by the community.
- If other uses are included, likewise ensure their image matches the community perception of that type of use.

Visual appropriateness—an example from Sullivans Cove.

If a building is 'broken down' into a number of parts, its apparent bulk may be reduced.

IN SCALE in bulk and height.

OUT OF SCALE in height.

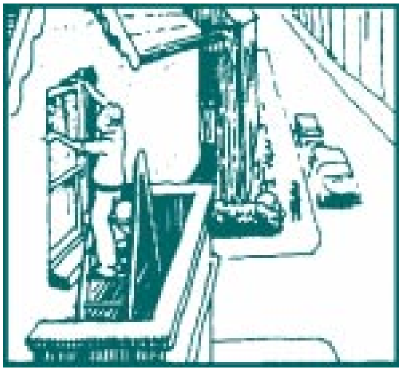
How to Achieve Richness

Design for visual and non-visual richness of the sense of smell, hearing, touch, and, most importantly, sight:

- Decide which locations have potential for which sensory experiences.
- Analyse the ground, wall and roof surfaces for ways in which richness can be incorporated.
- Consider likely viewing distances, positions and time of viewing, and number of people to whom a view is visible.
- Use visual contrasts to help achieve visual richness, varying the number of visual elements and their relationships.
- Maximise visual richness on surfaces which are likely to be viewed for a long period of time.

Richness—an example from Sullivans Cove.

Buildings should have ‘tops’: projecting eaves, parapet, gable or equivalent.



How to Achieve Personalisation

Encourage personalisation by designing:

- external surfaces that allow easy access to surfaces, articulation of door and window elements, and some variety in materials and selection of windows and doors;
- entry threshholds that allow location of plants or pot plants, verandahs or porches, seating and decoration;
- windows that provide a special place in a room such as a window seat, or enable personal display through use of wide sills, pelmets, and the potential for window boxes and shutters;
- internal wall surfaces that allow attachments (eg picture rails, dados, shelving, mantelpieces) which are easily fitted and maintained.

Quick Tips

Clarify fronts and backs
Make sure that the fronts and backs of buildings are clearly defined. Fronts should have a public face while backs should be more private and screened from view of passers-by.

Ensure that fronts of houses face each other. Avoid fronting one set of houses onto the more private backs of other houses, even if communal open space buffers the two.

Design the inside and outside together
At more intensive densities, the spaces formed by buildings are critical. Without care, they can become left-over spaces between buildings rather than attractive, usable outdoor spaces. Such spaces can be created by deliberately shaping the relationship between buildings and external space, thinking of the two at the same time and considering the spatial qualities of both.

Further Information

For a detailed coverage of the responsive environments approach refer to the book:

Bentley, I. et al, (1985) *Responsive Environments: A Manual for Designers*, The Architectural Press, London.

For further information on legibility analysis refer to the book:

Lynch, K. (1960) *The Image of the City*, MIT Press, Cambridge MA, USA.

Relevant Practice Notes

See the following Practice Notes:

PNP 3: Sustainable Residential Development

PNP 5: Housing and Urban Form

PND 3: Neighbourhood Design

PND 5: Social Planning Considerations

PND 6: Mixed-use Development

PND 10: Streetscape and Neighbourhood Character

PND 11: Multi-dwelling Design Checklist

PND 17: Guidelines for Crime Prevention.

Practice Note PND 5
Social Planning Considerations

Scope

This Practice Note is a summary of *Social Policy Aspects of Urban Development* (1993), a paper produced by the South Australian Urban Land Trust. The paper was part of a project on Social Considerations in Urban Planning, and is intended to provide the basis for the incorporation of social policies and objectives into the statutory planning system. It provides a guide for individual councils and, indeed, for individual development projects to enable the formulation of more detailed and specific policies relating to social imperatives for urban development.

Statement of Philosophy and Values

The policies expressed in the paper are based on the following philosophy and values:

- equity and fairness in the use of resources and access to opportunities;
- the maintenance of a high quality of life for all people;
- the right of people to participate in community life and to influence decision-making affecting their daily lives.

The development of social policy in the paper is founded on the potential of the system of urban planning and development to influence social outcomes.

Key Social Issues and their Implications for Planning

Context

The socio-political environment of planning decisions has changed. Among identifiable changes are:

- a shift towards shared responsibility between the various stakeholders in urban development in order to achieve mutually desired outcomes (eg multi-agency planning approaches involving all spheres of government, and joint ventures between the public and private sectors);
- an increase in communication and education, which has heightened the expectation of communities that they can influence decisions which affect them.

Demographic and social trends

Significant demographic changes throughout Australia have major implications for urban planning and development, particularly for:

- the design of neighbourhoods;
- safety;
- the variety and affordability of housing;
- the provision and location of human services and community facilities;
- the spatial distribution of economic activity and associated infrastructure;
- accessibility and mobility;
- opportunities for recreation and leisure.

Planning for living

Research has shown that social well-being, health and quality of life depend on the nature of the environment in which people live.

The home and neighbourhood perform critical social functions. They provide shelter and an environment in which residents can engage in social interaction and develop a sense of community identity. Planning for residential neighbourhoods therefore needs to be responsive to the community's social and economic aspirations.

Accessibility to appropriate and affordable housing is generally considered the right of all Australians, as well as an essential precondition for a socially just society. Therefore the needs to provide for a variety of household types and ensure affordable housing opportunities are important objectives in planning for fairer urban communities.

Similarly, some urban areas characterised by poor housing and living environments represent opportunities for redevelopment and renewal. This in turn, will reduce socio-economic disadvantage and strengthen community identity. The availability of human services and community facilities in convenient and accessible locations also plays a major role in enhancing quality of life.

Planning for working

Changes in both the nature of work and the composition of the workforce also have important implications for social well-being. For example, increases in people working from home, in part-time work and women in paid work all have important urban form implications.

Issues such as the function, distribution and accessibility of centres and transportation systems also have important social and physical dimensions.

Planning for leisure

The provision, distribution and quality of leisure opportunities significantly influence the quality of living environments. Issues such as equitable distribution of facilities and open space, providing for a range of needs, and environmental quality all contribute to the quality of life.

Social Objectives and Principles

Urban design

The key social policy aspects related to urban design are to create safe, distinctive and interesting urban areas that:

- enhance safety and security;
- have a distinctive and recognisable character and sense of place;
- enable people to understand the intended purposes of, and links between, areas and facilities;
- include landmark and design elements which enhance character, and offer people a choice and variety of activities and experiences;
- conserve and enhance sites and items of local, historic, cultural or environmental significance.

Housing and land

A key social policy objective is to provide a variety and choice of housing which meets the needs and preferences of all households, and is consistent with long-term needs and demographic trends in particular localities through development that:

- provides more diverse housing and higher-density housing in strategic locations of residential areas;

- designs and locates accommodation to meet the specific needs of the aged and people with disabilities;
- facilitates the broad distribution of public housing throughout the metropolitan area.

Affordable housing through containing housing costs is another key social policy objective. This can be achieved by promoting:

- sequential development which contributes to the efficient use of land and infrastructure;
- cost-effective and innovative design of housing and subdivisions.

Disadvantaged socio-economic areas, which are characterised by degraded environments, poor housing and/or inadequate facilities, should also be progressively upgraded. A further objective, therefore, is the renewal of areas of poor residential amenity or environmental quality to provide high-quality living environments which:

- complement and enhance urban features that are valued by the community;
- provide a greater variety and choice of housing;
- are integrated with adjoining residential communities.

Neighbourhood and residential amenity

The quality and amenity of the immediate residential environment are significant in determining housing satisfaction, social well-being, community identity, and quality of life. This particularly applies to those sections of the community who spend a considerable part of their time at home, ie women, children, the elderly, and people with disabilities. Consequently, neighbourhoods, in planning and design, should:

- facilitate social interaction and provide a focus for community participation and activity;
- reflect the values and aspirations of residents and create an individual and recognisable community identity;
- encourage integration between neighbourhoods through the shared use of spaces and facilities.

There is also a need to consider the relevant issues and provide a high level of safety and security for residents and visitors.

The distribution and range of facilities and activities have significant social implications. Consequently, it is important to provide a mix of compatible and complementary activities and uses necessary for living, working and recreation through:

- land division which sets aside suitable sites for shopping, open space, employment, education, recreation, human services and community facilities;
- encouragement of compatible non-residential activities within, or accessible to, residential areas.

Streets serve a multiplicity of roles beyond carrying traffic. They are a principal element in the urban environment, contributing to the character, identity, interest, safety and amenity of neighbourhoods. This requires that local streets are designed and constructed to enhance:

- uses other than carrying traffic;
- the qualities of an area by incorporating significant site features and distinctive streetscape characteristics.

Human services and community facilities
The availability of human services and community facilities is a key factor in the achievement of

social objectives and principles. Therefore planners should aim to provide an adequate range of human services and community facilities in all residential areas that are:

- appropriate and accessible to the community they are to serve;
- provided in a timely manner to cater for existing and future demand.

Centres

Centres provide a focus for a range of compatible services, facilities and activities which:

- cater for the needs of present and future populations, commensurate with their role and function in centre hierarchy;
- integrate and link human services and community facilities with commercial, business and retail development.

There is a need for high-quality design to develop lively and vibrant centres as community focal points, providing a high level of amenity and safety for residents, visitors and workers. Centres should:

- reflect and contribute to the character, identity and quality of life of their surrounding communities;
- be integrated with surrounding residential areas;
- provide opportunities for social and community interaction and appropriate after-hours use;
- be designed and operated to enhance public security and safety;
- be accessible by public, private and community transport, and linked to adjoining areas by clearly defined and safe pedestrian paths and cycle routes;

- be designed to facilitate ease of pedestrian movement between various components of the centre and movement systems.

Economic activity
An important objective relating to economic activity is to enhance access to employment opportunities within or adjacent to residential areas, while minimising conflicts between residential and non-residential development through:

- development of compatible small-scale economic activities and other non-residential activities within or adjacent to residential areas;

- location of economic activities which are incompatible with residential development in suitable non-residential areas;

- appropriate design features and siting of non-residential activities which minimise the impact on residential use.

With increasing participation of women in the workforce, an important social policy objective is to provide an appropriate range of child-care services and facilities through:

- the development of a network of child-care services in conjunction with employment;

- accessible location of child-care facilities.

Recreation and open space
Community involvement in the design and management of recreational facilities and open space areas is essential. This helps to ensure high-quality, safe and diverse recreational opportunities and activities that:

- meet the needs of current and future populations;

- are safe for users;

- enhance opportunities for integration, multiple use and sharing between compatible activities.

Similarly, there is a need for the equitable distribution of recreational facilities and open space via:

- distribution of facilities and open space in accordance with a hierarchy of functions;

- recreational opportunities which are accessible to the communities they serve.

Another important objective is to provide a diverse range of safe, enjoyable, interesting and educational places for children to play in and around residential areas.

There is also the need for recreation and sport facilities to be designed and located to protect and enhance the natural environment by:

- public open spaces which have distinctive characteristics that complement and enhance their environs;

- facilities designed to be compatible with adjoining areas.

Access and mobility

Integrated land use and transport planning is needed to develop an efficient, accessible and safe public and/or community transport system that meets the needs of the community through:

- urban development which facilitates the early and efficient operation of public transport services;

- transport interchanges which provide for integration of metropolitan and local transport services;

- accessible location of transport interchanges;
- maximising casual surveillance of the transport system.

Other modes of transport (eg walking and cycling), which have obvious associated health, environment and economic benefits, also require consideration. Accordingly, direct, convenient and safe pedestrian paths and cycle routes are needed. They should:

- be constructed and maintained to provide safe and easy movement and links to residences, centres and community facilities;
- form part of a network of clearly defined pathways and routes to encourage commuter and recreational cycling and walking.

Finally, a comprehensive road network should encourage the safe and convenient movement of people and goods within the metropolitan area. Such a network would:

- minimise conflicts between different users, and incorporate design features for the safety of pedestrians and cyclists;
- be designed to minimise the detrimental impacts of noise and traffic.

Practice Note PND 6
Mixed-Use Development

Scope

This Practice Note is intended to provide an overview of the definition of and need for mixed use development as an alternative to the segregation of land uses that has become the ‘norm’ in much of Australia’s urban areas. The concept and application of mixed-use development is relevant in all urban areas of Australia, and requires careful planning if its many benefits are to be achieved.

Definition

The concept of mixed-use development has gained considerable credence in planning over recent years, and is being identified as an important means of introducing vitality into areas of cities which have been dominated by single uses.

Mixed-use development has different connotations for different people and in different areas. It can be defined as an integration of compatible land uses in the one locality, building, or group of buildings, including a range of residential, employment, community and recreational opportunities (compatible land uses are ones which can

Figure 1: An example of shop-top housing.

co-exist without resulting in adverse impacts). A common example can be shop-top development, with shops/restaurants at street level and with offices and/or residential dwellings above.

Why is it Needed?

Mixed-use development can have a number of economic and social benefits. It can also assist in achieving sustainability of urban development particularly by allowing for the reuse or multiple-use of existing buildings, and by potentially reducing home-to-work vehicle trips.

It is well documented that the employment characteristics of Australian society are changing.

From 1988 to 1993, part-time jobs have increased from 10% to 20% of all jobs in Australia. That percentage is expected to continue to grow to up to 50% by the turn of the century.

Equally, community changes are occurring which will (or do) impact on the way we should be planning our urban areas. For example, single-parent families and the number of women in the workforce have been growing at an accelerating rate.

Small businesses and home-based businesses are becoming major components of the workplace. Technological innovations mean that it is becoming practical for workers to work remote from a 'head office'.

These changes provide an important catalyst to rethink the ways in which we have traditionally planned our urban areas.

Development pressures and reform of metropolitan planning are now giving mixed-use development a strategic role in optimising both road and transit use. Attention is being given to the development of support networks, which implies a clustering of service centre and related activities around points of transit interchange. This has environmental, economic and social benefits.

Economic and environmental benefits

Mixed-use developments have the potential to create a local employment base. In locations experiencing high population growth, there is considerable opportunity for businesses to tap into this resource, by co-location through mixed-use developments.

In addition to local economic development advantages through job creation, mixed-use development has the following advantages in:

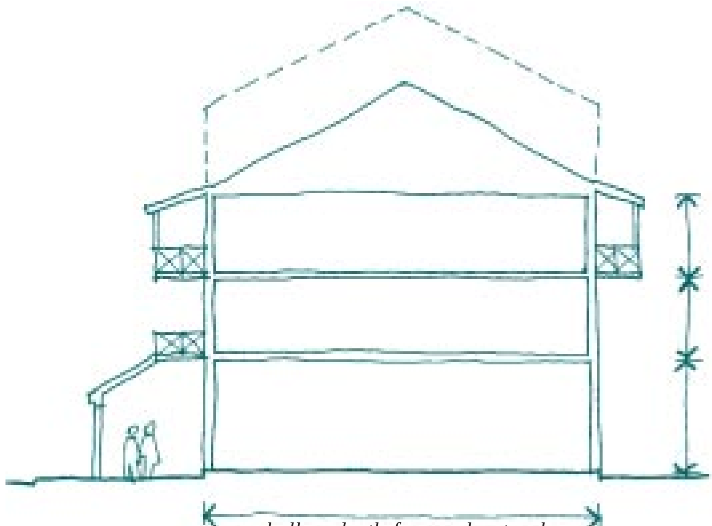


Figure 2: Robust building design for mixed-use development (incorporating residential).

- reducing the journey to work and increasing potential for employment;
- improving convenience, equity and access to work;
- increasing opportunity for complementary activities to co-locate;
- reducing transport costs (in terms of both time and cost);
- reducing greenhouse emissions as a result of shorter travel distances.

Social advantages

Mixed-use development has the opportunity to create an environment where:

- social contact is enhanced through improved access and convenience to community services and facilities;
- a physical, social, economic and community focus is created and developed for neighbourhoods, with strong community interaction;
- a vibrant environment with increased activity levels, which also improves opportunities for casual surveillance and hence increases safety levels.

Two examples of mixed-use town centres are Robina Town Centre in south-east Queensland and Tuggeranong Town Centre in Canberra. The types of integrated land uses in these town centres include:

- retail development (ranging from department stores and boutique boulevards, to outdoor market stalls);
- office park and service trade areas (with 'car courts' where vehicles are sold, serviced and repaired);
- government and private sector services;
- manufacturing, storage and distribution;
- a range of housing types and tenures (particularly medium-density housing).

Constraints

One of the greatest constraints to mixed-use development is the traditional segregated zoning patterns and principles that are characteristic of Australian town planning. Many land-use zones simply do not permit mixed-land uses in the one locality. AMCORD espouses the performance-based approach to planning and, for mixed-use developments, the test should be whether it will cause a detrimental impact to the economic, environmental and social well being of the locality. If it doesn't, there may well be an opportunity to encourage mixed use of land in that locality.

At the neighbourhood level another potential constraint is housing density. Many retail, community services, and commercial employment opportunities depend on a higher housing density in close proximity to sustain a high level of local activities.

Planning

If the regulatory and market constraints can be overcome, the following issues will be relevant in planning for and designing a mixed-use development:

- Mixed-use developments can apply to large town centre proposals catering to a catchment population of 30,000 to 50,000 people or to smaller local centres with a neighbourhood population of approximately 2000 people (particularly if neighbourhood densities are in excess of 15 dwellings per ha).

- Building and subdivision design should enable a range of businesses and residences to be located adjacent or close to each other—subject to compatible performance assessment—to create places with choice and variety.

- The centre for activity should provide a diverse range of housing types, places of work, shopping and community facilities in close proximity.

- Activity centres and mixed-use developments should preferably be located within 400 m of a railway station, bus terminal or other transport station/node.

- Surrounding residential areas should be protected by ensuring that the type, scale and location of non-residential uses are compatible with the preferred level of residential amenity.

- Streets should be designed as public places to encourage activity where appropriate.
- Buildings, regardless of their use, should exhibit a coherent style to provide a visual theme to an activity centre.
- Buildings should be located as close to the street alignment as possible, including the use of awnings, where appropriate, to promote interaction between pedestrians and shopfronts.
- The overall design should be closely integrated with public transport stations.
- Servicing of commercial uses (including service vehicles) must be designed to protect residential amenity. This can be aided by separating commercial vehicles from residential areas.
- Carparking should not generally be provided in front of buildings although it needs to be easily visible and accessible.
- Parking needs to be provided for disabled persons and for taxis/minibuses as well as for bicycles.

When implementing mixed-use development it is important to consider the environmental quality of the precinct. Formulating a development plan can establish a number of amenity and design principles and controls which mixed-use development should aim to meet. It is also important to place an emphasis on high-quality public areas which have the potential to create a number of spaces for recreation and exchange. These can be further enhanced if linked together by pedestrian/cycle networks.

This may be achieved through the development of a public space strategy which can be used as a mechanism to achieve coordination and quality in the public domain so that the precinct is an attractive place in which to invest and live.

Summary

There is a need to provide alternatives to the way we plan our urban centres. Changes in economic, social and environmental systems have occurred which warrant alternatives. Given the changing circumstances of work practices which no longer demand segregation of work and home, mixed-development provides an alternative with particular merit.

Further Reading

Qld Dept Business, Industry & Regional Development (1993) *Mixed Use Development—An Information Paper.*

Kemp, D. *Planning for Integrated Development* (1993) Workshop Proceedings.

Duamy, A. & Plater-Zyberk, E. (1992) *Towns and Town Making Principles* Harvard Uni, New York.

National Capital Planning Authority (1995) *Facilitating Mixed Use Development*. Draft Report prepared for the Better Cities Program, Commonwealth Department of Housing and Regional Development, AGPS, Canberra.

Practice Note PND 7

Multiple Use of Drainage Systems

Introduction

The majority of information contained within this Practice Note has been derived from the NSW Department of Planning publication *Better Drainage: Guidelines for the Multiple use of Drainage Systems* (1993). The publication and this summary are intended to illustrate to planning authorities, designers and developers methods for planning, designing and managing open space that has a drainage function. Although the guidelines were specifically formulated for NSW conditions, they are considered to be generally acceptable to most other parts of Australia.

Figure 1: Tennis courts in this housing project in Sydney serve as a detention basin.

Origin of the Concept

The concept of combining drainage and recreation reserves evolved in the 1970s and was referred to as 'dual use'. This concept has now been extended to include consideration of issues such as water quality maintenance, habitat retention and enhancement, water conservation and the provision for wider recreational and leisure pursuits.

The multiple use of drainage systems offers the following advantages and opportunities:

- efficient use of limited land;

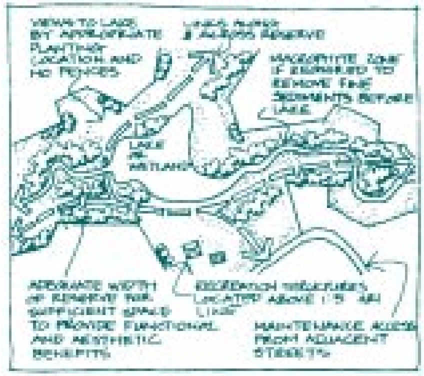


Figure 2: Design adjacent to detention ponds.

- conservation of valuable natural resources;
- targeting of local community recreational needs;
- the maintenance/improvement of water quality in receiving waters;
- providing for quality recreational opportunities;
- reducing long-term maintenance costs associated with conventional drainage systems.

Planning Policy and Framework

Each State has its particular planning mechanisms and objectives to allow and encourage the multiple-use of drainage and open space. Needless to say, the planning and design of a multiple-use drainage system is more easily achieved in establishing areas. Consideration of multiple-use drainage systems should be an integral component of the overall planning process for growth areas. Factors to consider should include:

- the requirements of an open space/recreation plan;
- land capability to accommodate a certain scale and arrangement of development together with the system needed to regulate and facilitate water run-off;
- catchment characteristics (land form, water volumes and flows);
- flood/run-off implications;
- environmental impacts (erosion, sediment transport, nutrient levels, pollution, infiltration, and habitats for fauna and flora).

Checklist for Multiple-Use Systems

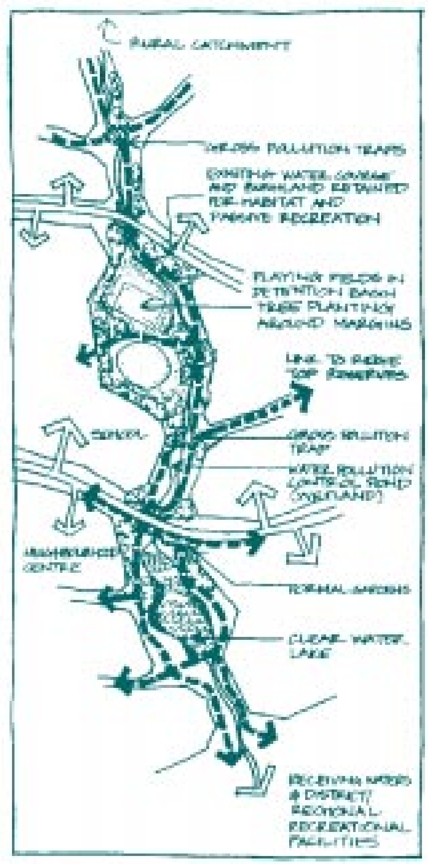
The following checklist is provided to assist in the introduction of alternative treatments to drainage systems. Councils should choose the evaluation method (quantitative, qualitative or both) and apply weighting to the various criteria to suit their particular conditions and requirements.

Land acquisition costs

- Reserve purchase
- Easement compensation

Capital works costs

- Allotment filling
- Existing waterway improvements
- Floodway construction
- Water quality control structures
- Pedestrian, cycle trail and vehicle access
- Recreation and leisure facilities and structures
- Landscape development works
- Services



Multiple use drainage systems have a high edge to area ratio which facilitates access to open space for the surrounding community. They can accommodate the majority of recreation settings considered necessary for the quality of life values demanded by the community.

Figure 3: Advantages of high edge to area ratio.

Annual costs

- Maintenance
- Foregone rates

Capital benefits

- Value of additional saleable/developable floodway land
- Increased sale value of adjacent blocks

Annual benefits

- Additional rates resulting from land enhancement

Public safety

- Anticipated level of risk

Water quality and conservation

- Effects on water quality in receiving waters
- Conservation of water resources
- Recharging of aquifer

Conservation of natural systems

- Maintenance and improvement of pre-development ecosystems

Recreation benefits

- Extent, type and accessibility of recreation settings

Visual amenity

- Landscape quality, beauty

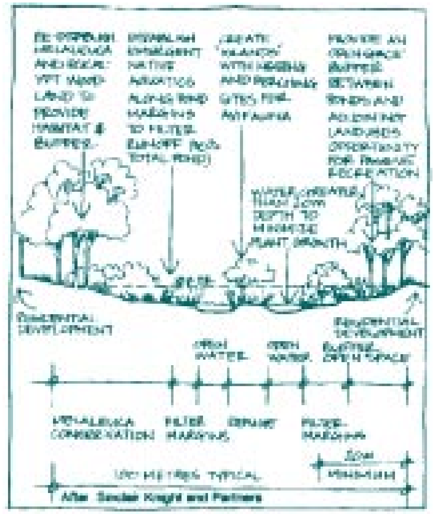


Figure 4: Design for habitat enhancement.

Open Space and Recreation Requirements

The fundamental difference between the multiple use of drainage systems approach and traditional approaches is the change in emphasis.

Essentially this is from one involving fitting recreation and amenity to a preconceived and designed drainage network to one focusing on providing a quality open space system. This is achieved by designing the drainage network in association with other elements to meet quality objectives for recreation, habitats, amenity and beauty.

Table 1 provides an example of the NSW Government's approach to providing for open space and recreational needs. Multiple-use drainage systems should fit within the recreation and open space context of particular areas and satisfy some of the community's needs.

Drainage Structures

The main components of drainage structures of relevance to multiple-use drainage systems are:

- drainage channels;
- flow control structures.

Drainage channels
In recent times, wide grassed channels have been preferred to formed concrete channels. However, in many cases grassed channels have tended to be sterile; not adding to the environmental or recreational amenity of an area.

Drainage channels are usually aligned within or next to existing watercourses which frequently support tree and shrub vegetation. In such circumstances emphasis should be placed on widening of the creek channel on one side only. The formation of a floodway parallel to the creek provides the additional flow conveyance required for urban development or to maintain significant vegetation.

Main trunk drainage channels should be designed for the designated flood adopted by council. Channels designed to retain vegetation and/or allow for subsequent planting are also encouraged. Planting should take into account factors such as debris build up, head loss and maintenance requirements.

Channel banks should preferably have slopes not greater than 1V:6H and the cross sectional profile should be varied to replicate natural watercourses.

Pedestrian paths and cycleways are preferably located above the two-year average recurrence intervals (ARI) flood level.

Flow within channels should be subcritical (ie relatively low velocity) with a typical maximum velocity of around 2 m/s. The selected value should relate to the scour potential and safety considerations.

A free board of around 0.2 to 0.3 m is required above the design flood level. This will vary in response to local factors such as slope of the channel, adjacent topography, adjacent land uses and level of risk.

Low flows can be conveyed in underground pipes or concrete or masonry invert channels (in low slope situations). However, it is preferable to direct flows along the existing drainage lines.

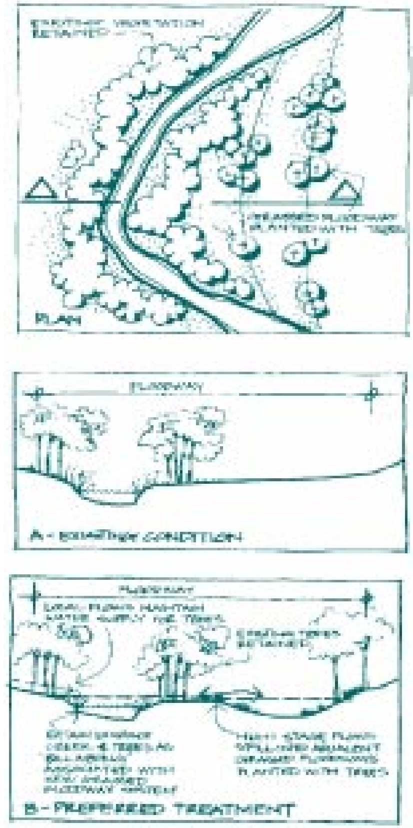


Figure 5: Preferred treatment of drainage lines.

Flow control structures

Urban development will invariably result in increased impervious areas and run-off rates, with possible adverse effects on downstream channel flow capacity, flood levels, water quality, a decline in ground water levels, soil moisture and stream base flows. These problems can be mitigated by a number of options which include:

- maximise pervious areas;
- development controls on the amount of impervious areas;
- use pervious pavement materials;
- divert flows to other catchments;
- on-site detention of flows;
- wetlands;
- detention basins;
- infiltration basins.

Site selection for detention basins and water quality control ponds depends on factors such as:

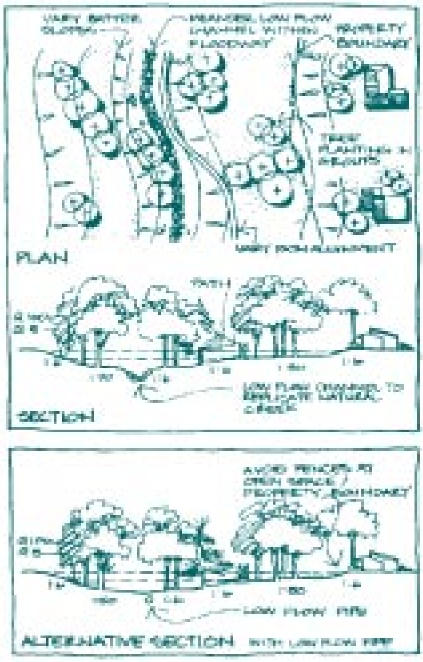


Figure 6: Alternative approaches for low flows.

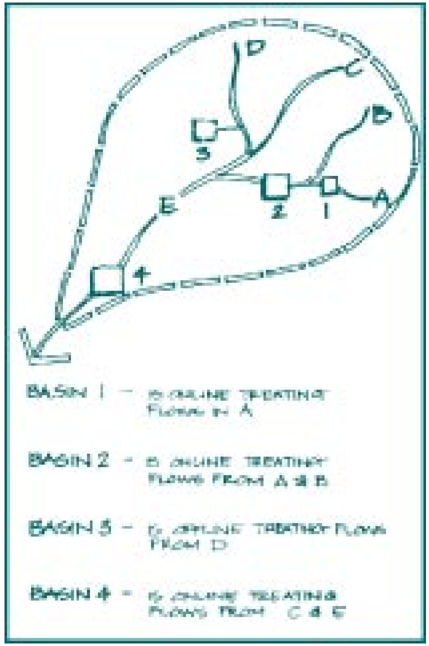


Figure 7: On-line and off-line basins.

- existing watercourse location and type;
- soil types;
- site topography;
- critical storm characteristics;
- position of development site in catchment;
- the need for correctly sized areas to suit various recreational uses which may be required.

Detention basins and water quality control ponds are located in or alongside the drainage channel (ie in-line or off-line structures). Off-line basins can control a specific portion of run-off while in-line structures are subject to full upstream catchment flows and water quality. This will have implications for the design capacity of weirs, erosion and control of sediments, vegetation retention and the management of suitable pond water quality during low flows.

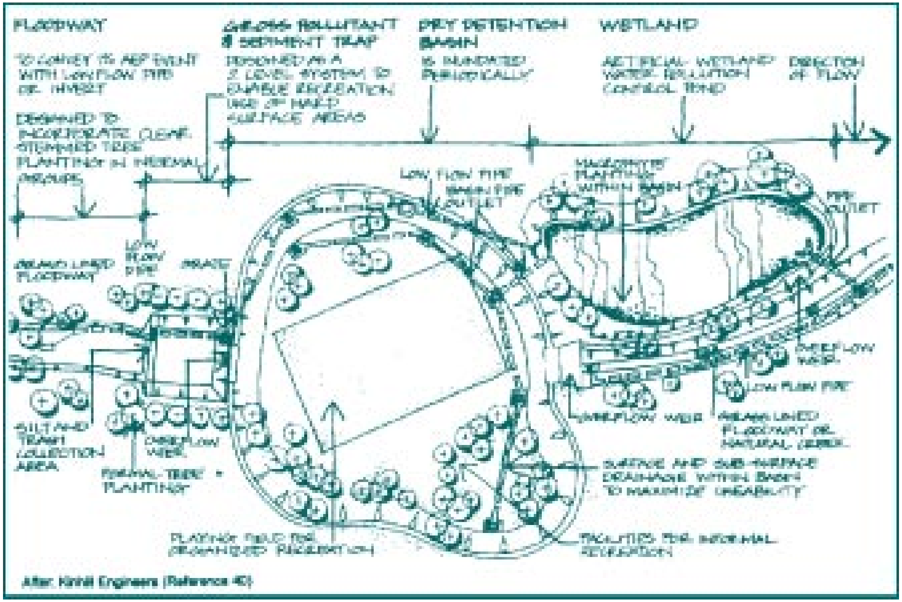


Figure 8: Main components of multiple-use drainage systems.

Detention basins can be formed in a cascading system in steep sites or as a single basin on flatter sites, and can either be dry based or wet based. The basin can be designed and developed for a

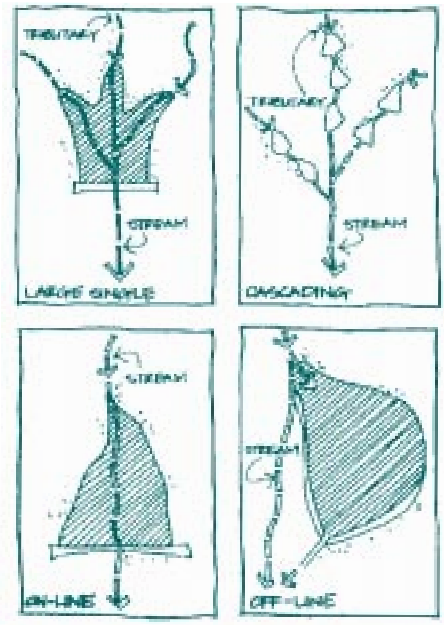


Figure 9: Various types of detention basins.

variety of organised and informal recreation pursuits. The location, shape and landscape details need to be formulated within the integrated site planning process to take account of drainage, recreational, environmental and landscape requirements.

Public safety

Care must be given to safety considerations at the planning and design phases of multiple-use drainage systems. Components of the system to be considered include:

• entries and exits to pipe systems should be designed to ensure children do not get caught in the pipes;

• banks of watercourses, ponds etc should be graded to shallow buffers, slightly roughened (say with vegetation) but containing no pot-holes, to enable safe egress under high flow conditions;

• preference should be given to cross-section design which allows water to spread out to shallow depths under high stage flows rather than being concentrated in steep sided and deep channels;

• provision of steps, handrails and depth gauges in deeper basins;

• fences have been found to be generally unnecessary, provided that the banks of basins are gently graded and community education and advisory signs are incorporated to inform people of the potential of inundation of accessible areas.

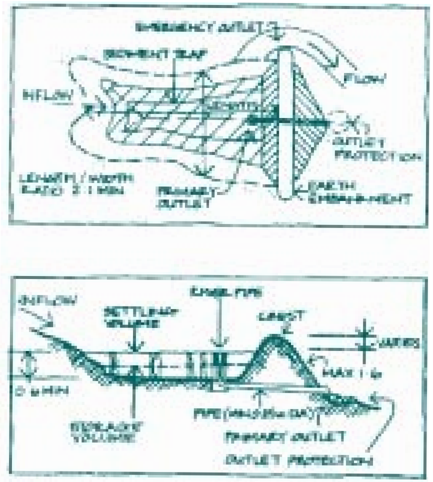


Figure 10: Sedimentation basins during the construction phase.

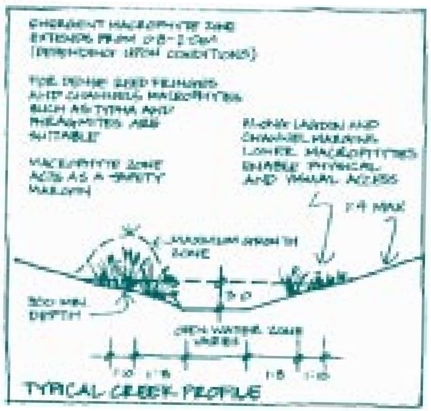


Figure 11: Encouragement of macrophyte growth.

Water Quality

The potential run-off water quality problems in the construction and developed phases require an integrated approach to maximise the reuse of common facilities such as basins.

Construction phase

During the construction phase emphasis is placed on control of soil erosion and trapping of sediments before discharge to watercourses. Measures to minimise soil erosion include limiting the surface area exposed and the duration of exposure, implementing rehabilitation or soil stabilising measures and the diversion of flows around the construction site.

The measures recommended to trap eroded sediment incorporate structures at appropriate locations between the individual loss, hay bale fences across flow paths and filter screens around inlet pit and sedimentation basins.

Developed phase

A range of measures are available to reduce the pollutant load in run-off, including:

- decrease run-off;
- increase infiltration;
- eliminate or treat sewage overflows;

- identification and control of high potential pollution source areas;
- litter reduction programs;
- street sweeping/pit cleaning;
- public education/awareness programs;
- gross pollutant traps;
- sedimentation ponds;
- water pollution control ponds.

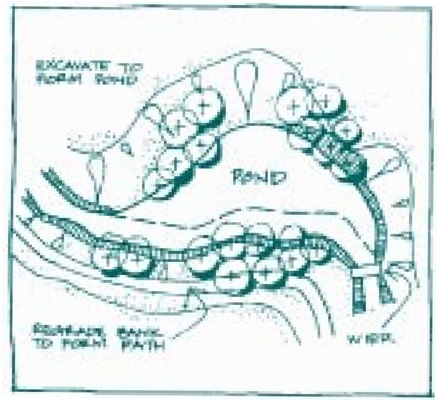


Figure 12: Permanent water bodies add amenity and improve water quality.

Gross Pollutant Traps (GPT)

GPTs reduce pollutant loads in run-off, and are designed to remove coarse sediment by settling and intercepting trash and debris in vertical grilles or other trapping devices.

It is preferable that GPTs be located upstream of water pollution control ponds (WPCPs) to reduce sediment and debris load. They should preferably be constructed in a natural form to complement the open space character of an area or screened by vegetation.

Water Pollution Control Ponds (WPCP)

WPCPs differ from sedimentation ponds in that they are formed as a wetland with emergent macrophytes over about 30% of the pond surface area. Macrophytes provide a physical obstruction to help the sediment settlement process and conserve nutrients. They are therefore more effective at reducing pollutant loads in run-off, and can also be a valuable water feature with environmental and landscape amenity attributes.

WPCPs should have a length to width ratio of at least 2 to 1 to aid settling of suspended sediment. Inlets and outlets should be located as far apart as possible to maximise effectiveness. Features such as islands are important to promote secondary flow currents and assist mixing, as well as form wildlife refuges.

The slope of the WPCP should be around IV: 8H to allow the establishment of macrophytes. Macrophytes generally grow in water depths of 0.3 m to 1.2 m and submerged macrophytes down to 2 m depth.

Landscape Development

Channel works

Efforts should be made to retain the natural alignment of watercourses through open space areas. However, it may be necessary to increase channel capacity. Where necessary, low flow pipes should be installed without disturbing the roots of existing trees.

Dry detention basins

Particular consideration is required to surface and subsurface conditions within dry detention basins to ensure usability as soon as possible after rainfall and inundation. The standard of treatment will depend upon intended use.

Wet basins, ponds and wetlands

Aspects to consider in the design of permanent water bodies include:

- quality of in-flowing waters and the standard of recreation and amenity which can be supported;

- the need to incorporate gross pollutant traps or wetland filters;
- the range of habitats to be provided;
- the areas necessary to fulfil various water quality functions;
- bank treatments to satisfy safety requirements and provide access;
- requirements for boardwalks, jetties and crossings to maximise use.

Maintenance

Once established, multiple use of drainage systems require regular monitoring and preventative maintenance to ensure the drainage and water quality system components maintain their quality. Regular maintenance is required to remove any blockages and debris dams, repair erosion and items damaged by flood and vandals, and to maintain vegetation and recreation surfaces and facilities.

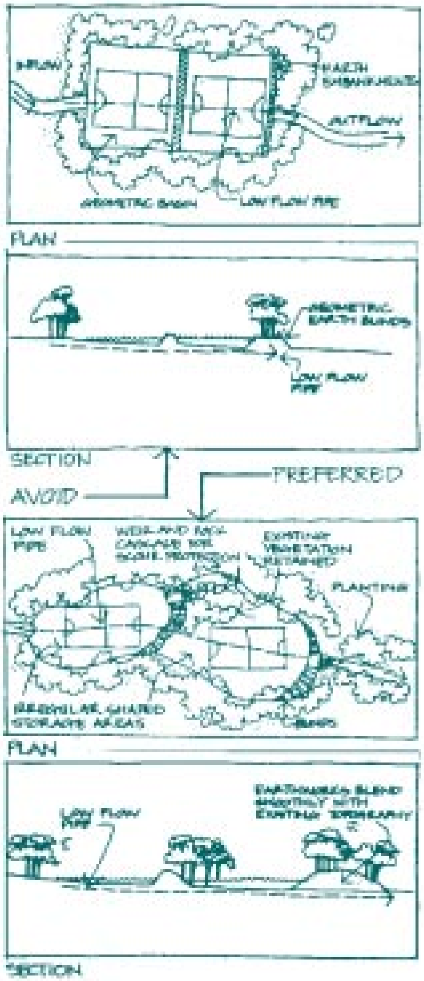


Figure 13: Sporting facilities within detention basins.

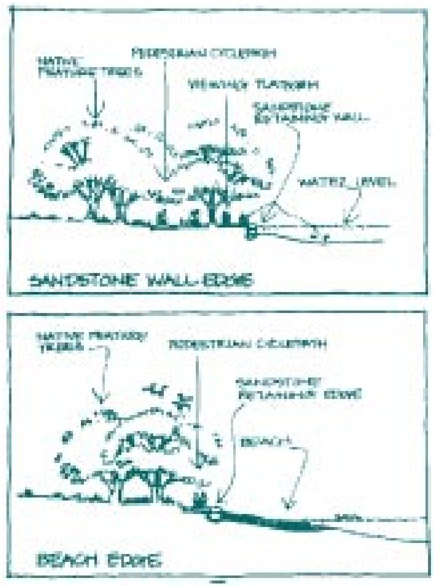


Figure 14: Use a variety of edge treatments.

Problems associated with maintenance can largely be reduced by considering maintenance ramifications in the planning and design phase. It involves ensuring that good design and construction practices are adopted, with the council establishing and enforcing quality standards.

GOAL	RATIONALE
Minimum open space size of 0.5ha for new release areas.	Increased maintenance cost and reduced useability for areas smaller than this. The pocket park concept has been shown to be largely a failure and many councils are attempting to dispose of many of these sites.
Each area of greater than 10 ha be linked to at least one other area.	To encourage linkages between open spaces. Footpaths and street narrowing can be used in some circumstances.
Each household should be within 500 metres of open space of at least 0.5 ha.	Equity and distribution and to reduce car dependence.
Diversity of settings is encouraged.	Diversity of settings will more likely cater for a greater range of recreation need. In new release areas this can be facilitated through flexible design modules.
Sportsfields should primarily be playable.	Sports fields should be designed to ensure that playing surfaces are in use for the maximum period possible, particularly if designed within detention basins.
Terrain should provide an alternative to that prevailing in the area.	More appeal and interest will be generated with mounding, creek lines and ridge tops.
Linear open space should have capacity for good pedestrian and bicycle movements and have houses "facing" and side-on.	Increase useability and decreased vandalism.

Source: NSW Department of Planning (Reference 17)

Table 1: NSW Governement approach to open space and recreation needs.

Practice Note PND 8

Services in Narrow Streets

Scope

This Practice Note covers the provision and location of public utilities in street reserves. It also outlines innovative and cost-effective solutions used in Australia which meet the objectives of AMCORD.

Background

Street reserves serve a variety of functions. The most obvious is vehicle and pedestrian access to residential allotments.

They are also essential for service conduits, including:

- water
- sewage
- telephone and telecommunications
- gas
- electricity
- stormwater.

Figure 1: Typical traditional service layout.

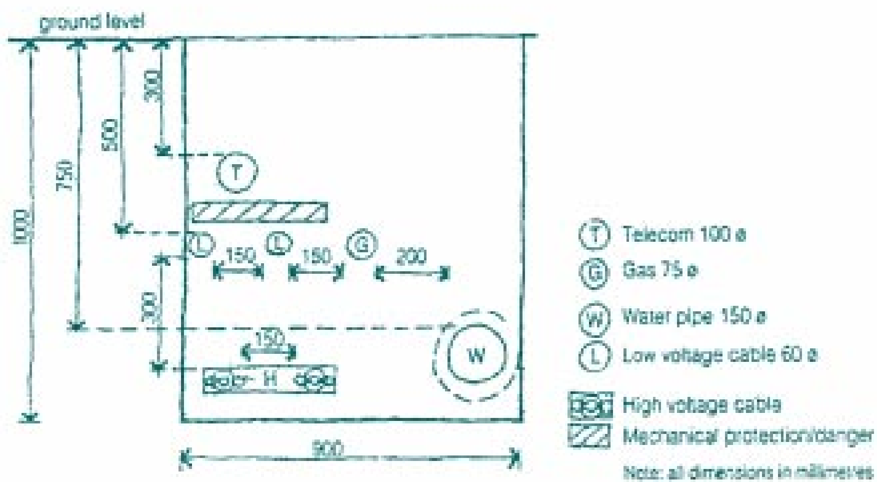


Figure 2: Typical joint trenching layout, New South Wales.

Source: Interim Guide to JointTrenching for New Subdivision.

As each of these services is usually provided by independent authorities, it is essential for a coordinating body, in some cases the local authority, to determine and allocate service corridors .

This approach has been followed around Australia, and most State and local authorities have a standard for service alignments.

While this approach satisfies the service providers' objectives of simplicity and ease of access for future maintenance, it is not necessarily cost-effective, and limits the ability to meet the urban design and streetscape objectives outlined in AMCORD.

Service allocations have a substantial impact on street width, design and construction. Consequently, reductions in allocation requirements can have considerable overall impact on residential development.

Key objectives identified in AMCORD relating to the provision and location of utilities include to:

- provide for the location of public utilities to each allotment and within street reserves in an efficient and cost-effective manner;

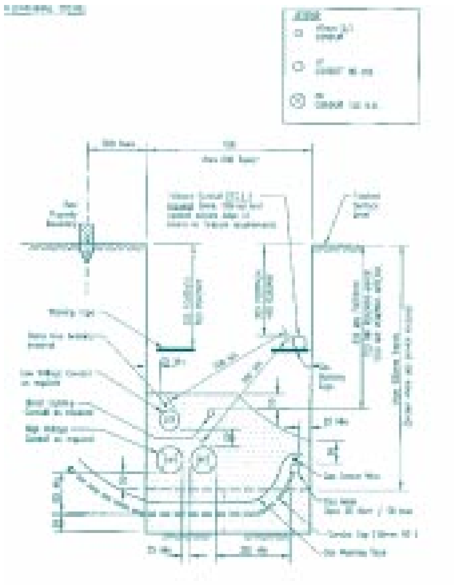


Figure 3: Common Trenching, Queensland.

Source: South East Queensland Water Board, 1991.

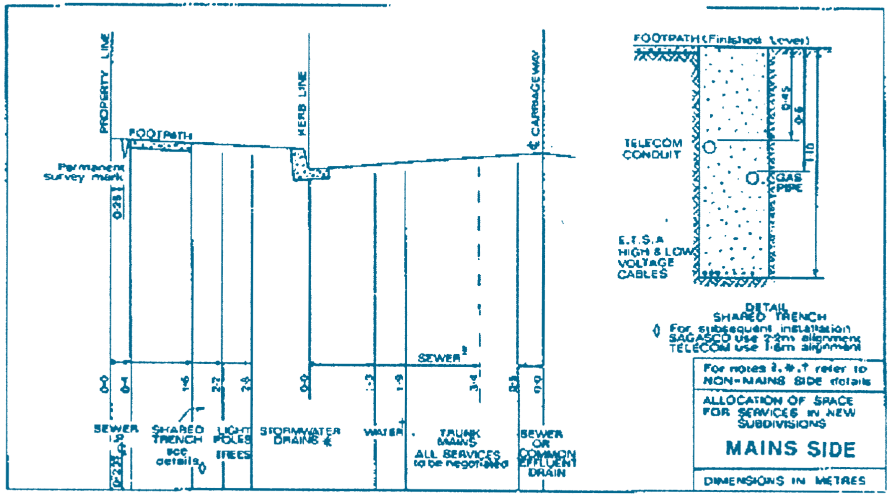
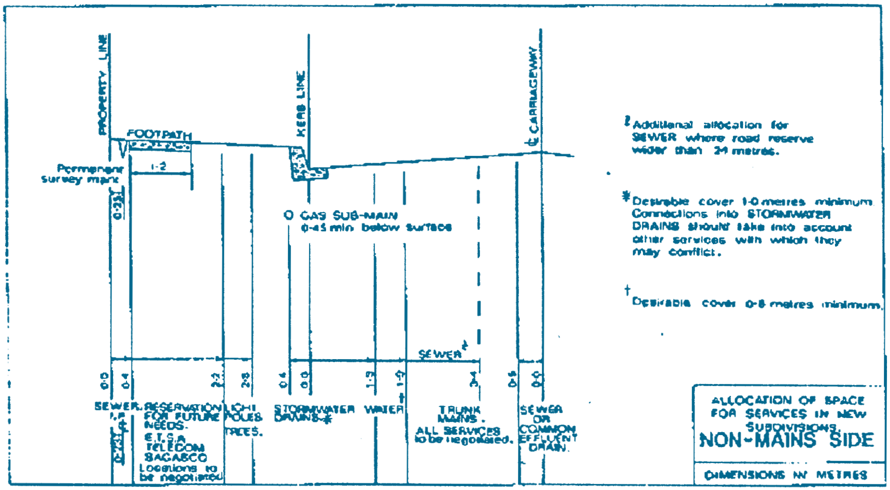


Figure 4: Common trenching, South Australia.

Source: Public Utilities Advisory Co-ordinating Committee, 1979.



- maximise the opportunities for shared trenching and hence reduced constraints on tree planting and landscaping within street reserves.

No specific Acceptable Solutions are included in AMCORD because of the number of service providers involved and the lack of a nationally accepted code of practice.

Innovative Practice and Experiences

Common trenching
Common trenching, or shared services allocation, involves the provision of a number of services within one trench or service allocation area.

The advantages of common trenching include:

- elimination of a number of single trenches, each with its own construction, settlement and reinstatement problems;

- accurate location of services for possible repair or maintenance;

- reduced verge width;

- increased verge width available for tree planting and/or landscaping;

- less conflict between services as depth relativities are known;

- more efficient use of construction equipment;

- reduced verge and footpath disturbance for earlier site establishment.

Examples of common trenching advisory codes include those of:

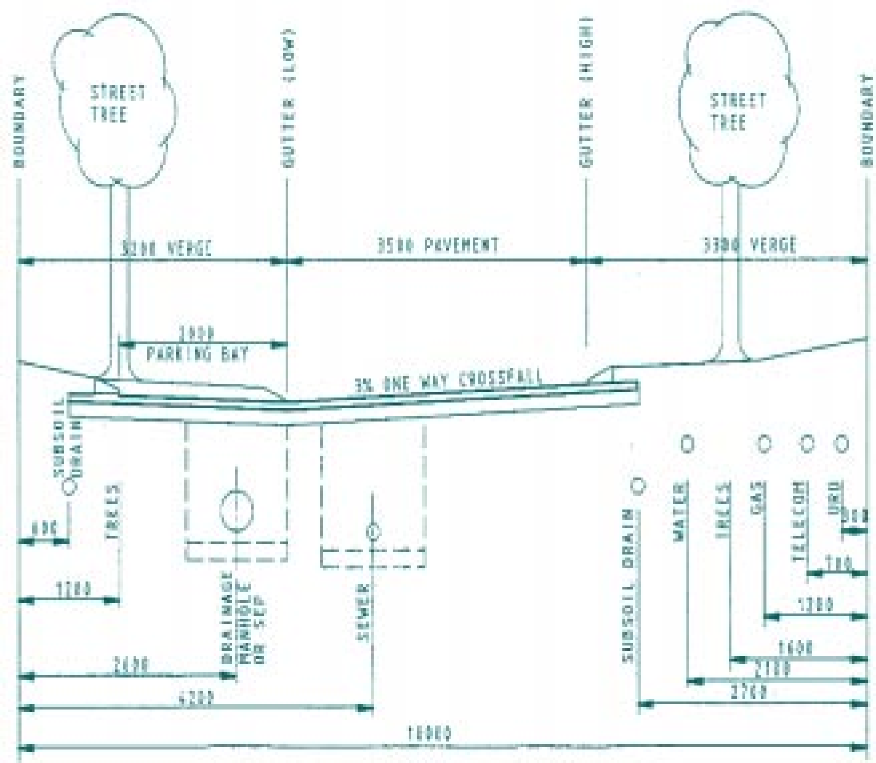


Figure 5: Street reserve cross-section, Perth.

Source: Wood and Grieve, 1993.

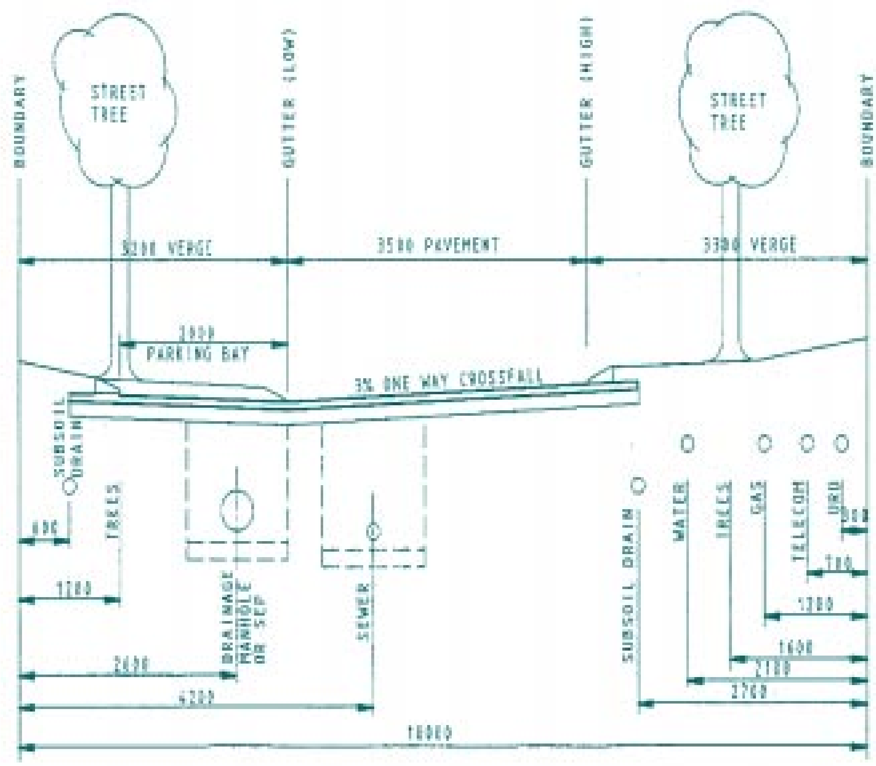


Figure 2: Street reserve cross-section, Perth.

Source: Wood and Grieve, 1993.

- Department of Planning, New South Wales;
- South Australian Public Utilities Advisory Coordinating Committee (this code is currently under review).

Common trenching is required practice in some States/Territories and is gaining acceptance in others.

Stormwater drainage

Stormwater drainage design and construction for narrow streets has a number of aspects requiring careful consideration for satisfactory results.

Experience shows that:

- conservative requirements for flooded street widths will lead to unworkable numbers of inlet pits for narrow pavements;
- lowering the street pavement to increase drainage capacity in the street reserve has an adverse impact on tree retention;
- manhole location in narrow pavements is critical in the construction phase and can lead to higher construction costs;
- inter-allotment, roof water drainage lines and inlet pit locations must be designed to ensure they do not clash with build-to-the-boundary locations;
- flush-edge kerbs may require alternative treatment for roof water discharge.

New Haven Village (Adelaide), Robina (Gold Coast), Forest Lake (Brisbane) and Settlers Green (Sydney) illustrate innovative ways of handling stormwater drainage.

Water reticulation
Apart from material for construction and common trenching, there are few ways of approaching water reticulation design and construction differently for more cost-effective results.

However, experiences which are of interest include:

- using non-standard alignments to retain trees;

- maintaining straight property alignments to avoid the necessity of bends and thrust blocks (this approach may require wider street reserves to allow the pavement, but not the street reserve, to meander).

Case Study 1: New Haven Village, Adelaide

The project
Located 20 km north-west of Adelaide's Central Business District, New Haven Village at Osborne is an innovative development comprising 65 dwellings, developed by the South Australian Housing Trust and sponsored by MFP Australia. The development occupies a 2 ha site, with a site density of approximately 33 dwellings per ha. Allotment sizes vary from 123 to 348 m^2.

Innovative aspects
New Haven Village features several innovative engineering concepts, including:

- creating a 6.8 m public utility street services corridor for the installation of water mains, sewerage, reclaimed water pipeline, stormwater, electricity, and telecommunications;

- using the entire road pavement as a V-shaped collection drain, ensuring maximum surface flows and capacity for peak stormwater events;

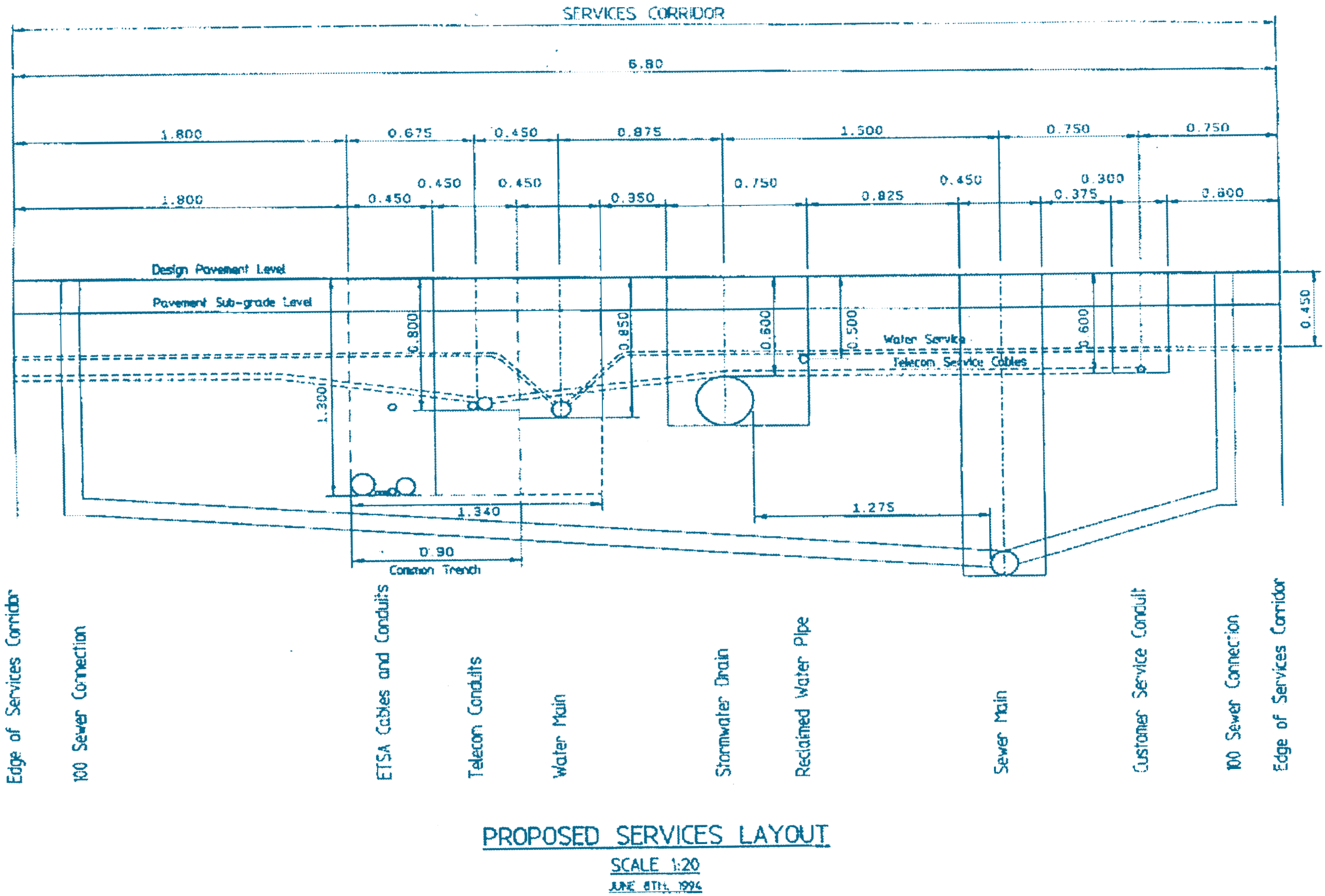


Figure 7: Services layout at New Haven Village, Adelaide.

- placing the underground stormwater pipe system centrally in the services corridor under a spoon drain with grated sump inlets, rather than conventional open-side entry pits, acting as a pollutant trap to prevent litter entering the system;

- treating stormwater and sewage on-site, with treated water recycled back into the development for toilet flushing and irrigation of gardens and streetscapes.

Experiences
The development at New Haven Village has resulted in:

- the need for service providers, local government, designers and developers to work in conjunction to achieve design solutions which lead to savings in construction costs.

- improved environmental management through the reduction of litter into the stormwater system, and the estuarine and marine environments.

Case Study 2:
Forest Lake, Brisbane

The project
Forest Lake is a 1000 ha residential project located in Brisbane's south-western suburbs. Begun in 1991 by Delfin, the development includes a mixture of lot sizes ranging from 300 to 1000 m². By mid-1995, over 2500 lots had been constructed and sold.

Innovative aspects
Aspects of the project's design and construction relating to innovative location and provision of services include:

- common trenching for electricity, telephone and gas;

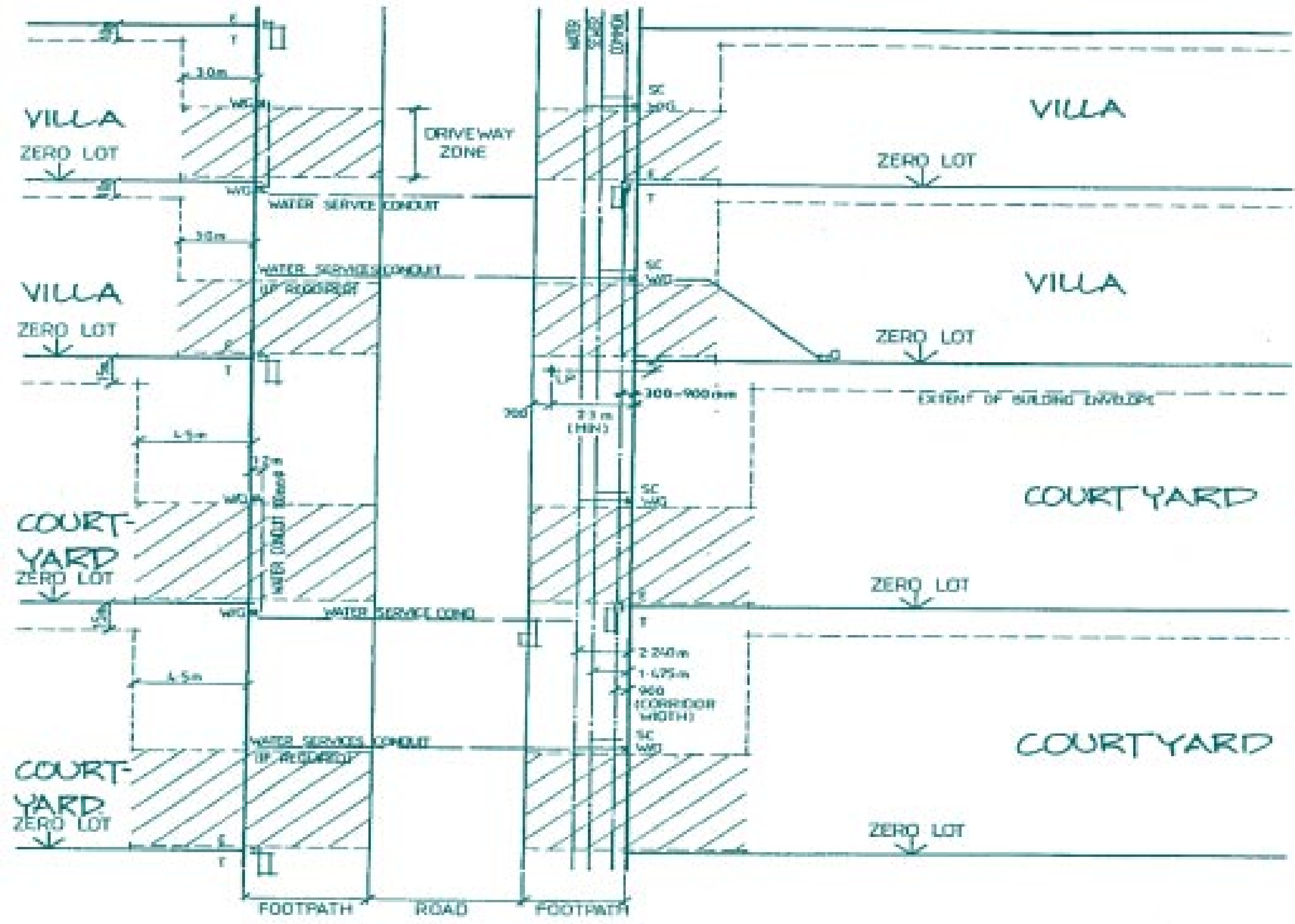


Figure 8: Service allocation and allotment design, Forest Lake, Brisbane.

Source: Delfin Property Group, Forest Lake, 1995.

- gully-to-gully connection of stormwater drainage;
- meandering of street pavement instead of street reserve to enable tree retention and simplification of service construction

Experiences
Experiences gained in the design and construction process include:

- savings in construction costs, increased flexibility in planting of verge areas, and better tree retention by using common trenching and varying other service alignments;
- locating light poles well behind kerb lines to avoid damage from large vehicles (at least 700 mm is recommended);
- designing the location of service conduits in conjunction with the build-to-boundary design;
- anticipating possible dwelling floor levels when designing inter-allotment drainage through narrow allotments.

Case Study 3: Robina, Gold Coast

The project
Robina is an 1800 ha residential project located on the Gold Coast. The project was begun in 1980 and, by mid-1995, over 5000 lots had been constructed and sold.

The project is predominantly conventional residential development. However, since the late 1980s smaller allotments have been produced in significant numbers.

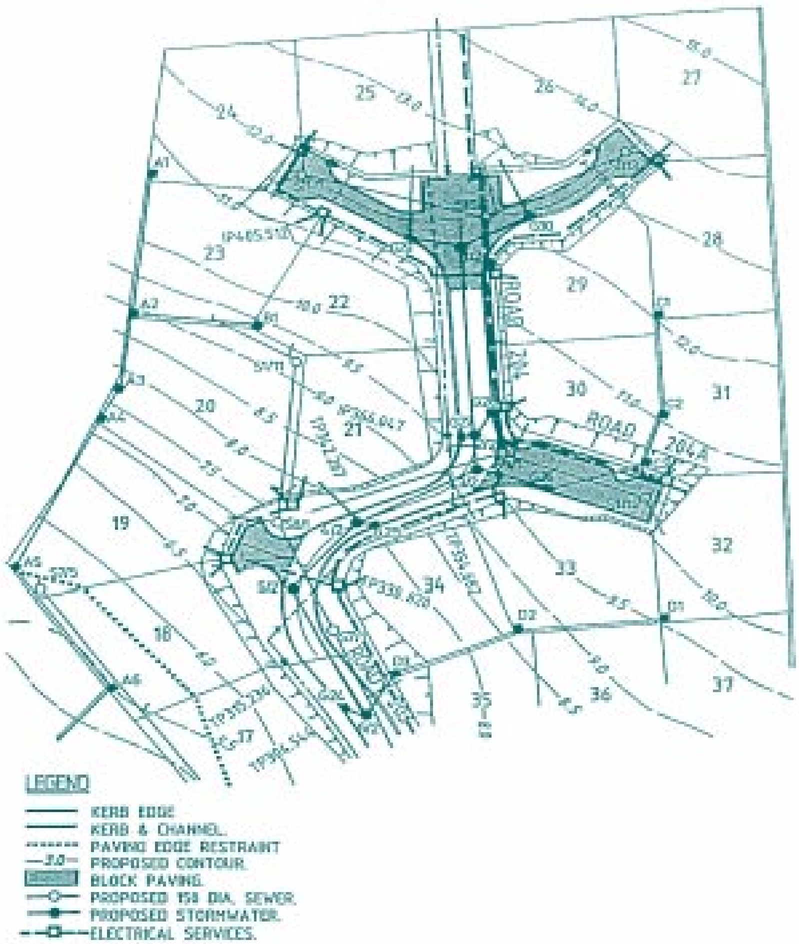


Figure 9: Service layout, Robina Quays, Gold Coast, Queensland, Stage 9.

Source: Kinhill Cameron McNamara, 1993.

Innovative aspects

In relation to service provision and location, innovative aspects include:

- integral design of lots and services to avoid construction problems;
- stormwater design to allow flush-edge kerbing;
- reduced and varied service locations to permit narrow pavements.

Experiences

Specific experiences include:

- the need for close interaction of design staff to ensure complementary services location and building designs;
- the additional cost of constructing 3.5 m pavements where manholes were located within the pavement;
- the necessity of additional stormwater connection lines where flush-edge kerbs were installed.

Practice Note PND 9

Total Stormwater Management

Case Study 1: Stormwater Management Strategy For South-east Perth

In 1993 the Water Authority of WA and the WA Department of Planning and Urban Development initiated a study to formulate a water sensitive management strategy and design concept for the proposed urban expansion around the towns of Byford and Mundijong and their hinterlands. The strategy was part of the structure planning process for the South-East Corridor of the Perth Metropolitan Region.

The stormwater management strategy had to ensure acceptable flood protection to urban development and restrict the peak rate of stormwater flow to pre-urban rates to ensure and retain pre-urban water regimes of valuable wetlands and creeks. This will require additional storage of stormwater as well as flood conveyance and the application of other water sensitive planning and management practices.

Water Resource Management

General objectives for water sensitive design are to:

- maintain water balance;
- maintain and enhance, where possible, water quality;
- encourage water conservation;
- maintain and enhance water-related environmental, recreational and cultural values and opportunities.

Study Objectives

In addition to the above general objectives, the Water Authority required the following objectives to be met:

- Ensure the provision of adequate flood protection for existing and future developments.
- Ensure that flow regimes in natural watercourses are not significantly altered from pre-urban conditions.
- Retain natural watercourses together with fringing vegetation.
- Incorporate natural watercourses in drainage systems.
- Integrate the drainage system with open space and recreation facilities.
- Ensure that water levels in wetlands are maintained at existing levels (hydrology of wetlands is not altered).
- Ensure the provision of effective interception measures for potential water pollutants.
- Ensure that drainage infrastructure does not impinge on the integrity of heritage areas.
- Retain benefits of water resource management provided by remnant vegetation.

Approach

The Water Sensitive Urban Design Guidelines recognise that to be effective, water sensitive design needs to be part of a wider water resource management strategy. This has required an analysis of the water resource management issues of the wider structure plan area.

In summary the approach adopted was to:

- identify water resource management issues for the structure plan study area and, in particular, for the localities of Byford and Mundijong;
- identify major river basins, catchments and subcatchments;
- describe areas subject to permanent and seasonal inundation or waterlogging;
- describe areas of remnant vegetation;
- describe planning units, precincts and subprecincts;
- apply water sensitive design principles to establish best planning and management practices for each precinct and subprecinct.

Best planning and management practices considered essential by the Water Authority to achieve their objectives, included the provision of adequate multi-purpose water management corridors; distributed detention basins/artificial wetlands/recreational lakes and channels and protection of remnant vegetation. These are to be incorporated within an aesthetically pleasing landscaped/ linked/ revegetated network of public open space.

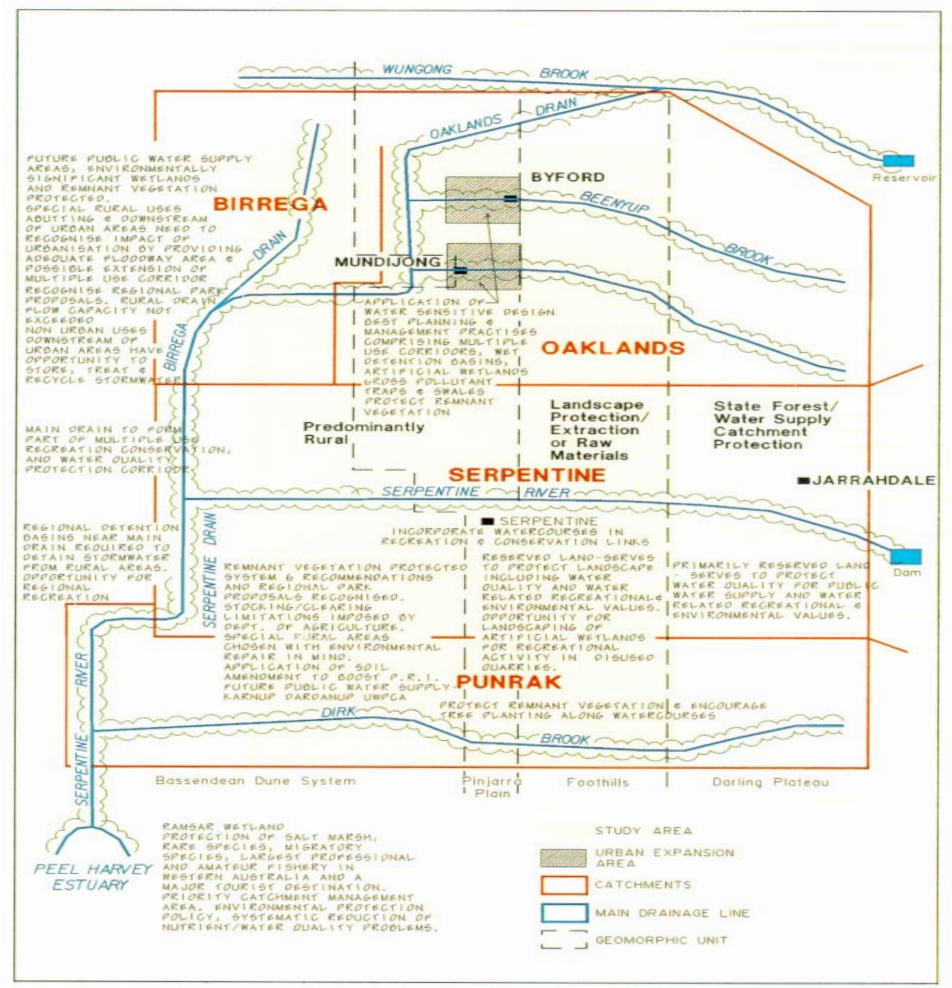


Figure 1: Conceptual summary of water sensitive design issues and proposals

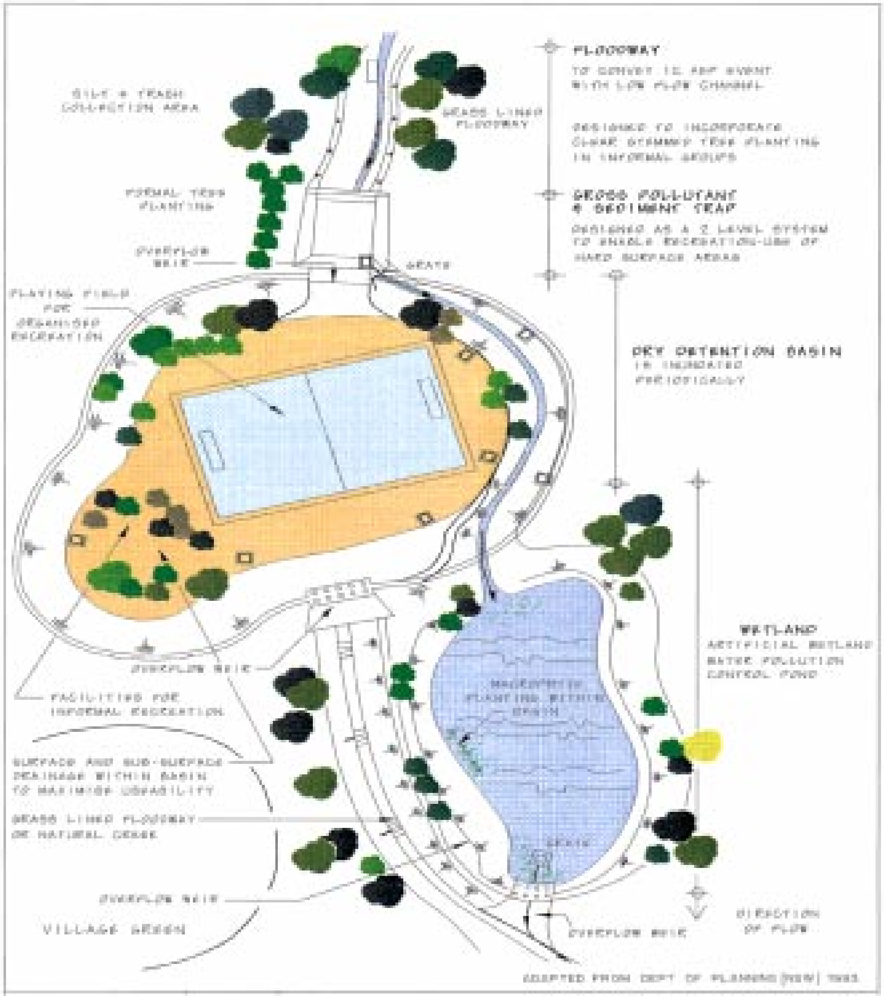


Figure 2: Typical water-sensitive storage treatment within a multiple-use corridor.

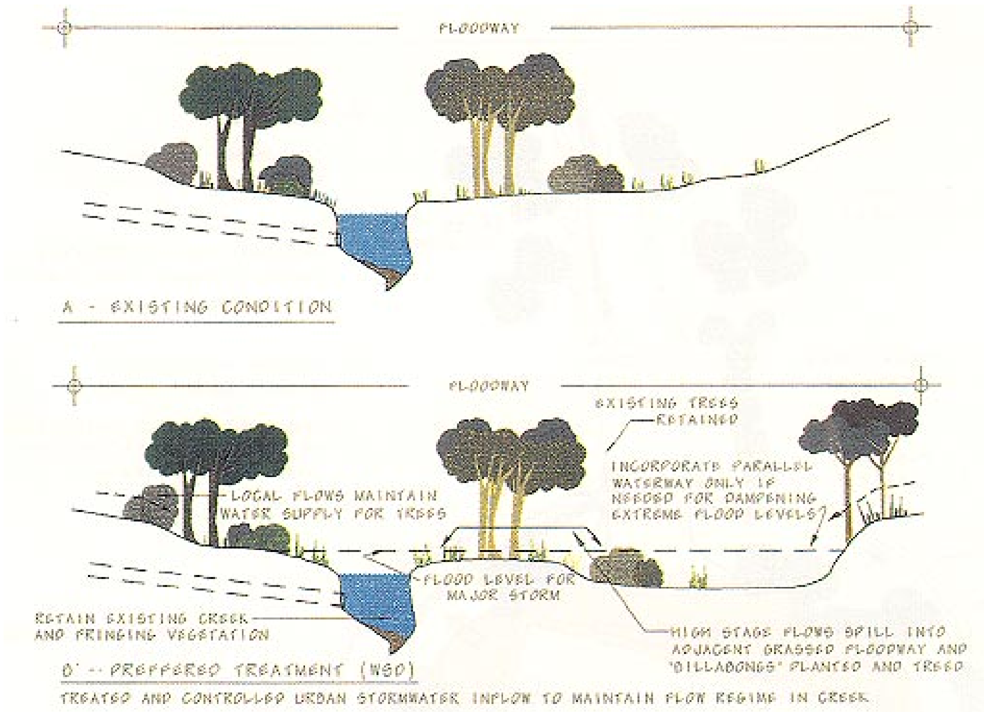


Figure 3: Water-sensitive floodway treatment within multiple-use corridor.

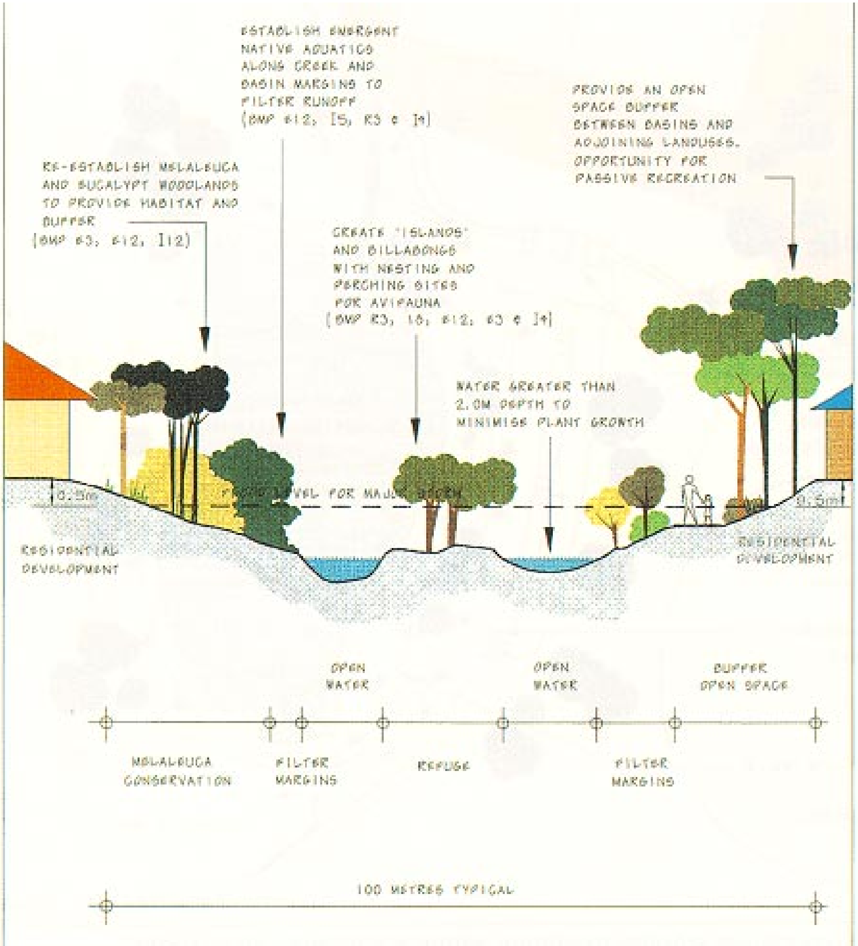
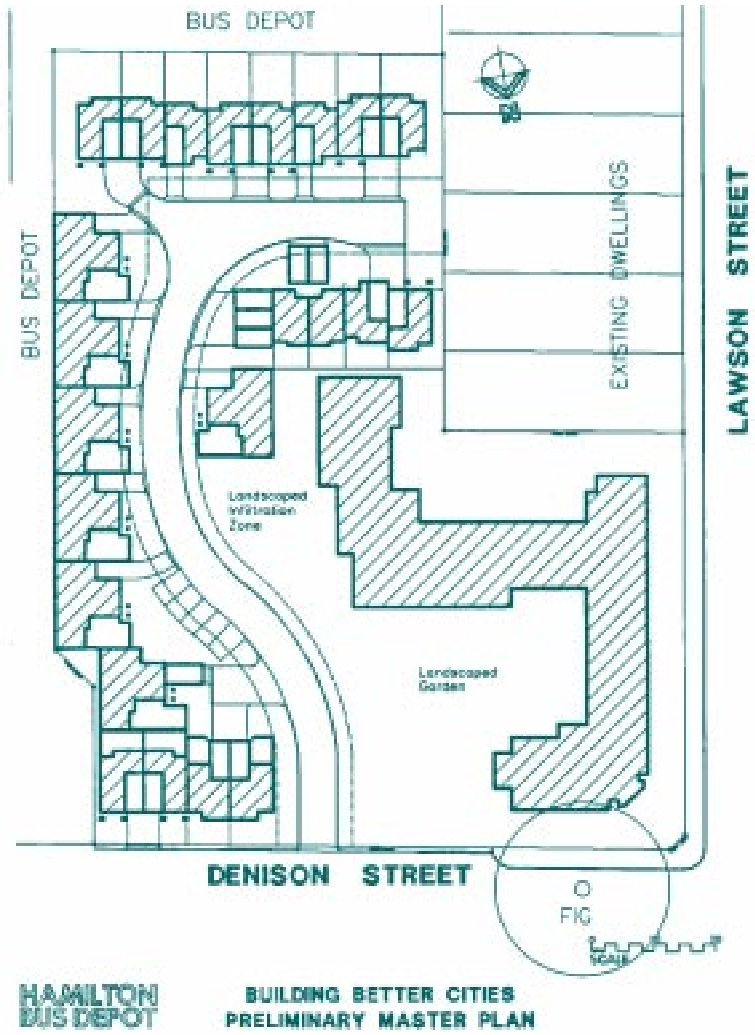


Figure 4: Cross section of typical multiple-use corridor incorporating best management practices.

Case Study 2: Hamilton Bus Station Redevelopment

In April 1995, the City of Newcastle in conjunction with the Building Better Cities program commissioned Urban Water Resources Centre, University of South Australia to prepare a Total Water Management Concept Study for Inner Newcastle.

Stage 1 includes a Concept Study of the Hamilton Bus Station site and involves a collaborative approach to site development and layout of buildings. Water management issues have been addressed and solutions integrated into the initial planning concept.



Steps in the Concept Study Process

The task of determining and reporting on a total water management scheme for the Hamilton Bus Station site redevelopment involved the following steps:

- Review the physical properties of the site, including contamination, to ascertain what practices should be considered, and to recommend any necessary additional site test or explorations.

- Determine approval agency reactions to total water management proposals and report conditions and constraints which are likely to be imposed.
- Identify specific constraints which are subject to practices considered suitable for inclusion in the redevelopment and which must be taken into account in its planning.
- Identify practices considered suitable for inclusion in the redevelopment and which can be matched to an appropriate planned layout.
- Develop an appropriate layout in collaboration with the site planners incorporating the selected practices.

Properties of the Site

The portion of the Hamilton Bus Station site which is the subject of Stage 1 of the Concept Study is approximately 1.1 ha in area and represents about one-third of the area used previously for transportation activities including trams and buses. About 40% of the redevelopment site is occupied by a hostel for elderly citizens.

A number of geotechnical and environmental reports were studied to establish site capability including total water management practices.

Data suggested that sand present at the site is at least 4.5 m deep and probably extends to a depth of 9 m.

The groundwater level varies, seasonally, from around 3 m to 4.5 m below natural surface level.

The quality of groundwater outside the confines of the bus station site (where it is uncontaminated) is suitable for open space irrigation.

The movement of groundwater is very slow—around 4 m per year–in an east–north–east direction to the closest intrusion of Newcastle Harbour.

Sewage in the vicinity of the bus station is collected and conveyed to the central treatment system via a 225 mm diameter main which runs north along Lawson Street.

The proposed redevelopment site therefore has access to full sewerage services.

Access to a formal stormwater drainage system within the former bus depot is provided as part of the subdivision plan. Three access points are available in the south-east corner of the proposed redevelopment site.

Site Contamination

Levels of contamination, above those acceptable to approval agencies such as NSW Department of Health and Environment Protection Authority (EPA), were widely dispersed on the site. There were also a small number of pollution 'hot spots' both within the site and/or immediately adjacent to it.

Explanations for the presence of the contamination rely heavily on anecdotal evidence including reports of past major spills of oil and fuel.

Redevelopment Process

The process under which STA handed over the site to the Newcastle Council included a major task of site restoration within its boundaries. This will provide a land surface suitable for the proposed redevelopment.

Tests carried out on the groundwater before redevelopment showed levels of contamination well below EPA limits. The water is suitable for open space irrigation but not for potable use.

Water Management Practices

There were seven innovative water management practices considered for the residential segment of the Bus Station redevelopment. Three of these were integral to planning the layout of the site and the remaining four practices could be matched to any conceived layout.

Specific constraint practices

- Stormwater run-off from internal paved surfaces will be directed to centrally located sumps in the south-east region of the site where it is cleansed in surface filters/hard-standing areas before soaking through to groundwater.

- Major storm run-off involving surcharge from all rainwater collection systems will be directed to the central sumps where sufficient storage capacity will be provided to hold run-off from a design storm of low frequency, eg 'once in 20 years' or 'once in 50 years'. Overflow from the sumps in extreme events will enter the formal drainage intakes provided on the eastern side of the site.

- An annual volume of 2ML of groundwater, recharged with stormwater collected on the redevelopment, will be extracted and treated for use in a new bus-washing facility in the adjacent bus depot

Non specific requirements of the water management scheme

- Roof run-off collected in rainwater tanks on individual or group housing units and used as base supply for (gravity) hot water systems. Such rainwater tanks are supplied with devices which divert 'first-flush' pollution loads and/or filter inflow and prevent mosquito access.

- Roof run-off and/or overflow from rainwater tanks will be directed to 'leaky' wells or gravel-filled soakage trenches located on individual unit or group housing allotments before soaking through to groundwater.

- Stormwater/groundwater interaction will result in an approximate annual balance of recharge and retrieval. This requirement is important to maintain fairly constant groundwater levels and is in the nature of a management strategy.

- Groundwater extraction will supply irrigation water for public and private open-space areas in the redevelopment; two bores will be needed, along with associated pumps and pipeline infrastructure.

- Sewage effluent from all units, not included in the greywater treatment/reuse system will be collected and conveyed to the formal sewerage system in the conventional manner.

Case Study 3: Parfitt Square Stormwater Retention System

The Parfitt Square development site, located 2 km north west of Adelaide in the City of Hindmarsh and Woodville, demonstrates a new approach to on-site stormwater retention. This approach manages the total stormwater run-off from its own catchment for a 'once in 100 years' storm event.

Parfitt Square is being developed by the Hindmarsh Woodville City Council, as a small recreational park (0.6 ha) with adjoining medium density housing (1.0 ha). Council expressed the desire to improve amenity and reduce irrigation costs using similar principles to those employed in the nearby New Brompton Estate development.

In September 1994, Council approached the Urban Water Resources Centre, University of South Australia, to investigate the costs and practicalities of installing an innovative stormwater management system at the site.

Benefits demonstrated at New Brompton Estate include the enhancement of community 'quality of life' and amenity factors, plus

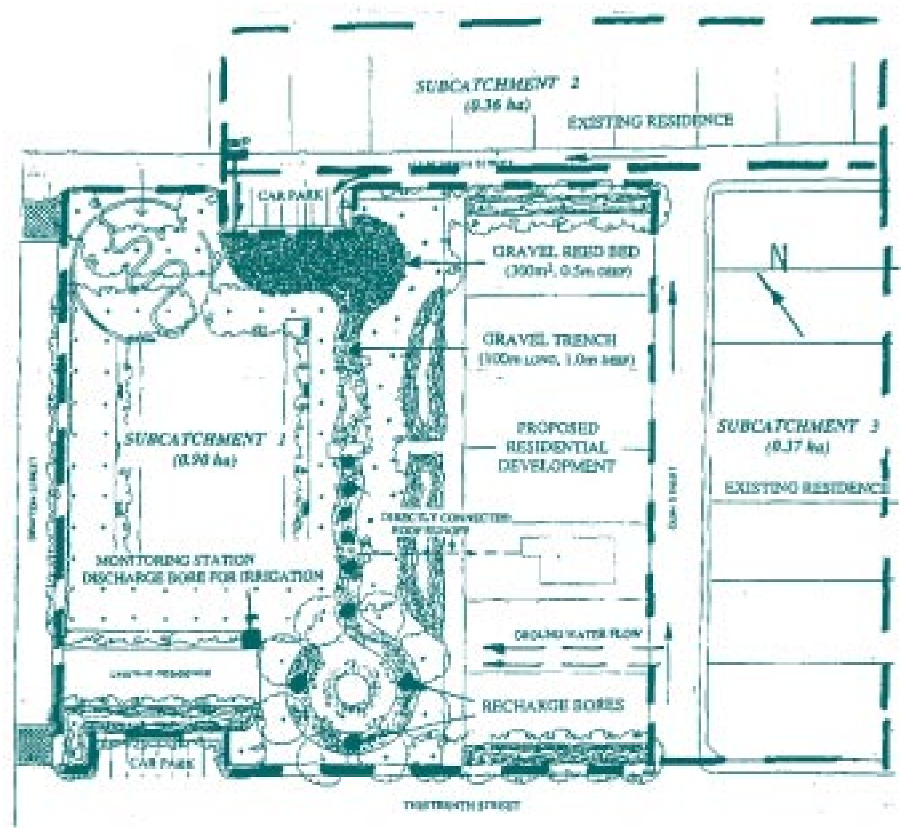


Figure 6: Parfitt Square stormwater retention scheme.

significant cost savings associated with the use of stormwater to irrigate common areas. Given that council is the owner and developer of Parfitt Square, the site presents an ideal opportunity for the trialing of innovative stormwater techniques and design approaches.

The strong sense of community apparent in this neighbourhood meant that a mandate for the stormwater system had to be given by the residents in the surrounding area before proceeding.

In this regard, Council sought community involvement and cooperation at the earliest stage of planning.

Participants in the 'community consultation' in November 1994 and the 'community barbecue', held in December 1994, heartily endorsed the concept design for Parfitt Square. Residents were particularly impressed with being given the opportunity to trial the use of stormwater in their community.

Stormwater Retention

The stormwater retention scheme is designed to collect stormwater from a total catchment area of 1.3 ha, treat the stormwater through a gravel-based reed bed and trench system, and inject the treated stormwater into the aquifer where it is stored for future low-cost retrieval for parkland irrigation. Key features of this system are:

- sedimentation trap;
- gravel-based reed bed receiving poor quality run-off from roadway and carpark;
- 100 m-long, gravel-filled trench for storage and infiltration, and into which high quality roof run-off is directed from adjacent houses;
- four bores used to recharge filtered water to the underlying Quaternary aquifer;
- separate discharge bore and pump system for irrigation.

Objectives

The principal agreed objectives of the Parfitt Square Stormwater Retention System are to achieve zero run-off from the 1.6 ha mixed development site in all storms up to the 100 years event; to include the capture, treatment and injection to the aquifer of stormwater run-off from the roadway and adjoining residences; and to retrieve stored stormwater for use in irrigating Parfitt Square.

Total Catchment Management

The total catchment consists of three sub catchments (see Figure 6). All the stormwater that falls outside the park and the proposed residential development on Quin Street, is directed into a sedimentation trap, followed by a gravel-based reed bed, for treatment. Roof run-off from newly constructed houses will be directly connected to the gravel trench via PVC pipes but will initially pass through sediment traps, removing gross pollution. The park was constructed so that the ground surface slopes towards the trench, thus collecting run-off from the park.

Stormwater Treatment

A significant requirement of the design is to provide a means of treating the poor quality stormwater (ie road surface run-off) to a level which is acceptable for aquifer recharge.

Currently accepted practice decrees that water to be injected into an aquifer must be of a higher quality than the water already contained in the aquifer.

The solution to this difficulty is to direct the stormwater to a 300 m2 gravel-based reed bed where processing includes sedimentation, filtration and absorption. From the reed bed, the stormwater enters a 100 m long underground gravel trench (4.0 m2 in cross section), where further filtering occurs prior to diversion into the aquifer. Both the gravel-based reed bed and trench are separated from the surrounding soil by geotextile.

Detention of Stormwater

Analysis of the drainage design was performed using ILSAX computer software. Useful information obtained included peak flow into the park, inflow hydrographs and peak storage heights for a wide range of design storm conditions. During minor storms (ie ARI =5 years), the stormwater is contained within the gravel trench which has a storage volume of ~135 m3.

For large storms (ie ARI =100 years), the park functions as a detention basin, providing adequate storage in excess of 800 m3. The required storage volume has been determined taking aquifer recharge into account. Ground infiltration, however, is not taken into account since permeability tests reveal the soil to have low hydraulic conductivity, (k60 – 8 x 10–7 m/s). The trench design includes bore headworks situated 100 mm above the bottom of the trench.

This enables seepage of stormwater to surrounding soil and vegetation to take place between storm events.

Aquifer Recharge

An unusual part of the project is the four bores interacting with each other while recharging the Quaternary 1 aquifer. The Quaternary aquifer system exists beneath much of the Adelaide metropolitan area at depths ranging from 2 to 10 m. It is estimated to have a storage capacity of 50,000 ML. There are approximately 3,000 bores currently connected to this aquifer system. A comprehensive report released by the Centre for Groundwater Studies, ‘The Potential for Storage and Reuse of Adelaide Stormwater Run-off Using the Upper Quaternary Ground Water System’, identifies areas for groundwater recharge and use suitable for domestic, municipal and industry in Adelaide. The Parfitt Square site is located close to an area deemed suitable for such purposes.

In order to design the storage volume needed within the landscaped reserve, it was necessary to determine the rate of recharge using a simple computer model simulation. The model, assuming transient conditions, was developed on Excel.

In February 1995, the Department of Mines and Energy agreed to sink two test bores on the site and conduct the drilling, casing and testing. The testing involved a constant discharge or recharge at one bore while measuring the effects at the other bore over approximately 6–12 hours duration.

Aquifer hydraulic characteristics obtained from these tests were incorporated into the model to complete the design.

Benefits

This project demonstrates the enormous advantages to be gained from stormwater retention and use. These include:

- no polluted stormwater run-off leaves the catchment area for all storms up to and including the ‘once in 100 years’ event;
- localised treatment of stormwater not contributing to downstream problems;
- replenishment of the aquifer;
- reduction in groundwater salinity levels;
- reduction in, and in some cases the elimination of, increasingly expensive mains water for irrigation.

Continuing, long-term monitoring of this project will foster civil engineering and local government confidence in these benefits and will ensure the provision of valuable research tools for future projects of this nature.

Case Study 4: Regent Gardens And The Intelligent Home

Project Features

Regent Gardens is located 8 km north-east of the City of Adelaide and occupies an area of 77 ha. The development within this area comprises 1250 residential home sites and includes 10.6 ha of public reserves. It is being developed as a joint venture between the South Australian Government and AVJennings Holdings Limited, in cooperation with the City of Enfield. The project is a model for future inner urban 'volume builder' residential developments, and is the recipient of several environmental and planning awards, including the 1995 National Stormwater Industry Association Environmental Management Award.

It was recognised early in the design phase that the proposed urban development would significantly increase both the rate and volume of stormwater run-off. It was also appreciated that the established, downstream residential and commercial areas had no excess capacity to handle increased flows without substantial infrastructure upgrades. In addition, the design team did not want to contribute to the pollution and increased flow rates of the River Torrens.

As a result, a unique stormwater management strategy was implemented to provide new standards for water conservation through the detention of the 'once in 100 years' event within the site and the treatment of on-site stormwater and its retrieval for irrigation purposes via aquifer storage.

In addition, an experimental stormwater cleansing system, featuring a series of retention ponds and wetlands which filter water prior to it being pumped underground, was designed.

Aquifer Storage and Recovery

The prime requirements for a viable stormwater aquifer recharge–reuse scheme are the availability of a source of relatively good quality stormwater and a convenient underground (natural) reservoir in which to store it. Regent Gardens satisfied both requirements.

The Department of Mines and Energy (MESA) sunk an ‘investigation well’ which was completed in a fractured rock aquifer.

The production and injection capacity of the well was determined at 20 L/second.

A key component of the scheme is a wetland which acts as a retention reservoir and pretreatment facility. Benefits of the wetland are its ability to improve the water quality of the stormwater before draining into the groundwater system (sedimentation of matter carrying potential contaminants such as heavy metals, bacteria and nutrients), and its aesthetic benefits including improvement of the surroundings and amenity in the area.

Stormwater Detention ASR System

The facility incorporates:

- a series of artificial wetland ponds;
- a well with a 35 m-long gravity diversion from the downstream end of the wetland;
- a controlled/monitored pump system fitted to the well which supplies water to a local reserve irrigation system;
- a standby production well which also doubles as a water quality/level monitoring point.

Automated turbidity monitoring supported by routine analyses of water quality in the wetland pond will determine times when the natural treatment process has resulted in water acceptable for injection to the aquifer.

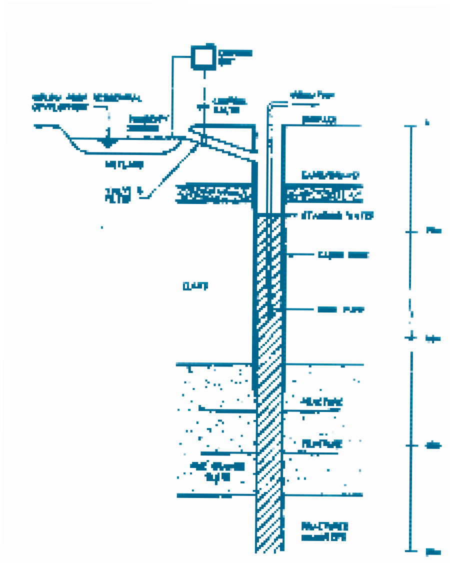


Figure 7: Borehole and stratigraphy.

A valve controls water flow from the pond into the aquifer to store it for future irrigation of the landscaped reserves, and also directs it back to the ponds to maintain water levels.

A control system monitors water levels in each of the three ponds, and also records recharge and irrigation pump flows and water level in the bore.

Recharge Quality Monitoring

A program has been developed to monitor the quality of pond water prior to recharge into the underground aquifer at Regent Gardens.

Water which is to be recharged is required to meet the ANZECC guidelines for irrigation water quality as this is the proposed end use of the recharged water upon recovery. When the recharge water does not meet the guidelines the quality must be no worse than the existing groundwater quality.

The program covers a wide range of parameters, including solutes, turbidity, suspended solids, nutrients, heavy metals (total and soluble), pesticides, herbicides and bacteriological quality. It includes monitoring over four distinct periods of seven days following a 50 mm rise in the wetland pond water level with all parameters measured each day. Metals are also analysed on the last day of the period.

To date only faecal coliform and total iron have exceeded the guidelines. Faecal coliforms are expected to die off over a period of time in the aquifer, particularly as the highest numbers are associated with the first flush at the beginning of winter. The fate of amoeba and viruses will be monitored over time.

Intelligent Home

The Intelligent Home is part of the Regent Gardens development and is designed to demonstrate practical energy and water management applications in an individual home environment. It is the result of collaborative research and development by AVJennings, the Construction Industry Institute, building industry companies, the University of South Australia and Murdoch University.

Water Management Strategy

The water technology being installed in the Intelligent Home represents a significant step in the direction of 'total water management' and involves:

- rainwater collection and use, mainly, as the base supply for the hot water system;
- treatment of bath and shower water in a gravel-based reed bed for reuse in toilet flushing.

Rainwater Collection/Use Systems

Hot water supply

The main component of the rainwater collection/use system is a 2 kL rainwater tank located on the northern wall of the dwelling. The home will provide a (roof) catchment area of some 120 m2 supplying run-off to the tank (total roof area is 160 m2).

A ground level pump beside the tank will top up water (nightly) to the hot water head tank located in the roof of the dwelling.

The (gravity) hot water head tank will be fitted with two inflow lines, each with its own ball valve cistern, one providing water from the rainwater tank, the other connected to the SA Water main. In periods of high run-off from the roof catchment, the head tank will be supplied entirely from the rainwater tank. When supply from the rainwater tank fails, mains water will be admitted to make good the deficiency on a day-by-day basis. A head tank overflow to the roof of the dwelling will be fitted to guard against tank overflow in the event of system malfunction.

Mathematical modelling of Adelaide rainwater yield from 150 m2<D> productive roof area, managed as described above and used by an average family shows an effective annual production of 32 kL from a 2 kL rainwater tank.

This will be the first monitored trial of a rainwater-supplied hot water system in South Australia.

Cold water supply

The proposed second component of the rainwater collection/use system involves supply directly to the kitchen sink—the ‘third tap’. It is essential for health reasons that this supply be subject to in-line UV irradiation treatment which destroys harmful bacteria present in roof run-off.

Greywater Treatment/Reuse System

A second and major water management innovation to be included in the Intelligent Home is the greywater treatment/reuse system.

The central feature of this system is the 6 m by 3 m gravel-based reed-bed located in the backyard of the dwelling.

Successful operation depends on many factors including input water quality, reed-bed geometry, gravel type, reed type, residence time and flow paths, climate, output water quality, and reuse operation.

In Stage I of the design, only bathroom effluent (bath and shower water) will pass to the reed-bed for treatment. Effluent from the reed bed, after treatment, will be stored in a concrete tank adjacent to the reed-bed and pumped to a head tank above the toilet cistern. Sufficiently treated greywater will be pumped up each night to meet the daytime toilet flushing needs.

An overflow from the greywater head tank will pass excess treated water directly to the sewerage network.

The system will include mains water reserve supply to the toilet in the form of a float-operated cistern in the event of malfunction (in which case a mains valve must be opened manually for operation to begin).

In Stage I of the development, it can be assumed that normal family use of water for toilet flushing—some 40 kL per annum (dual flush toilet) will be completely met by greywater reuse, with excess available for outdoor watering.

Stage II of the system, involving the addition of greywater from the laundry (rinse cycle washing machine water), is anticipated to result in even greater excess.

These two water management innovations included in the Intelligent Home layout will lead to reductions in family water use of approximately 70 kL per annum or 50% of the present SA Water domestic water allocation.

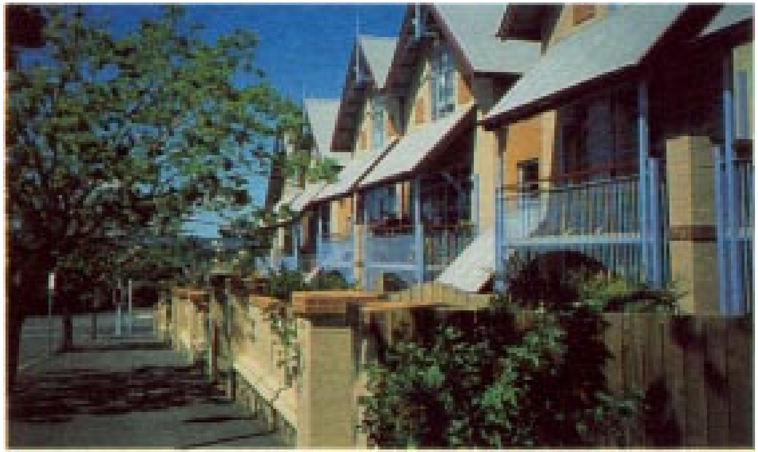
Practice Note PND 10

Streetscape and Neighbourhood Character

Scope

Market research shows that streetscape perceptions are crucial to public acceptance of new housing. This Practice Note focuses on infill housing in recognition of community concerns in some areas about proposed development, particularly in terms of street appearance. It provides a suggested process for appropriate design responses by designers.

The approach outlined recognises:



- the legitimate public interest in streetscape appearance and functioning;
- the need to ‘get it right’ in the public areas with fewer controls in the more private areas;
- the need to provide more information at the development application stage.

Desired Future Urban Character

Establish whether the municipality has identified the desired future urban character of the area. This will provide the framework for any design response

The degree of ’fit’ that a proposed development should have in an established area depends to a large extent on the amount of change that is envisaged and the time frame within which that change may occur. Ideally the local authority (with community input) should attempt to define the desired future urban character of an area, and thus make clear both the extent of change that is seen as acceptable, and the type of built form and landscape that is envisaged.

Where little change is intended, the design emphasis is on responding to the existing context and enhancing existing streetscapes. Where significant change is proposed, the design response would be guided more by the definition of the desired future urban character than the existing context.

General photograph.
One photograph should be taken looking along the street from its centre near the closest intersection to the subject site.

The rate of change is also important. Medium to long-term changes in urban character over a number of years require design responses that emphasise being 'neighbourly' to existing development, while also satisfying future visions for the area.

In the absence of a defined future urban character, the emphasis is likely to be upon 'fitting in'. Identification of existing urban character will assist designers to understand the locality and the range of appropriate responses. AMCORD Part 1, Section 1.4 identifies typical components of urban character and heritage.

Site and Street Context Analysis

Undertake a site context analysis.

A good site analysis is the basis of successful design. AMCORD calls for a site analysis plan to be submitted as part of the approvals process, and details of such plans are in PND 2: Development

Application Information. In addition to the analysis recommended in this Practice Note, there is value in undertaking a general appraisal of the locality to identify existing urban character.

A number of guidelines have been prepared by various authorities to direct and inform developments within local areas. The following case studies are extracts from guidelines prepared by the Brisbane City Council and the Victorian Urban Land Authority. These guidelines list the type of matters which should be considered during the examination and detailing of streetscape and neighbourhood character.

Case Study 1: Streetscape Guidelines for New Housing in Established Areas

The following extracts are from a survey/checklist for identifying streetscape context, developed by Brisbane City Council (BCC).

For new housing in existing residential areas, each application must include a description of the proposal in terms of its response to the existing character of the area, and a description of the area's period, style, building form, materials and detail. In addition to typical site plan, floor plans and elevations, the following information is required:

- location plan showing surrounding streets;
- site and street photographs;
- a drawing of the street elevation of the proposed building;

Photographs of the site and adjacent buildings.
Three photographs taken from the same position, with some overlap, should cover the site and two adjoining buildings. If a building on the opposite side is to be considered in the development of streetscape relationships this should also be photographed. The subject site should be photographed before any existing buildings and landscape elements are removed or changed. Photographs should be taken from the angle which reveals the maximum amount of information about the sites with which relationships are intended to be formed.

- a layout plan of the front area of the development.

In areas where the concern for streetscape is particularly high, additional information may be required, including:

- streetscape survey sheet—this is concerned mainly with the major built elements and can indicate about a street:

  - its general setting

  - the level of homogeneity or diversity

  - type of car accommodation and its dominance

  - the type of fencing;

- overall assessment summary sheet;

- building relationships sheet.

There are few areas in Brisbane with unusual intactness of building styles that constitute ‘conservation’ areas. Buildings are often changed over time through modifications and additions. Therefore an effort should be made to classify a building according to its original period.

The guidelines also provide factual information detailing those elements of the different house styles/ periods which are distinctive and assist in determining the era in which houses were built.

Two examples are:

Federation period (1890–1915)
Principal characteristics of this style:

- Walls of timber frame clad in chamferboard or hardwood weatherboard. Single skin walls to verandahs.

- High-set on timber stumps.

- Asymmetrical elevation and complex planning and roof forms.

- Timber detail more simplified but decorated with fretwork, turned timber elements and shaped valances.

- Roofs of terracotta tiles and corrugated iron, often with ventilation devices.

- Stained glass leadlight around the entrance door.

Late twentieth century
This period is typified by a diversity of styles from the Late Modern house styles to a mixture of international and various vernacular influences. There are also increasing ‘colonial’ elements being added, often without the fine proportions of the original. A single most common form could be described as:

- Usually low-set concrete slab-on-ground construction.

- Brick veneer construction (brickwork external).

- Metal (usually aluminium) windows.

- Tile roofs of low or moderate pitch.

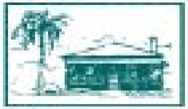
- Windows that run from floor to ceiling with various infill materials above head and below sill.

STREETSCAPE SURVEY SHEET 1

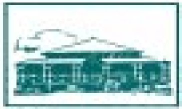
GENERAL DESCRIPTION OF AREA (Topography, Landscape, Urban Character)

HOUSE STYLES/PERIODS

(INDICATE NUMBER OF EXAMPLES IN STREET IN BOX BELOW)

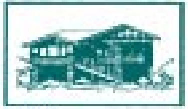


Colonial

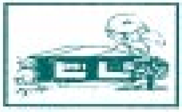


Victorian

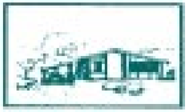
Federation



Inter War



Post War



Late 20th Century

SUMMARY (tick appropriate box)

Houses in street are

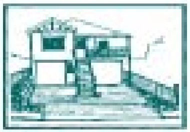
❐ Very Homogeneous

❐ Fairly Homogeneous

STREETSCAPE SURVEY SHEET 3

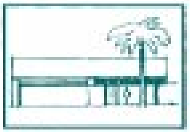
FENCING

(INDICATE NUMBER OF EXAMPLES IN STREET IN BOX BELOW)



No Fence

Open Fence



Solid Fence

SUMMARY (tick appropriate box)

Fencing in street is generally

❐ Highly Varied

❐ Moderately Varied

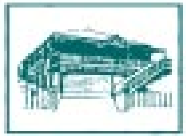
❐ Fairly Uniform

STREETSCAPE SURVEY SHEET 2

CAR ACCOMMODATION

(INDICATE NUMBER OF EXAMPLES IN STREET IN BOX BELOW)

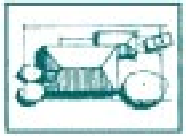
Car under building & inconspicuous



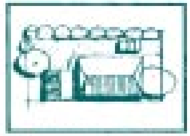
Car under building & prominent

Car in detached garage behind building line

Car in attached garage in front of building line



Car in detached carport in front of building line



Car accommodation not visible from the street

SUMMARY (tick appropriate box)

Car accommodation in street is generally

❐ Inconspicuous

❐ Evident but Fairly Inconspicuous

❐ Fairly Prominent

❐ Highly Prominent

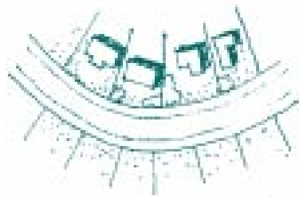
• Verandahs not prominent on front.

• Minimal or no adornment and decorative details.

Special considerations
Sites requiring special consideration, mainly due to topography and street layout, are identified in the BCC guidelines:

Corner sites
These tend to have more prominence.

Sites on a terminal view from a cross-street
A building which is at the end of a view, such as along a cross-street, usually commands some attention and may be considered similar to a corner site.



Sites on the convex side of a street bend
Buildings in such locations tend to be seen in isolation from their immediate neighbours.

Sites steeply sloping down from the street
Less of the frontage may be visible to the street and so roof forms may become more dominant. A low-set building (slab-on-ground) next to its high-set neighbours is likely to appear as a gap in the streetscape.

Sites steeply sloping along the street
Buildings on such sites usually have special prominence and tend to be seen individually rather than as part of a group.

Sites steeply sloping above the street
Building height in relation to neighbours becomes more important, with buildings being seen individually rather than as part of a group.

Sites on split level and divided streets
In some hillier parts of Brisbane, streets are sometimes on different levels separated by an embankment. The embankment between the two levels is usually an important landscape element in the streetscape.

Sites on narrow streets
Buildings in narrow streets tend to be closer to their front boundaries than those in wider streets and have generally less distance between their frontages. In these streets, buildings are viewed from a closer distance and building detail therefore becomes more significant.

Prominently located sites
Some sites in the street may have special importance because of their individual topography, size, shape, location, historical association, or possibly as a previous prominent building or landscape feature. These sites are likely to require special attention.

Sites with other reasons
On newly created sites within established areas, there may be other reasons which influence or determine the appropriate streetscape response. If so, these should be stated by the applicant.

Case Study 2: Guidelines for Williamstown Central Estate

Victoria's Urban Land Authority has developed urban design guidelines for Williamstown Central Estate to encourage new housing stock which is sympathetic in style to the existing diversity in Williamstown.

The guidelines for Williamstown Central Estate provide details which relate to the architectural style and character of the neighbourhood. Following is an extract from the guidelines which is aimed at maintaining and establishing the streetscape and neighbourhood character of Williamstown.

Design objectives

The intention is not to reproduce the decorative elements of the buildings or typical streetscape of Victorian and Edwardian Williamstown. Rather it is to encourage development which meets the established broad urban design themes, and is consistent with the building stock of old Williamstown.

It is important that the form, shape, colour and scale of a new development reflects the character and charm of Williamstown's existing housing stock, particularly the older residential areas.

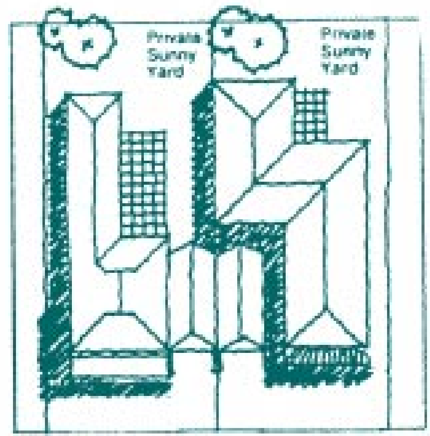
The design of new buildings should be simple and sympathetic to the dominant elements of building form, proportion, scale, colour and materials which already exist.

The design requirements cover building form, roof design, car parking and vehicle access, building materials (including brick colour and type, and the nature of mortar joints), roof materials, colours of external surfaces and fencing, and location of carports and garages. Several of these are outlined below.

Building form
Two-storey buildings must contain the following design elements:

- a combination of single and double-storey sections;
- the-two storey section located in the rear two-thirds of the dwelling;
- the encouragement of attic-type construction for second storeys;
- the minimisation of sheer or unbroken two-storey walls.

Roof design
Roofs must be pitched on that part of a dwelling, carport or garage visible from the street. Roof pitches should be:
dwellings—25 to 45°
carports and garages—12.5° min.
verandahs—5° min.



Carports and garages
A carport or garage must be located towards the front of the property, with only a single car width allowed at the front. It must be at least 5.0 m from the street frontage and no part of it is to be located between the line of the main front wall of the dwelling and the frontage.

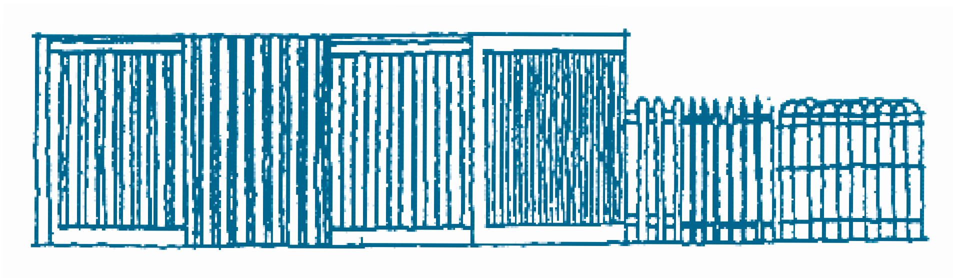
When located towards the rear of the property, it can be of double car width and its location shall not shade the north-facing day-use rooms from northern sunlight.

Fencing

Generally front fences must be ‘open’ in appearance (as illustrated below), although some are not permitted along the front.

Maximum front fence height—1.2 m.

Side fences may be built to a maximum height of 1.8 m up to 2.5 m from the front boundary. The last panel (2.5 m) should slope down towards the street to a maximum height of 1.2 m.



Case Study 3: Guidelines for the Kensington Banks Site

Design guidelines are being prepared for the Kensington Banks site in Melbourne. Extracts from the Stage One plan follow.

In addition to such details as building height, roof style, landscaping etc, the guidelines broadly set out the desired future character for the precincts within the neighbourhood. These character statements provide a strategic framework within which new development should occur, and enable specific precinct character to be established.

Design objectives

The design objective is to achieve an urban residential character that is:

- reminiscent of traditional inner Melbourne streetscapes such as Kensington, Flemington and Carlton;
- totally adapted to 21st century inner-city living with improved access and parking, proximity to public transport, and the latest cable and telecommunications technology channelled direct into every home;
- able to provide a variety of housing types from mews and studio units, through terraces and duplexes, to detached homes on their own allotments.

Stage One will have a cohesive character, evocative of the streetscapes of inner Melbourne and drawing upon unique association with the historic stockroute. The site has been divided into precincts, each developed around a main theme, and housing in each precinct will be encouraged to reinforce that theme.

Precinct One:
Streetfront character

This precinct generally faces on to Stockmans Way and forms the main entrance into the Stage One neighbourhood.
It is intended to have an inner-urban character with narrow, hard-edged streetscapes. Houses of the two-storey terrace type will typically have no or minimal setbacks (up to 1.5 m) from front boundaries. Where houses are set back from the street, front boundaries should be defined by fencing which complements the building design.

Some modelling to the facade is to be encouraged. Footpaths will be asphalt, constructed up to front property boundaries. Street trees on both sides of the road will create a leafy avenue, and breaks in the streetscape will be provided by urban plazas and grassed open spaces.

Precincts Two and Three:
Mews character

The mews precincts have the character of urban lanes and informal paved squares. Housing fronting on to the mews is to be built generally to the boundary.

Mews should be two-storey but may be single-storey if appropriate. As many car spaces and garages face on to the mews, the design of gates, doors, fencing and gardens is important and should be carefully considered, with some variety in detail. Paving in the mews will be asphalt with exposed aggregate drainage swales.

Precinct Four:
Secondary Stockroute character
This is situated around the central open space created by the secondary stockroute, a green and leafy informal parkland setting.

Housing facing the park will have elevated views along this historic open space, and will comprise lower-density semi-detached and detached dwellings.

Housing forms should generally be expressed as individual buildings, although adjacent buildings should be sympathetic in character.

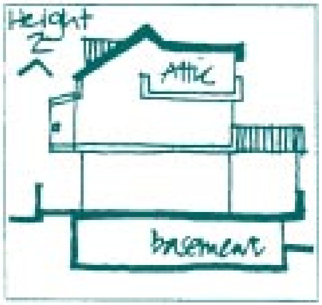
Details of fences should relate to the stockyards in style.

The general guidelines provide details on the following:
• Yield
• Street Address and Open Space
• Setback
• Building Height
• Roofs
• Private Open Space
• Landscape
• Fences
• Privacy
• Vehicle Access and Carparking
• Satellite Dishes
• Building Materials and Colours
• Changes of Level
• Engineering.

Dwellings should have a clearly identified main entrance which addresses the street and any adjacent open space, so that casual observation of these public areas is maintained. This is particularly important for the historic and secondary stockroutes which have been set aside for open space.

Building Height

Two storeys maximum; basement and roof spaces are not included in the calculation of storeys.

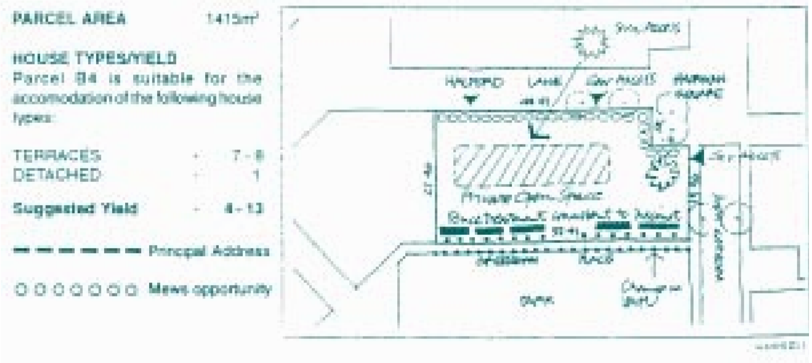


Roofs

Pitch—25° to 40°; preferred range 30° to 40°.

Shape—articulated; hips and gables are encouraged.

Precincts have been divided into builders parcels, each with a specific guideline and information sheet that draws together such key issues as access and orientation for that particular site. This helps every parcel to be developed to its full potential in terms of both amenity and yield.



Builder's Parcel B4 (shown above) is located in Precinct 4: Secondary Stockroute character.

In addition to the precinct character description and the general guidelines, there are specific guidelines for this parcel which add detail to the former. Most of these are detailed on the plan.

Quick Tips

Landscape integration
Landscape development offers opportunities to improve street appearance and integration into existing neighbourhoods. Some tips include:

- selecting trees with height, shape and mass related to the bulk of proposed buildings;
- using fewer big trees rather than a series of small trees when blending with larger buildings, to reduce the apparent bulk and increase the sense of open space;
- locating trees of adequate scale to soften transitions in storey height and to help screen the junction of new and existing developments;
- planting advanced trees to achieve immediate impact, while being cost-effective in terms of the added value it can give a development.

Image of detached housing
Where the look and feel of detached housing is desired but buildings are clustered and walls attached, consider:

- aiming for dwelling differentiation so that individual homes can be clearly identified (eg would a visitor be able to tell the homes apart?);
- making roofs of distinct dwellings look independent (possibilities include varying form, height, materials, or colour, although the pitch should generally remain constant);
- enabling individual dwelling entries to be clearly visible;
- varying each house form at the street frontage;

- providing a recessed setback to the portion of shared wall so that it is not dominant when viewed from the street;

- using complementary materials and/or colours for the building.

Garaging the car

To reduce the impact of double garages to the street, visually treat them as two single garages. This is aided by:

- using separate doors;

- recessing one of the garages (while still keeping a single internal space);

- changing the roof form to articulate and reinforce their separateness;

- detailing to make one garage more prominent (eg gable treatment to one garage);

- using complementary rather than the same materials and/or colours.

Acknowledgements

The information in this note is drawn from the following:

Unpublished Brisbane City Council Report and brochure *Streetscape Guidelines for New Housing in Established Areas* (1993) prepared by the Loder and Bayly Consulting Group, Juris Greste Consulting and Robert Riddel Architect.

Urban Design Guidelines for Williamstown Central Estate (1994) prepared fopr the Victorian Urban Land Authority by Leith Bartlett Cuthbert Architects.

Design Guidelines for Kensington Banks (1994) prepared for the City of Melbourne and Pioneer Homes Australia by Hassel Pty Ltd.

Practice Note PND 11
Multi-Dwelling Design Checklist

Scope

This list is drawn primarily from research done for the Victorian Department of Planning and Housing (Tract Consultants et al, 1990), augmented with recent findings from research undertaken for the Coalition Against Crime in South Australia (Bell,1992) and the Economic and Social Aspects Background Research Report (Scott Carver, 1992). It also includes some relevant criteria from the Design Elements of AMCORD but does not cover all provisions.

Figure 1: This housing development ensures that entry to each individual dwelling is clearly defined.

The list of topics must be interpreted as matters for consideration and not as a definitive set of requirements. Many developments are small and some of the matters listed will not be relevant. In addition, there are always trade-offs in design, and the list is not intended to be a design tool or checklist.

The list of topics provided here addresses aspects affecting resident's satisfaction with their housing. The questions focus on how day-to-day activities in the home and its surroundings relate to the physical form of the development. The list may help designers to test the general impression of a development from the users' viewpoint. Equal importance has been given to each question, although not every question will be applicable for a given development.

Topics to Consider

1. Image and legibility

1.1 Does development blend in with its surroundings and seemappropriate to its context?
1.2 Does the development minimise intrusion on adjacent land uses in respect to such things as noise, overshadowing, carparking overflow or vehicles reversing onto busy streets?
1.3 Does the development meet the need for visual variety in its design?
1.4 Do external cladding materials and colour schemes reasonably conform to currently acceptable, local standards of attractiveness'?
1.5 Does the overall impression of the development convey a 'home-like' image?
1.6 If the number of dwellings is large, are they clustered into small groups, with their territory clearly defined?
1.7 As a first-time visitor, would you sense any 'logic' in the arrangement of buildings and uses on the site? Is the site plan easy to 'grasp'?
1.8 Would it be easy to find your way to a friend's house if you came here as a visitor?
1.9 Does the development clearly define 'ownership' of all parts of the site and enable residents to feel a sense of'territory'?

2. Access and entries

2.1 Are pedestrian and vehicle accesses clearly organised, with a minimum number of entry and exit points to the site?
2.2 Is there a defined and well-lit pedestrian 'safe route' which is visible to others and which provides direct access to dwellings from likely night-use areas?
2.3 Do as many dwellings as possible have individual private front entries? (Figure 1).
2.4 Is access to front/visitor entries clearly visible from a major circulation route, such as the street or internal driveway?
2.5 Where several dwellings share one semi-interior or interior stairway, corridor or deck, is the number sharing eight or less?

2.6 Does each front entry have a porch or porch-like transition space?
2.7 Are there opportunities for residents to experience a sense of territory or personalisation around the front entry?
2.8 Is the site accessible to people in wheelchairs?
2.9 Is the dwelling entry accessible to people in wheelchairs or, if not, able to be easily modified?

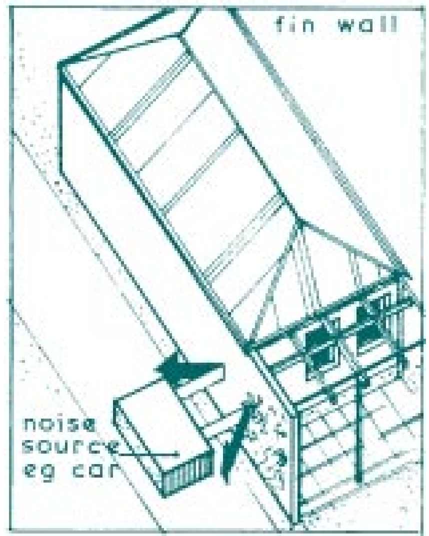


Figure 2: Arrangement and design of this dwelling ensures that vehicle noise is minimised.

Source: City of Adelaide (1993) Planning and Design Guidelines.

3. Parking and services

3.1 Is vehicle access to the site restricted to a minimum number of in/out points?
3.2 Does the location of parking areas seem reasonable, considering site size and its density?
3.3 Are communal parking areas within view of residents?
3.4 Are the accessways from parking areas to dwelling entries reasonably close, direct and visible to others?
3.5 If provided beneath buildings, is the parking area secure, well lit and ventilated?
3.6 Is there a minimum number of driveways and vehicle penetration into the site?
3.7 Are traffic calming measures used to provide a safer vehicle and pedestrian environment?
3.8 Are driveways, parking areas and garages sited away from close proximity to habitable rooms, particularly bedrooms?
3.9 Is visitor parking located close to dwellings and clearly identified?
3.10 Are mail boxes secure, of a reasonable size and conveniently located for all residents (eg en-route between parking area and dwelling entry)?
3.11 Is rubbish disposal convenient for all residents and does it enable recycling of materials?
3.12 Is there provision for secure external storage, and is bicycle parking conveniently located outside the dwelling?

4. Private open space

4.1 Do all dwellings have access to their own private open space (eg garden, patio, balcony, deck)?
4.2 Is the private open space of each dwelling clearly defined and distinct from communal areas?
4.3 Are these spaces adequately screened for privacy from passers-by or adjacent dwellings?
4.4 Do all private open spaces receive winter sun for several hours?
4.5 Are noisy places (such as roads, play areas or communal recreational facilities) arranged to minimise any adverse effects on adjacent dwellings? (Figure 2)
4.6 Is there visual privacy between main windows of neighbouring units?

5. Communal open space and landscaping

5.1 Has the site been designed so that as extensive an area as possible is traffic free?
5.2 Does the landscape design of the common open space take into account probable use by residents both day
5.3 If communal areas are fenced, is the fencing visually permeable?
5.4 Is planting kept either high (canopy trees) or low (ground covers) around paths and buildings so as not to provide screening for intruders?
5.5 Are real or symbolic barriers provided to discourage unwanted entry (eg change in level or texture, fencing, planting)?
5.6 Does the footpath and access system appear to be able to accommodate predictable patterns of use in termf its surfacing and location?
5.7 Are footpaths and accessways located and screened so as not to violate the privacy of nearby dwellings?
5.8 Is the distance between living-area windows of dwellings facing each other across open space at least 9 m?
5.9 Does the communal landscape design minimise water usage and maintenance requirements?
5.10 Are materials and fittings selected for vandal resistance and ease of replacement in places vandalism is likely to occur?

6. Children's needs

6.1 Are there opportunities to provide facilities on site specifically geared to the needs of children (eg sand pit, play equipment, etc.)?
6.2 If present, are these facilities located within sight and calling distance of most dwellings?
6.3 If present, do these facilities cause annoyance to nearby dwellings?
6.4 Can small children be contained in a yard and observed from the work areas of the home?

Figure 3: This residential development enables its residents to easily view the street, and provides an opportunity for informal surveillance.

7. Youth and adult social needs

7.1 Is the number of households sharing any one communal open space fewer than 100?
7.2 Would a resident find pleasant places to walk and sit in the common areas of this site?
7.3 Does the design provide opportunities for residents to 'watch the world go by' from their own territory?
7.4 Are spaces for youths provided that will not cause nuisance to neighbouring dwellings?

8. Security

8.1 Are most dwelling entries capable of being casually surveyed from inside other dwellings?
8.2 Can visitors be seen from inside a dwelling without opening the door?
8.3 If communal entries are provided, are they visible to passers-by, can they be locked, and is an intercom provided where considered necessary?
8.4 Has the site been designed so as to minimise hidden spaces, overgrown areas, or planting or fencing that may screen intruders?

8.5 Is the site free from ambiguous areas whose ownership or use is unclear?
8.6 Is there a clear definition between publicly accessible areas and more private or 'owned' areas, both at the boundary and within the development?
8.7 Can residents easily see the street and areas in public use through informal surveillance from the windows of dwellings? (Figure 3).

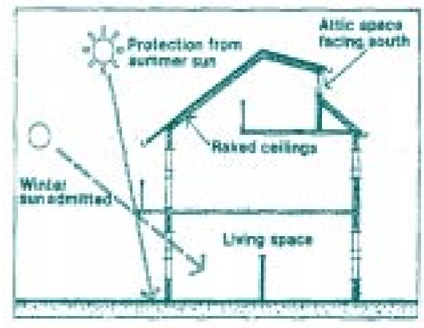


Figure 4: Orientation of this dwelling takes advantage of the sun in both summer and winter.

Source: City of Adelaide (1993) Planning and Design Guidelines.

9. Internal dwelling design

9.1 Do rooms seem reasonable in size?
9.2 Are rooms sensitively oriented to adjacent outdoor spaces?
9.3 Does the interior layout, specifically the relationship of rooms to each other and to the entry, make sense?
9.4 Do the design and orientation of the dwellings take advantage of sunlight into the major living area? (Figure 4).
9.5 Do the construction materials and fittings minimise maintenance requirements and provide adequate security to windows and doors?
9.6 Does the building design make it difficult for intruders to access upper floor windows?
9.7 Can the dwellings be readily modified internally and/or extended to meet future needs?

10. Environmental sensitivity

10.1 In temperate areas, are living areas within dwellings sited within 20º west and 30º east of true north?
10.2 Are windows adequately shaded (depending on the climate zone)?
10.3 Do the dwellings incorporate insulation (in temperate and hot-arid climates) and energy efficient design principles for all climates?
10.4 Are gas or renewable energies used for cooking, heating and hot water?
10.5 Are outdoor clothes lines provided for each household?

10.6 Do the site design and landscape minimise the use of impervious surfaces, maximise on-site infiltration of stormwater and help to maximise energy conservation? (Figure 5).
10.7 Has significant, mature or high-quality existing vegetation been retained, and in a manner that is safe both to people and trees?
10.8 In hot and humid climates, does the orientation and design maximise cross breezes and ventilation?
10.9 Does the building and landscape design incorporate methods to conserve water?

11. Cost effectiveness

11.1 Are there any inclusions required by authorities that are not essential to the health, safety, environmental or social amenity of the community?
11.2 What are the cost impacts of these inclusions?
11.3 Has the project been designed to allow further inclusions by the residents or resident body as and when necessary/affordable?
11.4 Have the parking numbers required by the authority been kept to a minimum?
11.5 Has the parking been provided in the most cost-effective manner?

12. Trade-offs

12.1 Are there any opportunities to improve the quality of the development or provide additional benefits to the new or existing community?
12.2 Would density increases and/or the relaxation of other development standards be possible environmentally in exchange for those improvements/benefits?
12.3 Does the trade-off result in a net financial loss to the developer?
12.4 Does the trade-off result in a net environmental or social loss to the community?

Figure 5: This visitor carparking area is on an impervious surface, allowing stormwater infiltration

Practice Note PND 12
Integrated Housing

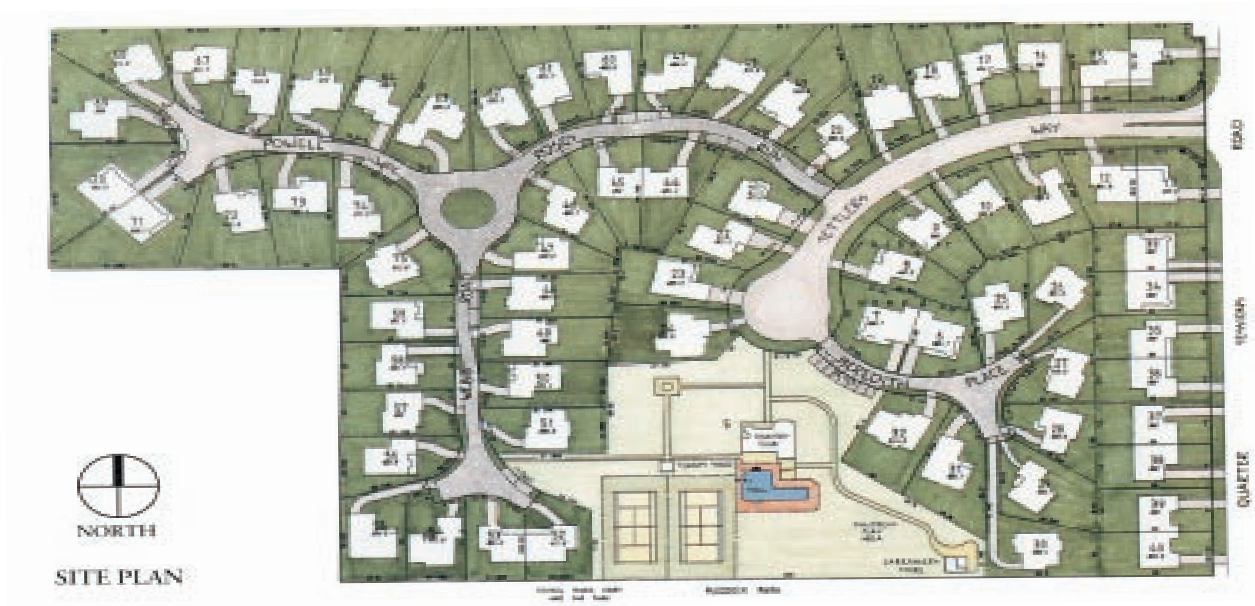


Figure 1: Settlers Green integrated housing development, New South Wales.

Scope

'Integrated housing' is a form of development suitable for performance-based proposals, and can take different forms.

In AMCORD, it is defined as 'a form of development where housing and its associated facilities are planned, designed and built by the same developer or developer–builder consortium'.

An integrated housing project occurs where the developer undertakes the site planning and development, and establishes detailed requirements for building design (in some instances, building 'envelopes' and site-specific design guidelines may suffice), with formal agreements to ensure construction is carried out in accordance with such designs.

Sometimes the same company will also be responsible for marketing; this is the most advanced form of integrated housing.

Integrated housing as a concept is significant in that important matters such as privacy, overshadowing, access, parking and landscaping are all considered at the planning stage and carried through to the implementation stage.

One of the difficulties faced in providing housing is to make it affordable while maintaining a good standard of housing. There are often additional requirements (eg the provision of garages, and observing siting conditions to ensure privacy) that are not essential for low-density housing. These all add to the housing costs.

Commencing with Site Selection

Finding the most appropriate sites for integrated housing will be based on strategic and development planning.

Sites selected for integrated housing include:

- new sites at the urban fringe;
- infill sites within existing residential areas;
- redevelopment sites within existing residential and commercial/ industrial areas.

New sites for integrated housing at the urban fringe

The creation of integrated housing sites at the urban fringe is playing an important part in achieving urban consolidation objectives, especially when such sites offer opportunities for affordable housing and choice of housing type.

In creating such sites, planners and developers recognise that people have a wide variety of housing requirements and do not necessarily accept the common example of the detached house on a large allotment as the only housing solution. Indeed, there is growing demand for a variety of housing in the urban fringe, including town houses, villa units and homes, and terrace houses.

Figure 2: Integrated housing development, Excelsior Grove, Castle Hill, Sydney.

For integrated housing in newly created residential areas, it is especially important to consider the future title arrangements, as direct competition will occur with the highly efficient detached-house industry. There is also a need to ensure that a sufficiently large amount of land is made available through zoning and other means. This is essential so that prices are not increased as a result of a scarcity of sites.

It is envisaged that such sites will have the following characteristics:

good location and accessibility: making the best located and most accessible land available to the maximum number of people;

Figure 3: Gresham Gardens, Brisbane.

microclimate considerations: locating sites to best meet microclimate objectives for intensive building (eg access to winter sun, prevailing breezes);

special site features: capitalising on the potential of special site features. For example, a site might contain a significant stand of trees. Integrated housing techniques (eg increasing densities and clustering of buildings) might relatively easily protect them by creating common open space. This would, in turn, add to the attractiveness of the housing environment.

capability of integrated development: selecting and assembling sites of sufficient size for integrated housing development.

capability of subdivision: selecting and assembling sites with potential for further subdivision before housing development proceeds.

Small-lot techniques prevent the developer from being locked into the full risk and cost of constructing a major higher-density residential project before being able to access proceeds of sales, because titles have not been created. This, in turn, can reduce the end-cost to the housing consumer.

Residential infill

An adequate supply of sites for integrated housing encourages the sharing of valuable and scarce urban land resources. This means that more households have access to commercial services and opportunities, as well as to a wide variety of cultural and recreational experiences.

Generally, infill sites will be:

- single sites;
- consolidated sites (two or more lots);
- large sites (leftover parcels of residential land or disused non-residential land that can be converted).

Infill on individual lots can present problems by adversely affecting the streetscape, causing a loss of privacy, or creating overshadowing or overlooking problems. However, these problems can be overcome by design techniques that ensure compatibility with the streetscape, maximum access to sunlight, protection of privacy, and optimum use of private open space.

Additional factors have to be considered for larger infill sites, such as development of the site in relation to the existing urban and social fabric, parking, traffic and drainage, and building siting and design.

The interface between existing and new development is critical, especially when the new development is higher-density housing.

Infill sites on non-residential land generally offer much greater flexibility as they tend to be larger.

A concept plan may be required so that development stages are coordinated within an integrated design. As some of these developments may be quite large, any potentially adverse effects on existing nearby communities should be assessed.

Figure 4: Oploo Court, Dingley, Victoria.

The site's previous use should also be carefully considered, as a site decontamination program may be necessary.

Additional road traffic may be generated, and the development may need to be integrated with the social infrastructure. Hence, these sites must be considered within a local and, perhaps, regional planning context.

The performance emphasis of AMCORD makes it unnecessary to set out any minimum site dimensions for infill sites.

Redevelopment of sites within existing residential areas
Housing redevelopment involves adding to or changing housing stock or demolishing and replacing it.

Redevelopment of sites may also involve a more extensive change to a locality, as it usually means the demolition of large numbers of existing dwellings and their replacement with higher-density forms of housing.

In selecting such sites, careful consideration should be given to the existing community fabric, and the benefits of major change should be clearly evident. Benefits may be achieved with site amalgamation, as larger sites improve the scope for integrated housing and a strengthened sense of local identity.

Criteria for selecting redevelopment sites should reflect the potential benefit to the wider community. For example:

- Sites should have ready access to important community resources, such as major business and shopping precincts, cultural and recreational facilities, and public transport.

- Redevelopment should not be detrimental to existing attractive streetscapes and landscapes.

- Significant population density increases should be possible (eg at least 50% more people should be able to share the benefits of living in the redeveloped location).
- Community services and facilities should have sufficient capacity to accommodate the increasing population or be able to be relatively easily augmented.

Developing Guidelines for Integrated Housing

Every integrated housing development will have its own special needs. During the design process it is important for designers, developers and council officers to work together to produce appropriate site-specific guidelines that can be used in the promotion and explanation of a project.

The guidelines are particularly relevant where lots are being created for housing using a variety of approaches, including:

- designing a range of suitable houses for the relevant lot sizes (the pattern-book approach) and requiring future purchasers to choose from the range;
- developing a display village of specially designed houses that future owners can choose from;
- pre-planning the siting requirements on a precinct basis so that the available building envelope is fully described.

Guidelines assist careful thought about how dwellings will be designed on individual lots. This important exercise ensures the most efficient use of available space, and the avoidance of negative impacts, such as excessive overshadowing of adjoining lots.

On the following pages of this Practice Note are some guidelines for an integrated housing development in a provincial town with a seaside location and heritage characteristics.They are included here as an example of one approach that could be used.

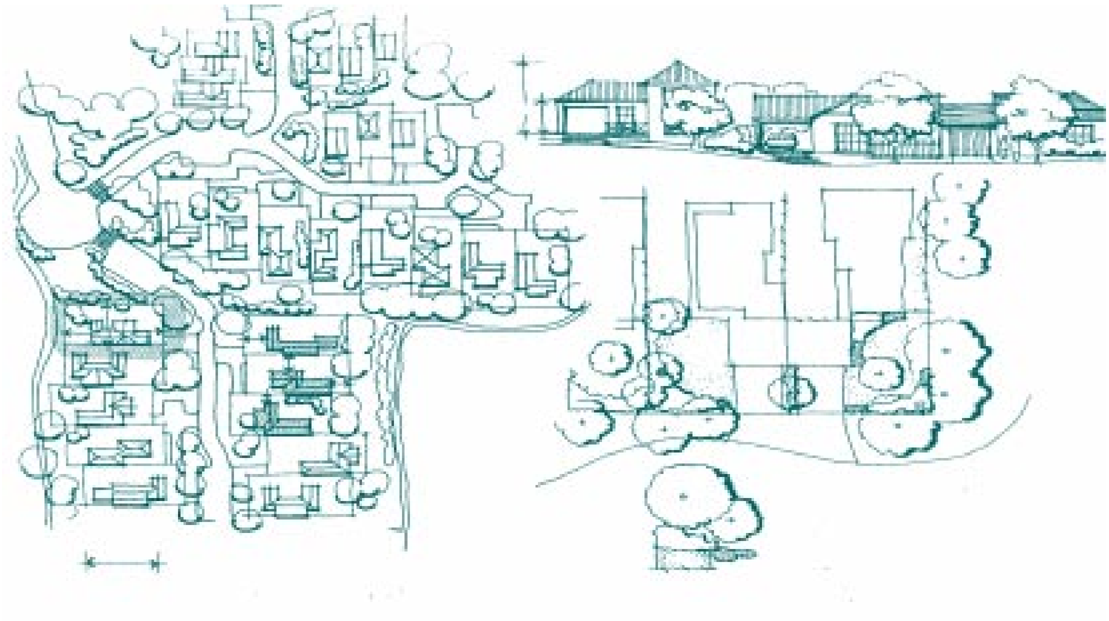


Figure 5: Site plan, building envelope plan and typical streetscape evaluation for an integrated housing project.

Subdivision into Small Lots

Much interest has been shown by the development industry in the small-lot subdivision approaches in AMCORD. The approaches offer the traditional detached housing industry the opportunity of utilising its considerable experience to produce housing forms that are attractive and cost-effective.

A variety of examples of the small-lot forms of housing now exists around Australia. They are variously described as ‘cottage houses’, ‘courtyard homes’, ‘villa homes’, ‘terrace homes’ and so on. The recent demonstration project at New Brompton in Adelaide is a good example. Other projects include Scope housing in Stratton, Perth; Urban Land Authority smart-lot housing in Timbarra, Melbourne; Green Street housing in Robina, Gold Coast; and villa homes in Forest Lake, Brisbane.

In particular, there is interest in a process that enables the subdivision of land into small lots to proceed well in advance of the construction of dwellings. This is a cost-effective approach that facilitates early sales, and significantly reduces the holding costs normally associated with such forms of housing as apartments, town houses and villa units. In essence, it is an approach paralleling that existing at the beginning of the century when builders offered to build houses on small lots in accordance with 'pattern-book' designs.

Planning for small-lot subdivisions

There is no reason why a modified version of this early twentieth century approach cannot continue today, provided the primary objective in planning any new part of a city or town (ie establishing a framework for a community that is sustainable, safe and stimulating) is not overlooked.

This means giving appropriate emphasis to the subdivision design to ensure not only that a residential area functions properly in terms of personal, traffic and property safety, but also that the potential for vandalism and other antisocial activities is minimised. Good design will also help efficient use of scarce fossil fuels and protection of natural assets.

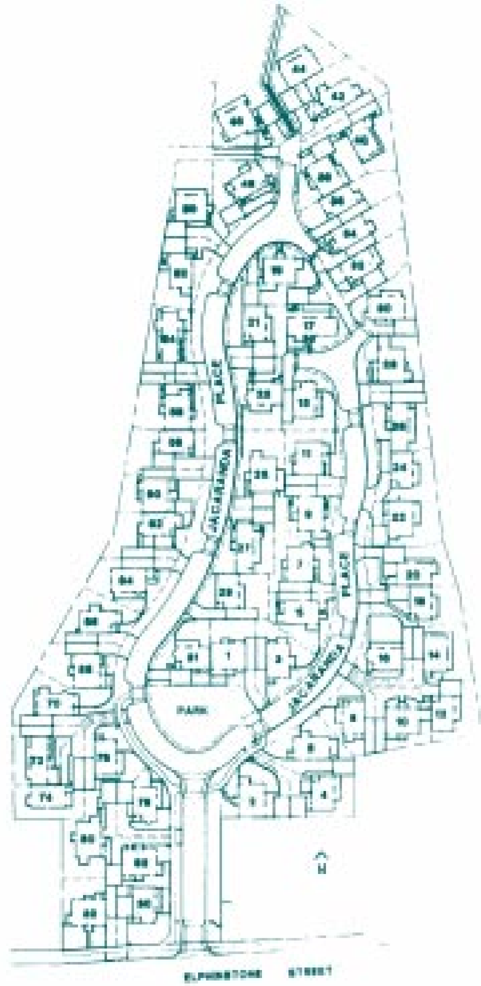


Figure 6: Site plan for stage 1 at Moverly Green, Randwick, New South Wales, where lots start at 232 m2 in an area.

The small-lot subdivision approach to integrated housing is of particular relevance, given the changes in the demographics of many localities.

Significantly, there has been a growth in the number of households where small numbers of people (one to two persons) occupy a dwelling. Such households are increasingly looking for smarter housing approaches that offer a range of positive features, including:

- the lifestyle advantages of having attractive, compact accommodation that requires minimal maintenance, allowing more time for recreation;
- the benefits of energy efficiency;
- well-designed private outdoor open spaces which serve as extensions of the main indoor living areas;
- increased opportunities for access to community resources and facilities.

Planning for larger-scale integrated housing projects involving extensive subdivision into small lots between 100 m2 and 300 m2 must deal with a range of community planning issues. It especially involves consideration of a number of important questions, such as:

- What are the objectives for the development of the area?
- What is to be the identity of this community?
- What is to be the role of the area? (eg is it to provide additional housing only, or employment and facilities as well?)
- What types of households are likely to be attracted to the area?
- What mix of housing, in terms of cost, design, location and tenure, is to be provided?

- What links will the new community have with the neighbouring areas?

- Are there any groups or individuals who will possibly be disadvantaged by the development? How will these factors be addressed?

- How will the design of future houses be controlled to ensure an integrated residential environment?

Subdivision timing
It is important to facilitate the subdivision process which should be effectively as-of-right once a site development plan has been approved.

Councils have in the past had difficulty agreeing to a small-lot subdivision where construction of dwellings on a one-by-one basis might cause disruption and complaint.

There is now a vast number of small-lot subdivisions throughout Australia, nearly all of which have been successful in the marketplace. However, there have been some problems, in particular a lack of on-street visitor parking due to the restricted area remaining against the kerb caused by an increase in driveways. AMCORD now includes considerable information on how to successfully design for small-lot housing (refer to Part 2: Design Elements).

The most common and effective technique for controlling future houses in small-lot estates is to prepare building envelope plans at the subdivision approval stage. These commonly include controls over setbacks, the position of garages/carports and driveways/crossovers, the location of courtyards, building height, and/or other criteria.

Titling and subdivision aspects
Different titling and subdivision options have evolved in response to the need to finance the private ownership of dwellings, whether on separate parcels of land (as strata units in a building), or as part of an identified community with shared facilities (either with separate land parcels or with strata units).

A key component of any strata or community title system is the creation of common or shared property, jointly owned by the proprietors and administered through a collective body (eg Body Corporate). By-laws are binding on owners and occupiers alike and, in the main, provide a behavioural structure.

The most recent product of this evolution is the community title approach found in one form or another in Victoria, New South Wales and Queensland. This system has several advantages for integrated housing, in that it allows:

- integrated housing (where boundary divisions can be applied after the buildings are laid out or constructed);
- fully or partly planned and managed estates, both large and small;
- staging of the project to improve cash flows, in line with financial and sales expectations;
- tailor-made management by-laws (which may include the requirements or controls of local government and other authorities);
- reduced capital and maintenance costs to the public where services or facilities are provided by the relevant community association (Scott Carver, 1992).

Many local authorities have recognised the opportunity to contribute to the management statement controls which they perceive as essential to the planning and management process. The inability to change those by-laws without the consent of the public authority (which is a party to them) provides sufficient security, and has contributed to the acceptance of this form of title by such authorities.

Where community title or strata title subdivisions are permitted, there is no real need for minimum lot sizes or dimensions for integrated housing projects.

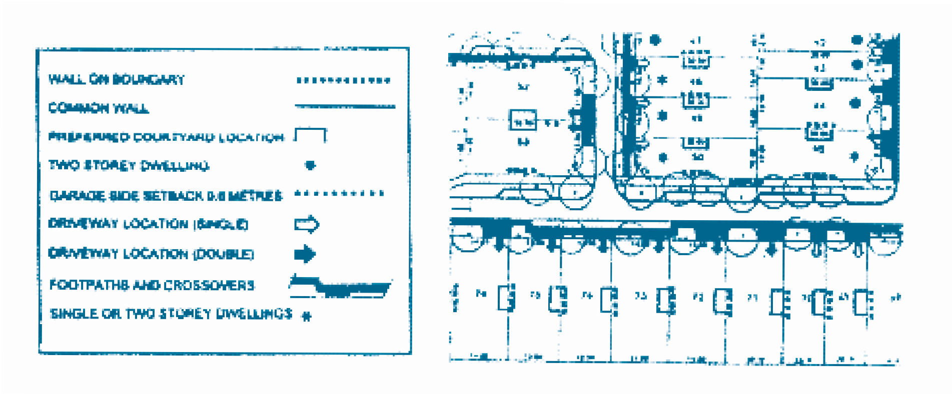


Figure 7:Typical allotment development plans associated with design guidelines for an integrated mixed allotment housing project.

Good management of integrated housing estates with strata or community titles is essential to the ongoing success and acceptance of this form of housing by the community. Care, maintenance, insurance and management must be adequately funded by levies.

Practice Note PND 13

Lot Layout and House Siting for Temperate Climates

Scope

This Practice Note has been prepared to encourage an integrated approach to the layout of residential lots in temperate and cool-temperate climates based on a number of considerations, including:

- the type of dwellings to be accommodated on the allotment;
- the positioning of the dwelling on the allotment;
- maximising opportunities for solar access and the design of dwellings which capitalise on passive solar heating, cooling breezes or other climatic factors (depending on location within Australia);
- maximising opportunities for usable private open space;
- minimising the potential for overlooking.

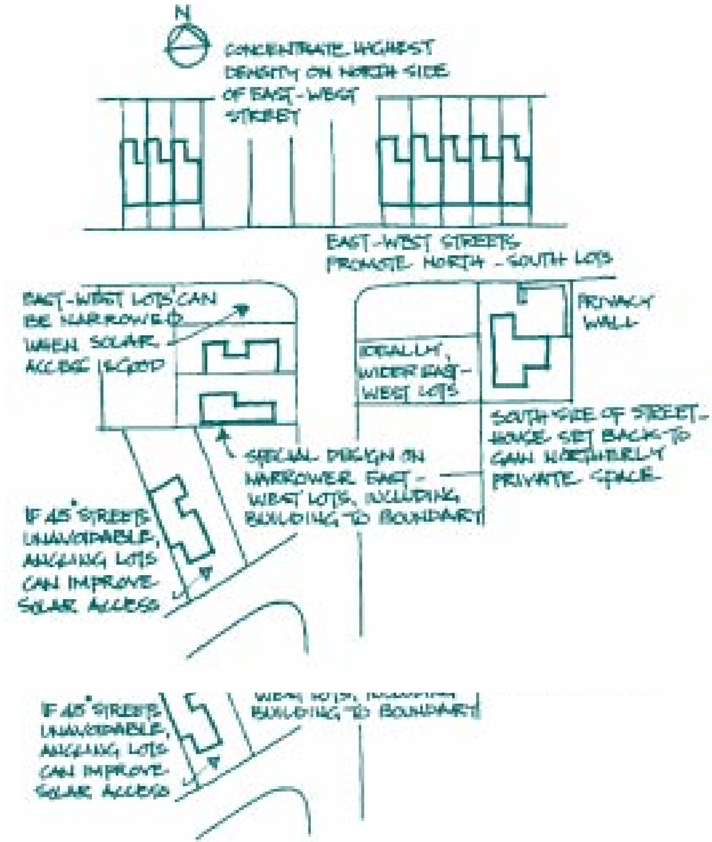


Figure 1: Allotments located to maximise efficient homes.

It recognises that the size, shape and orientation of an allotment will influence the type and nature of the dwelling to be accommodated. With this knowledge, the design of residential subdivisions can be executed in a more thoughtful and responsive manner.

The move towards providing a diverse range of allotment sizes compels the designer of land divisions and dwellings to have greater consideration to the above factors to create functional, efficient and comfortable living environments.

Subdividing for Solar Access

There are a number of design techniques that can be adopted to maximise opportunities for solar access to allotments and allow for the consequent designing and siting of energy efficient housing. For example, in temperate climates (eg Melbourne, Adelaide, Sydney and Canberra) it is preferable to align streets east-west and north-south, aiming for north- south streets within 20º west and 30º east of true north, and east-west streets within 30º south and 20º north.

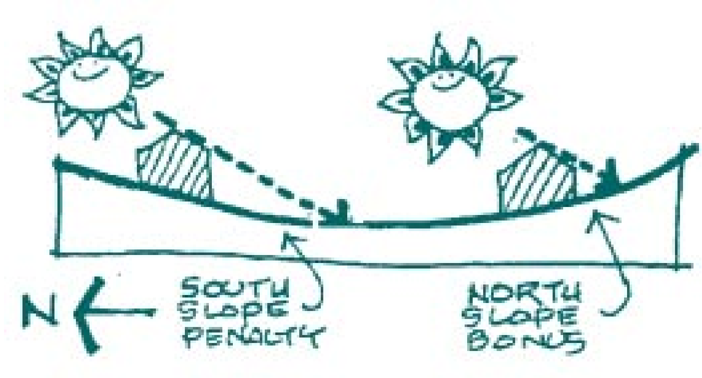


Figure 2: Deeper lots preferable on south-facing slopes.

Additionally, by concentrating smaller and narrower allotments on the northern side of east-west streets, the number of allotments with excellent opportunities for solar access to both private open space (to the rear of the dwelling) will be maximised along with opportunities for living rooms which have a north orientation. Allotments on the southern side of east-west streets will need to be wider to accommodate carparking and dwelling entries, while still allowing the opportunity to locate living rooms and private open space with a north orientation. Allocating larger lots to these locations also minimises the number of lots on which it is more difficult to provide north-facing private open space (unless high front courtyard fences are incorporated). Similarly, east-west lots should also be wider (preferably at least 12.5 m) to prevent the potential for overshadowing and provide opportunities for north-facing courtyards and living areas (refer Figure 1).

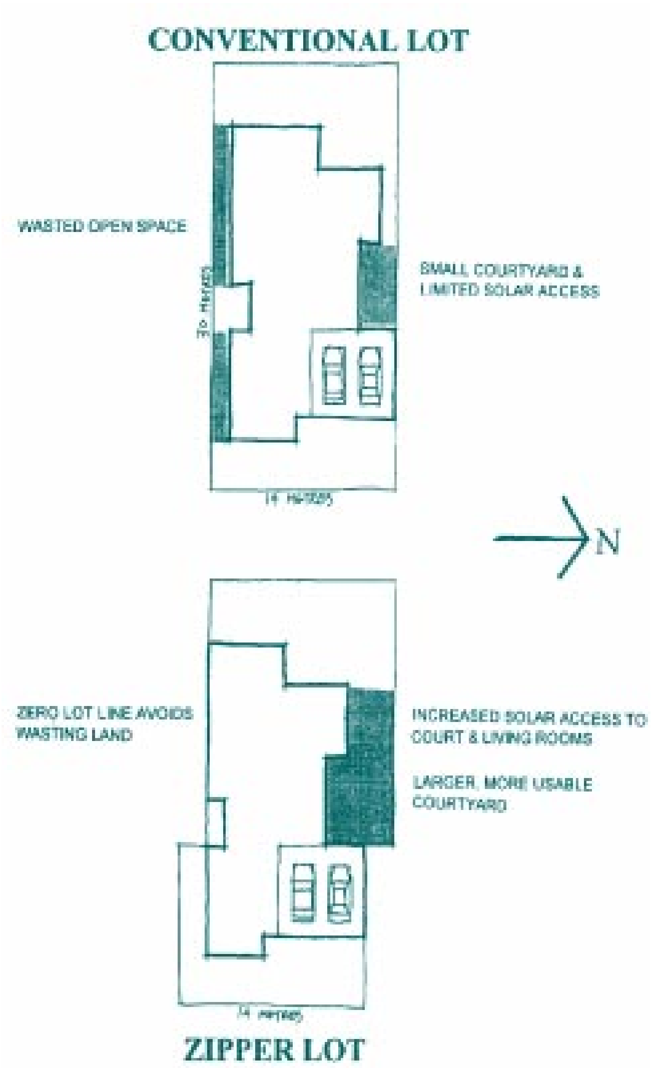


Figure 3:'Zipper' lots increase area of north-facing courtyards.

Creating regular rectangular shaped allotments maximises siting opportunities and increases the potential lot yield. On sloping sites, north-facing slopes improve opportunities for solar access while south facing slopes impose a penalty on solar access. Accordingly, smaller lots should be concentrated on northern slopes and large lots on southern slopes (refer Figure 2).

Another technique for maximising solar access for living areas and private open space in temperate climates is to create 'zipper' lots. Combined with appropriate house design and siting a 'zipper' lot can result in a more generously proportioned and usable courtyard with a northern orientation (refer Figure 3).

Other Lot Layout Considerations

A land division layout should always respond to the particular characteristics of the site and therefore generalised 'rules' should be applied with caution. While there is a move towards achieving allotment diversity, opportunities may be constrained by factors such as the slope of the land or concentrations of vegetation which are worthy of preservation. Creating small or narrow allotments on steep slopes (say in excess of 15%)

may cause the potential for considerable overlooking and overshadowing and is usually difficult to achieve due to the need for expensive retaining walls and earthworks. Furthermore, the potential to achieve significant size trees on small allotments is curtailed and therefore the visibility of the subdivision from other vantage points may be a concern. Similarly, imposing a small lot subdivision on an area which contains significant vegetation will invariably result in the removal of a substantial portion of that vegetation which may not be a desirable outcome.

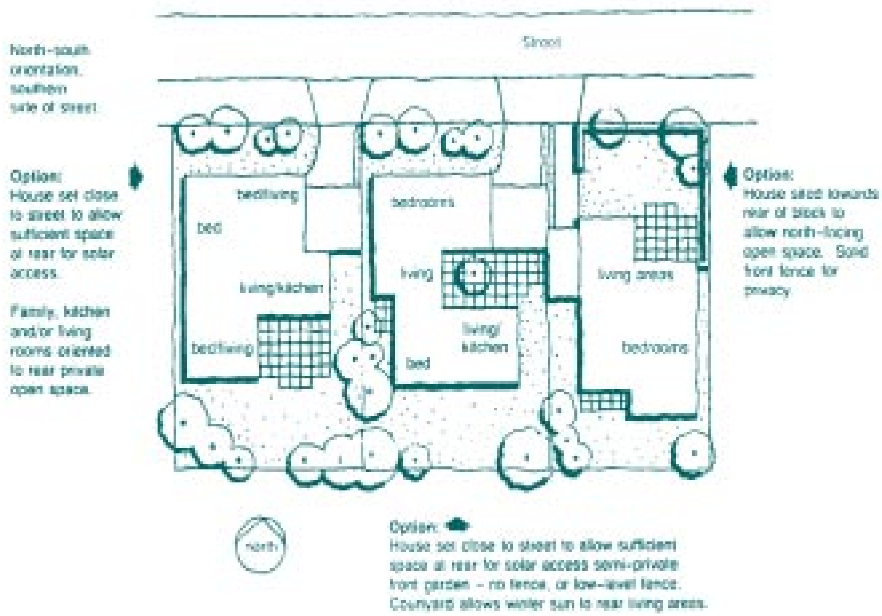


Figure 4: House siting for lots on south side of east-west streets.

Notwithstanding these factors, it is desirable to concentrate smaller allotments in close proximity to neighbourhood facilities (although a mix of allotments is often appropriate and marketable throughout a neighbourhood). Given the reduction in the area of private open space which accompanies small lot subdivisions, it is appropriate to ensure that reasonable sized areas of public open space are provided within walking distance of smaller allotments. Proximity to public transport and convenience facilities which are used on a daily basis is also encouraged.

Matching the House to the Lot

Lot layouts which are designed in response to these issues will not necessarily result in energy efficient housing with good privacy and usable open space. There is a need for housing designers

Figure 5: Zero lot line homes—on floor plan of the 5 star energy efficient home by Caj Amadio Projects.

and planning authorities to ensure that the eventual dwelling maximises the opportunities presented by good lot layout design.

AMCORD also encourages an integrated approach to lot and dwelling design at the land division stage, particularly for small-lot land divisions. This will ensure that particular allotment types accommodate the category of dwellings for which they were designed and in the intended location. This is usually achieved by creating an allotment development plan with an accompanying set of guidelines which identify, among other things, the preferred siting of dwellings, the location of courtyards, the type of dwelling (eg terrace, semi-detached, detached), height, setbacks, building envelope, number of undercover carparking spaces etc (refer Figure 4).

House Siting to Maximise Solar Access

It is worth reiterating a number of design principles which (for temperate climates) should allow for energy efficient housing design. Setback design is a critical factor in maximising opportunities for solar access to private open space and living area. Allotments on the northern side of east-west streets should be positioned close to the road boundary to maximise private open space behind the dwelling which will have excellent solar access. Allotments on the southern side of east-west streets should be set back a further distance from the road boundary to provide opportunities for private open space with good solar access at the front of the dwelling (providing a privacy wall is incorporated). Alternatively, houses can be sited to the front of the allotment if specifically designed to create an internal north-facing courtyard (refer Figure 4).

Dwellings on east-west allotments should be positioned as close to the southern boundary as practicable to provide opportunities for solar access to living areas and maximise the area of private open space to the north of the dwelling. Locating the dwelling on the boundary (ie zero lot line) in these circumstances will allow a more efficient use of the allotment and minimise areas which are not functional as usable open space (given their limited dimension and predominantly shady disposition). It will also allow enhanced opportunities for visual and aural privacy.

Care needs to be taken in these circumstances to ensure that the dwelling does not obstruct solar access to the allotment to the immediate south. This may require attention to the height of the dwelling, pitch of the roof, and location/setback of any two-storey component.

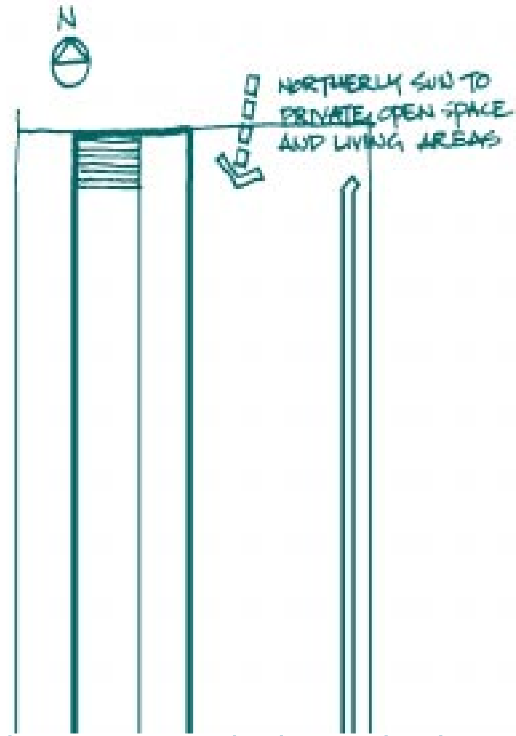


Figure 6: Two-storey (part) terrace housing on east-west allotments.

Generally two-storey housing is best positioned on the northern side of east-west aligned streets to prevent the potential for obstruction of solar access. This includes two-storey terrace or row housing. If two-storey terrace housing is contemplated on allotments with frontage to north-south aligned streets it may be possible to design the dwellings with a single storey component to the rear which is approximately half the width of the allotment (refer Figure 6). This will allow for the creation of an area of private open space and living area with a northern orientation, and reduce the obstruction of sunlight to the dwelling to the south.

Figure 7: Internal living spaces with direct outlook and connections to private open space.

Practice Note PND 14
Parking

Introduction

Providing carparking for new infill housing that meets appropriate criteria for good design can be one of the most difficult tasks for a developer.

Motor vehicles are still an integral part of our way of life. It is difficult to gain acceptance for significantly less on-site carparking, even when the household characteristics suggest a much reduced demand (eg aged housing developments) or when the location of the dwelling is near high-quality public transport.

Fieldwork assessments around Australia have confirmed that carparking provision varies widely, according to factors such as resident income, access to public transport and its quality, and the amount of space available.

Figure 1: Garages designed as integral components of their associated dwelling.

Parking takes valuable space. With high land prices in established areas, there is a tendency to require that parking in multi-unit developments be situated under the building, adding considerably to costs (up to 20%).

The design of parking areas is also an important issue. Grouped parking, which separates parking from an individual dwelling forming part of a group of dwellings, may considerably assist the overall quality of design. However, it is not popular. Grouped parking is usual in the case of multi-dwelling developments, but questions of security and access arise.

There are often requirements for the provision of on-site parking for visitors, as there may be limited frontage to a public street where on-street parking might be available. There is also a widespread perception that any impact of a proposed development should be contained within the site and that residential streets be kept free of parked cars.

Many housing projects in established areas are small in scale, making it difficult to satisfy stringent visitor parking requirements. Some existing streets are of sufficient width for some visitor parking to be accommodated.

There are also psychological considerations. Some observers believe that when the density of cars passes a certain limit, and people experience the feeling that there are too many cars, subconsciously they feel that the cars are overwhelming the environment—that the environment is no longer ‘theirs’; no longer a human place (Alexander et al, 1977).

There are three main aspects associated with the provision of parking:

Quantity of parking
- visitor
- resident

Location of parking
- accessibility
- covered/uncovered
- security

Design factors
- dimensions
- screening
- visual appearance of structures

The Quantity of Parking

Obviously there is a need, irrespective of the viewpoint taken as to the place of carparking in residential environments, to determine the quantity of carparking for any new housing development.

Typical regulatory practice has been to make a distinction between the amount of parking to be provided for visitors to that for residents.

This is a logical division as the demand for parking will vary between the two.

Residents carparking
The amount of carparking to be provided for residents will vary according to the location and to market expectations.

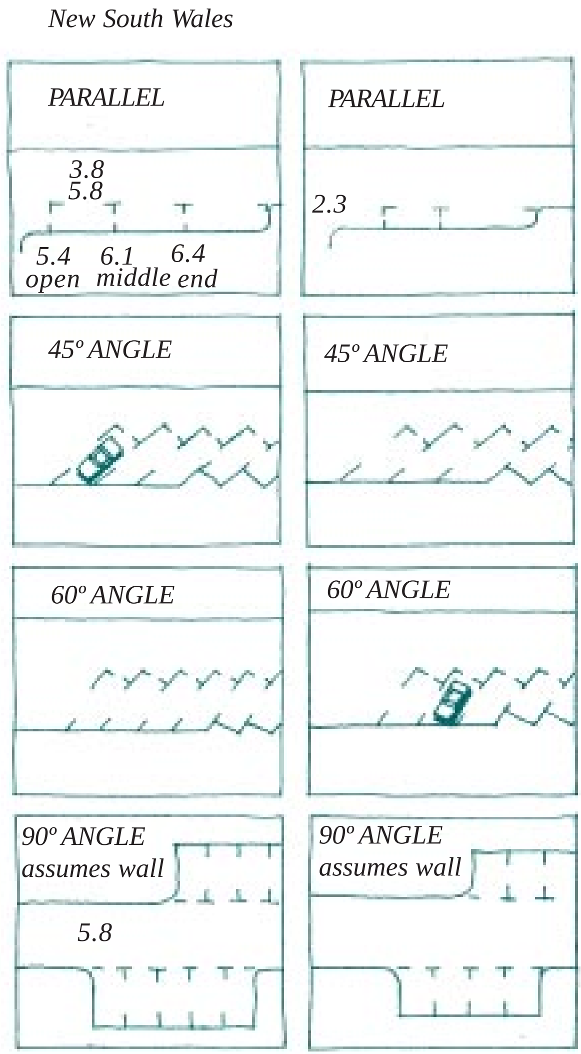


Figure 2:Typical carparking dimensions.

Additionally, it may vary from council to council, with rates based on numbers of bedrooms, size of dwelling, site area or simply numbers of dwellings.

Where new infill housing is provided in a locality of high, or potentially high, car ownership it is likely that the market will dictate the maximum provision of on-site parking for residents.

This will usually be of the order of 2 spaces per dwelling occupied by a household of 3 or more people. Generally there is no statutory impediment to the developer responding to particular local conditions by providing more spaces than a recommended minimum.

There is a question whether such a provision should be used indiscriminately. The general community objectives of trying to minimise the use of non-renewable resources, and achieve at least some return towards the use of public transport, are not served by insisting on high parking standards irrespective of the location and occupancy.

It is recommended that where new housing developments are to be located in areas with good public transport, the community objective of supporting public transport should be given emphasis by ensuring that the maximum amount of carparking provided for a dwelling be fixed, probably at one space per dwelling. This can be less, depending on socio-economic considerations or if 'special needs' housing is proposed. In areas of an infill nature close to central business districts this could be further reduced.

Consideration may also be given in the design of residential projects to enable car spaces to be transferred more freely among residents. For example where a resident had, say, one or two car spaces, that resident should be able to dispose of one or both where they have no need.

In many inner urban housing projects, car parking spaces/garages are sold separately to the dwellings, significantly reducing housing costs for purchasers who do not own a car.

Visitor parking

A significant amount of new housing is built as infill residential development in existing localities.

One of the most significant areas of complaint is that there will be increased traffic congestion in the street and/or the parking of additional vehicles as a result of visitors.

There has therefore been a tendency for planning authorities to attempt to locate visitor parking on the development site rather than allow use of the street.

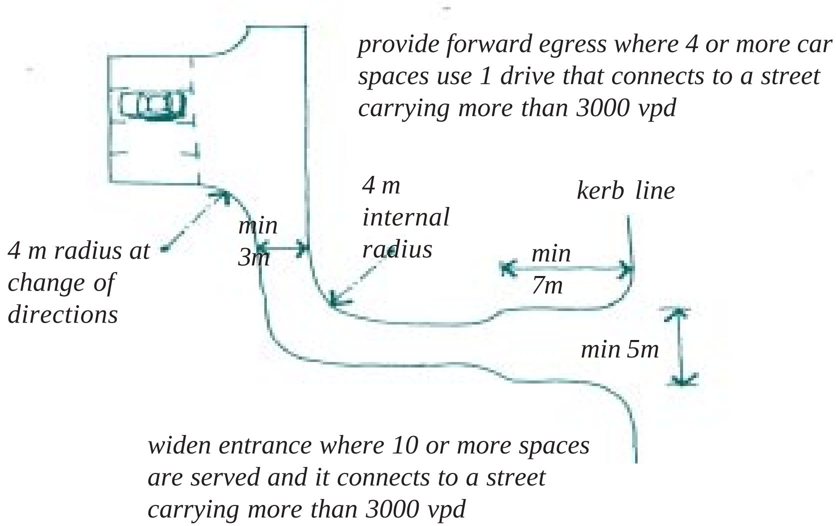


Figure 3: Access lanes and driveways.

This is not surprising in that much infill development is of a relatively small scale, often involving only two residential allotments. By the time the additional crossover is provided to the new development, there is usually only 2 or 3 spaces left in the street that could be seen to directly apply to that particular site.

However, in parking calculations some credit should be given for parking in the street.

Visitor parking should also be assessed having regard to other factors such as proximity to public transport, and the availability of on-street or other nearby off-street carparking which might be able to be used at peak visitor demand—usually at night and on weekends.

As is the case in established residential locations, there should always be an acceptance that there will be times when parking demand will exceed supply.

It is considered quite inappropriate to attempt to provide for all parking circumstances in residential locations, and infrequent events (such as parties, garage sales and auctions) during which there is an overload should be accepted as a part of living in an urban community.

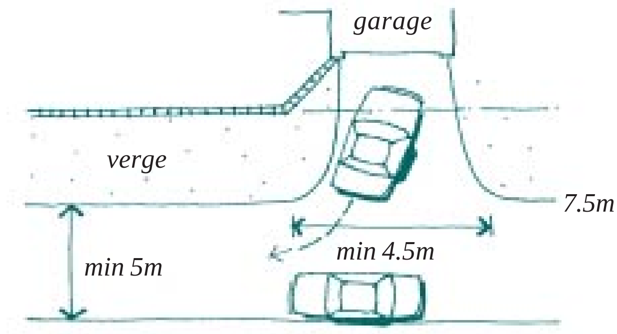


Figure 4: The crossover is splayed to enable backing into narrow streets.

The Location of Parking

Location of parking will often dictate or predetermine the site layout for an infill housing project. So too will be a requirement for all the parking to be covered.

Accessibility
A primary consideration is accessibility. The normal resident expectation is that their own parking space, whether it be a carport or a garage, will be located as close as possible to the main entrance to their dwelling.

While this has to be generally accepted, there are many successful examples, particularly in denser localities where space for vehicles is at a premium, where there has been a more flexible response.

Covered or uncovered parking?
The carport is seen as an acceptable, although second, choice to covered parking. Uncovered spaces are usually only provided in higher density locations where a covered space for every single dwelling is impossible.

Where the topography suits, or where density is high enough, parking can be achieved underground.

In some locations in Australia this is encouraged by the introduction of definitions to the planning scheme which do not include a basement as part of a storey for a residential building.

For larger urban infill projects a mixture of garages, carports and uncovered spaces is appropriate. This is seen to work very well in retirement villages where car ownership levels are not as high.

Security

In a *Pattern Language* (Alexander, 1977) it is recommended that consideration be given to small parking lots: 'Making parking lots small, serving no more that 5–7 cars, each lot surrounded by garden walls, hedges, fences, slopes and trees, so that from outside the cars are almost invisible. Space these small lots so that they are at least 100 feet apart'.

DESIGN CHECKLIST FORTHE GARAGES

In the design of garages, as outlined in Sarkissian (1991), it is possible to consider the following design responses:

- As a highest priority locate private, lockable garages within or very close to dwellings, within the enclosed property boundary. If this is not possible, allow for an enclosure to be erected by residents.
- Ensure that garages are visible from the dwelling.
- Provide a lockable storage closet within the garage.
- Ensure room in garages for a small work bench.
- Provide at least one power point in the garage for lighting, power tools, etc.
- Ensure that garage lights can be turned on from inside the dwelling.
- Locate support structures so that gthey don't interfere with opening car doors.
- If density and site requirements demand decked parking, provide only a limited number of entry points and a secure lock or plastic 'key' card operation for each. Develop management procedures to collect keys when residents move.
- Design roofs to be high enough to accomodate vehicles with rear doors which swing up, roof racks, trailers or converted vans.
- Design roofs in such a way that storage could be added above vehicle level.
- Ensure that garage roofs cannot be used to gain entry to upper-storey windows or house roofs.
- If building access is limited, provide a limited entry through the garage as well.

This is shown in Figure 5.

Obviously such a proposition should have relevance to new housing today. However, security is now a significant concern to residents, and such a response, even though it may provide a better site layout, may not be achievable.

Sarkissian (1991) warns that unsupervised share-parking facilities which anyone can enter, may attract associated criminal activity and should be avoided by designers/developers.

Ideally, parking for new housing should be capable of easy surveillance. If this is not possible, then careful consideration should be given to ensuring a high standard of security. Easy surveillance may create a need to carefully consider the appearance factor and the potential impact of the carports or garages on the streetscape.

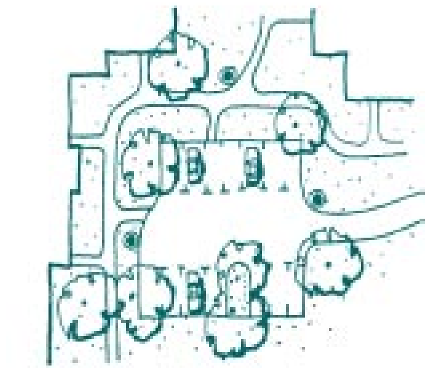


Figure 5: Security in parking.

Design Factors

Design factors such as the dimensions of carparking, the means of screening and the visual appearance of structures are important factors.

Dimensions

It is important to ensure that adequate access and ease of use of parking areas occurs as part of the design layout for a project.

Figure 1 contains some typical responses for the provision of parking.

Generally it is desirable to ensure that vehicles can be driven into a space and reversed out in one movement, leaving the site in a forward direction.

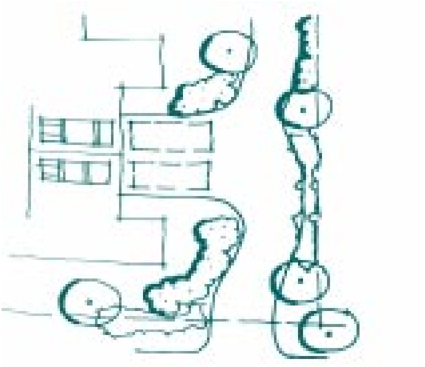


Figure 6:Tandem parking is acceptable.

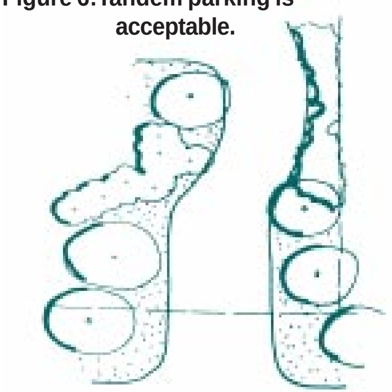


Figure 7: Bend the driveway to help screen the parking.

It is important not to be too hard and fast on these rules as there are many instances, especially for infill locations in quieter streets, where it is perfectly satisfactory for there to be reverse movement from a site of, say, up to 4 dwellings, particularly where space is at a premium.

Screening

Taking into consideration the requirements for security, it is nevertheless important to ensure proper landscape treatment to carparking areas.

This generally requires landscape strips at least 1.5 metres wide for trees and appropriate ground covers.

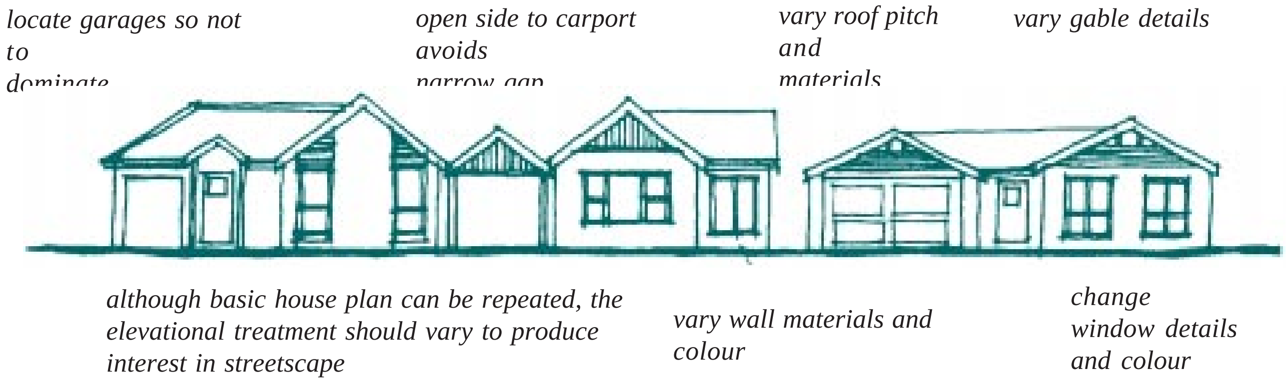
'Hard' screens such as brick walls or metal sheet walls should be avoided except where acoustic requirements dictate some form of barrier.

In these circumstances there still should be space for landscaping between the screen and the carparking area.

Visual appearance of structures

As infill housing can be in the form of individual houses on quite small allotments, eg lots with 200 square metres in area and a frontage width of 7 metres, it is important to consider the effects of visual appearance of parking structures.

A review of affordable single-family housing and associated development standards in America (W. Sander, et al, 1984), showed that with reduced frontages, garages were difficult to accommodate at



the front of an allotment. They usually dominated the streetscape, particularly when double garages were used or when they were forward of the building line.

Where there are narrower street pavements, the driveway points must be lined up so that vehicles being reversed from a site are not inadvertently backed into a car parked near to the driveway on the opposite side.

In many projects the difficulties of providing carparking to small lot developments has been dealt with by creating rear access. This has the advantage of also ensuring that the garages or carports are not located in front of the dwelling facade which is seen to be not desirable as it can visually dominate the streetscape, decrease the amenity of pedestrians, and may contribute to personal security problems.

However, since small lot housing was introduced, a range of design improvements have been developed by planners and designers to reduce the impact of garaging on the streetscape. These include:

- setting the garage back from the main building alignment;
- only allowing a single garage/carport for lots with a 10 metre frontage or less;
- highlighting the dwelling entry and/or rooms with the elevation treatment rather than the garage;
- locating the garage under the roof of two storey dwellings (eg terrace houses).

It is also appropriate to consider possible design responses for secure underground parking as follows:

- Provide underground or multi-storey parking areas with limited entry points, each with a sturdy locked gate; or each resident has a lockable garage in this space with robust, vandalproof, metal doors garages within garages’
- Maximise casual surveillance by locating the structure near streets or walkways, and by providing an ‘open’ form of construction.
- Provide only a limited number of entry points, each with a secure lock or plastic ‘key’ card operation.
- If building access is limited, limit entry through underground garage as well.

Practice Note PND 15
Landscape Guidelines for Water Conservation

Need

The conservation and more efficient use of water resources is important throughout Australia for a number of reasons including:

- the increasing costs (in monetary, environmental and social terms) of constructing and maintaining the infrastructure necessary to store, treat and distribute water;
- the scarcity of water in a dry and often drought affected continent;
- the environmental impacts of increased run-off in terms of pollution and erosion.

These alone are compelling reasons to encourage and adopt more responsible water conservation measures inside and outside of our homes. This practice note provides some guidelines on how to conserve water on individual allotments outside the home. Because of different climatic and topographic characteristics throughout Australia some of these guidelines may not be applicable or may need adaptation to the prevailing circumstances.

In an average home, 55% of water consumption is used to water the garden of which up to 80% is used for irrigation of grass. These guidelines, therefore, offer opportunities for substantial savings to households.

Physical Features of Site

Before designing a garden, the following physical features of the site need to be taken into consideration:

Figure 1: Use of mulch to improve root development.

- location of house, garage/carport and services;
- access for vehicles and pedestrians;
- natural fall of land;
- surface water runoff;
- prevailing summer and winter winds;
- views to be retained;
- views to be screened;
- solar access.

User Requirements

Water use areas need to be determined before designing a garden to ensure the provision of outdoor facilities. These may include:

- utility areas (clothes lines and storage);
- outdoor living and entertainment areas;
- paved links from house to facilities;
- children's play areas;
- protection from wind;
- provision of shade;

- positioning of services (water and power);
- space for pets.

Soil Preparation

Soil preparation is important in achieving good plant growth. The quality and characteristics of soils obviously vary from site to site. It is therefore important to identify the particular soil type and to redress any shortcomings by specific actions.

Some tips for improving soil include:

- Adding as much organic material as possible eg compost, manures and grass clippings. It is preferable to compost all organic material before digging into top soil. Given that worming tablets can effect soil worms, care should be taken if horse manure is used;
- An application of gypsum can assist in breaking up clay soils;
- Using organic mulches such as a mixture of pea straw and lucerne which will break down and add humus to the soil.

By establishing a layer of humus over all soils, microbial activity and soil worms will be encourage which, in turn, will improve the soil's capacity to hold moisture and create a better medium for plant growth.

A little fertiliser placed in the bottom of each planting hole below the root zone will also will also give plants a good start.

Weeds will compete with the plants for nutrients and moisture. They should be eradicated by digging or by suffocation with a layer of mulch.

Low Water Gardens

The main principles for reducing water use are:

- keep areas of lawn to a minimum (lawns are generally water and fertiliser hungry);
- select appropriate native and exotic species in terms of their water and climatic needs (avoid water-loving trees and plants);

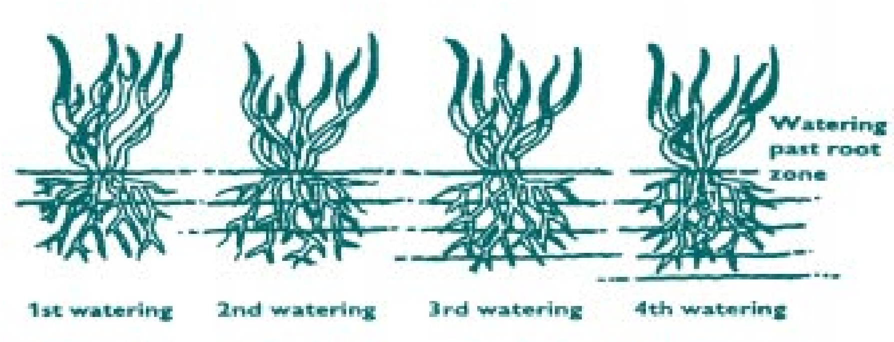


Figure 2: Cyclic watering.

- locate and group plants according to their water needs;
- design an irrigation system to minimise water wastage;
- conserve soil moisture by the use of mulches or groundcovers.

Irrigation systems

The design of the system is basic to efficient irrigation. Sprinklers or water outlets must be the right type for the system, spaced at the correct centres and be supplied with sufficient water at the right pressure.

In general, lawns are best served by pop-up sprinklers; trees and shrubs by drippers; and flower borders and groundcover by microsprays. These cannot be mixed on the same line. Each system should be separate and only used for a time appropriate to each watering method.

Micro-irrigation systems are water efficient and are used in low water-use gardens. These systems deliver small quantities of water to individual plants by drippers (emitters) or sprays (to small areas).

Some tips for irrigating gardens include:

- water only at cooler times (preferably late evening) and avoid watering in strong wind;
- water for longer periods at reduced frequency to encourage deep root growth and drought tolerance;
- develop an irrigation system specific to plant and soil type (eg clay soils need watering less frequently and flowers and vegetables need relatively short and frequent watering);
- don’t over fertilise lawns and don’t cut grass below 4 cm in height as this will reduce root depth and increase water demands;
- aerate lawns during spring and early autumn;
- practice cyclic watering, ie a series of consecutive periods of watering with short intervals to encourage water to soak down into soil and avoid runoff.

Lawns
Lawn areas are great for children and barbecues, but require large amounts of water and fertiliser to maintain them in good condition, and should be kept to a minimum. Consideration should be lawn with areas of paving or mulched garden beds.

There are some excellent drought resistant lawn grasses available throughout Australia. Guidance should be sought from a turf specialist before buying lawn seed. Consideration could also be given to using native grasses which have excellent drought tolerance and require little irrigation or fertiliser.

Mulches
Mulch reduces evaporation, provides cool root runs for plants, reduces runoff, suppresses weed growth, allows better water penetration and (if organic) encourages worms and microbial activity. This becomes important in temperate and arid climate zones where evaporation exceeds rainfall and in areas where soil erosion may be of concern.

Pine chip/pine bark
Pine bark produces an acidic soil reaction which is an advantage with alkaline soils. Newspaper mulch or other similar material can also be used under the pine chip, bark or other mulches.

Gravel
Blue metal (14 mm to 20 mm aggregate) makes a suitable mulch in regions with cold winters. It extends the growing season because it absorbs heat and irradiates it at night. It also reduces weeds and retains soil moisture.

Lawn clippings
Use only well rotted lawn clippings. Fresh clippings tend to repel water as they dry and deplete the soil of available nitrogen as they decompose. Symptoms of nitrogen deficiency are yellow leaves with green veins.

Almond shells
These are excellent on paths for reducing weeds. However, almond shell mulch which contains high level of almond hull should not be used on garden beds as they produce an alkaline substance when they decompose. Almond mulch, which has more than 90% of almond shell, is recommended for gardens.

Groundcovers
Dense groundcover plants protect the soil in the same way as mulch. Groundcovers can also be used on banks of steep slopes to stabilise them and prevent erosion. ‘Green Manures’ (eg peas, lupins, lucerne, buckwheat) can also be grown and slashed before flowers set to provide a valuable mulch layer to a garden.

Pea Straw
Pea straw is an excellent, relatively cheap organic mulch which eventually decomposes and adds

organic material to the upper layer of soil. If mixed with lucerne it will also contribute some of the nitrogen needs for plant growth.

It is advisable to aim for around 50 mm to 75 mm of compressed mulch (begin with about 100 mm). Mulch should be kept away from the stems of plants to avoid collar rot, and moisture levels should be monitored by regularly scraping back mulch.

Plant Selection

General guidelines

Selection of plant species requires careful planning. The ultimate height and spread of the plants (particularly trees), their form, habit, root system and proposed location need to be considered in relation to adjacent buildings and services and other plants.

Consideration needs to be given to the plant's foliage, colour and texture, flower colour and season and whether it is deciduous or evergreen.

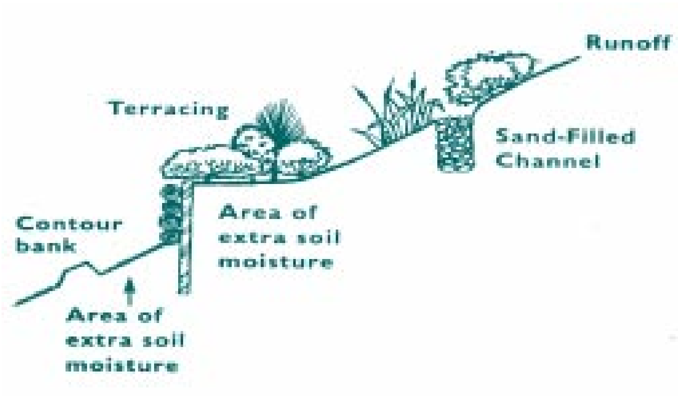


Figure 3:Water harvesting on slopes.

In temperate and hot arid climates, the use of deciduous trees, vines and creepers should be considered for planting on the northern side of the house as they provide summer shade, but permit winter sun to penetrate indoor and outdoor living spaces.

There are a wide range of native and exotic plants available from nurseries which are suitable for use in low water-use gardens. Many native species which have adapted their growth habits to suit low rainfall areas are particularly suitable.

The form and habit of the plants influences the selection and layout for the garden. For example:

- Trees provide shade and shelter from winds.
- Large shrubs screen adjoining properties and provide privacy.
- Medium shrubs add variety and colour.
- Small shrubs and ground covers replace areas of lawn, provide cool root runs for larger plants and add interest.

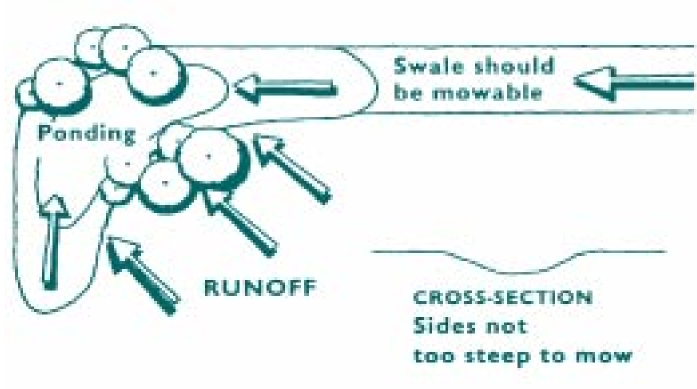


Figure 4: Use of swale to direct runoff to pond/depression.

Consideration could also be given to fruit trees (both deciduous and evergreen), herbs and vegetables. In general terms fruit trees, herbs and vegetable gardens should be well separated from other types of trees and shrubs to avoid invasive root systems, nutrient take-up and shade.

Grouping, establishing and locating plants to minimise water usage
To reduce overall water consumption it is important to group plants that require higher water consumption. A common mistake is to mix native plants and exotics. In this situation the high water demanding exotics nominate the amount of water required, resulting in rampant growth of the native plants which is detrimental to their flowering.

Other Considerations

Use of paving
Paving can be used instead of lawn for outside recreation purposes. Consider using compacted crushed rock as an alternative to clay or concrete blocks. Water runoff from paved areas should be directed on to the garden.

Water harvesting

Depending on the circumstances of the site (ie size, type of soils and vegetation, proximity to adjoining buildings) it may be possible to collect stormwater from roofs to use on the garden. Ideally, roof runoff should be directed to a storage tank with an outlet pipe to the garden. Soakage trenches consisting of sand and gravel-filled narrow channels will allow water to soak into the ground. They are particularly effective on sloping sites to avoid runoff and possible soil erosion. Swales (shallow depressions extending in line with the contours of the site) are also effective in retaining stormwater on steeper sites. They should be intensively planted to encourage water takeup.

Use of greywater

Considerable research is under way to identify the risk and benefits of using greywater (ie water from washing machines, showers, baths and dish washing) for irrigating the garden. If using greywater for irrigation, the choice and amount of detergents should be carefully considered and the effects on plant and soil life should be monitored.

An effective method of purifying greywater is to direct it through the root zone of particular species of reeds (macrophytes).

Practice Note PND 16
Design for Tree Protection

Scope

Urban development has, in the past, resulted in a gradual decline in the number of mature trees within an area. The trend towards smaller allotments and medium-density housing with reduced areas of private open space is further exacerbating this decline. In areas where mature vegetation is a major determinant of character, the incremental removal of mature trees can have a devastating effect on the amenity of the area and a more subtle negative influence on microclimate and fauna habitat.

Recognising these factors, the City of Nunawading formulated a tree policy in 1994 to provide guidance and direction on the:

- importance of keeping trees;
- principles of tree retention;
- means to successfully retain trees;
- principles used in determining whether trees should be removed;
- means to successfully regenerate tall canopy trees.

This Practice Note provides a brief summary of the policy document, which represents a suitable model for other councils' responses to the particular characteristics and circumstances of their areas. Ultimately, policies should recognise that some mature tree removal is inevitable; however, the careful integration of buildings and trees so that both may coexist is possible and desirable.

Reference should also be made to the relevant Australian Standard regarding footing construction and specialist technical assistance should be sought in devising policies to ensure that the structural integrity of buildings is maintained.

Impact Of Buildings On Trees

There are important differences between managing buildings near mature trees and locating new trees near buildings. For instance, siting a building close to a mature tree may cut through a number of stable roots (ie large roots of 5 mm to 150 mm), which can cause instability and sever nutrient supply to the tree. In contrast, a newly planted tree will determine its root system by occupying the space available to it.

Similarly, the placement of buildings or other hard surfaces above the root system of mature trees is likely to affect the health of the trees as a result of deoxygenation.

The roots of a tree will spread from 0.4 times to twice the height of a tree depending on soil moisture and oxygen levels, water table and the species of tree. In most cases, the important region for nutrient intake is within 4–5 m from the trunk of a mature tree.

Tree roots in themselves rarely cause structural damage to buildings. Damage can be caused, however, as a result of soil ‘heave’ (ie due to the absence of a source, such as a tree that formerly existed, to remove the water) or ‘shrinkage’ (ie due to extraction of water by trees). This is particularly the case in reactive soils.

Tree roots can, however, cause structural difficulties when they create direct leverage against a structure.

Six factors determine the relationship between trees and structural integrity:

- the depth and strength of building foundations and footings;
- soil type (eg clay or sand);
- climate (dry or wet area);
- the concentration of plant roots near the vicinity of footings (extraction of moisture from the soil is more probable);
- tree species (invasive or not);
- the amount of watering around the building.

The Zone Of Competition

Building foundations require a firm footing which, in some cases, is represented by a clay base. In such cases roots are predominantly lateral and located between the ground level and the clay base. A ‘zone of competition’ therefore exists where standard strip footings are required to go down to a clay base where tree roots will predominate.

Principles Used To Determine Whether Trees Should Be Retained

The Nunawading Council adopts the following principles to identify whether a tree should be retained:

- Is the tree in a location which is reasonable to retain (eg in the centre of the lot or towards the boundary)?
- Is the structure of the tree sound (ie are there any dead or dying major limbs, any major fungal or insect damage, rot, termite attack or any major forks low in the trunk)?

- Is the health of the tree sound?
- Is the species a concern (eg invasive)?
- Is the tree so significant in beauty, or for cultural or historical reasons, that it takes on an importance beyond the immediate surrounds of the site?

If the tree is sound in health and structure, and can reasonably be incorporated into the design it should be retained.

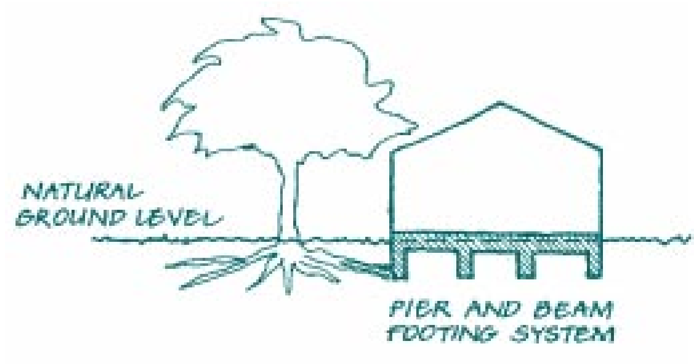


Figure 1: Pier and beam footing system.

Distance Of Building To Tree

The Nunawading Council has determined that a 3 m minimum setback should be maintained between buildings and the mature tree to be retained. This may be increased depending on the size and species of the tree.

Means To Successfully Retain Trees

Footing design

Conventional methods of strip footings and slab-on-ground will have a significant impact on mature trees. Stump footings have little impact on trees but are only suitable for lightweight construction techniques (eg weatherboard). A variation on the strip footing is the pier and beam type footing, a technique commonly used in areas where reactive clays predominate or on filled land. This involves a pier being driven down to a firm base to support the foundation. This technique can be successfully used near mature trees to provide a 'saw tooth' or 'missing tooth' profile to minimise cutting through tree roots.

To minimise damage to retained trees, the beam must be either out of the ground or at a maximum of 150–200 mm in the ground. The span between the piers is also important for minimising root damage.

Importantly, this footing technique also allows trees to be planted closer to the building than conventional footing practices allow.

Hard surfacing

Hard surfacing around mature trees should be minimised so that water can be supplied to the whole of the root zone. Where some form of hard surface treatment is required (eg driveway), its form and materials should allow penetration of water and not result in deoxygenation (eg crushed rock).

Figure 2: Paving or hard surfacing around mature trees should be minimised.

Installation of services

Trenches required for the installation of services should be located at least 3 m away from mature trees. If this is not possible, the services should be 'thrust bored' under the tree or its roots (preferably directly under the tree, as this will cause less damage).

Protection of trees during construction

The topsoil around the base of a tree to be retained and the tree trunk should be protected by an adequate tree barrier. Topsoil should not be removed around the tree and compaction of the surface should be avoided. The desirable distance for protection is at least 3 m, although this will vary according to the size and type of tree. Similarly, placement of different soil around a tree is undesirable as this can prevent absorption of air and other gases. Mulching around the tree is beneficial.

Tree Regeneration

The Nunawading Council has determined that new trees should not be planted closer than 3 m to a building. Potentially large trees should have at least 35 m² of open ground (not built or paved) to grow, with this area having a minimum dimension of 4 m. A lesser area may apply depending on the mature size and type of tree, soil conditions and the type of footing design. This area should be free of other tree canopies.

If advanced plantings are used, or if the surface area for natural seepage is constrained, it may be necessary to incorporate vertical irrigation tubes around the base of the tree to help water reach the root zone.

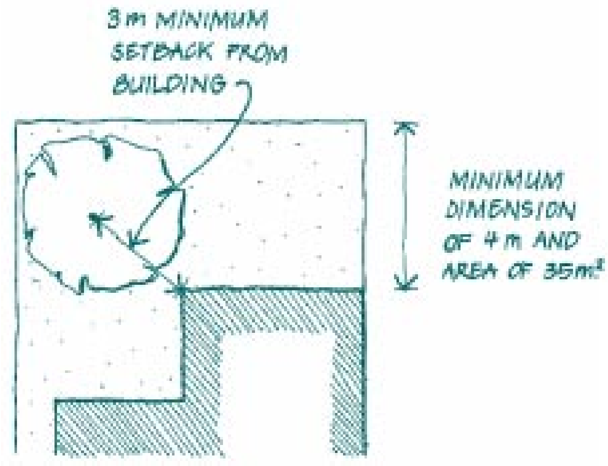


Figure 3: Trees should not be planted closer than 3m to a building.

References

City of Nunawading (1994) *Tree Policy.*

AS 2870: Residential Slabs and Footings.

CSIRO Sheet No. 10–91: Guide to Home Owners on Foundation Maintenance and Footing Performance.

Practice Note PND 17

Guidelines for Crime Prevention

Scope

The need to design for community safety in neighbourhoods and other urban areas has been increasing over the past decade. Although crime statistics are of growing community concern, research suggests that fear of crime affects people more than the actual risk to their safety. In turn, this perceived risk tends to limit the mobility of the more vulnerable, including women, children and the elderly. Where actual criminal activity is prevalent there is evidence to suggest that much of this is opportunistic and can be influenced by reducing the opportunities for unobserved crime and ease of escape.

Matters Addressed

Two issues, in particular, that can be addressed through urban design are:

- Increasing the public's sense of safety when using streets and other public spaces which, in turn, may lead to increasing public use and safety in numbers;
- Discouraging the potential for crime, including breaking into buildings and damaging property, through a combination of obvious security measures and other more subtle deterrents.

Designing for safe environments should be an integral part of the initial design process, whether for single dwellings, a medium-density housing project, shopping centres, infill land divisions or entire neighbourhoods.

Surveillance

Casual surveillance from private homes or public streets is often a most effective means of deterring antisocial behaviour. There are a number of techniques to consider during the design process:

- Orientate the fronts and entrances of buildings towards the public street and avoid screens, high walls, carports and landscaping which would obscure direct views to public areas.
- Place entrances of buildings opposite each other across the street, or group entrances of multiple-dwelling developments on to a commonly visible area to provide maximum mutual surveillance.
- Arrange living areas, windows, accessways and balconies to overlook recreation areas and provide observation points to all areas of a site, particularly entrances and carparks.
- Restrict access to the rear of sites, thereby reducing the opportunity for people to wander around (eg with gates or a continuation of side fencing to the building).
- Reduce the opportunity for people to be unobserved in foyers of buildings by providing direct access from the street and by placing windows to ensure that the area can be observed before entering.
- Install peepholes and chains on doors to monitor visitors and increase the feeling of security.
- Clearly display street numbers where they can be readily seen by emergency vehicles.

Lighting

The veil of darkness can hide and encourage inappropriate or criminal behaviour. The provision of lighting both on private property and in public spaces can be an effective deterrent. Artificial lighting has the disadvantages of ongoing costs and possible vandalism. However, solar and low-wattage technology have made lighting an efficient investment in relation to total benefits. Toughened glass lamps or shields may be required in higher-risk areas and are essential where human-scale lighting is used in public areas.

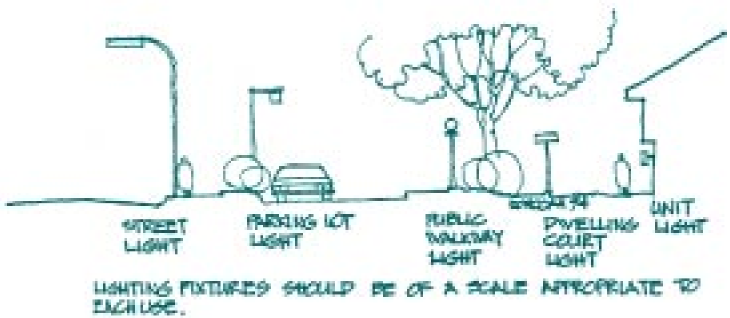


Figure 1: Select lighting appropriate to conditions and requirements.

Achieving continuous lighting of public spaces in low-density areas is not always feasible. In these circumstances it may be more appropriate to identify popular routes along which lighting is concentrated. To be effective 'safe routes' should include other measures such as signage, opportunities for casual surveillance, clear sight lines, appropriate paving, accompanying night-time patrols by police, straight routes, and appropriate landscaping.

Other considerations when designing for lighting are:

- Achieve consistency of lighting to reduce contrast between shadows and illuminated areas.
- Ensure lighting is directed towards pedestrian pathways and public spaces rather than on the road or into the windows of housing. The design of lighting must also take into account the mature height of landscaping and other potential impediments.
- Ensure adequate lighting of common areas such as corridors, entrances, laundries, lifts, stairwells and parking areas.

- Locate bright lights in heavily used spaces, but ensure that they do not create a ‘wall of darkness’ or create glare for pedestrians and motorists.

Appropriate Land-Use Mix

Encouraging a range of complementary land-use activities, which extends the duration and level of intensity of public activity in particular areas is one of the more effective means of discouraging antisocial behaviour. This will increase the possibility of casual surveillance during the day and night, and increase the feeling of ‘safety in numbers’. Some factors to consider are:

- Balance facilities such as bars and discos with other night-time uses such as restaurants and entertainment for a range of users.

- Mix uses of a compatible scale, such as primary schools adjacent to local or neighbourhood centres, and secondary schools adjacent to district centres, major recreation and leisure centres, within regional and town centres.

- Mixed uses should provide a range of day and night-time activities in close proximity, and should not segregate perceived ‘nuisance’ users such as youth from other age groups after hours.

- Reinforce activity generators along an ‘active’ edge of centres, along pedestrian paths in large parks, or on the boundary of large developments such as universities or exhibition grounds.

- Mix land uses vertically as well as horizontally (eg shop-top housing with views to public areas).

- Provide for street-related after-hour activities such as theatres, restaurants and street vendors, and limit areas that are accessible to pedestrians only (eg malls).

- Design the premises of such after-hour activities so that the public realm is visible to patrons within (eg provide for outdoor seating).

- Encourage night-time activities within public parks (eg tennis, netball, basketball, group night walks) with suitable lighting.

Landscaping

The landscaping of parks, streets, public and private car parks and private property should take account of opportunities for informal surveillance by drivers, pedestrians and residents. Accordingly landscaping schemes should consider these principles:

- Avoid vegetation which conceals paths or building entrances or which is close to windows. The use of plants with repelling characteristics such as thorns, spikes or nettles may be a useful deterrent to gaining access to ground-floor windows or other areas that need to be protected.

- Provide low to medium shrub planting with a height no greater than 1.5 m and/or taller clear-stemmed trees. This allows sight lines for motorists to be retained, as well as encouraging informal surveillance of potential car vandalism and theft. Dense planting in corners and behind high walls should be avoided.

- The mature height and spread of landscaping should be considered in order to preserve the sight lines of pedestrian and cyclist pathways.

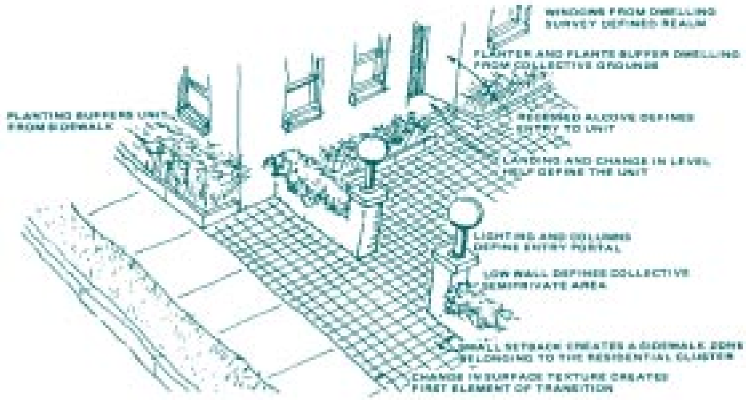


Figure 2: Symbolic barriers defining zones of transition.

Boundary Delineation

Clear delineation of public and private space can assist in deterring trespass. The use of building features, shrubbery, changes of level and low to medium-height fencing should clearly delineate property boundaries and private spaces. Fencing should be used to prevent easy access to the site from outsiders, without creating a fortress. High courtyard walls obscure opportunities for resident surveillance of the street and vice versa. Exceptions may need to be considered where traffic noise is a problem or where screening for private open space is required.

Public Telephones, Toilets, Street Furniture and Bus Shelters

The location, design and material selection of public facilities such as telephones and toilets can go some of the way to preventing deliberate vandalism. Some measures which should be considered include:

- Locate public toilets at well-illuminated park entrances or close to commercial areas where they are more visible to casual surveillance by passers-by. Facilities should be well-lit with vandal-proof lighting, be clear of landscaping which might obscure sight lines from roads, paths and houses, and have pedestrian paths concentrated in the vicinity.

- Street furniture should be selected for its quality of workmanship and materials to ensure long-term durability. A high-quality finish which contributes in a positive way to a pleasant streetscape may have an effect on reducing vandalism.

- The design should vary depending on location and circumstances. However, preference should be given to robust materials which do not have components that can be easily removed.

- There should be clear visibility of bus stops and train stations with well-maintained and lit shelters that allow direct views to and from the public street.

- Provide passenger information of routes and timetables at each bus stop and train station.
- Avoid locating bus stops adjacent to vacant land, lanes, car parks or buildings set back from the street.
- Telephones and public toilets should be located close to well-utilised areas which are open into the night (eg restaurants, local centres).
- Provide effective signage in suitable locations to direct pedestrians to various facilities.

Pedestrian and Cycle Routes

- Focus pedestrian movement after dark along a few, well-used and observable entry and exit routes.
- Ensure that those routes are the most direct and logical routes between commonly visited locations.
- Provide comfortable places to sit and socialise adjacent to building entrances.
- Provide separate areas for teenagers to sit or socialise so that territorial conflicts do not occur. Ensure, however, that these 'territories' do not violate the security of dwellings or other buildings, or compromise the safety of pedestrians or cyclists.
- Provide adequate, vandal-proof lighting which does not cast dark shadows.

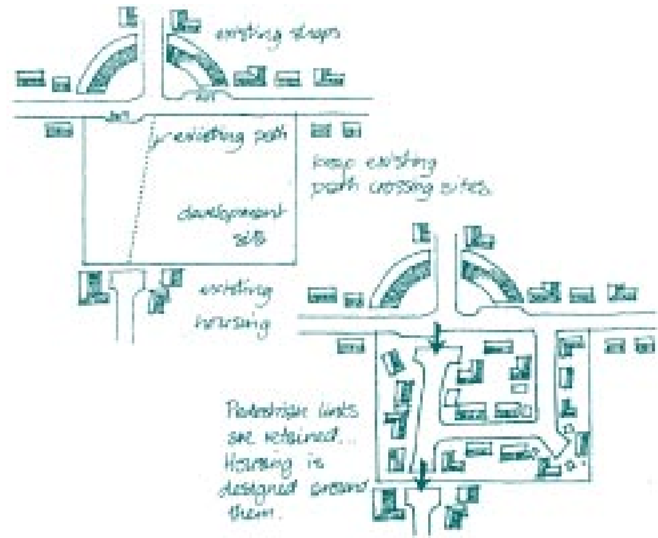


Figure 3: Infill development should attempt to retain and reinforce established lines of communication.

- Locate the dwellings of particularly vulnerable groups (elderly people, families with small children) close to the services and facilities they frequently use (eg shops, seating area, play space).

- Minimise the likelihood of a potentially intimidating group (ie young men or teenagers) taking over some space en route by locating facilities for them elsewhere. For example, if the route older people must take from their homes to shops or the bank passes through a schoolyard or playground dominated by young people, consider re-aligning the path or allocating units to older people in less vulnerable locations.

- Provide clearly marked ‘exit’ points to an area of high pedestrian or vehicular traffic every 500 m along recreational bicycle and pedestrian paths.

- Provide bicycle parking which can be informally surveyed from streets, and buildings or by parking attendants.

- Pedestrian and cyclist paths should be well-lit and signed, and should avoid underpasses and dense clusters of trees next to the path and at stop points such as road crossings.

- Avoid the necessity for grade separation along pedestrian and cyclist paths, or provide safe, alternative, and clearly marked at-grade crossing points.

Centres

- Development within centres should provide carparking areas and other transport facilities next to after-hour uses such as video stores, fast food outlets, late-night chemists and entertainment facilities.

- There should be an appropriate mix of activities and uses aimed at extending hours and levels of activity.

- Public spaces should be bounded by a range of compatible day and after-hour activities (eg schools, local shopping facilities, community facilities).

- Pathways and public spaces in centres should be identifiable, legible, appropriately lit and visible.

- Entry and exit points to centres should be well-defined and signposted.

- Casual surveillance should be possible from adjacent developments.

- Public and private spaces should be clearly defined.

- Landscaping should enhance security (eg avoid dense shrubbery that will conceal attackers, specify high-branching trees).

- Automatic teller facilities should be located in well-lit and highly visible areas, preferably adjacent to other after-hour activities.

Public Open Space and Public Spaces

- Provide seats on the perimeter of the park or other space for use by people with mobility problems or concerns about security and to encourage viewing into the space.

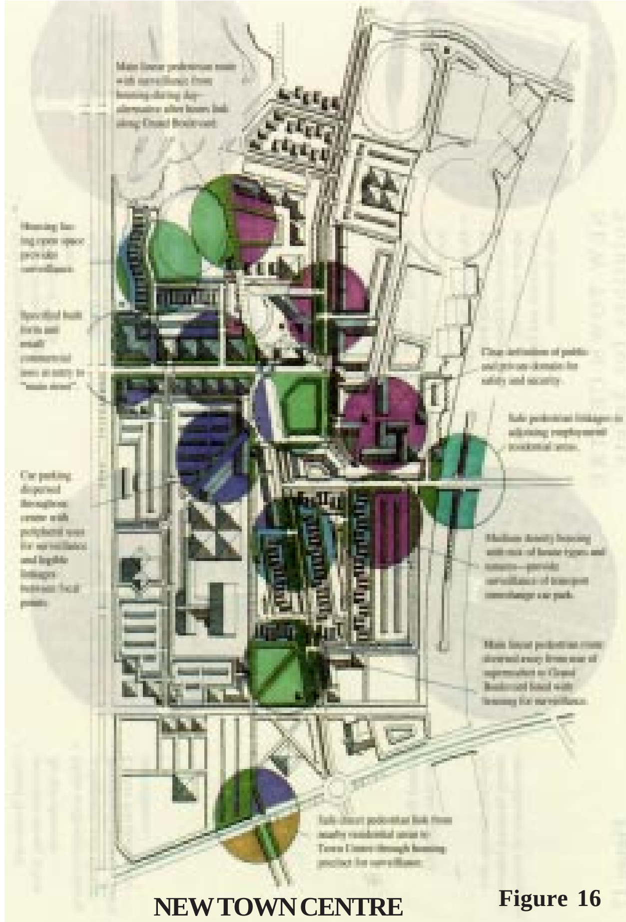


Figure 4: Crime prevention for new town centres.

- Ensure that the path system and overall layout allows pedestrians to observe an area of potential social contact before entering it.
- Ensure that open space, community buildings and other structures are capable of casual surveillance from the activity rooms of adjacent dwellings.
- Ensure that open space is attractive to legitimate users so that heavy use will discourage antisocial activities.
- Ensure that open space and paths are well-lit and has good sight lines for easy surveillance.
- Public toilets should be provided in all neighbourhood and larger parks. The buildings should be designed to maximise safety including being well-lit, with no recessed entries, and using steel instead of porcelain fixtures.
- Locate larger parks within easy walking distance to public transport systems (200 m walk preferred).
- Accommodate shortcuts through public spaces and ensure that there are several clearly visible escape routes.
- Encourage people to stop and linger by incorporating dense furnishing, attractive focal elements and defined edges.
- Accommodate heavy use and minimise vandalism without ‘hardening’ the design.
- Design public spaces for year-round use.
- Ensure that no boundaries render the public space visually or functionally inaccessible to passers-by.
- Consider visual and functional transitions between the public space and adjacent buildings.

- Encourage ground-level uses in buildings which can contribute to the enlivening of the public space (eg cafes with comfortable outdoor seating, rather than offices or blank walls).
- Design subspaces so that a person sitting there alone will not feel uncomfortable or unsafe.
- Design public space as part of the central area's pedestrian and cycle circulation systems, linked to safe neighbourhood pedestrian and cycle paths.
- Locate public space along direct routes in front of building entries and ground-level uses.
- Consider the eventual height and mass of mature vegetation with regard to shade, views and maintenance.
- In terms of public art, consider both the maintenance and ecological costs of various designs and operating systems.
- Display names and addresses of all buildings clearly on walls in high-contrast

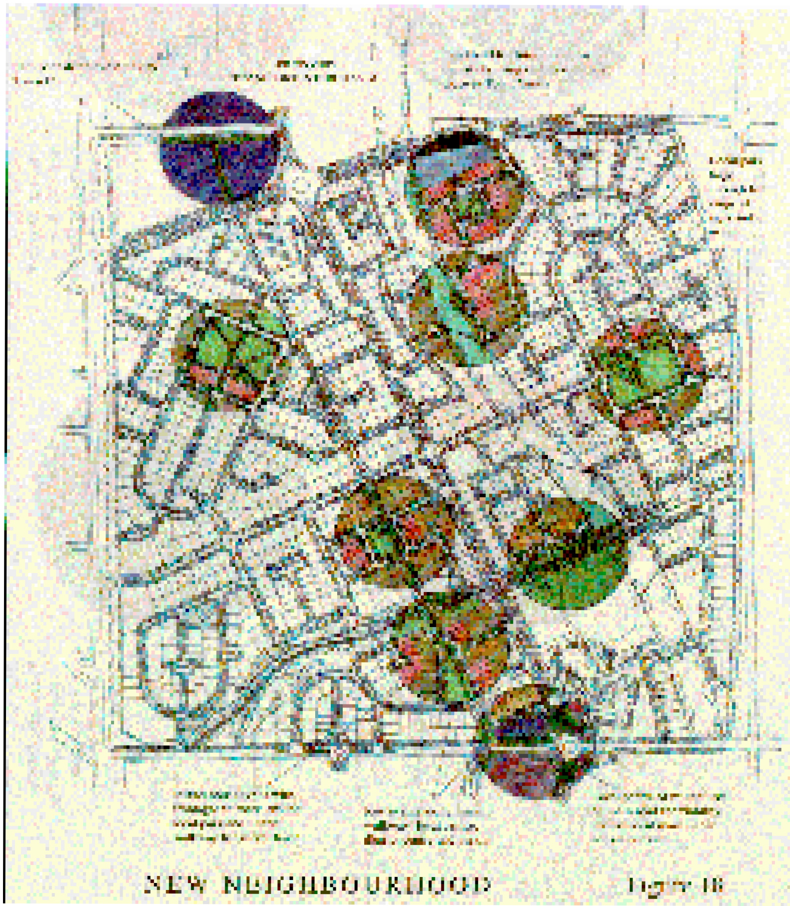


Figure 6: Crime prevention for new neighbourhoods.

letters in well-lit positions and ensure that building entrances are easily identified.

- Consider providing a clear, well-lit, glass-enclosed map of the central area, showing ‘you are here’, names of nearby streets, public transport stops, taxi ranks, safe pedestrian night routes, cycle paths etc.

- Ensure that there will be adequate staff to maintain the public space and environs.

- Develop management policies that encourage extended hours of usage through special events and involve the community in planning and managing festivals, exhibitions, concerts and performances.

Vandalism

- Specify materials that withstand normal hard use and can easily be replaced.

- Use standard-sized panels, light globes, panes, fittings etc to facilitate speedy replacement.

- Avoid obvious ‘problem’ materials which encourage willful damage. These include:

  - soft-textured wall finishes which can be easily scratched or damaged (especially in entry or accessways);

  - large, long areas of light-coloured wall finishes susceptible to spray-paint graffiti;

  - light-coloured wall finishes next to planting beds (or any but paved surfaces) where rainfall or irrigation is likely to cause unsightly staining;

  - glass (especially full-length glass) in vulnerable positions, particularly along much-used public access routes;

  - tiles or glass below the height of ground-level windowsills;

- external copper and lead piping, which are vulnerable to theft;
- painted metal or wood posts or fences in public spaces;
- flimsy panelling or lightly constructed wood fencing in public areas;
- loose pebbles or rocks in landscaping. Especially avoid ‘tan bark’ as it never lasts, stains paving and brickwork, and is a significant hazard for older people or people with disabilities.

• Use textured or ‘fluted’ surfaces, paint walls different colours, or plant vines to cover large wall spaces to avoid graffiti.

• Allocate adequate funds for staffing to speedily repair damaged or worn areas or to rectify obvious design flaws.

• Replace all defective lights regularly, as a result of systematic reviews of lighting performance.

References

Sarkissian, W (1984) *Safe as Houses: A Manual for Crime Prevention in the Design of Medium Density Public Housing*

Bell, W (1992) *Crime Prevention: A Planning and Urban Design Approach.*

Bell Planning Associates (1995) *Role of Urban Design in Crime Prevention and Community Safety.*

The Centre for Residential Security Design (1973) *A Design Guide for Improving Residential Security.*

Practice Note PND 18

Design for Temperate Climates

Scope

This Practice Note provides a number of case studies which each exhibit energy efficient design principles and are contained in the document *Energy Efficient Housing Manual: Design Guidelines and Case Studies* (1994) prepared by Energy Victoria. The guidelines have been specially formulated for Victorian conditions; however, they are equally applicable to other temperate climate areas throughout southern Australia.

Also included is a case study summary of Stringybark Grove, a medium density housing project in Sydney which adopted energy and water efficient design techniques. Further information can be obtained from the NSW Department of Urban Affairs and Planning.

Figure 1: Stringybark Grove.

Case Study 1: Stringybark Grove

Energy efficient design principles used at Stringybark Grove

At Stringybark Grove housing has been designed using passive solar design principles. As a result heating is mostly provided free by the sun and artificial cooling is not needed.

Living areas and windows face north and to prevent the house from overheating in summer, the eaves are extended to prevent the summer sun's rays entering. The angle of the winter sun is low enough to come in below the eaves.

Windows facing east or west are either eliminated or given adequate screening in summer to keep out the low angle of sun in the mornings and afternoons.

To maximise the houses' ability to store the sun's heat effectively in winter, concrete is used for the floors. The thermal mass of concrete enables it to absorb heat; once room temperature starts to cool and the concrete becomes warmer than the air, the heat is released from the concrete.

In summer, strategically placed windows and the stairwell let cool air circulate. Ceiling fans in all living and sleeping areas provide essential air movement when there is not enough breeze to do the job. Combined with careful use of windows and shading, this ensures the house stays comfortable all summer without needing air conditioning.

Contained energy
Building materials with a low contained energy have been used. Timber has been used for window frames instead of aluminium; and timber walls have been used for the upper floor instead of brick.

The total contained energy used in construction is more important than the contained energy of the individual components.

Water efficient design
Each townhouse has dual flush toilets and low-flow, aerated taps and showerheads which add bulk to water flow so that less is needed for the same effect.

Rain-water will be collected and piped into a 21,000 litre underground tank from where it will be transferred by solar powered pump to a 240 litre storage tank in the roof space of each house. This will provide the water for toilet flushing, garden watering and car washing. The underground storage tank will only need topping up from the water mains during times of low rainfall.

A second underground tank, with a capacity of 21,000 litres, has been constructed for detention of

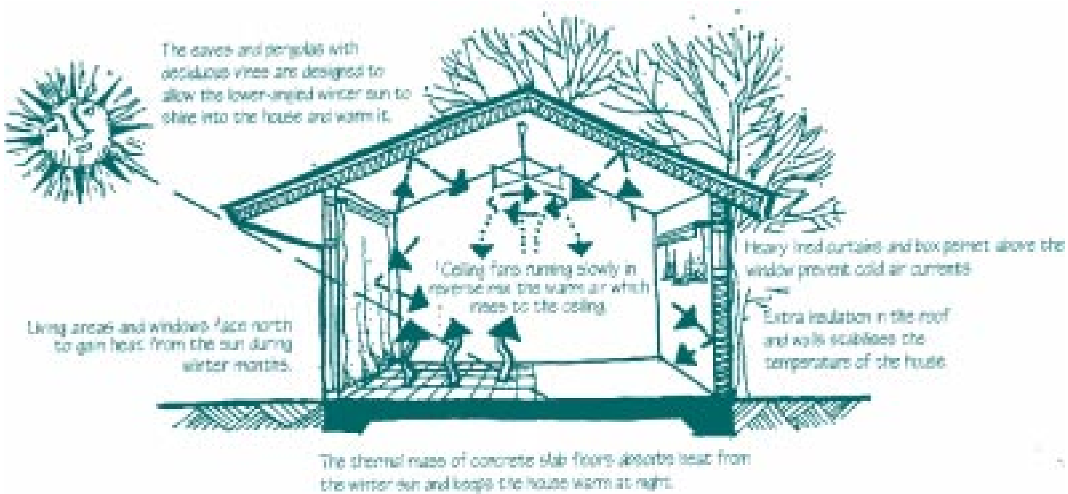


Figure 2: Energy conservation principles used in housing at Stringybark Grove (Winter).

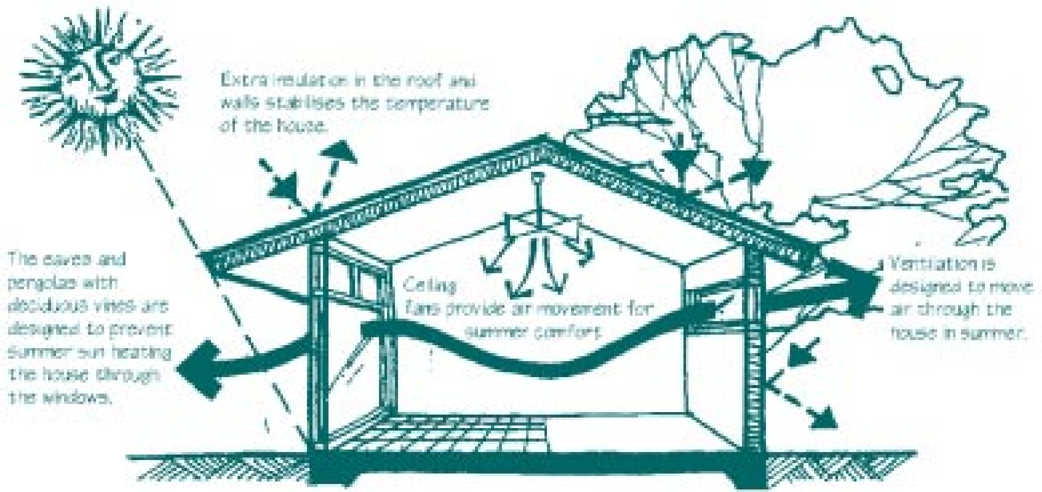


Figure 3: Energy conservation principles used in housing at Stringybark Grove (Summer).

storm-water. This will temporarily detain storm-water on the site until the peak of the storm has passed, allowing it then to flow away at a slower rate into the main storm-water pipe under the street.

Landscaping and environmental management
The gardens have been specially designed to reduce dependence on watering.

The design criteria for the siting and building of the townhouses included the desire to minimise hard (impervious) ground surfaces and maximise rain-water penetration. More than 40% of the area of the site is landscaped.

Waste materials were recycled on site. Disturbed topsoil was stockpiled and used in landscaping. Excavated sandstone was used for fill behind the retaining walls. Recycled crushed concrete, obtained from a recycling plant, was laid to form the base of the driveway.

Case Study 2: Green Home

Australia's first Green Home display house, that complies with the ACF Green Home guidelines, is set in Roxburgh Park, a new housing estate in Melbourne's north-west outer area. It is designed for the first home buyer. It features energy efficient design of the building fabric, good selection of appliances and building materials, and water saving features.

ACF Green Home Guidelines
The Australian Conservation Foundation (ACF) Green Home guidelines were launched in March 1992. They set out requirements for material selection, energy efficient house design, appliance selection, and water usage, in order to minimise environmental impacts including greenhouse gas emissions. A design and construct competition for a two storey display home for the Department of Planning and Development was run in June 1992. The winning design is described below.

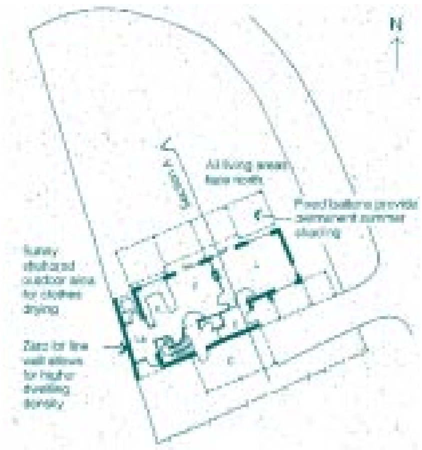


Figure 4: Ground floor plan.

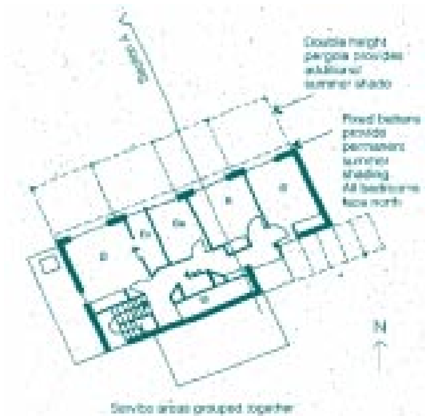


Figure 5: First floor plan.

Site

The site chosen for the display home is 620 m² in area, which is greater than the maximum Green Home requirement of 500 m². In order to satisfy this requirement, a 1650 mm high timber fence was erected at an average distance of about 8 m from the south boundary, thus reducing the area to the required 500 m² (Figure 4).

A corner site was chosen in the subdivision to give prominence to the building. The site is nearly flat and has good solar access. Views to the city, the Dandenong Ranges and the You Yangs can be obtained from the upper storey of the building.

House Design and Zoning

The house is 150 m² in two storeys. It is freestanding. However, the western boundary wall in the laundry butts onto the zero lot line. All spaces except the entry face north (Figure 4).

The wet areas are grouped together on both levels to reduce hot water pipe runs.

Windows

Windows are timber framed using recycled timber and fitted with single glazing, except for south windows which are double glazed. Curtains or blinds are fitted to all windows.

North Facing Windows

North facing windows on the ground floor are 13 m² in area and are 26% of the concrete slab floor area. On the first floor the north windows are 5 m², 15% of the timber floor area.

Shading of Windows

The north facing windows are shaded by the two storey pergola (Figure 5). Fixed battens provide summer shading to the windows (the width of the battening varies according to the sill height of the window) while the deciduous vine that will grow on the recycled steel mesh frame will provide a delightful shaded outdoor area. The east window is shaded by a fixed screen, and both east and west windows are small and fitted with internal reflective blinds.

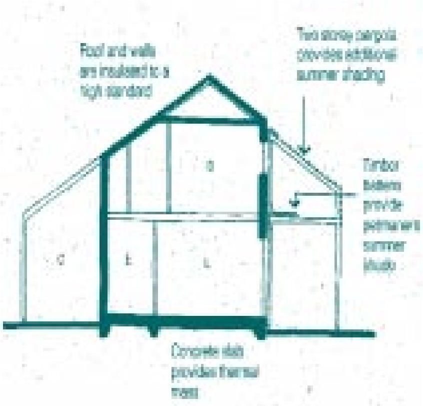


Figure 6: Section A.

Insulation

The brick veneer walls are insulated with foil and R 1.5 batts (resulting in an overall R 2.1), while the roof has sarking and R 2.5 batts on the ceiling below (resulting in an overall R 3.5).

Draught Proofing

All external doors have bottom door seals. The entry provides an air lock for the house. The stairs are isolated from the bottom floor by a door.

Appliances

The display features appliances with a high star rating. The heater for the kitchen and family rooms is a gas fired space heater with a six star rating. The hot water service is a roof mounted gas booster system with a five star rating. The refrigerator has a four star rating and the dishwasher has a five star rating.

Bathroom fittings include a dual flush cistern, low flow shower and low flow taps.

*House Energy Rating: ***** (5 star)*

Case Study 3: A View to the West

Many sites have wonderful views to the west. Energy efficient design principles advocate small, if any, areas of west facing glass. This house uses an external timber frame to support the external canvas blinds that completely shade the large areas of west facing glass in summer. Double glazing is used to minimise heat losses and gains. Clerestory windows facing north are introduced for winter solar gain.

Site

The 9.25 ha site is set high amongst rolling land in the gold mining area north-west of Melbourne with distant views to the west. The client bought the land for the views and wanted to retain them.

The house is sited on the highest part of the land and the area around the house slopes down to the north-west.

Design Captures Views and Sun

The 290 m² house has the living spaces located to capture the sweeping views to the west (Figure 7). A 180 m² basement provides space for a garage, a workshop and storage.

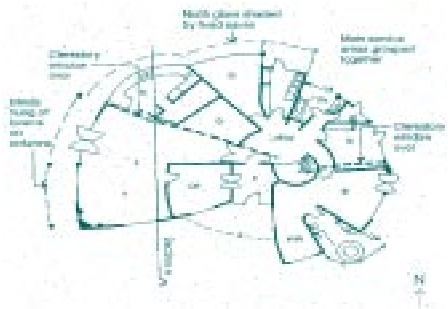


Figure 7: Plan.

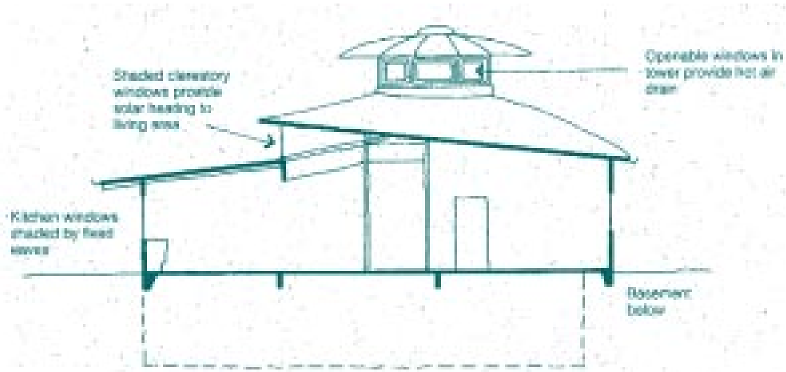


Figure 8: Section A.

North facing clerestory windows have been provided for passive solar heating to the west facing living area (Figure 8).

Window Sizing
The combined area of north facing windows and clerestory window varies between 21% and 27% of the floor area to which they are connected, representing a good size for passive solar gain.

The west windows are limited in height to 2.4 m, and run half the length of the living and meals area to capture the views of the mountains beyond. They are large (18% of the floor area of the room) but are within recommended limits due to the complete summertime shading, the high level of thermal mass in the concrete slab and masonry walls, and good cross ventilation.

Shading of Windows
All the north facing windows are shaded by a fixed eaves overhang that varies from 45% to 60% projection to window height ratio. This allows winter sun penetration.

The west windows are shaded by a 1200 mm fixed overhang formed by an extension of the roof, but mainly by movable external blinds that run the full length of the west elevation and fully shade the windows. These blinds are supported on timber beams that are fixed between the roof and support columns.

Therefore during summer, the whole of the north and west elevations can be completely shaded by the eaves and blinds.

Ventilation Cooling
On hot summer nights, full advantage can be taken of cool breezes by opening the windows to provide cross ventilation. The external blinds can be fully raised to facilitate this.

As well as cross ventilation, additional cooling can be achieved by utilising convection currents by opening the windows at the top of the central tower and draining of the building (stack cooling).

Double Glazing Used
All the windows are double glazed to limit heat loss on cold winter days and nights, and to reduce heat gain during summer days. Low E glass is used on all the windows to provide further control for heat loss in winter and heat gain in summer.

Water Heating
A thermosyphoning solar hot water system is provided. A slow combustion stove provides any back-up heat required.

Wood Fired Heating System
A wood fired boiler in the basement feeds small bore hydronic heating system in the concrete slab.

*House Energy Rating: ***** (5 star)*

Case Study 4: No Solar Access

This single storey terrace house in the middle of a row faces east and there is a 4.5 m high party wall on the north boundary. There is therefore no north solar access to this building. To overcome this problem, the renovation provided high level of insulation, improved draught sealing and obtained solar access and natural light from roof mounted clerestory windows.

Site
The site is a small (5.8 m wide by 30.5 m long) lot, and it is located in the inner suburbs of Melbourne. The lot runs east-west with the street frontage on the east, and is flat. It is in the middle of a row of single storey terraces and shares a party boundary wall along most of its north boundary (Figure 9).

Existing Conditions
The existing solid brick 86 m² single storey house had one living space and two bedrooms, with the service areas at the rear (Figure 9). The existing building was completely uninsulated.

Brief for Renovations

The brief for the renovations was to provide another living space at the rear of the building, as well as a new kitchen, laundry and bathroom. The building was to be as energy efficient as possible.

The existing three main rooms were to be retained. The renovation is shown in Figure 10.

Insulation added to the existing building

The opportunity was taken to replace the old, cracked and patched hard plaster in the existing board with 10 mm plasterboard backed with 25 mm foam insulation instead of hard plaster. (providing an R 1 insulation level to these walls).

This insulated plasterboard surface provides an R 1 insulation level to these walls.

R 2.5 fibreglass batts are installed in the existing ceiling.

New Building Well Insulated

The double brick skin external walls are insulated with 25 mm of expanded polystyrene insulation. The cathedral ceiling is insulated with R 2.5 fibreglass batts and reflective foil beneath the corrugated steel roofing.

The concrete slab in the extension also provides good insulation.

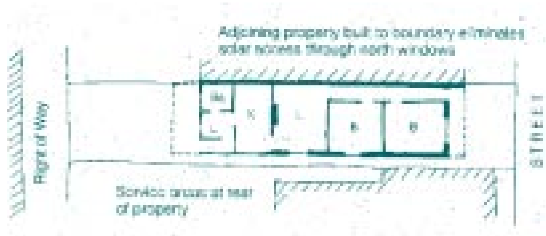


Figure 9: Existing conditions plan.

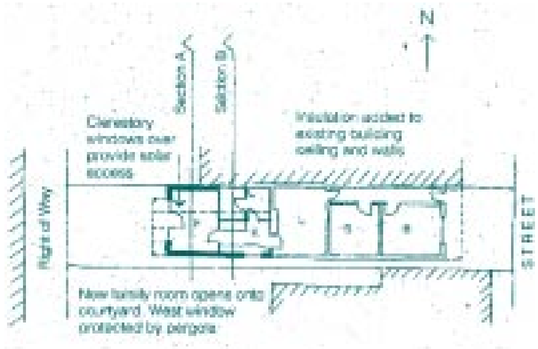


Figure 10: Revised plan.

Solar Access Gained Through Roof

In order to gain northern sunlight, north facing clerestory windows are incorporated into the family room (Figure 11) and kitchen (Figure 12). Normal 600 mm square unshaded skylights are used in the laundry and bathroom, which is acceptable since these are not normal habitation rooms.

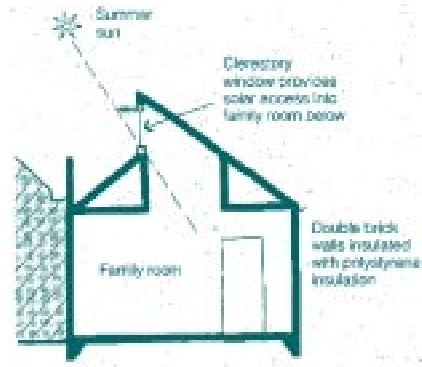


Figure 11: Section A.

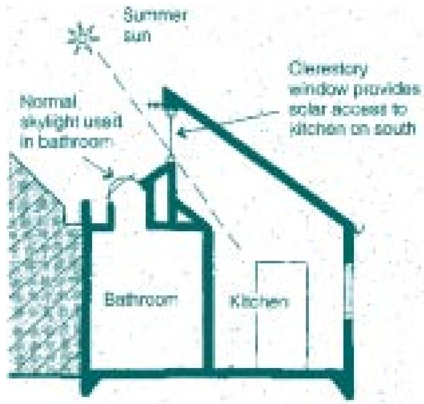


Figure 12: Section B.

Building Well Sealed

Draught excluders were added to the bottom of both the new and existing doors. The exhaust fans in laundry and the bathroom have self closing seals, and these spaces also have seals on the bottom of the doors that lead into them.

Thermal Mass

The west facing family room has a large 2.7 m wide by 2.1 m high window to the west. A concrete slab provides thermal mass to moderate summer temperatures.

Shading

The large west window of the family room is protected by a pergola that has a 50% overhang to window height ratio. External vertical bamboo blinds are fixed to the outside face of the windows to provide additional protection.

To the west of the property on the other side of the right of way, at a distance of 10 m from the end of the building, a 6 m high factory wall is built to the boundary. This provides additional protection from the late afternoon summer sun.

The east end of the property has an existing 1.2 m wide veranda that has an 80% overhang to window height ratio.

*House Energy Rating: *** (3 star)*

A 4 star rating could be achieved by double glazing clerestory and south windows, and adding a blind to the west windows.

Case Study 5: Multi-Unit Development

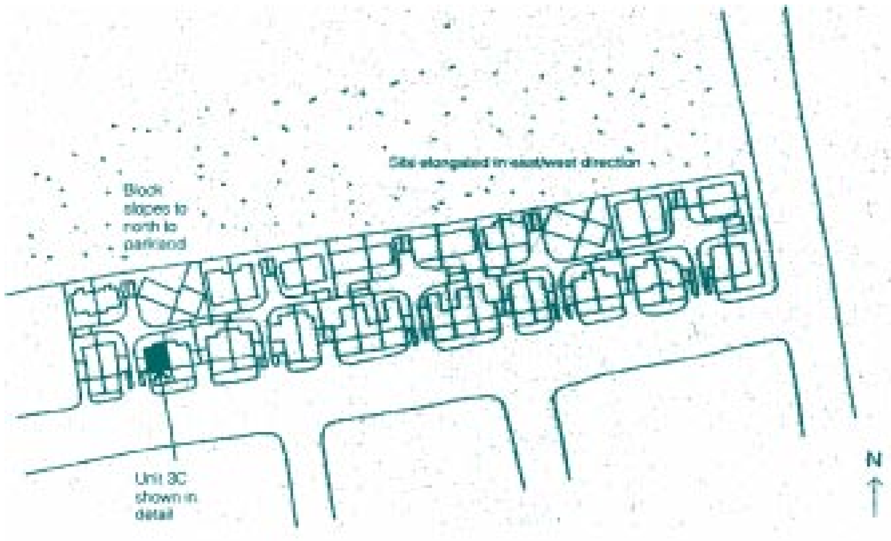


Figure 13: Site Plan.

This 42 unit development is a good example of medium density energy efficient housing. Consisting of two storey two bedroom semi-detached houses, it uses good site planning backed up with a well insulated and orientated building envelope design. On this sloping site, suspended concrete slabs have been used in all the north facing rooms to provide added thermal mass.

Site

This large site in northern Geelong is just west of the Melbourne/Geelong highway and railway line. It is long and narrow (approx. 240 m x 37 m) and on an east-west axis. It is bounded on the south and east by roads, and slopes down somewhat steeply to the north at about a 1:7 grade. The site area is about 8600 m² and has good solar access and views over the parkland to the north. Figure 13 shows the site layout.

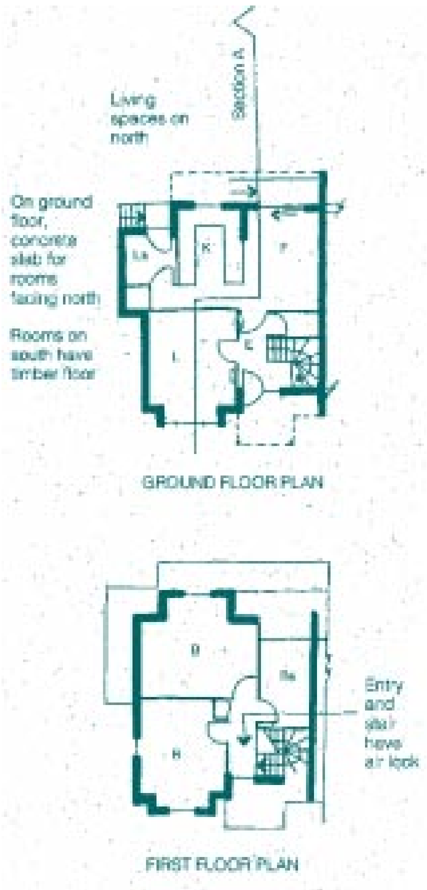


Figure 14: Ground and first floor plans.

Overall Development

The overall development by the Department of Planning and Development consists of 42 two bedroom, two storey units (Figure 13). They are mostly semi-detached. Brick veneer construction is combined with suspended concrete slabs for areas that have north facing glass; elsewhere timber floors are used (Figure 15).

All except one of the 42 units achieved a Five Star Design Rating.

A Typical Unit

Unit 3C is a typical unit in the development. The ground floor area containing the living spaces is 50 m² and the first floor area containing the bedroom is 43 m² (Figure 14). The family room and one of the bedrooms face north.

Zoning

The entry area and stair are zoned off from the rest of the house. The daytime spaces are grouped together and heated by a gas fired wall furnace on the east wall of the living room. The bedrooms are located together on the first floor.

Wet areas of the kitchen and laundry are grouped together on the ground floor, and WC and bathroom are one above the other. All this minimises hot water pipe runs.

Glazing

All windows are single glazed. All north windows are shaded. In Unit 3C, a 1200 mm pergola is used for shading on the ground floor, while an attached sunscreen is used on the first floor.

North facing windows on the ground floor are 21% of north floor area, and the party wall and concrete slab provide a thermal mass surface area 7 times greater than the north facing glass area.

Throughout the development, east and west windows are minimised. The small west window in bedroom 2 of Unit C is externally shaded by a timber screen.

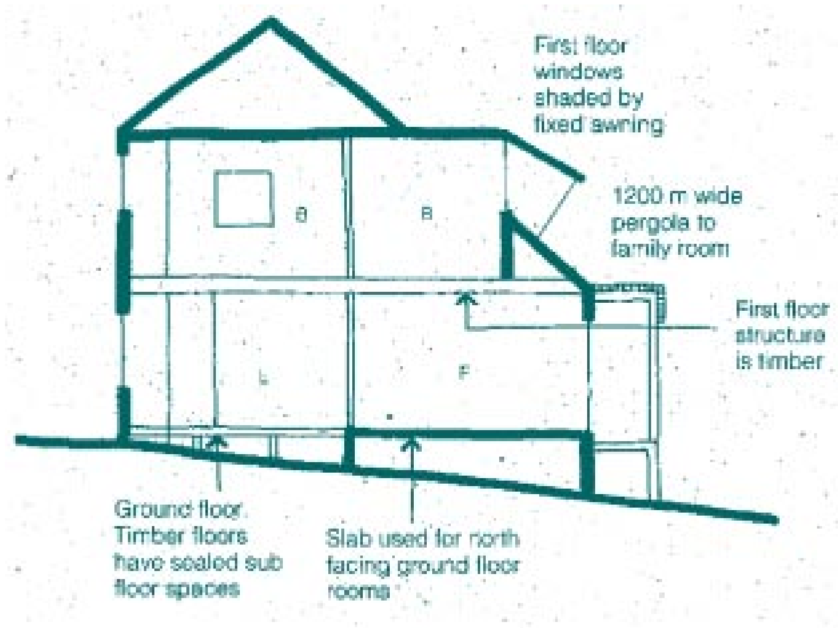


Figure 15: Section A.

Insulation

The steel corrugated roof has a 50 mm blanket plus double sided foil below, with R 2.0 batts on the ceiling, which together make up the required R 2.5 rating.

All external walls have double sided foil and R 2.0 batts.

The sub-floor space beneath the slab is sealed (Figure 15).

Air Movement

All external doors are draught proofed. Cooling cross ventilation is provided by having opening doors on the south and north sides of the building (Figure 14).

*House Energy Rating: ***** (5 star)*

Case Study 6: Alpine House

Dinner Plain is a new alpine village in the Dargo High Plains. The winters are snow bound and the summers are comfortable with temperatures rarely exceeding the mid twenties. This house typifies good alpine construction which is characterised by small areas of double glazed and well sealed windows, a well insulated and air sealed envelope, and energy efficient appliances.

Site

Dinner Plain is located in the Great Dividing Range beyond Mount Hotham and is 1584 m (5200 feet) above sea level. The site slopes down to the south at a grade of 1:5 which is also the direction of the views. The entry is from the road on the south-west. The block is 840 m² and there are houses on either side of this block.

Solar access to the north is good since the blocks run at 45 degrees off north so that each block provides space for its own solar access.

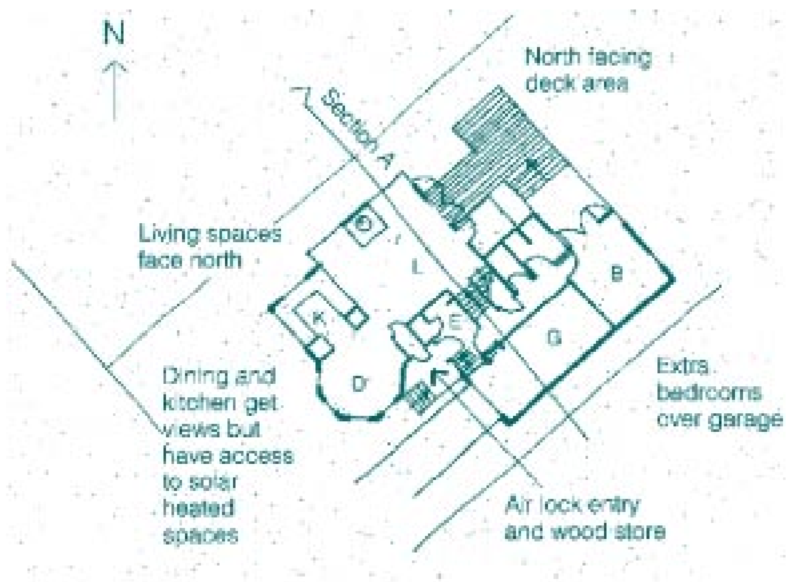


Figure 16: Plan.

House Design

The house is 117 m², with 28 m² of garage and store, and the same area of external deck on the north side (Figure 16). The house is detached and is one and a half storeys high, rising on the south side over the garage (Figure 17).

Orientation and Zoning

The design copes with sun on the north and views to the south by having a single room width design in the living areas. The living room and kitchen face north, while the dining alcove faces south. The main bedroom also faces north.

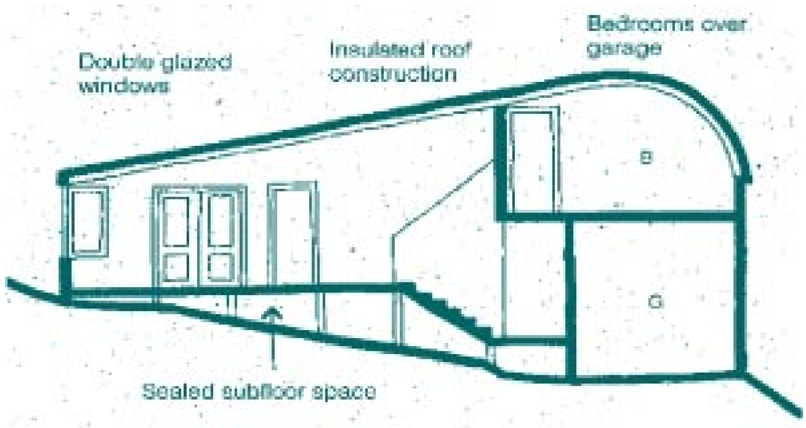


Figure 17: Section A.

High Performance Glazing

The windows are western red cedar with double glazing and a special air infiltration weather seal. The factory sealed double glazed unit consists of a 4 mm glass sheet (or 6 mm depending on size), a 12 mm air gap that provides a better thermal resistance than a 6 mm gap, and then another 4 mm glass sheet.

Glazing areas are kept to a reasonable size to limit heat losses but still provide sufficient area for daylight and views.

Air Infiltration

External doors are sealed around the door frame and across the bottom. Two air locks are provided on the south, one for the entry and one for the wood store. External walls of the whole house are wrapped with Dupont 'Tyvek', an imported building paper that is not only a breathing moisture barrier but also an excellent air infiltration barrier. It is stapled and taped to the timber frame and windows and doors to provide a complete barrier.

Well Insulated Wall Construction

The walls are engineered timber stud framing in accordance with the relevant codes for construction over 1200 m elevation. External cedar weatherboards 19 mm thick are fixed over the 'Tyvek' system described above. The 90 mm stud frame walls are filled with fibreglass insulation then lined with clear polythene that is nailed but not sealed to the studs. Openings in the polythene for power points allows inside moisture to migrate to the outside. The internal walls are finished with plasterboard nailed to the timber frame.

Roof Construction
The roof is corrugated steel Colorbond decking with a 50 mm blanket and double sided foil below to stop condensation forming on the underside of the tin. Beneath this foil layer another 50 mm insulation blanket is provided between 75 mm x 38 mm battens that are fixed over 12 mm plywood. This rests on exposed rafters at 600 mm centres.

Sealed Sub-Floor
The timber floor is uninsulated, but the sub-floor space is sealed off by a sealed plinth lining system to provide an insulating still air space. Pipes that pass through this area do not freeze either. In summer, openable shutters can be used to ventilate this space.

Energy Efficient Space Heating
An hydronic gas fired boiler is used to heat the house (the gas used is LPG which is reticulated through the village from a central storage tank). The heated water from the boiler is circulated via a small bore system to hydronic heaters.

The slow combustion heater is also used for space heating.

House Energy Rating: Not Available.

This design would rate 5 stars in Melbourne. Ratings are not yet available for alpine climates.

Practice Note PND 19

Design for Hot Humid Climates

Scope

This Practice Note provides information on the location and characteristics of hot humid climates and the types of design responses that can be adapted to facilitate the creation of energy efficient and comfortable housing.

Characteristics and Location of Hot Humid Climates

The Hot Humid Tropics include the following sub-regions (see Figure 1):

- Far Northern Tropics
- North Queensland Coast
- Transitional Zone
- Sub Tropics

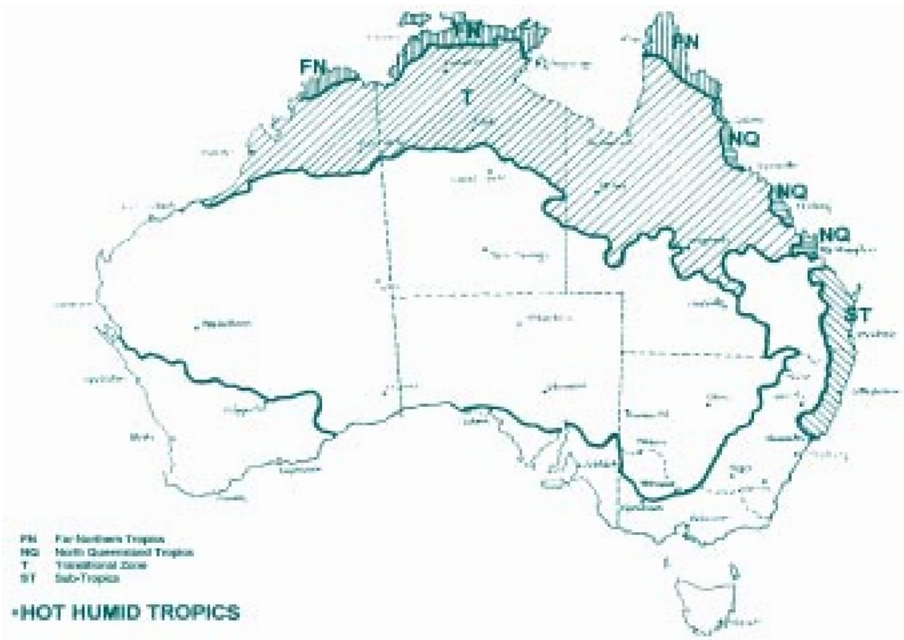


Figure 1: Sub-regions of the Hot Humid Zone in Australia.

All regions are characterised by high rainfall, insolation and high temperatures; strongly defined breeze patterns; and susceptibility to cyclonic activity. Characteristically, rainfall is summer predominant and humidity at this time of year is high. Early and late summer rains are generally storm driven. In winter, cloud cover and humidity decrease but still remain comparatively high in more inland areas.

The sun's path is both south and north at varying positions throughout the year, with the exception of the Sub Tropics where the sun always passes to the north.

The particular characteristics of the sub-regions within the Hot Humid Tropics are described below.

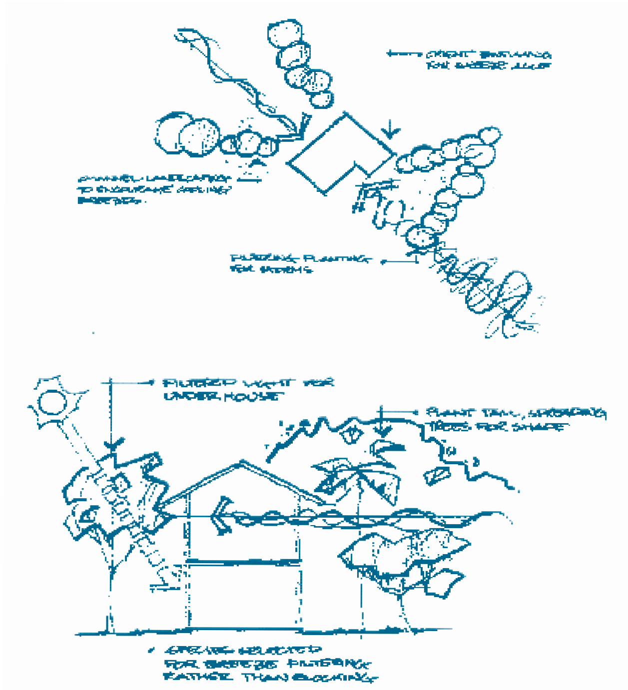


Figure 2: House siting and landscape considerations for the Hot Humid Zone.

Far Northern Tropics

This region has the highest average minimum temperatures and the most constant high maximum temperatures (though rarely above 36°). It is nearly always hot, but with consistent drops in evening temperatures to 20°–25° and occasionally in winter to 15°–20°.

Rainfall is high and the seasons are readily characterised as Wet (summer) and Dry (winter).

Breezes are predominantly north-west tending west in the Wet and south-east tending east in the Dry. Coastal afternoon sea breezes are a common microclimatic effect.

North Queensland Coast

The ameliorating effect of the Great Dividing Range ensures a less harsh climate in this area, although average rainfall and relative humidity are the highest in the Hot Humid Tropics. In the more southern parts of this sub-region solar paths to the south are marginal.

The Range also creates microclimatic differences along the coast and inversion layers and coastal 'fog' are also often characteristic. Generally, as altitude increases the climate cools.

Breezes are generally from the north-east to south-east quarter but at Cairns include a strong southerly morning breeze shifting south-east in the afternoon.

Christmas Island is included in this sub-region (note that Townsville is not in this sub-region).

Transitional Zone

This area is transitional between Hot Arid and Hot Humid Tropics climates. The zone receives summer monsoonal rain but significantly less than in the Far Northern and North Queensland Coast; and there is higher insolation. Cloud cover through summer is relatively high and relative humidity is also high - but not as high as in more coastal areas.

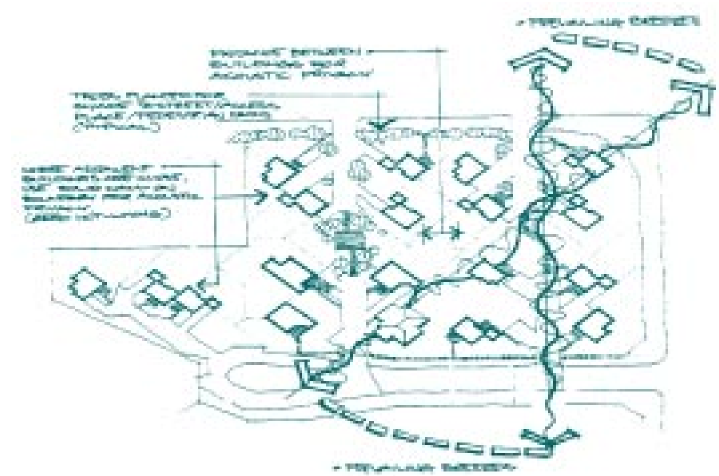


Figure 3: Site planning considerations for the Hot Humid Zone.

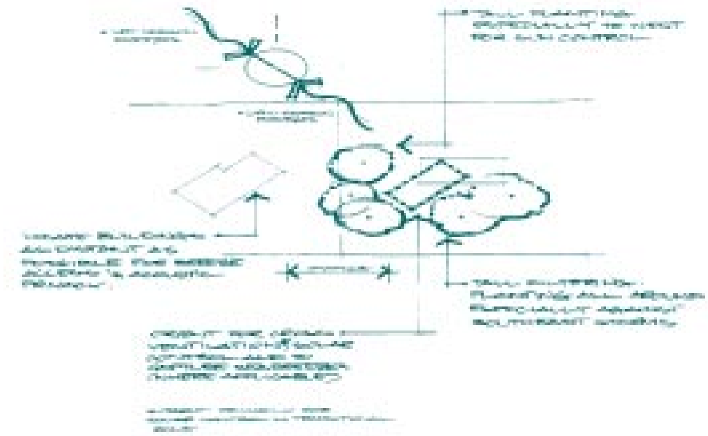


Figure 4: Building siting considerations for the Hot Humid Zone.

Breeze patterns are generally west/north-west with the Monsoon and east/south-east otherwise. Occasional 'incessant' hot winds from the east/south-east prevail.

Summer temperatures are significantly higher than elsewhere in the Hot Humid Tropics, reaching 40°–43°, and winter minima less, occasionally reaching 7°–10°.

A cooler microclimate exists along the western Gulf of Carpentaria coast in winter and the Atherton Tablelands (at higher altitude in the Great Divide) is generally cooler than immediately further inland or along coastal areas.

In Townsville the nor-easter is generally an afternoon 'Doctor' (commonly shifting from the south-east).

Sub Tropics

The Northern NSW and Southern Queensland coasts are dependent on significantly high summer rains, and have high relative humidity. Average temperatures are not as high as elsewhere in the Hot Humid Tropics but average minima are not the lowest. These are generally milder tropics, but erratic unseasonal climatic conditions also occur. Solar paths are always to the north.

Unlike the rest of the Hot Humid Zone, autumn/winter breezes include the colder south/west quarter. Cyclonic activity is marginal.

Site Planning and Landscape Design

Except in the Sub Tropics, all-year-round shade is desirable, but solar access should be retained for fruit trees and vegetable gardens.

Tree species which filter, rather than block, breeze access, ventilation by convection and filtered light to lower storey species are desirable. Consideration should also be given to the use of landscaping to reduce the impact of storms (in all Sub-regions), and hot winds/dust storms in the Transitional Zone.

Opportunities also exist for channelling desirable breezes by landscape design.

The major site planning consideration is to achieve access to prevailing and/or sea breezes, and the provision of shade to living areas and private open space (particularly to walls with westerly and southerly orientations in all sub-regions other than the sub-tropics). In designing to facilitate natural ventilation and breeze penetration into the dwelling, consideration needs to be given to the wind frequency characteristics of the location, and the siting of the dwelling in relation to other buildings and structures.

A balance between providing natural ventilation, shading and acoustic privacy therefore needs to be achieved.

Building Design

Key principles to consider are solar control and ventilation through cross ventilation and relief of rising heat (including during rain).

Design for strategies against cyclones is also a basic demand. When designing to encourage breeze penetration, care needs to be taken to direct internal and external noise sources away from nearby noise sensitive areas and to carefully orientate wall openings to maximise acoustic privacy.

Regional variations include increased significance of solar control, dust mitigation and reduction of the access of hot winds in the Transitional Zone, and winter considerations in the Sub Tropics. Breeze patterns are generally consistent for any given location in the Hot Humid Tropics, but these do vary from sub-region to sub-region, and microclimatic effects especially related to coastal/altitude influences.

Infrared radiation from interior surfaces (eg ceilings) should also be minimised through design. This will usually require the provision of reflective foil laminates (RFL) and insulation to ceilings to minimise internal surface temperatures. The provision of ceiling fans in habitable rooms directly above activity areas will also assist in creating cooling breezes. Where rooms include mechanical airconditioning, careful attention should be given to issues such as enclosure, insulation, and condensation to maximise energy efficiency and minimise the potential for dampness.

On small lots two-storey construction is usually necessary to minimise site coverage and encourage natural ventilation, maximise separation between dwellings for acoustic control, and maximise garden area for shade landscaping.

Rainwater collection should be a priority in the Transitional Zone and Sub Tropics. Waste water recycling should be a requirement in all sub-regions, but especially in the Transitional Zone because of the general existence of a pronounced Dry Season (winter).

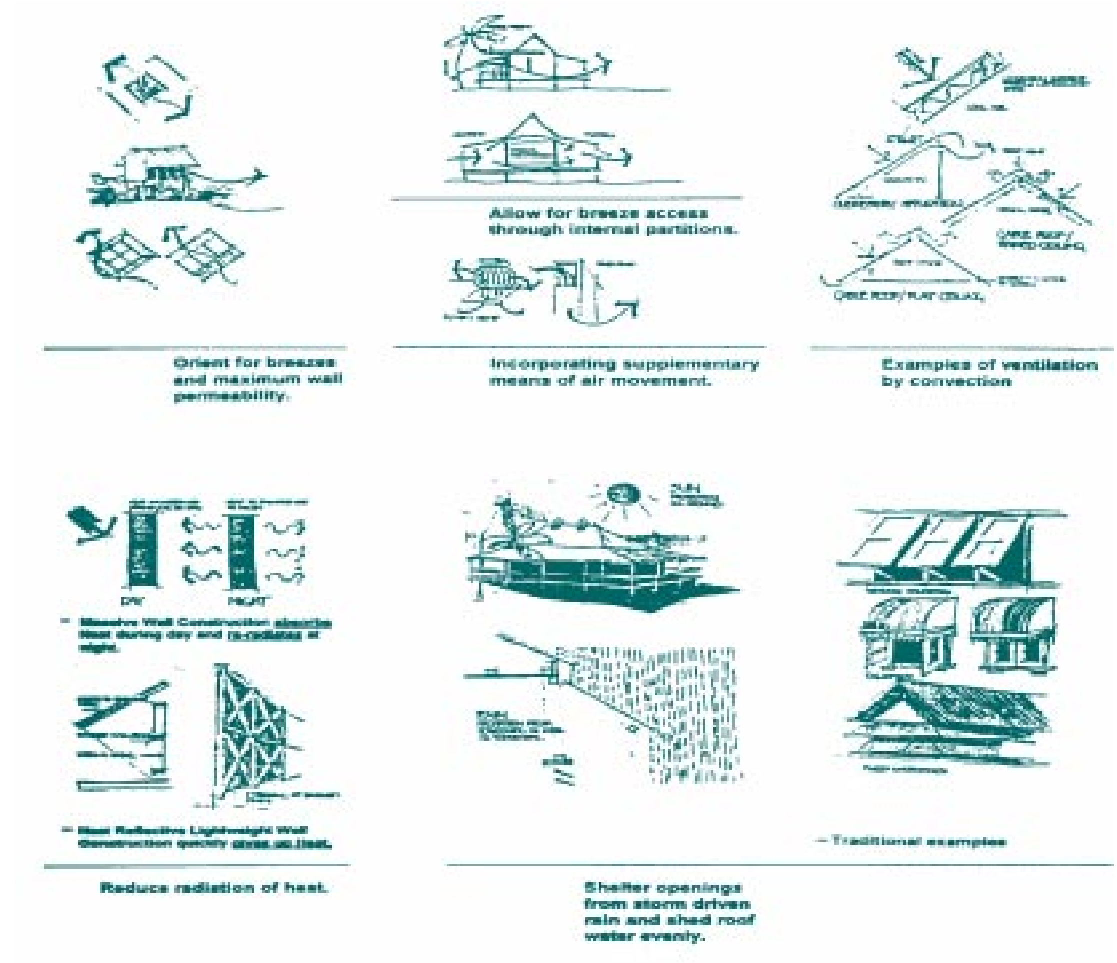


Figure 5: Building design and construction principles for the Hot Humid Zone.

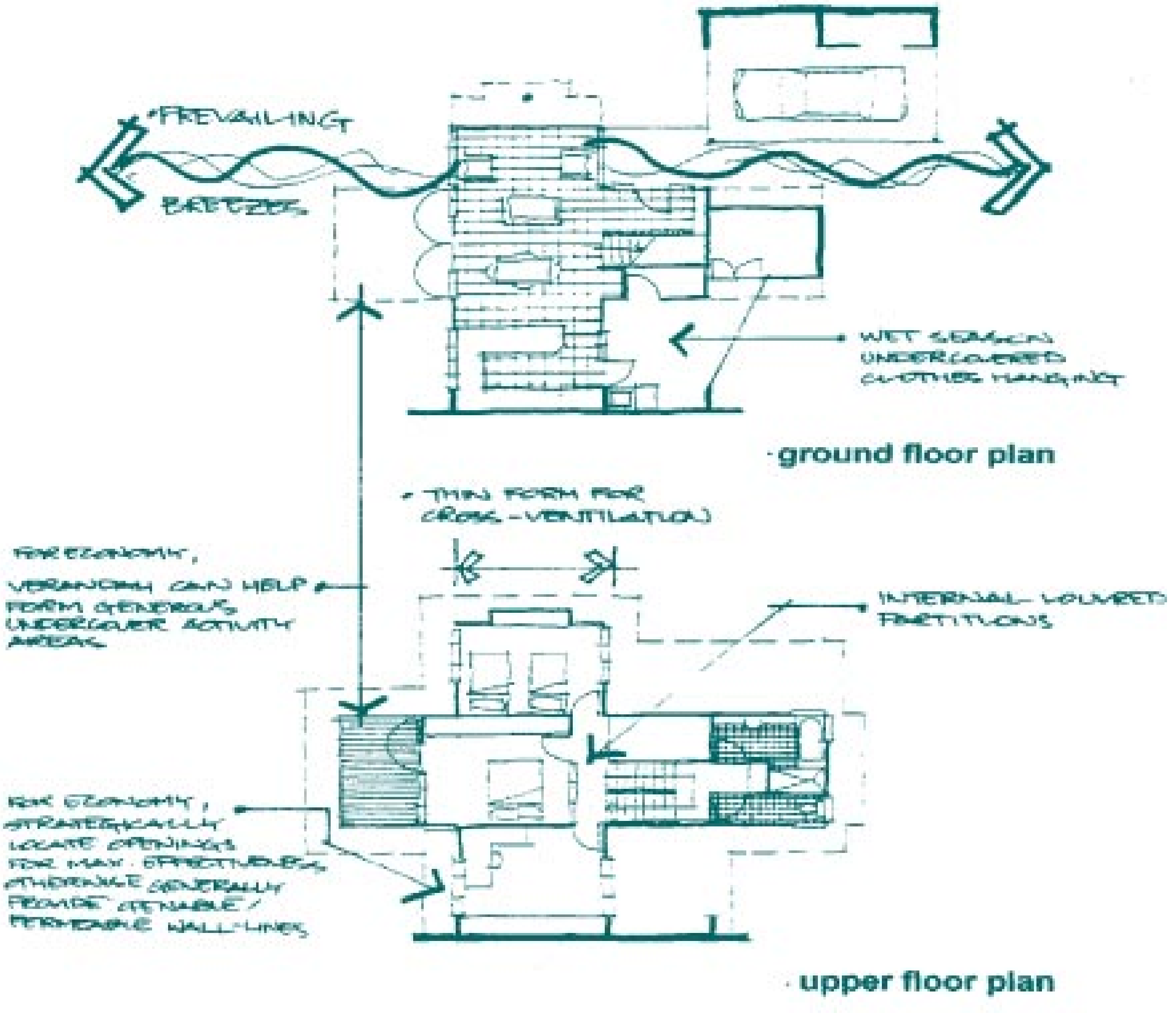


Figure 6: House design considerations for two storey dwellings in the Hot Humid Tropics.

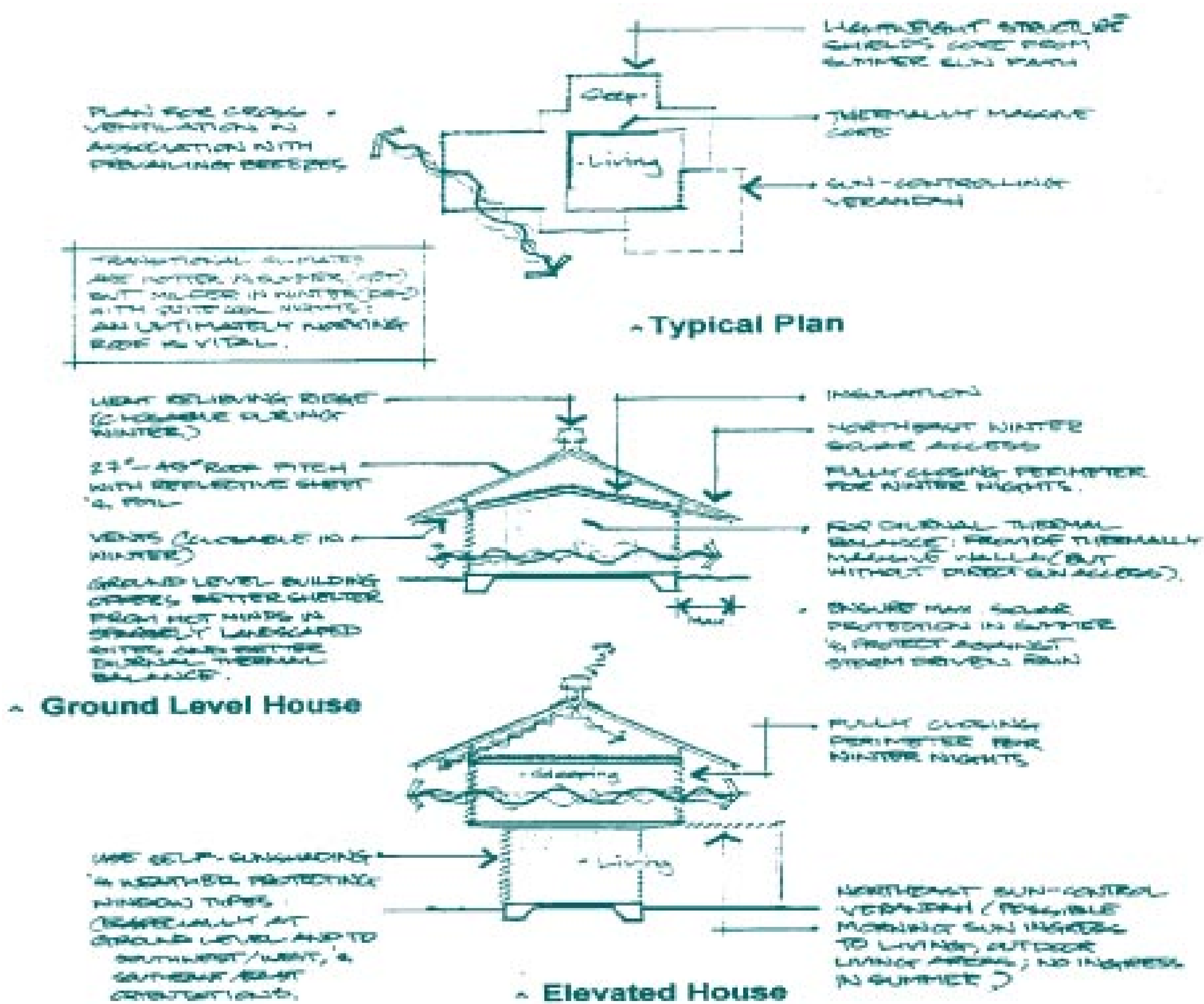


Figure 7: House design considerations for ground level and elevated dwellings in the Transitional Zone.

Practice Note PND 20

Design for Hot Arid Climates

Scope

This practice note provides information on the location and characteristics of hot arid climates and the types of design responses that can be adopted to facilitate the creation of energy efficient and comfortable housing.

Characteristics and Location of Hot Arid Climates

The extent of the hot arid climate region in Australia is shown on Figure 1. Within this region there are a number of sub-regions, including:

- Western Coastal
- Southern
- Northern
- Pilbara
- Central Ranges/Central Desert
- South-West Queensland
- Arid Temperate.

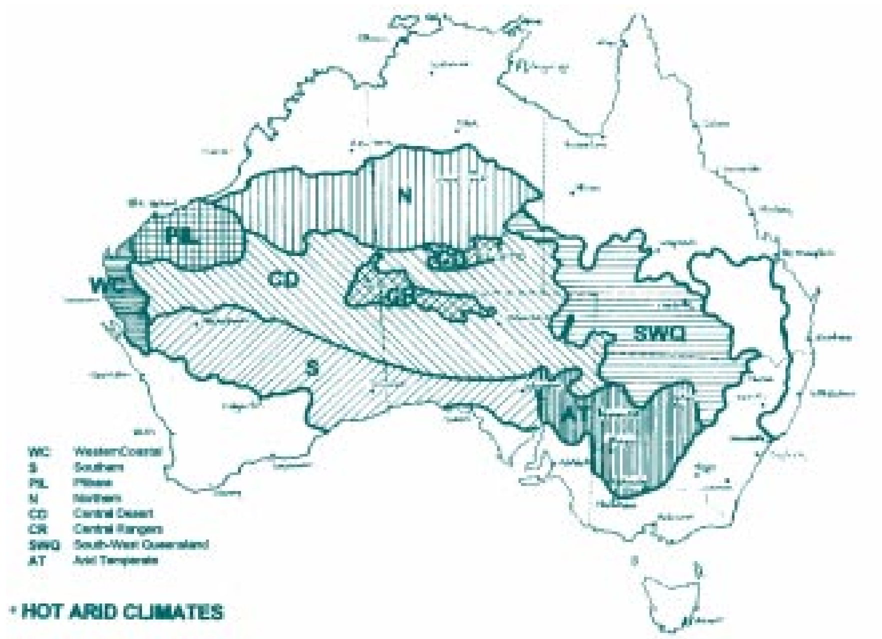


Figure 1: Sub-regions of the Hot Arid Zone in Australia.

The characteristics of each of these sub-regions which will influence the house design response are detailed below.

Western Coastal

This area is influenced by southern as well as inland airflow. In general, morning breezes are south to east and afternoon breezes from the south to south-west. Consequently winter (rather than summer) rain predominates.

This is a 'mild' region in terms of average temperature compared to more inland and northern sub-regions, and there is less diurnal temperature variation with lower average maxima and higher average minima.

Southern

In coastal areas of this sub-region sea breezes offer summer heat relief, otherwise breeze patterns are not regular.

As for the Western Coastal sub-region, winter rain predominates and temperatures are 'mild'.

Cloud cover in the sub-region is significantly higher than elsewhere in the Hot Arid Zone, and in coastal areas the climate begins to approximate the Southern Temperate climate.

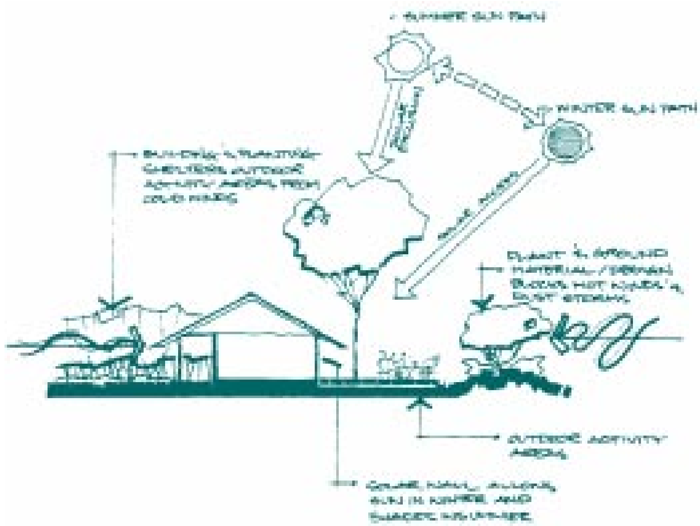


Figure 2: Landscape and site planning.

Northern

This sub-region is defined by:

- a strong general easterly breeze pattern;

- potential annual influence of the monsoon (bringing more cloud cover, storms, humidity and north-westerly breezes - the extent of this influence varies from year to year);
- sun paths that are more overhead and also to the south; (especially to the northern perimeter);
- annual rainfall is higher than elsewhere in the Hot Arid Zone;
- rainfall is summer predominant.

Pilbara
This is the hottest sub-region and has the highest daily average of bright sunshine hours. Average temperature minima are not as extreme as elsewhere in the Hot Arid Zone (these characteristics are shared with South-West Queensland.)

Breeze patterns are strongly east/south-easterly in the morning and north-westerly in the afternoon. The east/south-east component is also more evident in winter and the north-west more so in late summer, with the monsoonal influence. Except in the absolute coastal strip, this is not reflected in relative humidity.

As this sub-region is in part ‘mountainous’, the microclimatic effect of ranges (eg radiant night-time heat and breeze modification/generation) can be locally notable.

Coastal areas of the Pilbara are also susceptible to cyclonic activity.

This sub-region has above average rainfall for the Hot Arid Zone.

Central Ranges/Central Desert
These sub-regions are typically Hot and Arid: very low to zero rainfall (influenced by either northern or southern climatic factors); hot days and mild nights in summer, and mild-hot days and very cold nights in winter; with high insulation and very low cloud cover and east/south-east breezes.

The Central Ranges have higher average rainfall and milder temperature maxima. Additionally the potential for microclimatic effects is greater.

Stony Plains and Simpson-Strezlecki Dunefields are strikingly different ecology systems but with climatic characteristics close to those of the Central Desert proper.

South-West Queensland

This region includes the Channel Country of QLD, NT, SA and NSW and the plains country to the north and east.

Together with the Pilbara, this is generally the hottest area in Australia, with the highest levels of insolation and least cloud cover. Humidity and rainfall are generally also the lowest and evaporation the highest; but the tail end of monsoonal activity in the Gulf of Carpentaria can affect the north of the region, the waters of which can also affect the whole sub-region.

Breeze patterns remain east/south-east dominant.

Arid Temperate

These areas, while Hot Arid, on average are less hot and are more influenced by Temperate Zone winter rainfall activity and corresponding wind directions.

Broken Hill and the Murray-Darling Depression and Riverine Plains areas are overall similar to Central Desert areas but ‘milder’ climatically.

The Flinders-Olary Ranges region effectively matches Central Ranges climatic character but again is ‘milder’; and winter/spring breezes from the south/south-west also occur.

General Characteristics

There are other ecological variants that would create even further sub-groupings. Accordingly, designers should seek out this knowledge in order to create the most environmentally sensitive building solutions. In general terms, hot arid climates are characterised by:

- high daily temperatures in summer;
- temperate-warm daily air temperatures in winter;
- low winter minima;
- spring/autumn as such do not occur but there is a gradation from winter to summer conditions;
- low to zero annual rainfall;
- high insolation and very low levels of cloud cover;
- dust storms and erratic wind patterns.

The Arid Zone is also characterised by subtle ecology systems where issues of floodway and water management are of vital importance to natural environment sustainability.

Site Planning and Landscape Design

In Hot Arid climates selection of plant material for no/minimal watering is basic. This greatly limits species choice in regard to achieving functional landscaping requirements of dust-storm/hot winds control, winter breeze control and the summer/winter sun exclusion/ inclusion dynamic. Trees can also draw from the water table and the impact of ‘over-loading’ a site with plant material should be carefully considered. In the main, local species that ecologically fit site characteristics of topography, soil and aquifer types are likely to be the most appropriate. ‘Shape and/or plant more of what you see if the site is in a relatively natural state’, is probably the best start in this climate.

House siting and siting of other built elements (eg paving and fencing) should be carefully considered in regard to potential disruption of surface water flow. Although appearing sandy, many Hot Arid Zone soils are in fact high in clay content and quickly ‘close’, prompting rapid run-off . Disruption to surface water flow will not only have local ecological impact but may (if cumulative across a number of sites) result in flooding of property.

Planning/designing for opportunities for summer shading and winter sun access are basic - this need not mean that all of the street/site need be in shade/ sun at once, but that areas of choice in appropriate locations are made. Solar access to solar transmissive walls to north-west/ north/north-east building faces must be achieved.

Building Design

In Hot Arid climates temperature fluctuation from day to night is generally extreme. This provides opportunities through insulation of dwellings,

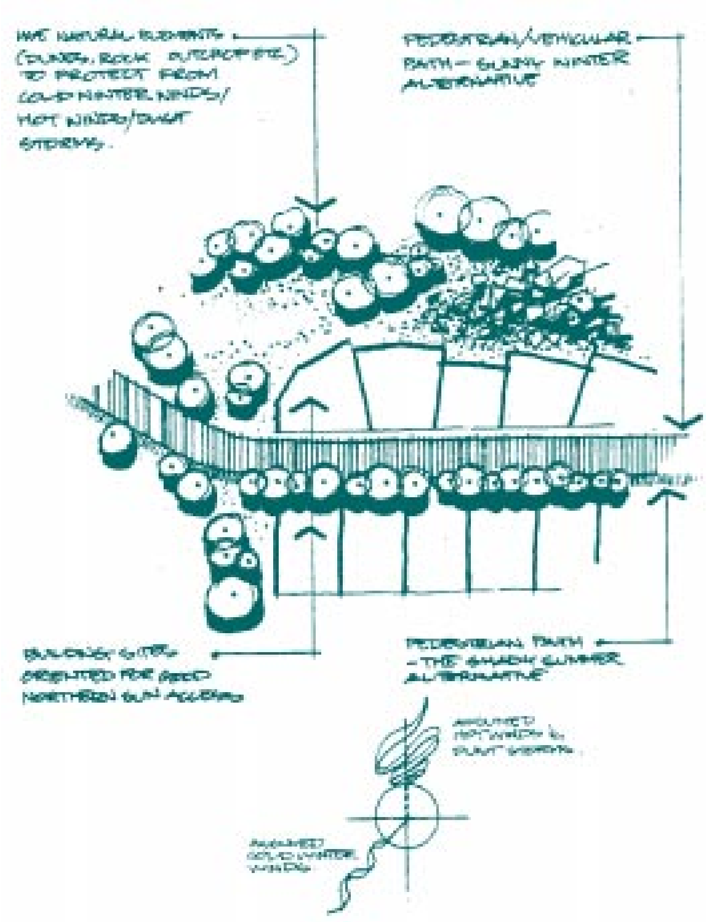


Figure 3: Allotment layout and site planning considerationbs for the Hot Arid Zone.

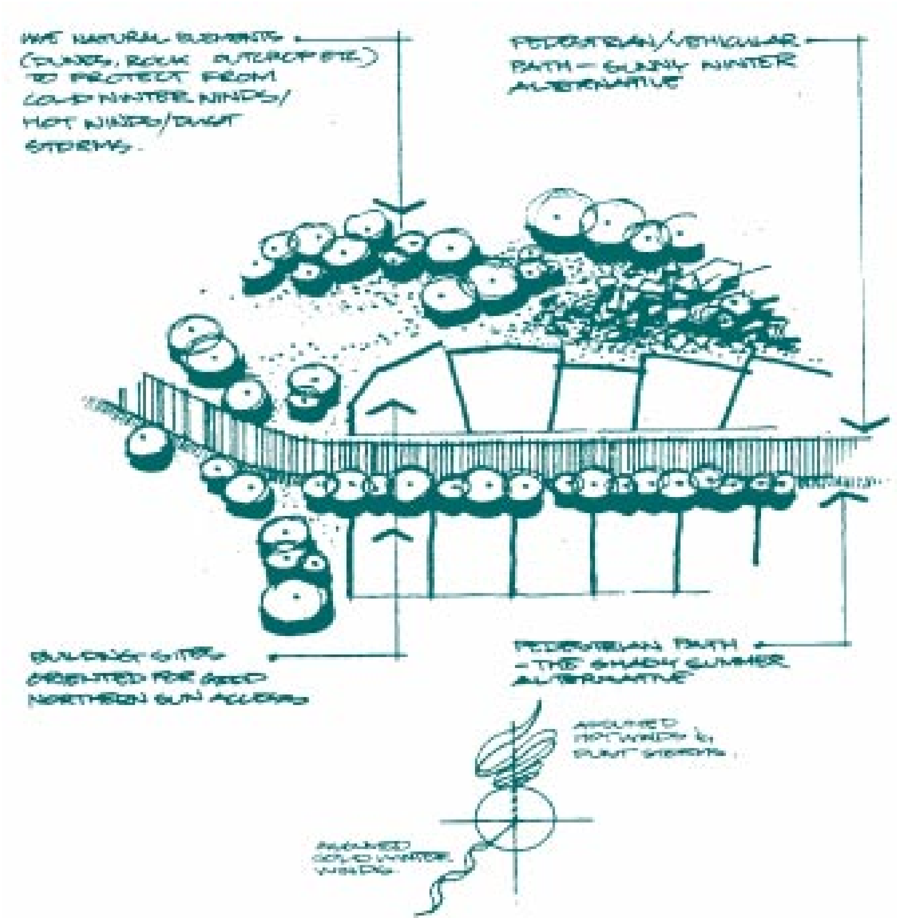


Figure 3: Allotment layout and site planning considerationbs for the Hot Arid Zone.

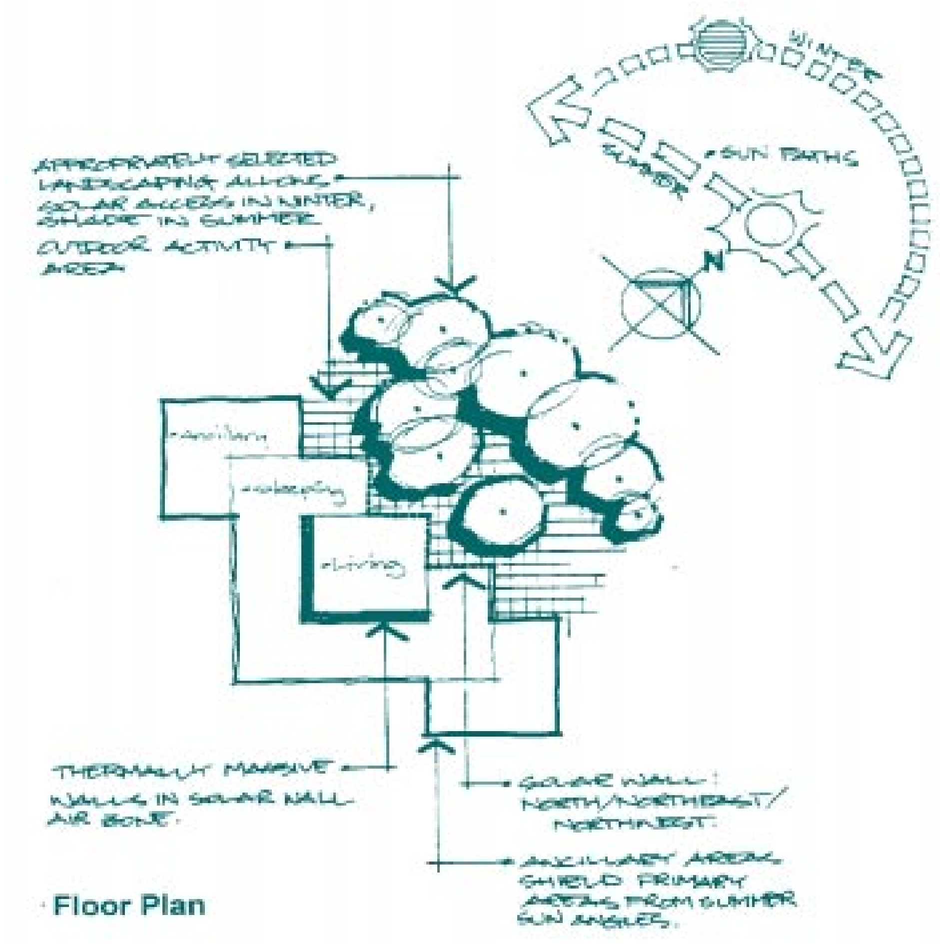


Figure 5: Dwelling layout and site planning considerations for the Hot Arid Zone.

together with techniques for controlling outdoor/indoor air flow, for achieving thermal comfort conditions.

Two storey construction can work in this climate, but difficulties should be expected in reducing incident summer insolation and reducing the impact of dust storms and hot winds - unless there are useful natural features (rock outcrops, tall trees etc) or opportunities to plan peripheral shielding structures. Even then, radiant heat from such elements needs to be considered.

‘Dug-in’ (full or partially in-ground or bermed) houses are considered appropriate; but careful consideration to winter solar access and opportunities for activity flow to outdoor spaces need to be considered. Design against flooding also needs to be undertaken.

In any solution, planning and detailing to achieve strategies for summer and winter modes of building operation are basic. Building design should also consider the notion of the zoning of plan areas, such that ancillary areas are used peripherally and oriented to insulate primary living spaces from outdoor temperature extremes. Planning and detailing of outdoor/indoor ‘interactive’ zones (where building ingress/ egress occurs) of ‘entry’, ‘verandah’ etc zones, are also required to reduce outside/inside air change in summer daytime and during winter generally (and certainly at night).

In coastal areas and the Arid Temperate Sub-region, planning (including orientation) and detailing for access to sea/southerly (summer) cooling breezes should be made.

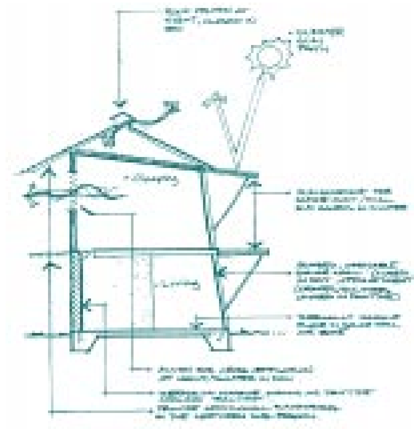


Figure 6: Two storey house design principles (Summer strategy) for the Hot Arid Zone.

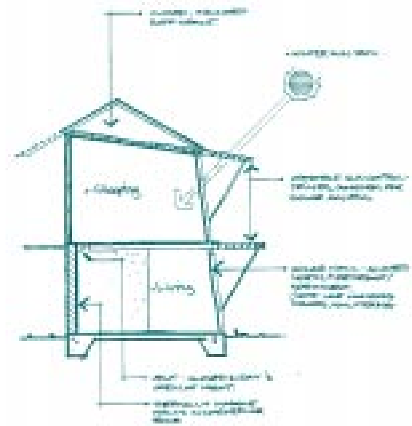


Figure 7: Two storey house design principles (Winter strategy) for the Hot Arid Zone.

Practice Note PND 21
Designing for Different Lifestyles

Scope

This Practice Note provides advice on designing residential development to suit a range of different lifestyles. It takes into account the needs of different cultural groups, as well as those of different household types.

The concept promoted here is that of 'adaptable housing' that can accommodate a range of needs and preferences, and be adjusted to different uses over time. As society changes, there is an increasing demand for such flexibility.

Matters addressed

- The different cross-cultural needs that should be accommodated in a multi-cultural society.
- The functional needs arising from different forms of household.
- Contemporary lifestyle trends which need to be reflected in design flexibility.

Housing a Multi-Cultural Society

Australia is home to indigenous cultures with strong traditions relating to the use of residential space, as well as to people from many different overseas cultures. Cultural traditions give rise to particular needs in relation to the use of space, its orientation and visibility, the appearance of the dwelling, and the facilities it provides.

It should be recognised that if certain essential housing components are not incorporated, there is likely to be one of three results:

- the prospective occupants will move elsewhere;
- there will be some loss of amenity for the occupants;
- the occupants will seek to alter their housing environments to match their lifestyle.

A more flexible approach to design can avoid these outcomes.

Housing form

Australian housing has already absorbed a wide variety of cultural influences which are reflected in the form of its housing stock. As housing form is not readily changed, it is important that any large development provide for a range of housing choice to suit different values and aspirations. These forms might include single and two-storey housing, housing raised above ground level, large clusters of housing, housing with internal courtyards, attached town houses, and units.

Figure 1: A Japanese Garden.

Source: Morse, E.S. (1961) Japanese Homes and their Surroundings. Dover Publications, New York.

Street use

For a variety of functional and symbolic reasons, the relationship between the house and the street is of considerable importance to occupants. However, it is recognised that compromises may be required in the interests of balancing public and private amenity. This may necessitate compensation being provided for loss of access to streetspace, by providing alternative spaces within the dwelling or the allotment.

In relation to the street, it needs to be recognised that there is a wide variety of behaviour likely to emerge. In particular, there are people who wish to view the street and be observed from it, and others who seek total visual seclusion.

Private open space

Mainstream Australian housing has tended to favour front and back gardens. This is derived from North American and some North European traditions. The front garden often has public decorative value whereas the back garden provides for private leisure activities, as well as functions such as drying clothes, storage etc.

Different needs might include:

- complete visual screening of outdoor areas;
- vegetable and herb growing for home use;
- shaded and sound-insulated spaces;
- provision of water features;
- shared leisure facilities between households;
- low maintenance open space;
- division of open space into semi-enclosed areas for different household members;
- use of flat roofs as open space;
- accommodating various home business activities;
- use of outdoor space for cooking and sleeping.

Figure 2: Storage on a balcony – the result of inadequate internal storage.

Source: Thiberg, S. (1990) Housing Research and Design in Sweden, Swedish Council for Building Research. Stockholm.

Balconies, verandahs and terraces

These spaces may also be used in many different ways. For example, they can accommodate entertaining, guest and resident sleeping, daytime naps, as well as household recreation. They may be opened up for visibility and to catch breezes, closed in with blinds, or adapted for different uses by movable screens.

Entrances

The ways in which entrances are arranged reflects both symbolic values and lifestyle. Some households may prefer formal gateways and entry porches onto the street, screened or 'bent' entrances into private open space, provision of separate visitors' and tradesmen's entrances, entry ways capable of a high degree of supervision, and entrance structures that can accommodate shoes or coats. Others may have no requirements for formal entry, or may prefer an arrangement by which the external space around the house can be accessed directly from different rooms.

Windows

Windows can serve many functions. They lighten and ventilate the interior, and provide occupants with the opportunity to look out and to communicate with people on the street. They may be provided with fixed or removable shutters, glazed for filtered light, screened with sheets or curtains, or deeply cased with built-in seating and storage.

Use of internal space

It is important when considering cross-cultural housing to avoid preconceptions about the use of rooms. Terms such as 'bedroom' and 'living room' may not be relevant in some circumstances. The segregation of different rooms in the house varies considerably, and can include rooms which are converted from daytime to night-time use, the seasonal rotation of different rooms and the separation of areas of the house between occupants.

Others may include:

- placing a high priority in allocating space to guests;

- reserving areas of the house for formal occasions;
- providing large quantities of storage space;
- orientating to floor-level activities such as of seating and sleeping;
- accommodating different types of furniture, including lightweight movable pieces and built-in or fixed furniture;
- using a large internal space as a substitute for an internal courtyard;
- making use of the external space rather than the house interior for day or night-time use.

Figure 3: The internal space of a Japanese house.

Source: Mores, E.S. (1961) op cit.

Cooking and bathing areas

These are areas of marked cultural difference, in terms of their use, placement and size, and in appliances use. A variety of spatial arrangements may be necessary to ensure that there is choice, and that prospective occupants can find areas best suited to their cultural values. Preferences for size and visibility of kitchen areas varies considerably even among western cultures. They are often derived from different priorities for cooking activities, and on the role of entertainment in the household.

Special features

Many cultures have a need for special spaces within or adjacent to the house. They include the Scandinavian sauna, the South-East Asian spirit house, the Japanese storage house as well as the internal tea ceremony space, the Middle Eastern symbolic guest room, the South Pacific kava ceremony space, and special rooms denoting personal territories for individual household members (studies, libraries, workshops, sewing rooms, or dens).

Signs and symbols are additional features which have profound significance for the occupants, though they may not readily be recognised. They can include house numbers, spacing of steps or house posts, orientation of spaces towards compass directions or landscape features (eg to Mecca), and use of particular materials, and landscaping plants or structures.

Flexibility and choice

There may be instances where a specific design solution to particular cultural needs and values may be appropriate—as is the case in many Australian indigenous communities, for example. However, within our main urban centres, it is necessary to look to solutions which can cater for a variety of needs.

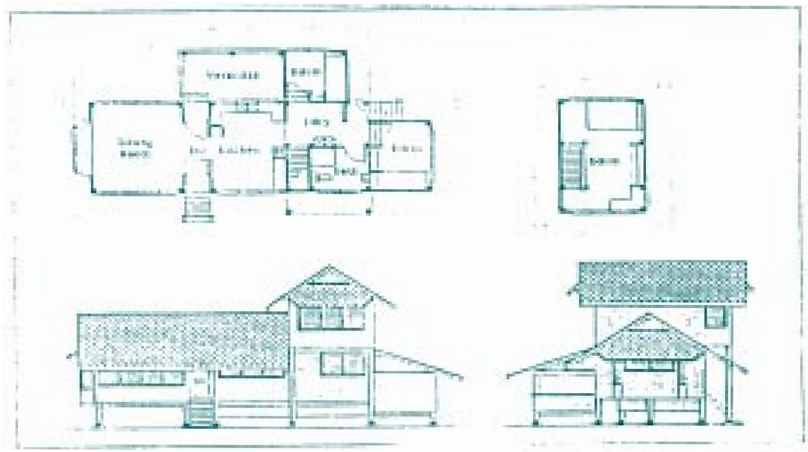


Figure 4: House design for Papua New Guinea.

Source: Davis, H., Week, D., and Moses, P. (1993) The Village Meets the City, Architecture Design. March-April.

It will be useful to apply the checklist developed later in this Practice Note, to test design solutions against a range of potential cultural preferences. Designers need to be conscious of the lifestyle choices they are excluding when they develop houses in a particular way.

Designers also need to overcome their own cultural preconceptions. Awareness of other cultural values, and the lifestyles that result, will assist designers in providing for a diverse range of clients.

Changing Household Structures

A decline in the proportion of nuclear families is leading to reconsideration of the structure of dwellings in relation to site context, type, size, layout and fittings. Households are becoming smaller as families choose to have fewer children (or none at all), couples become divorced, and teenagers leave the family home. Other trends which are leading to household changes are greater longevity of those who are retired, and a rapidly increasing proportion of people working from home.

The challenges for the designer are similar to those confronted in attempting to design for a diversity of culturally determined lifestyles. It is becoming increasingly difficult to determine how any particular household will use its residential environment. However, designers need to be aware of the range of uses that their housing products may need to accommodate.

Housing for children

While conventional housing has been biased towards designing for families with children, our approaches to child rearing are changing, as are the choices made by children themselves.

Housing is the primary environment for children, particularly before they reach school age. The home environment has a very significant impact which may last beyond childhood itself. Conceptual development can be enhanced by a stimulating and friendly space which encourages varied types of play and learning.

Children need spaces that can become their personal territories; areas where they can modify their environment, create private spaces, have close contact with carers, and areas where they can play or otherwise socialise with other children. Beyond the home, children can develop a sense of spatial recognition if the environment is safe, and if facilities such as child care, schools and shops are nearby.

many of the wild places (urban or fringe bushland) which used to be accessible to children, and which are recognised as being valuable to childhood experiences, are no longer safe for them to use.

Residential development may need to look at replacing the bushland experience with something equally stimulating, but capable of providing better security.

Useful guidelines in designing for households with children include :

- consider all private and public spaces, extending to the street, as potential play areas;
- assume that children will play everywhere;
- avoid hazards created by sloping, surfaces, structures, drainage works and traffic movement;
- provide stimulating and varied spaces and surfaces, that can be used in different ways;
- create some spaces that are specially for children's play or socialising, with dimensions that can accommodate a range of activities;
- ensure that areas likely to be used for ball games are separated from glazed areas;
- ensure that private and public spaces are overlooked by carers and neighbours;
- provide storage for children's toys, bicycles and sporting equipment.

Housing for single parent households

There is an increasing trend towards single parent families, and in most of these the parent is a woman. Single parent households are likely to be heavily influenced by location when choosing a house, in terms of achieving good access to neighbourhood facilities. Other considerations likely to have a high priority are security and low maintenance.

Some single parents prefer a group living environment, so that there can be some sharing of household tasks with other adults. There is also frequently a demand for an environment in which

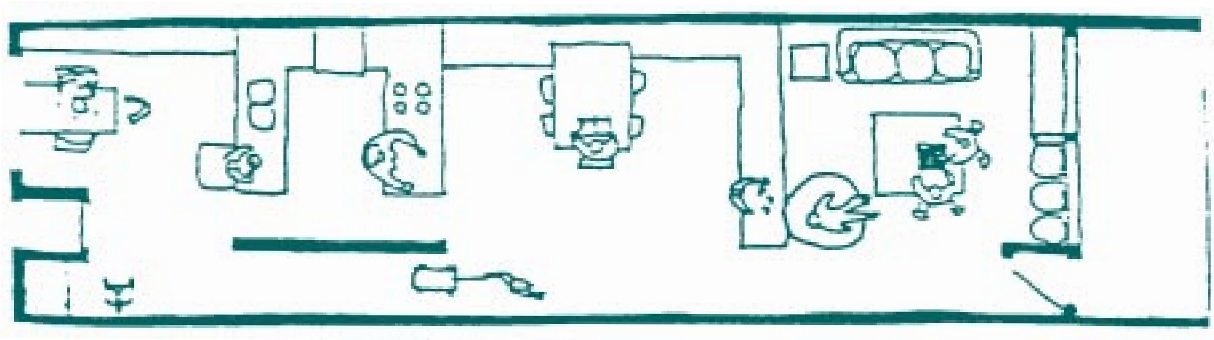


Figure 5: House layout to facilitate child supervision by a single parent.

Source: Sarkissian et al.

neighbours can meet and socialise. However, this is an area of considerable diversity in lifestyle choice.

Housing for teenagers

Teenagers have needs which are different than those of children. Inside the house they may require a large amount of privacy in their personal space. Outside, they may need public space where they can watch others and be seen. They need areas to sit and socialise, as well as spaces in which they can be physically active.

Housing for elderly people

A particular feature of the housing choices made by elderly people is that there is a reluctance to move from accommodation that they have lived in for some time, even when the traditional home is demonstrably inconvenient in its design or location. This may partly be because the alternative housing options available to elderly people have not proved sufficiently attractive. There are, however, increasing efforts being made by the public and private sectors to develop new housing solutions, and to effectively market them to older consumers.

Figure 6: Flexible space for single person households.

Source: Sarkissian et al.

When a move does take place, it is often provoked by a particular unsettling event—death of a partner, a serious illness or accident, a house break-in (either affecting the elderly person or someone known to them).

The challenge of housing for elderly people therefore applies to adaptation of existing housing as well as constructing appropriate new housing. The particular design issues that need to be addressed are:

- Security from crime ranks as the top priority in many consumer surveys, and housing for the elderly needs to reflect this level of concern.

- Security in terms of internal safety is a further issue, of concern to carers as well as occupants. It is important to design access, and fitting and fixtures with careful regard to occupational health and safety—security alarm systems may also be a desirable feature.

- It is important for people who may (either temporarily or permanently) have difficulty in walking to have accessibility into and around the home. In some housing developments a set proportion of units are designed for wheelchair users; however it is recommended best practice for all units to be readily capable of adaptations of this kind.

- Accessibility to dwellings and around the grounds should be promoted by flat or gently sloping pathways, with slip-free, well-drained but reasonably level surfaces, with a good standard of lighting. Bollard lighting of footpaths is often appropriate, and kerb ramps are recommended.

- Outdoor seating in common open space may be popular with residents of a development, if located in pleasant spaces (eg sunny in winter, shaded in summer) suitable for socialising.

- It is important that where the occupant is responsible for maintenance of the dwelling and/or its grounds, that tasks and costs are kept to a minimum.

- A ‘spare bedroom’ within the home, or on a shared basis for a group of units, is highly desirable to accommodate visiting friends and family members.

- Room sizes and openings may need to accommodate bulky traditional pieces of furniture, which the elderly may have retained from their larger homes.

- To maximise access, proximity to shops, medical facilities, post office and social facilities is an important consideration.

- Proximity to public transport to enable people to travel further afield to visit friends and family members, hospitals and other facilities, is important.

- Parking requirements for private cars are typically less than those of other age groups; however, it may be important to provide for some parking of vehicles adapted for disabled drivers and in close proximity to dwellings.

- There are arguments about whether a social mix for elderly people is a positive (stimulating and encouraging socialising) or a negative feature (causing stress and annoyance from clashing lifestyles). For example, there are both good and bad experiences documented from deliberately locating housing for elderly people near to primary schools or child care centres.

- In a large development of housing for the elderly, it is desirable to provide for a ‘continuum of care’ so that individual occupants can remain within the same development as their needs for supportive care increase. Design should accommodate access for home support services provided to occupants’ homes, as well as providing some units where more intensive medical care can be provided.

Housing for youth

When designing housing for youth, it is important to not confuse needs for teenage housing with those for youth housing.

Some issues which should be considered when providing/designing housing for youth include:

- Youth housing may require less access to private open space than 'mainstream' housing.
- Dwellings may not need to accommodate much furniture (although built in storage is important).
- Large bedsitting rooms may be appropriate for flexible living arrangements.
- Small individual kitchenettes or shared kitchens may be suitable, rather than a full kitchen for each unit.
- Provision of floor coverings and curtains or blinds may be appropriate as part of the dwelling provision, to reduce set up costs.
- Car parking requirements are less than for 'mainstream' housing (on a per unit basis).
- Converted offices have good potential for youth housing.

Housing for single person households

Although single person households have often been characterised as 'non-traditional' households in Australia, they are increasing in numbers and as a proportion of all households. People are marrying later, experiencing separation, and choosing to live alone. Single person housing is rapidly becoming the norm rather than a departure from convention.

A large proportion of single person households are elderly, and many of these have special needs arising from physical disability. The implementation of adaptable design to cater for a wide range of physical abilities as well as lifestyles is a desirable 'best' practice.

Single person households need less living space than larger households. However, lack of appropriate options within the housing market is encouraging many such households to occupy houses that exceed their spatial needs. This can lead to stress in terms of housing cost and maintenance responsibilities. If our urban areas are to promote efficient use of space to suit the whole range of community needs, the development of better housing solutions for single people is a very high priority.

The challenge is for designers to provide small dwellings which have a high level of internal amenity, attractive but low maintenance open space, privacy, and an appearance which provides for a sense of personal identity—avoiding institutional connotations.

Opportunities for socialising with neighbours, for instance through the provision of shared recreation facilities (swimming pools, gyms, coffee rooms, workshops etc) may be popular. If housing is smaller, it needs to be designed with considerable care, so as to avoid wasted or unusable space and to ensure value for money. Possibilities for customising the space, eg by moving walls or otherwise altering the environment to suit personal preferences, may be important to some individuals.

There is some controversy over the desirability of providing housing for single people (particularly elderly people) within an environment likely to be used by children. While some people may prefer to live near others of similar lifestyle, others prefer the stimulation of a mixed community.

Share housing for unrelated groups

There are considerable economies to be achieved by single persons sharing accommodation rather than each maintaining their own dwelling unit. There is a market for well designed shared housing, but relatively few models exist.

Features appropriate to share housing include:

- large bedsitting rooms for personal privacy;
- ensuite bathrooms to all bedsitting rooms;
- generous provision of secure storage space;
- security between different areas of the shared dwelling;
- acoustic privacy between rooms;
- surveillance of strangers in communal areas;
- space for entertaining visitors;
- large shared spaces including cooking, dining and sitting areas;
- high levels of parking provision for the overall resident population unless there is good access to public transport.

Affordability and lifestyle choice are the reasons young people choose to share houses. However, this often involves occupying houses designed for families, which cannot provide an optimal degree of personal privacy and separation between individuals.

Young people and older single people will benefit from more creative design approaches.

Accommodating shift workers

Our residential environments are often designed on the presumption that the occupants have conventional working and sleeping patterns. This applies to the location of bedrooms in relation to external sources of daytime noise, and the acoustic privacy of sleeping areas within the house.

It is quite likely that the demands of a society with increasing investment in technology will be for more flexible work patterns, covering a wide range of hours as well as days of the week. People will need space where they can sleep at any time of day or night, separated from other occupants who are awake. Housing may need to accommodate occupants being at home for extended periods and away for other long periods, creating challenges in terms of security and compatibility with neighbouring lifestyles.

Accommodating people who work from home
A revolution in workplace practices is occurring, with more and more people working from home. This has implications for the way in which the house is used, and the technology it has to accommodate.

Those working from home typically require well proportioned and well lit workspace that can accommodate the equipment essential for telecommuting, as well as storage of files and resource materials. Some households may contain more than one home worker. There is a wide range of personal preferences for the separation or integration of work spaces into the rest of the house.

Questions to be Applied to Housing Solutions

1. Is there a variety of house forms and sizes, internal housing layouts and fittings?

2. Can some housing achieve a high degree of privacy for occupants, including privacy of external space?

3. Are there opportunities for socialising within semi-public and public spaces, and sharing some facilities?

4. Are there sufficient external and internal spaces designed to safely accommodate children's play?

5. Is the size and shape of rooms adequate to provide flexibility for day and night-time uses,

workspaces, sleeping or living spaces?

6. Are there opportunities for outside sleeping, cooking, food production, and enclosure of space for different purposes?

7. Can individual households create their own personalised entrances to the garden or yard and the house?

8. Can internal spaces be divided into areas with a measure of privacy between them?

9. Can extra enclosed spaces be created for special uses?

Practice Note PND 22
Integrating Pets into Residential Development

Scope

Keeping domestic pets is popular because they provide companionship, security, the opportunity for exercise, and recognised therapeutic benefits (studies suggest that the keeping of pets can reduce the heart rate and lower blood pressure of owners). Thus the consideration of pets in the housing and neighbourhood design process is important. Most of this Practice Note has been derived from the report *Pets in Urban Areas: A Guide to Integrating Domestic Pets Into New Residential Development* (1993) by Harlock Jackson Pty Ltd. For more detailed information on this subject refer to that report and its reference list.

This Practice Note should not be interpreted as an encouragement to keep pets, particularly those pets that are known to have a detrimental impact on the environment.

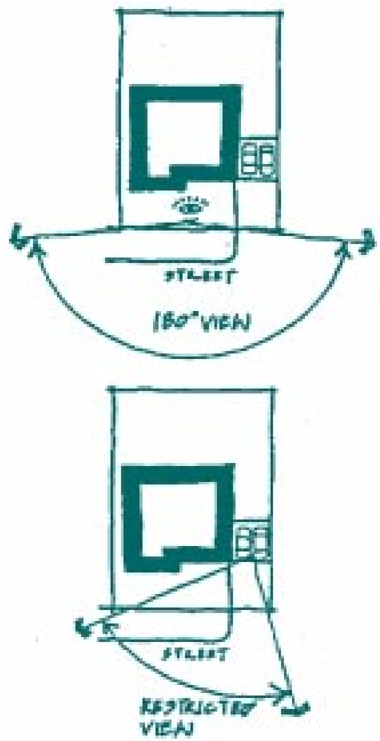


Figure 1: Allow for wide view of public arena.

Housing Type

The move towards higher housing densities throughout Australia compels both pet owners and housing designers to consider more carefully such factors as species and breed choice, design features of the house and open space, management and training of the pet, and environmental enrichment. It does not necessarily mean that the choice of pet will be restricted because of space limitations. However, in higher-density housing projects, problems may become more acute and affect a greater number of people.

Most types of domestic pets can be successfully accommodated within most forms of housing.

House Design

Houses that allow overlooking into areas of activity (eg the street or reserve) are preferable to houses built from boundary to boundary, preventing views of public areas. In each case attention must be given to the quality of open space available to the pet, and possibly allowing access into the house and providing pets with a view from within the house.

Dogs in particular should be provided with a direct interface with public areas where they can hear and see public activity.

Private Open Space and Landscaping

Amount, location and design
Open space is of particular importance to dogs. The following principles should be considered in providing open space for dogs:

- Private open space should be maximised as appropriate to the housing type.

- Dogs should be allowed access to most, if not all, of the open space.

- Solar access to open space should be available (with some provision for shade and a ‘cool spot’ for hot periods).

- Part of the open space should allow for views to public streets and parks.

- The view of public areas should be as wide as possible.

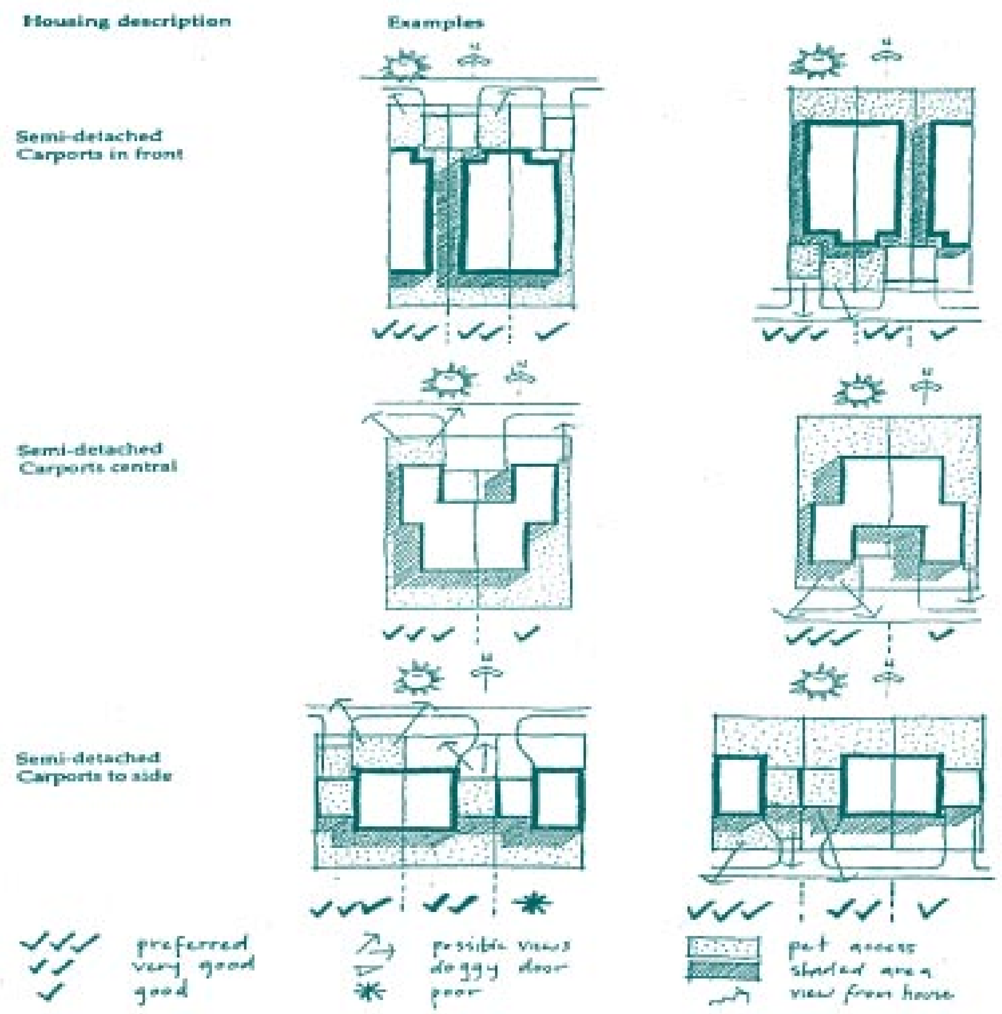


Figure 2: House design and location of garages.

Other factors to consider include the shape of the open space, with a preference for rectangular shapes that provide greater lineal distance and potential to vary landscaping. Housing built to a boundary provides for more usable open space and, in medium to high-density multi-dwelling developments, the provision of communal open space for owners and their pets should be considered. If roof-top gardens are proposed, pets should be restrained from falling over the edge.

Landscaping

Landscaping in the form of tall shade trees provides shelter and interest for pets. It also offers opportunity to hang play-inducing 'toys' (eg ropes, tyres).

A diversity of surfaces should be provided including paved areas, lawn and soil. Fruit trees and vegetable beds may need to be protected, particularly as both dogs and cats can be attracted to some fertilisers.

Fencing

Fencing that allows pets to view public areas is preferable to solid fencing. If solid fencing is required for other reasons a number of 'viewing windows' can be inserted in the fence. A fence of 1.2 m in height will restrain most dogs from escaping. Attention to the space where the fence meets the ground will reduce the possibility of dogs digging their way out.

Windows

Where access to areas of open space to the front of the dwelling is restricted, it may be possible to allow pets views of the public street or reserve via windows from inside the house. Similarly, if pets are to be kept outside, windows allow a view of family activities within the house by the pet.

Garages, Carports and Car Spaces

If possible, pets should be allowed access to carparking areas to maximise the amount of usable open space. Perforated garage or carport doors will also allow pets to view public areas.

Dog and Cat Doors

Dog and cat doors allow pets to access the house or sections of the house at their leisure while the necessary security is maintained.

Disposal of Excrement

Pets' faeces can be composted along with other organic material. If worming tablets are used, the reclaimed waste should not adversely affect garden worms. Commercial waste treatment systems are also available and are relatively inexpensive and easy to maintain.

Figure 3: Window design to increase views.

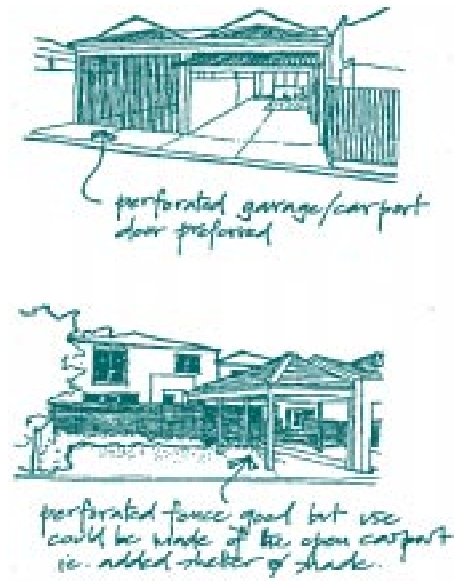


Figure 4: Use of garages to increase usable play area.

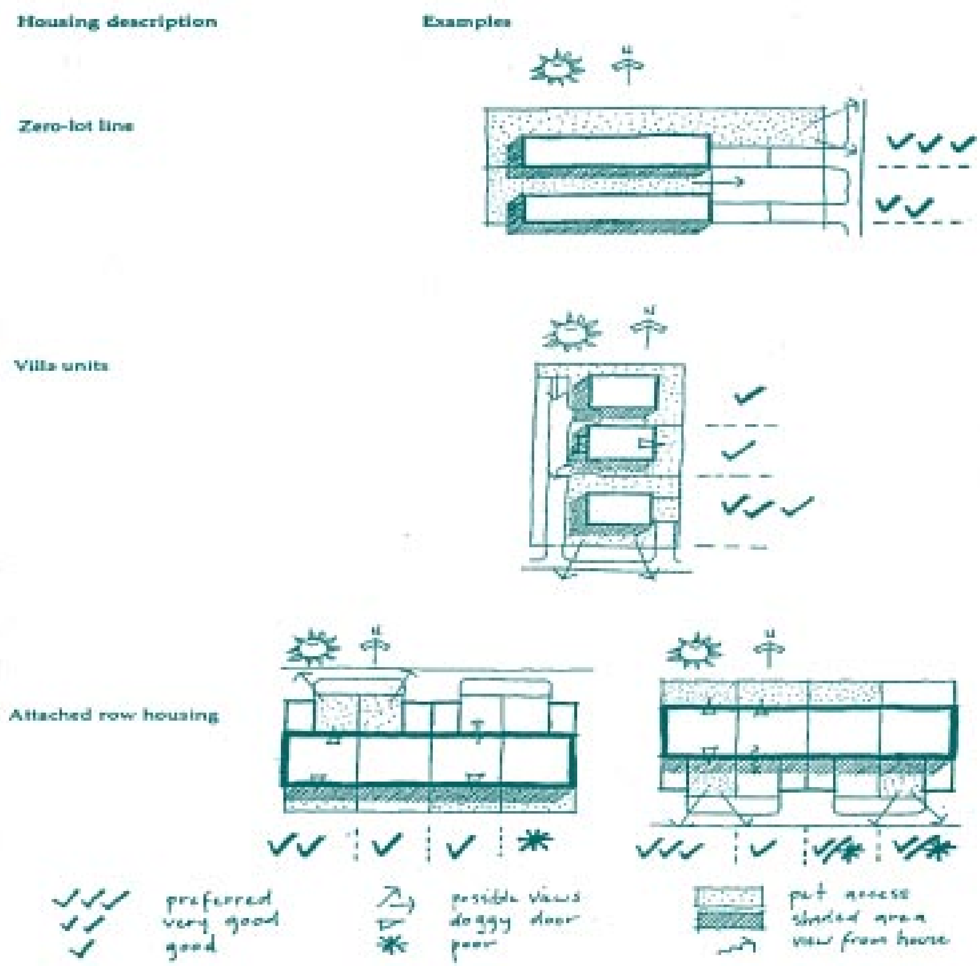


Figure 5: Implications of various house designs.

Practice Note PND 23
Residential Use of Recycled Buildings

Scope

Changes in industrial and warehousing processes, relocation of industrial activities and over-production of commercial office space, particularly within inner-city locations, have all led to increased conversions of existing non-residential buildings to residential accommodation. Most opportunities for such conversions appear limited to central city or inner urban locations. However, the potential to satisfy a range of alternative accommodation needs at comparatively high densities, close to services and facilities and relatively cost-effectively, justifies for encouraging such development.

This type of housing will only appeal to certain sectors of the residential market. Nevertheless designers and assessors must ensure that the accommodation satisfies occupant needs, particularly in terms of privacy, private and communal open space, safety and security, parking, access to sunlight and ventilation, and comfort. It is also important that, if large non-residential buildings are used for residences, developers consider the capacity of the local area's social and physical infrastructure to cater for the additional residents likely to be generated.

Occupant Needs

Such recycling can present a challenge for designers, given that most buildings were previously designed and constructed with no regard for their possible conversion into residential accommodation. Consequently only certain buildings will lend themselves to conversion or recycling, and only following considerable modification. Despite the unconventional nature of this form of housing, basic occupant needs must be satisfied and the potential for impacts on neighbouring activities must be minimised.

Sound insulation

Both external noise entering the building and the transmission of noise between dwellings within the building should be considered. Often buildings which offer potential for residential reuse are located within or close to noisy environments. As a first measure planning authorities must assess the compatibility of residential accommodation with the predominant activities within an area. If the policies of an area call for a transition from non-residential activities then conversion of non-residential buildings may be one effective way of speeding up this transition. On the other hand, increased housing in an area characterised by non-residential activities with associated impacts of noise, fumes and heavy traffic could result in conflict, discomfort and complaints.

The designer must therefore demonstrate that the infiltration of external noise can be limited to reasonable levels.

Sound transmission within a building is often under-estimated by building designers and is one of the most important factors to affect occupant comfort.

Careful attention is required to the construction of dividing walls, the surface of common walkways and hallways, the location of air-conditioning/heating units, the location of plumbing pipes and the noise generated by any other electrical, hydraulic or mechanical equipment likely to be used.

Natural light, ventilation and views

If multi-storey buildings are to be considered for conversion to residential use, basic occupant comfort needs such as access to natural light, natural (as opposed to mechanical) ventilation and long-distance views should be accommodated.

As with all other residential buildings, the design of the dwelling unit should try to maximise the entry of sunlight into living areas during the winter and minimise heat load during the summer. This means examining the location of rooms and windows, the size of windows and the use of shading devices.

Natural light and ventilation should be provided for in all living areas/rooms if possible (ie lounge, dining, bedrooms).

The outlook from living areas should avoid blank walls, or the windows, balconies or doors of other dwelling units. Ideally views should be distant and not result in overlooking into the private open space of neighbouring properties. This may require adopting various design techniques such as increasing the sill height, using planter boxes or louvre screens to obstruct downward views, or splaying windows. Similar measures should be adopted where balconies are intended to be used.

Private and communal open space
In multi-storey developments the provision of private open space at ground level for each dwelling unit is not always possible or necessary. It is preferable to incorporate an area of private open space which is directly linked to the main living area of each dwelling. In the upper storeys this should be provided in the form of a well-proportioned and positioned balcony. The designer should take into account issues of privacy, safety and protection from wind and summer sun. If possible, recessed balconies should be considered to improve the external appearance of the building. Minimum dimensions of 3 m by 3 m are generally considered appropriate to allow for a range of uses and activities.

While screening devices may be required to provide shade from direct summer sun, balconies should not generally be fully enclosed.

Where there are a large number of dwellings within the one building, an area of communal open space is desirable. This could be in the form of internal space to accommodate various leisure activities (eg reading, board games, table tennis, snooker) or outdoor space. The outdoor area should preferably be provided at ground level, or alternatively the rooftop space of multi-storey buildings could be utilised. If rooftop space is used consideration has to be given to user safety, noise impacts on occupants of the building and neighbours, the visual impact of any structure, and the maintenance of privacy for neighbouring activities.

Safety and security

Safety and security are important influences on occupant comfort, particularly in multi-dwelling developments. If large former commercial buildings are considered for conversion to residential use, issues of access to the building and to each dwelling within the building require attention.

The entrance to the building should be inviting, of human scale and safe, with careful consideration to lighting and landscaping. In multi-unit developments the design, scale and treatment of the foyer can have a major effect on the perception of the overall development and either encourage or discourage antisocial behaviour.

Long featureless walkways to the entrance from public spaces or carparking areas should be avoided, as should long featureless hallways within the building proper. Where possible, hallways should be kept to minimum lengths, provide for access to a minimum number of dwellings and allow for natural light and ventilation. The detailing of walls and floors and the use of public furniture are critical elements in enhancing usability and minimising the potential for vandalism.

At ground level, the design should ensure that there is an obvious visual distinction between public and private space. This includes private carparking areas for tenants which should be well lit and secure, and the entrance to the building should be clearly visible from each space. It is preferable in a multi-dwelling development to screen carparking areas from public view.

All multi-dwelling developments should include security systems which allow for quick and easy access to the building by occupants and guests. Where possible, opportunities for casual surveillance of public areas by residents should be maximised.

Parking

The provision and configuration of vehicle parking areas should be a matter for discretion by planning authorities. It can be influenced by factors such as the size of dwellings, proximity and convenience of public transport, location of activity and employment centres, and other areas of under-utilised parking spaces close to the development with opportunities for shared use.

Given that recycled buildings are generally located in city-centre or inner urban locations, there is a greater likelihood that occupants will use bicycles for short trips. Accordingly, provision should be made for securing both occupant and visitor bicycles in a location and manner that will deter vandalism or theft, and ensure safe movement to and from the bicycle to the entrance of the building/ dwelling.

Design Detail

The conversion of multi-storey commercial buildings offers the designer a number of challenges in creating a comfortable residential ambience. In addition to the matters mentioned, other issues include providing movement systems within the building; maximising natural light and ventilation; creating rooms with generous proportions to accommodate all expected activities, furniture and appliances; and engendering visual interest and a sense of belonging for all occupants.

Particular attention should be given to communal areas, whether they are general circulation areas, the entrance to the building, or purpose-built communal space. The emphasis should be on developing spaces of interest that will not encourage vandalism or fall in arrears of maintenance.

Above all else, the design effort should result in the creation of distinctive and varied spaces. There should be the potential for individual dwelling occupants to ‘own and recognise’ their dwelling from others within the complex.

Local Area Impacts

Where the building to be recycled is located among or close to existing or future residential areas, and it has the capacity to accommodate a significant number of occupants, there may be a need to consider the potential for wider impacts on the character and amenity of the local area. Proposals will need to address the long-term consequences of increased numbers of residents into the area, including:

- The expected number of vehicles likely to travel to and from the site. What route will they take and what is the potential impact on the capacity of local streets and adjoining land uses? Will the additional traffic require traffic management initiatives away from the site?

- The expected number of residents and their general characteristics (eg single, aged, 'empty nesters', young families). What demands will the residents place on the existing physical and social infrastructure in the area? Will the development attempt to encourage a mix of household types? Has the development considered providing for some of the specific needs of potential occupants on-site?

Figure 1: An elevation of 1 Exhibition Street, Melbourne.

There may also be an expectation that the building's exterior reflect the changed use and present a residential character. This can be achieved by introducing additional elements such as balconies, awnings or shade structures over windows; treatment of the entrance; and the use of colour and landscaping. Efforts should be made to reduce the visual bulk of buildings and achieve a human scale, visual interest and variety.

Attention must be given to issues such as overlooking into neighbouring properties and the generation of noise from the proposal (eg car parking areas, communal open space and air-conditioning units).

Mixed-Use Development

It may be desirable to retain some non-residential activities within the building, particularly at ground-floor level. These could be services and facilities that can cater for occupants, visitors and surrounding residents (eg cafe, restaurant, delicatessen, newsagent, child care facility, hairdressing salon). If this is intended, separate entrances should be clearly defined for the residential and commercial components of the development. This should include separation of vehicle traffic, including delivery vehicles and visitor parking areas.

Attention also needs to be given to possible impacts including noise (from cars and mechanical equipment such as exhaust fans and air-conditioning units), fumes, traffic generation, garbage disposal and physical appearance.

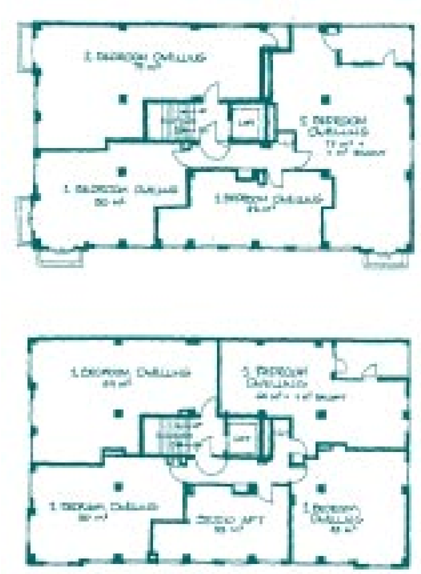


Figure 2: A typical floor plan of 1 Exhibition Street, Melbourne.

Case Study 1: 1 Exhibition Street, Melbourne

This building in central Melbourne is a 1920s structure, originally occupied by retail uses on the ground floor, offices on the first to sixth floors, and penthouses on the remaining levels. A large proportion of the building was recently converted to residential use, with the retention of retailing on the ground floor.

It is a unique central-city property, particularly suited to conversion because of its prominent corner location, frontage to streets on three sides, and large window areas.

The building is served by a lift, and has no carparking. A total of 24 dwellings is provided on seven levels above ground-floor retail shops.

The mix comprise: 1 studio dwelling, 13 one-bedroom dwellings, 9 two-bedroom dwellings, and 1 three-bedroom, two-level penthouse dwelling. The one-bedroom dwellings range in size from 42 to 69 m2, and the two-bedroom dwellings from 79 to 122 m2.

The design gives a choice of five different layouts for each of the one and two-bedroom dwellings.

Good design features include:

- very efficient floor plan (low ratio of public to private space);
- thirteen units with balconies;
- good mix of unit types and sizes;
- good natural light and ventilation;
- separate, spacious entrance for residents;
- direct access from well-travelled, well-lit street;
- three levels of security (building entrance, lift, entrances to dwellings);
- close to tram stop and parking facilities;
- excellent views.

Case Study 2: Broughton House, 177–181 Clarence Street, Sydney

This building in central Sydney is a heritage listed building which was originally occupied by warehouses and offices. The building was converted in 1980 to residential use, with resident carparking on the lower ground and ground floors. Parking on the ground floor is screened from view behind the heritage facade.

The mezzanine and eight upper floors were converted to residential flats comprising 8 one-bedroom, 42 two-bedroom and 7 three-bedroom units.

The building was suited to conversion because of its corner location, frontage to streets on three sides, and an existing light well on its fourth side. The building had an optimal ratio of available daylight to depth due to the size and number of windows in its facade. It also had a column grid which lent itself to residential layouts and allowed underground carparking.

To enhance access to light and ventilation new windows were carefully added to retain the character of the existing facade.

Access to outdoor space is provided by recessed balconies contained within the facade so that the external appearance of the building is not altered. A tennis court, landscaped open space is provided on the roof top, and an internal swimming pool with a landscaped deck are provided.

Good design features include:

- a good natural light and ventilation;
- a good mix of unit types and sizes (some two storey flats are incorporated);
- 50 of the 57 units with balconies;
- a central location in what is beginning to take form as a residential precinct along the western edge of the CBD;
- close to public transport (rail and bus);
- short walk to public open space.

References

North Sydney Council (1994) *Draft Development Control Plan for the Residential Use of Recycled Buildings*.

City of Melbourne (1993) *Building Recycling Guidelines for Residential and Mixed Uses in the City of Melbourne*.

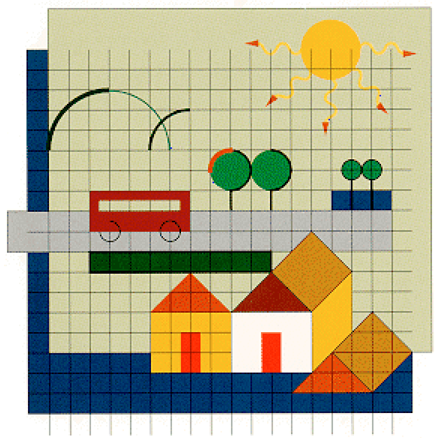
Figure 3: A photograph of the heritage listed Broughton House, Sydney

Acknowledgements

This Practice Note has been prepared from a draft set of guidelines prepared by North Sydney Council (1994).

The case studies illustrated in this Practice Note are drawn from:

- City of Melbourne (1993)Building Recycling Guidelines for Residential and Mixed Uses in the City of Melbourne.
- Sydney City Council.



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