BEYOND THE PAVEMENT
RTA urban design policy, procedures and design principles
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ALL PHOTOGRAPHS ARE SOURCED FROM THE RTA UNLESS OTHERWISE INDICATED.
COVER IMAGE: Pedestrian bridge over the Pacific Highway at Billinudgel (Brett Boardman Photography).
Following the publication of its high level urban design document *Beyond the Pavement* – *RTA Urban and Regional Design Practice Notes* in 1999, the RTA has systematically incorporated urban design thinking into the infrastructure projects for which it is responsible. These projects include arterial road upgrades, new highways, motorways, bridges, tunnels, bus transitways, street improvements and related pedestrian, bicycle and bus networks and facilities.

The result has been improved design quality and increased community satisfaction with these projects. Many of these projects have received recognition and awards for design excellence. I am proud of what we are achieving.

The RTA has learnt a lot in this time and has now produced an updated urban design policy and guide for RTA projects and related planning. This firmly establishes good urban design as a workable practice for the RTA for the forthcoming years. It is applicable to small as well as large projects that fall under a range of programs and that are planned, designed, built and maintained in all RTA regions.

This updated policy and guide is to be adopted not only by project managers and teams responsible for the design and implementation of RTA infrastructure projects, but also by others in the RTA whose work and actions affect urban design outcomes. Additionally it is for use by those in the design and construction industry who participate in our projects. Not least, it should be a source of inspiration for newcomers to the RTA.

I look forward to the continued application of urban design to road infrastructure, to produce a high quality built environment in urban and rural areas and meet the RTA’s commitment to continual improvement and high achievement.

When *Beyond the Pavement* was published in 1999 it was part of an awakening consciousness about urban design which led to a number of initiatives in NSW Government. These included the establishment of the Urban Design Advisory Committee, an Urban Design Charter for NSW Agencies, the Urban Design Advisory Service within the Department of Planning and the Government Architect’s Design Directorate to advise on the public realm for the Sydney Olympics.

*Beyond the Pavement* was unique in that it came out of the RTA, an organisation with a long history in the design and delivery of road infrastructure, but not normally associated with thinking beyond that infrastructure. There were many quality projects – roads, bridges, tunnels – but often the urban consequence was less considered than now.

The 1999 publication changed that. Its title reveals a consciousness about design in context. That context for roads is ever changing, confronting pastoral, suburban, and urban conditions. It demonstrated a commitment to urban design as a principle, concerns for the environment beyond the road corridor, and for the impacts of infrastructure on the surrounding environment.

This update, 10 years after the original, is exciting not only because it shows a continuing concern for urban design, but more importantly because it now illustrates the issues with examples of successful urban design outcomes that are the product of initiatives from the original document.

It is therefore both illustrative and celebratory. The document shows many successes achieved over the last 10 years and uses them to continue to educate, and guide projects, for better built outcomes.

*Beyond the Pavement* demonstrates an evolving understanding and commitment to the ongoing pursuit of design excellence on all types and scales of projects but importantly it addresses these issues at the scale of large infrastructure projects. Its successes are therefore big successes and its relevance is self evident.

MICHAEL BUSHBY
CHIEF EXECUTIVE | RTA | JULY 2009

PETER MOULD
GOVERNMENT ARCHITECT
RTA commitment

The RTA is committed to providing excellent outcomes for the New South Wales community from its infrastructure projects. This requires each project to be developed and delivered using an urban design approach – ‘thinking beyond the pavement’. As set out in the RTA’s Corporate Plan for 2008–2012, the RTA seeks to produce positive urban design outcomes while minimising the impacts from infrastructure on natural, built and cultural environments.

The goals of urban design in the RTA

The physical design outcomes that the RTA must achieve are:

• Road projects, and the networks of which they are a part, must fit sensitively with the landform and the built, natural and community environments through which they pass.
• Road planning and design must contribute to the accessibility and connectivity of communities and a general permeability of movement through areas.
• The design and management of roads must contribute to the overall quality of the public domain for the community, including road users.

These physical design outcomes need to be achieved in a cost-effective, safe and sustainable manner.

Urban design process

Urban design must be considered early, integrated into projects at the initiation phase and continued through the development, implementation and finalisation and operation phases. In particular:

• Road network area and corridor strategies should consider the future character and form of the network or route in their context.
• Route or project selection should integrate urban design criteria into the options assessment process.
• The development of a project’s concept design should integrate engineering and urban design.
• The detailed design should be in accordance with the project’s agreed urban design scope and quality.
• Implementation of the project should be monitored and reviewed to ensure that the agreed urban design outcomes are delivered on completion and maintenance is minimised.

Responsibilities for urban design

Achieving good design is a collaborative effort both within project teams and across the RTA. It involves many areas of expertise, including project management, asset management, environmental and landscape management, urban and regional planning, and road design.

The RTA’s urban design team is responsible for managing this policy. This team should be consulted regarding any proposed work that affects the quality of the built environment – from smaller projects, which the team can assist with, to larger projects that require the input of urban design contractors.

RTA employees working on road projects of any nature in any location must:

• Consider urban design process and principles consistent with this policy.
• Consult with the RTA’s urban design team.

Beyond the Pavement urban design principles

The planning and design of road infrastructure should be governed by the principles of:

1. Contributing to urban structure and revitalisation.
2. Fitting with the built fabric.
3. Connecting modes and communities.
4. Fitting with the landform.
5. Responding to natural pattern.
6. Incorporating heritage and cultural contexts.
7. Designing roads as an experience in movement.
9. Achieving integrated and minimal maintenance design.

MICHAEL BUSHBY
CHIEF EXECUTIVE
INTRODUCTION

What is urban design?

Urban design is both a process and a product, as captured in these two definitions:

“Urban design is the generally accepted name for the process of giving physical design direction to urban growth, conservation and change. It is understood to include landscape as well as buildings, both preservation and new construction, and rural areas as well as cities.”

JONATHAN BARNETT 1982

“Urban design... is ... the process and product of making and designing cities.”

JACQUELIN ROBERTSON 1985

The process of providing physical design direction to the development of human settlements should lead to good physical, functional and aesthetic design outcomes.

In NSW urban design is applicable to the variety of locations in which the RTA works: the wilderness landscapes of the Pacific Coast and New England tablelands; rural landscapes such as along the Hume and Newell Highways; villages such as Nabiac and towns such as Moree; provincial cities such as Coffs Harbour; regional cities such as Newcastle and Wollongong; and Sydney as a global metropolis.

Roads and key transport elements such as bridges are important to the design of human settlements in a number of ways:

• They are a key determinant in shaping settlements: roads provide an underlying structure for an area and are a key part of the overall transport infrastructure accommodating different modes of movement, connecting areas, providing access to developments and communities and markedly affecting the physical fabric.

• They are major visual features in built and natural landscapes: roads and bridges are built artefacts that can be feats of engineering adding visual interest and identity to the environment, or if not designed well, can be a visual blight from near and afar.

• They are the means by which travellers experience the built and natural environment, appreciate the historical and cultural landscape, and understand their whereabouts.

• They are public spaces between buildings: depending on their scale and location roads can provide the setting in which we stroll, eat and drink, shop, use public buildings and ride bicycles, thereby contributing to the character and vitality of settlements – a quality often referred to as ‘urbanism’.

In relation to road infrastructure, urban design brings together all of these considerations to achieve an integrated and context-sensitive design. This involves ‘thinking beyond the pavement’, that is, considering more than just engineering criteria.

It means that the RTA needs to continue to do what it can to meet the community’s expectations and deliver the outcomes identified in this document through:

• The location, scale and design quality of what we build.

• The way we address the immediate surroundings of what we build.

• Our understanding of the wider effects of what we build and how we respond to this through good design.

• The design of road infrastructure as part a total transport network – including the contribution that road infrastructure can make to public transport, cycling and walking.

• How we create a road environment that is safe for everyone.

• The way we work with other parts and levels of government.

• The way we consult with communities that may be affected.

Everything we do in planning, designing and managing road infrastructure has urban design implications – whether locating and designing a bridge, selecting the preferred route for a road project, planning and designing an intersection, accommodating bus infrastructure or a cycleway, designing a roadside barrier or retaining wall, advising on advertising, locating signage or maintaining infrastructure and landscape.
The need for this document

In December 1999 the Roads and Traffic Authority of New South Wales (RTA) published its urban design guideline titled: Beyond the Pavement – RTA Urban and Regional Design Practice Notes. This document addressed the changes the RTA needed to make in its thinking and approach to project management in order to improve the quality of urban design outcomes in its infrastructure projects. Furthermore, the creation of the guideline was a response to community and government expectations.

Following the release and promulgation of the document, the RTA established an Urban Design Section charged with facilitating good urban design outcomes from road infrastructure projects. An RTA register of urban design contractors was established to give project managers access to appropriate urban design skills.

The RTA is a foundational signatory of the State Government’s Urban Design Charter.

Other key initiatives have been the creation of an annual RTA Design Excellence Award and the establishment of an RTA Urban Design Training Course within the RTA’s Learning and Development Program.

Since 1999, many further developments have taken place.

- A number of supplementary urban design guideline documents have been published to address specific design issues in greater detail.
- All of the conceptual case studies, which formed a major part of the December 1999 document, have been implemented.
- The RTA has been formulating urban design frameworks for entire corridors, integrating urban design principles into area-wide road network strategies and applying such principles to bus facility improvements.
- Urban design reviews have been carried out on a number of projects.
- Urban design has been integrated with other RTA processes such as ProjectPac and the environmental assessment process.
- Methods of implementing urban design under different forms of contract have been developed.

This Beyond the Pavement – RTA Urban Design Policy, Procedures and Design Principles therefore supersedes the 1999 document.

How this document is structured

Section 1 – RTA Urban Design Policy: Thinking Beyond the Pavement

This section sets out the RTA’s policy on urban design. It outlines the benefits of adopting an urban design approach to infrastructure and contains the policy responsibilities for urban design within the RTA.

Section 2 – Managing urban design in infrastructure projects

This section sets out the requirements and processes to manage and carry out urban design throughout the lifecycle of infrastructure projects. The procedures described are consistent with the RTA’s project management systems for major and smaller projects.

Section 3 – Urban design principles

This section describes nine key principles of urban design that should be incorporated into infrastructure projects. These principles are then developed in greater detail in sections 3.1 to 3.9.

The purpose of these principles is to provide direction for the physical design of infrastructure projects and to help project and design teams and network planning teams produce projects, networks and corridors of high quality.

Appendices

The document is supplemented by:

- An appendix covering the international background to an urban design approach to road infrastructure.
- Advice on design methodology for RTA projects to be considered by urban designers.

These appendices are followed by a glossary of terms used in this document, a list of figures, and a list of references and documents for further readings.
Urban design as a policy

Road and bridge infrastructure has a major influence on the existing and future form, function and character of our cities, towns and villages, and the natural settings and wider countryside of which these settlements are part. All of this is what ‘urban design’ sets out to shape.

As an infrastructure organisation that builds in urban and rural contexts, we need to think ‘beyond the pavement’ of the road to consider the broader environments that are affected by infrastructure investment. Roads should be sensitive to the existing built, natural and community environments through which they pass. They should contribute to the future character, functioning and convenience of adjacent areas, provide an interesting experience in movement and should be safe for all users and the community. The architectural and landscape quality of road corridors themselves should be visually pleasing.

All of this should be safe, sustainable and cost-effective.
SECTION 1

RTA URBAN DESIGN POLICY: THINKING BEYOND THE PAVEMENT
SECTION 1

1.1 Policy

The Roads and Traffic Authority of New South Wales (RTA) is committed to adopting an urban design approach suitable for all infrastructure and related work that affects the quality of the built, natural and community environment, as set out in this document.

Urban design must be integrated into the process of developing, delivering and managing the road network by RTA staff and its contractors.

For further information see Section 1.6: Responsibilities for urban design (pp12-13).

This requires the RTA to ‘think beyond the pavement’ – that is, to consider the broader context of which road infrastructure is a part.

1.2 Purpose

The purpose of this policy is to ensure, as far as is possible, that:

• The qualities of the landscape are understood and protected.
• Roads contribute to the quality of the built environment in urban and rural contexts and leave a legacy for the future.
• The quality of life of communities is protected or improved – in terms of factors such as connections, access to facilities, proximity to noise, views, safety and sense of place.

1.3 Physical design outcomes

The three main physical design outcomes that the RTA must achieve are as follows. These are illustrated in the adjacent Figure 1.1 and elaborated in Section 3: Urban Design Principles (pp32-97):

• Road projects and the networks of which they are a part must fit sensitively with the built, natural and community environments through which they pass, in both urban and rural locations.
• Road planning and design must contribute to the accessibility and connectivity of communities and a general permeability of movement through areas by all modes of movement, including walking and cycling.
• The design and management of roads must contribute to the overall quality of the public domain for the community, including road users.

FIGURE 1.1 PHYSICAL DESIGN OUTCOMES

Sensitivity to environments

Rural bridges and related infrastructure should be in harmony with, and as far as possible protect, the scale and unique qualities of the places through which they pass and span:

• They should fit sensitively into their natural settings – the landform, landscape, vegetation, natural pattern and ecology of a place.

Accessibility and connectivity

The planning and design of roads, bridges and related infrastructure should provide good connections and movement options for communities whose quality of life is affected by:

• Their proximity to amenities and the time and effort involved in travel.
• The frequency and ease with which they can cross major roads.

Public domain

Rural, transitways and bicycle and pedestrian paths should be designed as part of the public domain:

• They are major visual elements and can add character to an area.
• The presence of vegetation contributes to the uniqueness of a place, and the ‘greening’ of a corridor.  
• The retention of views helps define the scenic quality of a road, or a journey.
• The design quality of structures and elements – the architecture of the infrastructure – contributes to how a corridor looks and feels and how robust and durable it is.
• They should fit sensitively with the form and scale of the built environment and respond to the community setting in terms of where people meet, visit or recreate, work or shop, and the places that are special to them.

This responsiveness to environments is also referred to as ‘context-sensitive design’.

• Their connectedness with other communities and parts of the urban environment.
• Ease of access to train stations and bus stops and how well buses service residential areas.
• How well environments allow for walking and cycling.

Urban design is as much concerned with functionality as it is with the quality of place.

• At the finer, more human scale, roads can function as liveable streets for communities – walkable, landscaped, well lit, interesting and safe.
• The road corridor may include art – artistic input to road elements, the use of sculpture or the use of painting.
• Improvements to the public domain may extend beyond the road corridor, such as the main street of a town where through traffic is removed by the building of a town bypass, road couple or other means.
• The quality of the public domain can be adversely affected by visual clutter, for example, poor placement and proliferation of signs.

The public domain should be well scaled, attractive and fit for purpose.
1.4 Performance themes applicable to urban design

The physical design outcomes (in section 1.3) – in terms of sensitivity to environments, accessibility and connectivity, and quality of the public domain – must be achieved in a safe, cost-effective and sustainable manner. For this to occur; safety, cost-effectiveness and sustainability must be considered throughout the design process. They should form part of design reporting at all project stages, as far as is appropriate.

These three themes are set out in the adjacent Figure 1.2 for the consideration of urban designers.

### Safety

The consideration of safety applies to all RTA activities. Therefore promoting safety is integral to an urban design approach to road infrastructure:

- All design must comply with engineering requirements for safer roads for all road users – the location, size and suitability of trees and other vegetation must be considered in terms of these.
- An urban design approach to roads and tunnels can contribute to safer driver behaviour by avoiding confusion, reducing monotony and providing visual clues to improve the legibility of the road and its speed conditions.

### Cost-effectiveness

The RTA needs to spend wisely so that urban design objectives are balanced with economic and transport objectives:

- Adopting an urban design approach can add value to the community beyond the road corridor.
- Once the optimal scope and cost parameters of a project are agreed – based on transport, economic and urban design factors – it is essential that urban design outcomes are delivered within the allocated project budget.

### Sustainability

An urban design approach should facilitate sustainable living:

- By ensuring longevity through durable, relatively low maintenance outcomes that transcend the fashions and styles of the day.
- By ensuring that a project is fit for purpose and useful for the long term.
- By facilitating good connections for all transport modes, reducing the need for car travel, bringing communities closer together and supporting local business.
• Vegetation can be used as a safety measure – it can reduce headlight glare or cushion the impact of cars accidentally leaving the road.
• Road network and road corridor planning should help avoid future conflicts between busy roads and busy town centres and between busy roads and nearby communities.
• Design should ensure there is good passive surveillance of pedestrians and cyclists by other road users and overlooked by nearby residents.
• Designs must be able to be built and maintained safely – this has particular relevance to planting.
• The needs of the vision and mobility impaired and the elderly must be considered in design.

• Urban design outcomes need not be costly and can in fact help to ‘design cost out’: minimising cut and fill; reducing costly and excessive use of structures such as retaining walls; avoiding unnecessary land-take and awkward parcels of residual land that then need to be maintained; deterring vandalism through clever design and use of robust, durable materials; and avoiding the need to mitigate impacts.
• Urban design must consider ongoing maintenance.
• Urban design must not be used as a way of adding features to a project or compensating for poor design.

• By appropriately incorporating vegetation – and all its ecological benefits – into our road corridors.
• By protecting heritage, biological diversity and ecological integrity in a project’s location and design.
• By providing public space and opportunities for walking and cycling for social and physical health.
• By adaptively re-using built form, landscape and materials.
• By considering the impact of the road’s footprint on the built, natural and community environment.

“We have worked hard with the community to reduce the road toll. But we must never be satisfied. We must innovate to achieve greater reductions and I believe we can.”

DR SOAMES JOB 2008

“There is hardly anything in the world that someone cannot make a little worse and sell a little cheaper, and the people who consider price alone are that person’s lawful prey. It is unwise to pay too much, but it is also unwise to pay too little.”

JOHN RUSKIN 1819-1900

“Environmental sustainability has been focussed on the three R’s – reduce, reuse, recycle. Rightly, this has created a strong emphasis of reducing energy, land and water use and on recycling materials, but little attention has been paid to the contribution of good design … making sure artefacts and places are useful, functional, safe, comfortable and legible … providing all these things in a well-integrated way that also achieves a good looking outcome.”

GARETH COLLINS 2008
1.5 Process

Urban design must be part of the project management process in each of the following phases:

- **The initiation phase** – in relation to network and route strategy activity that influences projects.
- **The development phase** – as part of options investigation and route (preferred project) selection, then concept design development.
- **The implementation phase** – including detailed design and construction.
- **The finalisation phase** – in terms of project review and monitoring of maintenance.

This is explained in greater detail in Section 2: *Managing urban design in infrastructure projects* (pp25-30).

The urban design process is integrated into *ProjectPack and MinorProject*, the RTA’s project management systems for larger and smaller projects, respectively. The RTA urban design team should be contacted to provide assistance on how this policy is to be applied.

1.6 Responsibilities for urban design

Urban design is a collaborative effort, both within the RTA and with the contractors it uses. The discipline and business responsibilities for implementing this urban design policy follow.

1.6.1 The RTA’s urban design team

This team is responsible for:

- Managing this policy.
- Facilitating good urban design outcomes on all RTA infrastructure programs and projects.

For further information see Section 2.1: *Requirements for the RTA urban design team* (p18).

1.6.2 RTA project managers

Project managers, including project development managers and project implementation managers dealing with major and minor projects, should use this policy and liaise with the RTA’s urban design team.

Large, complex road development projects should utilise urban designers from the RTA’s register of urban design contractors as well as the urban design team.

This is also the case for significant noise wall projects and bridge projects.

For smaller scale or minor projects, either the RTA urban design team or contracted urban designers from the registration scheme, or specialist landscape architects or architects, can be used.

For further information see Section 2.2: *Requirements for project managers* (pp19-25).
1.6.3 The rest of the RTA

This document applies to:

• Environmental managers and officers who facilitate the environmental assessment, documentation and approval of RTA projects. These personnel should collaborate with project managers and the RTA urban design team to ensure that urban design and environmental assessment processes are integrated. During a project’s development phase the aim is to avoid, or otherwise minimise or mitigate, negative impacts and achieve positive urban design outcomes.

• Staff involved in community involvement and communications. The design of a project is often challenged by the community and an understanding of the principles in this policy will assist communications staff in providing information and contributing to important negotiations.

• RTA staff involved in the development of strategies and plans for road networks and road corridors, transitways and strategic bus corridor routes and facilities, and plans and facilities for walking and cycling.

• Engineers and designers – including geotechnical, road and bridge – need to consider this policy and, in particular, the compendium guideline documents referred to in section 1.8.1 (p14).

• Those responsible for local area traffic management, intersection designs, fixed signage, variable message signage and the like.

• Asset managers and maintenance engineers who help to achieve cost-effective design solutions in terms of ongoing asset management.

• RTA staff responsible for road safety policies and design advice. Urban design can make an important contribution to safer roads and safer communities. Urban design specialists must address RTA safety requirements and standards in their work.

In relation to all of these areas, the RTA’s urban design team is available for consultation.

1.6.4 Urban design contractors

The urban design contractor is primarily expected to:

• Carry out contextual analysis and set down the project’s urban design objectives and principles.

• Contribute to the design of the project – in the whole and the parts – in collaboration with engineers and other team members.

• Contribute to the assessment of project impacts and help to avoid or minimise these impacts in the design of the project.

• Help communicate a project’s urban design principles and ideas to communities, government agencies and other stakeholders. This could include graphics, models, visual simulations and presentations. These tools can be used to develop and test designs with the team.

For further information see Section 2.2.9: Consult and communicate with the community, stakeholders and professionals on urban design (p24).

1.6.5 Engineering contractors

Engineering contractors are expected to:

• Ensure that urban design is integrated into their projects.

• Manage urban designers as part of their teams in accordance with this policy and, in particular, the project management principles outlined in section 2.

1.7 Evaluation

The RTA’s urban design team is responsible for the monitoring and review of this policy. Its success will be evaluated against:

• The RTA’s Corporate Framework as set out in the Corporate Plan 2008-2012 – that is, the degree to which the RTA achieves positive urban design outcomes and minimises the negative impact of roadworks on the natural, cultural and built environment.

• How the project has responded to the principles set down in section 3.

• The extent to which a project meets the agreed urban design objectives.
1.8 Related information

1.8.1 Urban design guidelines

A number of detailed guidelines, dealing with specific issues and elements, have been produced as a suite of documents. These, and any future detailed guidelines, should be read as a compendium to this policy:

- **Bridge Aesthetics**: Design guidelines to improve the appearance of bridges in NSW, RTA, July 2003.
- **Shotcrete Design Guidelines**: Design guidelines to avoid, minimise and improve the appearance of shotcrete, RTA, June 2005.
- **Noise wall design guideline**: Design guidelines to improve the appearance of noise walls in NSW, RTA, February 2007.
- **Landscape guideline**: Landscape design and maintenance guidelines to improve the quality, safety and cost effectiveness of road corridor planting and seeding, RTA, June 2008.
1.8.2 Other relevant RTA policies and guidelines

This urban design policy should be read and used in conjunction with other complementary RTA policies and publications including:

- Network and Corridor Planning Practice Notes, November 2008.
- Sharing the Main Street, RTA, February 2000.
- RTA Procedure for Aboriginal Cultural Heritage Consultation and Investigation, August 2008.
- Planning Guidelines for Walking and Cycling, Policy Number: P027, joint RTA and Department of Infrastructure, Planning and Natural Resources, March 2005.
- How to prepare a pedestrian access and mobility plan, March 2002.
Urban design as process

Urban design involves creating infrastructure that is sensitive to its context, serves communities well and has a unified architecture – to create an integrated engineering and urban design product.

This requires that a process or method be followed. The process must be more than a token gesture. This section sets out the project management procedures and methodologies to achieve the RTA’s desired urban design outcomes. This process is incorporated in the ProjectPack and MinorProject systems.

There are many examples of RTA projects that have followed this process and achieved successful results.

The uppermost considerations in managing urban design in relation to infrastructure projects are to:

• Consider an urban design methodology at the earliest stages of a project.
• Speak to the RTA’s urban design team for guidance on small and large projects.

Everything else flows from these two considerations.

IMAGE: Upgrade of Great Western Highway at Leura in progress.
SECTION 2
MANAGING URBAN DESIGN IN INFRASTRUCTURE PROJECTS
SECTION 2

2.1 Requirements for the RTA urban design team

The RTA urban design team is responsible for developing urban design policy and facilitating urban design on infrastructure projects. This involves a cyclical process as follows:

The development of an urban design policy and supporting detailed guidelines results in the need to equip staff with relevant skills and experience. Urban design training will help managers to implement urban design in the planning, design development and implementation stages of a project. Post-completion urban design reviews of projects provide feedback for research and development, which then influences policy making.

The RTA’s urban design team has a responsibility to advise and assist planners in their network and corridor activities, and to assist project managers to optimise urban design in all project stages. In particular, advice and assistance is provided on:

- The urban design objectives, principles and performance criteria.
- The urban design scope for a network, corridor or project.

- The adoption of the urban design process in major projects, as part of ProjectPack, and in minor projects, as part of MinorProject.
- The briefs for and selection of urban design contractors.
- The review of project deliverables.
- The project’s scope of works and technical criteria for tender at the implementation stage.
- The monitoring of construction to achieve high quality urban design outcomes.
- The post-completion urban design review of projects.

These requirements are incorporated into Section 2.3: Integrating urban design into the project management process.
2.2 Requirements for project managers

This section sets out the requirements that project managers need to meet to produce good urban design outcomes.

2.2.1 Commence urban design at the start of a project

The project manager must take into consideration urban design from the early planning stages of a project. A common misconception is that urban design need only be considered in the latter stages of a project in order to ‘dress it up’ or improve the concept design.

On the contrary, urban design is a process that should contribute to all project phases:

- From frameworks, objectives and principles at the initiation phase of programs and projects.
- To route and options assessment and concept design and environmental assessment work in the development stage of programs and projects.
- Through to the achievement of detailed design, workmanship and maintenance in the implementation, and then finalisation and operation, phases.

Urban design is to be considered early on in relation to small projects as well as large projects.

The integration of an urban design perspective helps:

- Realise a program’s, or project’s, potential.
- Avoid impacts (not just mitigate them).
- Produce an integrated engineering and urban design (which represents an improved public domain).

2.2.2 Include urban designers in a multidisciplinary design team

The project manager needs to build a multidisciplinary project team in which urban design staff sit alongside engineers, traffic planners, road safety advisors, environmental specialists, and others required for the task at hand.

On a small or simple project it may be that only a few people with broad skills make up the team, in which case urban design input can be provided by the RTA’s urban design team and/or specialist architects or specialist landscape architects experienced in urban design.

Urban design contractors are, however, needed on large and complex projects with multidisciplinary teams.

For further information see Section 2.2.4: Use suitable urban design professionals for the project (pp20-21).

2.2.3 Ensure the whole team is responsible for a good urban design outcome

At the start of a project, the project manager is responsible for ensuring that the project team is working together to develop a common vision and take joint responsibility for achieving the project objectives and urban design outcomes stated in section 1.3.

This involves more than just assembling a range of disciplines to have input into the design. Instead, project managers should facilitate a team that works together interactively to formulate and achieve the same vision and objectives.
In order to achieve this team responsibility, the project manager should:

- Ensure urban designers are incorporated into the team as equal members alongside engineers, traffic planners, road safety practitioners, environmental specialists and others.
- Identify, and gain commitment to, the project objectives at program or project initiation.
- Facilitate regular joint meetings, ensuring team members play a meaningful role in discussions throughout the design process.
- Remain open-minded to different opinions.
- Inspire the team to produce a project of high urban design standard that is cost-effective, safe and sustainable, including the maintainability of the design in terms of its ‘hard’ and ‘soft’ elements.

### 2.2.4 Use suitable urban design professionals for the project

It is essential to use the most qualified and experienced urban design professionals for a project. While the urban design process requires collaboration across a broad group of different disciplines, the term urban designer usually refers to architects or landscape architects that have extended their expertise into the field of urban design; they also have skills and experience in infrastructure design and often in city and regional planning. Urban designers may also come directly from the planning discipline rather than a strictly design background and can also make a useful contribution to project teams in the areas of environmental assessment, design review and community consultation. Participation in urban design may furthermore involve graduates and professionals who have undertaken special urban design training or completed urban design courses.
Some contractors have different experiences and knowledge in different geographic areas and project types.

The RTA's urban design team can advise project managers on these issues and on preparing an urban design brief tailored to the program or project. Any tender bid should demonstrate the right set of skills for the particular project.

The RTA's urban design team manages a register of urban design contractors on the RTA's Registration Scheme for Construction Industry Contractors. This register is available on the RTA's website and intranet. Urban design professionals can, at any time, apply to be included on the register; but can also be removed from the register if they are underperforming.

The RTA requires that any contracted urban designer be a member of the RTA registration scheme. This is the case whether the urban designer is employed directly by the RTA or indirectly, for instance as a sub-consultant of a lead professional service contractor.

In order to qualify for the register, work standards and levels of experience have to be met as set out in the RTA's Registration Scheme for Construction Industry Contractors (found on the urban design page of RTA's website).

It is important that project managers consult with the RTA's urban design team in regards to:

- The need for urban design contractors and suitable companies for a particular scale and type of project.
- The preparation of network and corridor urban design frameworks.
- The urban design component of design development and project implementation briefs.

### 2.2.5 Adequately manage and resource the contracted urban design task

The project manager's task is to ensure that urban designers meet the requirements of the urban design brief and other expectations regarding quality, deliverables, cost and time.

The urban design input should be adequately resourced. Consideration needs to be given to:

- The time required for attendance at briefings, meetings, workshops and presentations.
- The time and resources required for site visits, urban design analysis, and design integration with engineering, including design iterations.
- The preparation or use of design and presentation techniques such as architectural models, drive-through simulations and urban design documentation. When considering communication tools, the project manager should discuss options with the infrastructure communications branch prior to requesting proposals and commissioning. There is a range of technology available.

These considerations also need to be taken into account by urban designers in their tender bids, whether made directly to the RTA, or indirectly through a lead engineering company, prospective project proponent or delivery consortium.
2.2.6 Integrate urban design with environmental assessment and project approval

“.Traditionally, the detailed design of roads has been primarily undertaken on engineering grounds and environmental effects have subsequently been mitigated. The Fitting Roads Approach ... (that is, context sensitive design) ... combines engineering and environmental considerations from the outset of the design process, thus reducing the requirement for environmental mitigation.”

THE SCOTTISH OFFICE 1997

The RTA undertakes environmental assessments of all its road project proposals.

The NSW Environmental Planning and Assessment Act, 1979 and its regulations require all road projects to be subject to either an Environmental Assessment under Part 3A or a Review of Environmental Factors under Part 5.

Environmental impact assessment is part of the project design process. Ongoing design consideration and assessment should:

- Produce concepts that inherently avoid or otherwise minimise environmental impacts, thereby reducing the need for ‘add-on’ mitigation.
- Identify opportunities to improve the corridor’s built, natural and community environment and produce a high quality public domain that is fit for the purpose of the project.

Appendix C provides guidance for urban design contractors on design and assessment methodologies. The RTA Guidelines for Landscape Character and Visual Impact Assessment should also be referred to.

2.2.7 Ensure a cost-effective maintenance outcome

The project manager should review concept and detailed designs to ensure they are practical, cost-effective and require minimal, or an appropriate level, of maintenance.

Project managers should consult the RTA’s urban design team as part of the maintenance review. It is incumbent on both project managers and the urban design team to ensure that design solutions do not create an unacceptable maintenance liability.

2.2.8 Ensure design continuity throughout a project’s design, development and delivery

Projects are developed in stages, can take many years to complete and invariably involve different teams. Good design solutions can become diluted over time, if not altogether lost. At worst, this reduces the quality of the final built outcome, while, at best, funds may need to be spent on re-design.

It is important to ensure that urban design is considered across all stages of the project – throughout development and implementation. This can be achieved by:

- Continuity of urban design input.
- Continuity of project management.
- Clear urban design briefs.
- Clear and well documented design reports that consistently refer to the urban design objectives for the project.
Continuity of urban design contractors

Utilising the same designers, especially the individual personnel involved throughout the project, is the ideal way to ensure design continuity.

This may not always be practical due to competitive tendering rules for the different stages of a project, underperformance of contractors or changes in contractors and their personnel. Nonetheless, the continuity of urban design personnel can improve the design result.

Continuity of project management

Ensuring an overlap between the project manager in the design development phase and the project manager in the project implementation stage is an effective way to achieve urban design continuity.

Projects that are run collaboratively by project managers responsible for both development and implementation tend to demonstrate a better urban design outcome than those where the development manager, responsible for the concept design, simply hands the project over to the implementation manager to manage the detailed design and construction, without detailed background of the project and how the scope and features have been developed.

In the development phase, implementation managers should test the practicalities of implementing design concepts, and should also be encouraged to contribute to the development of better and more cost-effective solutions.

Development managers should then help guide the design intentions and concepts through implementation, essentially to ensure that the integrity of the concept design is upheld, if not improved.

This overlap of roles is depicted in Figure 2.3.

FIGURE 2.3 RELATIONSHIP BETWEEN PROJECT DEVELOPMENT MANAGER AND PROJECT IMPLEMENTATION MANAGER
Clear and well documented urban design briefs

A clear urban design brief should be prepared at each stage of a project.

The brief should be concise enough to ensure a focused approach to a project but flexible enough to cover unforeseen contextual issues and allow for innovation and creativity.

Poorly articulated briefs lead to poorly designed projects. When the objectives of the brief are clear, the products of the brief (often referred to as ‘deliverables’ or ‘outputs’) tailored to the project, and the timetable achievable, then the project has a better chance of success.

Systematic urban design reporting

As a project proceeds, urban design reporting is a means of ensuring design continuity and consistency across project phases. It assists in communicating the scope, purpose and features of a project to all personnel involved, including other agencies, over what may be a period of many years.

Such reporting also serves an important function in preserving the RTA’s ‘corporate memory’ of a project, especially if the design team changes or if a project is deferred and then resumed.

Design reporting should feed into the formal environmental assessment reports to be prepared, and should be as succinct as possible.

See Section 2.2.6: Integrate urban design with environmental assessment and project approval and RTA guidelines for Landscape Character and Visual Impact Assessment, 2009.

Such reporting is a useful resource in carrying out a project’s post-completion urban design review.

2.2.9 Consult and communicate with the community, stakeholders and professionals on urban design

“The role of public involvement and community participation … is widely regarded as one of the most important elements of ensuring a solution that is context-sensitive.”

NATIONAL COOPERATIVE HIGHWAY RESEARCH PROGRAM 2007

Community and stakeholder involvement is integral to planning and managing road projects in the RTA. Serious consideration is given to how a road project can be designed and improved through wide consultation with the community and stakeholders. Project managers are advised by the RTA’s infrastructure communication team on such involvement.

Refer to the RTA’s Draft community involvement and communications resource manual, 2008.

Adopting an urban design approach can make a project more acceptable, if not more welcome, to the community and stakeholders. In two-way consultations urban design intentions are illustrated as comprehensively and realistically as possible. Consultation with government agencies and interest groups should identify the full range of design issues that need to be taken into account.

The following presentation techniques should be considered, but tailored to the scale, importance, complexity and sensitivity of the project:

- Computer animations, including simulated drive-throughs, are valuable in explaining the three-dimensional qualities of a project. Although such modelling can be expensive, it can be of great assistance in explaining a project and assisting in a project’s design process. Computer-generated animations should be prepared on all large-scale projects, particularly freeways, motorways and significant bridges, or where large cuttings occur in the landscape. In the end, simulated models can be a cost-effective communication and design tool.
• Architectural models, to illustrate the three-dimensional, complex aspects of projects.
• Photomontage and drawings showing standard elevations, cross sections and plans. These must show important views from residential areas, scenic lookouts and the road itself. Simulation products can make photomontages relatively easy to produce.
• Simple line drawings can be acceptable, depending on the size and sensitivity of the project. Certainly they can suffice in the early stages of design.

These techniques can expedite the process of integrated engineering and urban design, communicate the project’s intention to communities and stakeholders and promote the project to clients and government.

The RTA has a panel of suppliers for animated products. Project managers need to ensure that these products are suitable for a project’s urban design.

For further information on specifications see the RTA’s Draft community involvement and communications resource manual, 2008.

2.2.10 Ensure continuous learning in urban design

Project managers and the RTA’s urban design team must learn from past successes and failures if they are to improve and produce better outcomes. To assist in this, the RTA undertakes a post-completion review of selected projects. As part of this process, the RTA’s urban design team prepares post-completion urban design reviews in consultation with project personnel.

See Section 2.3.5: The finalisation phase (p30) for more detail.

Project management principles in practice

All projects, whether small or large, need to be planned, designed and built so that their impact on the built environment is minimised or, more desirably, improved as a result. This is achieved by considering urban design, as well as the immediate traffic and transport, objectives of the project, by speaking to the RTA’s urban design team and by employing the right team for the job. The RTA’s Bus Network Development Section, Sydney Region, contacted the urban design team at an early stage and advice was provided on the general layout and planning of the project and the selection of an urban designer from the RTA’s Registration Scheme for Construction Industry Contractors. This process was quick and effective in producing a practical, useful project that already looks like it has been there for a long time.

A bus lane, bus laybys and a new bus stop was carefully designed to fit into the urban environment near the Seven Hills Road/Old Northern Road intersection. To compensate for the impact of road widening, the local park and frontage of the bowling club was redesigned with new landscape, improved boundaries, new seating and sympathetic paving materials. The pedestrian crossing was designed on the axis of the park at Olive Street to connect the bus stop and shops on either side of the arterial road. A new, tree-lined and direct footpath has been created and ramped for prams and disabled access.
<table>
<thead>
<tr>
<th>PHASE</th>
<th>STAGE</th>
<th>KEY URBAN DESIGN ACTIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initiation</td>
<td>Network/corridor/route strategy/formulation of other RTA programs</td>
<td>1. RTA urban design team contacted. If required, urban design framework prepared by RTA urban design team. Broad design objectives and principles developed for corridor, network and/or program where required.</td>
</tr>
<tr>
<td>Development</td>
<td>Options investigation and route selection</td>
<td>2. Urban design professionals to be employed subject to scale and complexity of project. Contextual analysis carried out. Project objectives developed, to include urban design objectives. Urban design criteria developed to measure how each option performs against those objectives.</td>
</tr>
<tr>
<td></td>
<td>Concept design development</td>
<td>3. Concept design developed by urban designers and engineers as best practice integrated engineering and urban design. Design iteration to ensure environmental impacts are avoided or minimised and design potentials realised.</td>
</tr>
<tr>
<td>Implementation</td>
<td>Detailed design brief (scope of works and technical criteria)</td>
<td>4. Brief reviewed by RTA urban design team to specify urban design requirements.</td>
</tr>
<tr>
<td></td>
<td>Detailed design and contract documentation</td>
<td>5. Detailed design developed by urban design and engineering contractors in line with concept design and RTA guidelines.</td>
</tr>
<tr>
<td></td>
<td>Construction</td>
<td>6. Urban designers and RTA urban design team involved with monitoring of implementation and quality of workmanship.</td>
</tr>
<tr>
<td>Finalisation/operation</td>
<td>Post-completion project review and monitoring of maintenance</td>
<td>7. Post-completion urban design review by urban design team as input to the project review. Monitoring of landscape maintenance by RTA urban design team.</td>
</tr>
</tbody>
</table>
2.3 Integrating urban design into the project management process

All scales and types of project need to be thought about in terms of their urban design. Large, complex projects need to factor in urban design thinking from their inception, as set out in ProjectPack. Smaller projects also need to address urban design from their inception, but may need less involvement of urban design thinking because of their smaller scope and shorter duration.

The following sections provide guidelines on how to incorporate urban design into project management. They should be tailored according to the scale and type of project.

2.3.1 Urban design as a part of the RTA’s project management systems

Figure 2.4 on the following page (p26), broadly illustrates the urban design process which is integrated with ProjectPack and MinorProject. It shows the four principal phases, with associated stages and activities, that a project typically goes through and the key urban design actions involved.

These phases – initiation, development, implementation and finalisation – are elaborated in the following sections 2.3.2 to 2.3.5 respectively (pp27-30).

Section 2.3 should be cross referenced with Appendix B: Design methodology: Advice for urban designers (pp100-103).

2.3.2 The initiation phase

In the initiation phase the broad approach to networks and corridors is established. Urban design involvement at this stage is essential and at its most influential.

Network and corridor strategies

The RTA analyses the State Road network, network areas and corridors to ascertain their physical condition, safety record, traffic efficiency and the future needs and opportunities arising from urban and regional growth and urban revitalisation. It then prepares strategies to manage road use, optimise existing infrastructure and prioritise future investments in new road infrastructure.

Urban design objectives and principles for a network or corridor can, among other factors, help to:

- Define a future road network structure and character in relation to the quality of existing environments and the planning aims and policies for a region.
- Integrate the major arterial road network within regional transport networks and local road networks.
- Integrate public transport facilities into the road environment.
- Incorporate ecological and open space systems along and across corridors.

Network and corridor strategies provide a framework to coordinate road infrastructure within state and local land use plans. These strategies give guidance to the property and infrastructure industries, local councils, property owners and communities on how the RTA proposes to manage State Roads over time.

Refer to the RTA’s Network and Corridor Planning Practice Notes, November 2008.
Corridor urban design frameworks

Road network strategies can lead to upgrade programs such as the Pacific Highway on the north coast. Such programs require specific whole-of-corridor urban design frameworks.

The preparation of corridor urban design frameworks greatly assist in the planning and design of corridor upgrades. An overarching framework of urban design objectives and principles for corridors can:

- Inform the individual projects to ensure a consistent and appropriate outcome for the corridor.
- Help avoid unnecessary, repetitive and costly design work on each project in the corridor.
- Assist in the strategic location and design criteria of facilities required along the corridor, for example, rest areas.
- Provide a basis for agreement between stakeholders and the RTA on corridor level issues.

Corridor urban design frameworks recognise that:

- Corridors traverse diverse ecological landscapes and community areas.
- Regional development and transport systems affect the future form and character of road corridors and, in turn, impact on individual projects.
- Individual projects are just one part of the travel experience of the corridor and landscape in which they fit.
- Whilst the corridor design should be unified, there is also a need for projects to be sensitive to the character of the different places through which the route passes.
- Designing each individual project as a separate entity can be costly, visually inconsistent and confusing.
- A whole-of-corridor approach can help lead to the best decisions regarding land acquisition and improve strategic corridor cost estimates.

2.3.3 The development phase

The development phase involves the investigation and selection of a preferred option followed by the concept design development of a preferred route or project.

Options investigation and preferred option selection (where applicable)

RTA projects generally involve an investigation of options. One of the reasons for this is to ensure that the road or project is appropriately scoped and sited in the best location before starting the concept design stage. There is relatively little scope for changing the project location to resolve a problem once the concept design has started.

Project or route selection must integrate urban design considerations into the options selection process. An analysis of context, formulation of urban design objectives and principles, and development of urban design criteria to measure those objectives, is an important early input (along with other criteria) to the selection of a preferred option.
This method can help ensure that a future route:

- Best fits into its context.
- Avoids or minimises at the outset impacts such as the severance of communities, the disruption of natural systems and patterns, noise, visual intrusion, the destruction of the cultural landscape and heritage, and erosion in the quality of the built environment.
- Best realises the potentials for regional development and multi-modal transport if appropriate.

Any urban design documentation carried out at this stage should be carried forward into concept design development and form part of a project’s environmental assessment.

**Concept design development**

Once the preferred option has been decided on, the concept design is developed. The concept design must address urban design objectives and principles, that is, be an integrated engineering and urban design outcome. The RTA, project stakeholders and the community should be able to understand:

- The project’s intended urban design outcomes.
- How the project fits into the natural, built and community context.
- Residual impacts (those that the concept design is unable to address) and the design mitigation measures proposed.

### 2.3.4 The implementation phase

Project implementation involves a project’s procurement, detailed design and construction. Project implementation translates the concept design into the final detailed design and built outcome.

**Detailed design**

The detailed design must:

- Be consistent with, and further develop, the approved concept design and the urban design objectives of the project.
- Achieve best practice urban design in accordance with the project budget, the required function of the project, the principles outlined in this document and supporting RTA urban design guidelines for specific elements.

**Delivery methods**

There are several methods of delivery that influence the design process:

- Construct-only is one contractual process traditionally used by the RTA. The RTA provides the design, which the contractor then builds – hence design quality is led by the RTA.
- Contracts that offset the design to the contractor include: design and construct; design, construct and maintain; and build, own, operate and transfer. In these cases the design work is carried out by the contractor, in accordance with a scope of works provided by the RTA, including urban design.
- Alliance contracts require the client and contractor to collaboratively develop the design of a project. A scope is required but the alliance team has the opportunity to refine and improve it. Incentives and a collaborative environment can assist in the development of good urban design outcomes, but, similarly to other forms of contracting, good outcomes are dependent on the quality and skills of the project team.
**Detailed design brief: scope of works and technical criteria**

Under these different contracts the RTA provides a brief called the *scope of works and technical criteria*. This brief includes a section on urban design requirements, together with the relevant RTA urban design guidelines. Compliance with design scope, including urban design, is reviewed throughout the contract with the assistance of the RTA’s urban design team.

Whether in an alliance, design and construct or construct only process the concept design is to be developed into a detailed design that can be documented, priced and built by construction companies. Model briefs (scope of works) are available to cover the different types of contract.

The scope of works and technical criteria should allow opportunities for the design team to improve on the quality of the tendered design or find better ways of doing things.

**Construction**

The implementation of the detailed design must be monitored to ensure that urban design outcomes are delivered to a high level of workmanship. Where required, project managers should be assisted by urban design professionals who understand both design quality and contractual situations. The RTA’s urban design team plays a critical advisory role in this process and should be consulted.

A high level of cooperation occurred between the RTA and the design joint venture team throughout the detailed design and construction of the M7 motorway. The RTA’s own integrated contract management and urban design team reviewed all design variations and participated in on-site inspections. This left little to chance and ensured that the required quality of design and workmanship was delivered. See *The Westlink M7 Motorway* by Raeburn Chapman, in *Infrastructure Australia, Special Issue, April 2006*.

The invitation to tender for the Karuah Bypass on the Pacific Highway in Hunter Region required the production of precisely specified tender design drawings and photomontages (above) to demonstrate that the design requirements were met. This enabled the capture of design proposals and surety in their final implementation (below).
2.3.5 The finalisation phase

The finalisation phase involves project review and commencement of maintenance actions.

Post-completion review

A post-completion urban design review is generally carried out by the RTA’s urban design team.

The urban design commitments described in the environmental assessment are compared to the final built outcome. These commitments are tracked through the stages of the implementation phase to investigate why the project went well or why the outcomes were not achieved as envisaged. Lessons and recommendations are developed for future RTA projects. These reviews are on the intranet for staff to access.

A post-completion urban design report must be signed off by the project implementation manager, in order to ensure that the review is correct and balanced.

Monitoring the maintenance requirements

The design process needs to consider ongoing maintenance needs at all stages.

Once a project is completed, it is essential to monitor and review the design to ensure that:

- The ‘soft’ landscape has been established in accordance with contract specifications.
- Maintenance will continue on the built and natural elements beyond the project’s opening.
- The need for watering, plant replacement, weed removal and graffiti and vandalism repair is minimised.

2.4 Methodology for urban design contractors

Much urban design work is undertaken by the private sector, working to standards set in contract documents and in accordance with RTA urban design policy, procedures and guidelines.

Innovation, design intuition and freedom to express potential design solutions is encouraged. Intuition and creativity are not incompatible with a logical engineering process. Urban designers can help project teams with a rigorous and transparent design methodology.

When the methodology to developing a design, has not been described and discussed in the team, some urban design inputs can appear to be unduly subjective and difficult to justify. This can make the design process:

- Time consuming.
- Difficult and confusing to implement.
- Complicated during implementation.

While there are, of course, many different ways to go about developing design, the absence of a clearly described methodology to develop options and test a range of solutions, is a serious issue.

Appendix B of this document sets out an advice note to guide urban designers on design methodology and to better inform project managers as to the approach they should expect. In simple terms, the method should relate to four main steps: contextual analysis, the setting of objectives, design and assessment iterations, and monitoring of implementation.

See Appendix B: Design methodology for urban designers (p100).
Urban design as a product

Adopting the right process is set out in the previous section. It is essential to think about the content of the design that will help produce quality road networks, corridors and projects. This section provides direction on how to design infrastructure by using fundamental urban design principles.

IMAGE: North-West Transitway, Sydney.
SECTION 3

URBAN DESIGN PRINCIPLES
SECTION 3

Overview of urban design principles

The following diagram summarises the nine fundamental principles – applicable to all projects – for designing roads in a manner which achieves the integrated engineering and urban design outcomes that the RTA wants from its projects. Each of these principles is expanded in sections 3.1 to 3.9.

FIGURE 3.1 PRINCIPLES TO ACHIEVE INTEGRATED ENGINEERING AND URBAN DESIGN

These principles:

- Capture the urban design qualities that any project should have and from which more project-specific urban design objectives and principles can be derived.
- Form the basis for thinking about design (influencing the project).
- Form a basis for evaluating design (deriving the criteria to judge the quality of a project’s urban design).

The principles should not be considered in isolation. They are interrelated and therefore need to be thought about as a whole. Good design does not result from systematically ‘ticking off’ the boxes.

Rather, successful design stems from an understanding of the interrelationships between all design aspects and addresses these in a unifying manner. As depicted in the diagram above, an integrated engineering and urban design outcome is the end result of such an approach and is more than the sum of its parts.

Each of these principles is expanded in the following sections, which are structured in terms of an introduction, illustrated guidelines and a conclusion. The illustrations consist of entire case studies as well as specific aspects of design.

These design principles are supported by various design guidelines on specific topics listed in section 1.8.1.
<table>
<thead>
<tr>
<th>PRINCIPLE ONE</th>
<th>Contributing to urban structure and revitalisation</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Consider the role of networks in the structuring of towns, cities and regions.</td>
<td></td>
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<tr>
<td>• Consider both transport and community needs in planning and designing road networks and hierarchies.</td>
<td></td>
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<tr>
<td>• Create streets and boulevards that provide a sense of place.</td>
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<tr>
<td>• Consider the potential opportunities of a reduction in traffic volume.</td>
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<thead>
<tr>
<th>PRINCIPLE TWO</th>
<th>Fitting into the built fabric</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Keep the road footprint to the minimum possible to achieve a good design outcome.</td>
<td></td>
</tr>
<tr>
<td>• Integrate noise control into road corridor and project design.</td>
<td></td>
</tr>
<tr>
<td>• Avoid adverse visual impacts in the planning and design of roads.</td>
<td></td>
</tr>
<tr>
<td>• Consider the potential use of adjoining land.</td>
<td></td>
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<thead>
<tr>
<th>PRINCIPLE THREE</th>
<th>Connecting modes and communities</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Consider connectivity into and through surrounding environments.</td>
<td></td>
</tr>
<tr>
<td>• Consider connectivity between modes.</td>
<td></td>
</tr>
<tr>
<td>• Consider where people want to cross and the quality of crossing points along a busy road.</td>
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<thead>
<tr>
<th>PRINCIPLE FOUR</th>
<th>Fitting with the landform</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Form a road in response to topography and landform.</td>
<td></td>
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<tr>
<td>• Consider slope stabilisation design as part of the project.</td>
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</tbody>
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<thead>
<tr>
<th>PRINCIPLE FIVE</th>
<th>Responding to natural pattern</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Integrate natural patterns and systems into road design.</td>
<td></td>
</tr>
<tr>
<td>• Ensure physical continuity of natural systems.</td>
<td></td>
</tr>
<tr>
<td>• Use natural characteristics in the road’s landscape design.</td>
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</tbody>
</table>

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<thead>
<tr>
<th>PRINCIPLE SIX</th>
<th>Incorporating heritage and cultural contexts</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Integrate historic buildings and precincts into road design thinking.</td>
<td></td>
</tr>
<tr>
<td>• Adapt and reuse heritage infrastructure in projects.</td>
<td></td>
</tr>
<tr>
<td>• Protect and incorporate Aboriginal heritage in road design.</td>
<td></td>
</tr>
<tr>
<td>• Recognise European cultural plantings.</td>
<td></td>
</tr>
<tr>
<td>• Protect bridges of heritage significance within their setting.</td>
<td></td>
</tr>
<tr>
<td>• Preserve roads that provide a sense of history.</td>
<td></td>
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</tbody>
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<thead>
<tr>
<th>PRINCIPLE SEVEN</th>
<th>Designing an experience in movement</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Enhance the view from the road.</td>
<td></td>
</tr>
<tr>
<td>• Provide visual stimuli within the road corridor.</td>
<td></td>
</tr>
<tr>
<td>• Create a progressive sequence of visual events.</td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>PRINCIPLE EIGHT</th>
<th>Creating self-explaining road environments</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Distinguish between the different functions and speeds of roads by differentiating their appearance.</td>
<td></td>
</tr>
<tr>
<td>• Improve the legibility of roads.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PRINCIPLE NINE</th>
<th>Achieving integrated and minimal maintenance design</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Use robust durable materials fit for purpose and place.</td>
<td></td>
</tr>
<tr>
<td>• Provide a self reliant and minimal maintenance natural landscape.</td>
<td></td>
</tr>
<tr>
<td>• Avoid opportunities for vandalism.</td>
<td></td>
</tr>
<tr>
<td>• Create a simple, coordinated and neat composition of road elements along a corridor.</td>
<td></td>
</tr>
<tr>
<td>• Consider the design quality of major road components and individual road elements.</td>
<td></td>
</tr>
</tbody>
</table>
In this chapter each of the nine key urban design principles is illustrated with a case study. These are not intended to be exemplars and, indeed, each demonstrates successes and lessons. They are included as clear illustrations of the application and outcome of the design principle. It is also important to appreciate that each case study at the same time demonstrates all of the principles combined as a whole, as far as the context allows.

The case studies are supplemented by various examples to demonstrate a particular point. These examples include many small projects in urban and rural contexts that fall under a range of RTA programs. All the case studies and examples in this document represent the work of many areas and disciplines in the RTA and outside working together — from the network planners to development and project managers and their teams, specialist and technical personnel, asset managers and the engineering and urban design professionals.
Case study seven

Fitting the landform

Pacific Highway Upgrade Project

The Pacific Highway, crossing the rural to urban interface between Sydney and the Northern Rivers, traverses diverse landscapes and environments. The project, which took 10 years to complete, involved more than 180 separate contracts across 200 separate locations. Major works included the construction of a new alignment, bridges, rest areas, cuttings and noise walls. The views are also diverse including the Illawarra escarpment, the Pacific Ocean and Kiama. The project has been designed to capitalise on these aspects. It provides an appreciation of the area for the road user and also a sequence of events – through distinctive design elements – that allows the road user to engage, interact and connect with the natural environments of the escarpment, the Pacific Ocean and Kiama.

The Pacific Highway corridor traverses the landscape of the Pacific Ocean. The arched bridge and rock cuttings frame views of the Illawarra escarpment. The bridges and barriers are designed to allow panoramic views of the Pacific Ocean.

Case study eight

Creating self-explaining road environments

Bangor Bypass (left) contrasts with Menai Road (right). Both clearly indicate what their function is, and both would make drivers feel comfortable exceeding the applicable speed limits. The function of the Bangor Bypass as a major arterial road is clear. While drivers would feel comfortable travelling at certain speeds, the Bangor Bypass was designed and built to link the existing road environments and ecological patterns have been protected, impacts on the local community have been minimised as far as possible with steep cuttings and the occasional noise wall.

The sinuous freeway skirts the edge of the canefields and woodland on the Yelgun to Chinderah Freeway in the Northern Rivers area of New South Wales. The freeway is located in the flatter land, avoiding the edge of the valley. A tunnel under Cudgen Road was designed to avoid and minimise impacts on the local community. A new bridge under Woronora Bridge was designed to be designed to accommodate heavy traffic at speeds in the vicinity of schools, residential areas and shopping centres.

The Yelgun to Chinderah Freeway

Responding to natural pattern

The occasional noise wall has had input from local artists with finishes that are used throughout. The project is a good example of a hierarchy of design types. Materials with high visual quality and durability are used in key areas of the project and built with durable materials as in this concrete barrier. Precast concrete noise walls are designed to serve different purposes and suit different locations. These panels, at a location close to the road, are repetitive and easy to replace. Experience is showing that laminated and toughened glass is best to emphasise different character zones along the M7 Motorway. Clear walls always overlap solid walls and primary colours are used to fit the landform.

All vehicular bridges have similar properties in terms of coordinated lighting locations, spill-through abutments, tapered safety screens and landscaping on the edge of the footway. The design of the 40 kilometre shared path is unified with the rest of the project and built with durable materials as in this concrete barrier. Precast concrete noise walls are designed to serve different purposes and suit different locations. These panels, at a location close to the road, are repetitive and easy to replace. Experience is showing that laminated and toughened glass is best to emphasise different character zones along the M7 Motorway. Clear walls always overlap solid walls and primary colours are used to fit the landform.
INTRODUCTION

This section explores the role of road infrastructure as a tool in city and regional design. The RTA, as the relevant road institution, can contribute to the creation of new urban structure or the re-ordering of existing urban structure through the shaping of road networks – thereby simultaneously influencing the form and quality of the built environment and achieving a better performing network.

GUIDELINES

Major road systems are more than just infrastructure for the efficient movement of people, goods and services. As well as meeting traffic needs, these road systems have a prime influence on the structure, revitalisation and functioning of the urban environment.

Investment in the road system also has major implications for urbanism, that is for the quality of the urban environments in which communities live, work and recreate. Major road systems strongly impact on essential community needs such as access and connection, convenience, movement choice, and an attractive environment.

Considering network planning and design in this way can substantially contribute to better traffic distribution, community safety, and an improved noise and air environment for communities. The guidelines that follow should be considered in the planning and design of road networks and systems.

3.1.1 Consider the role of road networks in the structuring of towns, cities and regions

Urban areas are formed not only by their geographical location, topography, coasts and rivers, but also by the initial transport lines laid down on this natural canvas. The combinations of main routes and their off-shoots go a long way towards deciding the character of a place, in terms of both its open areas and built form. For instance:

- Roads help to define the axes, avenues, streets, public frontages and focal points that towns, cities and regions are built upon and that help to make them distinct.
- Urban streets and associated urban block patterns and subdivisions have traditionally given order and structure to urban areas, from neighbourhood to city scales.
- Major reordering of city traffic, such as through tunnelling, bypassing of town centres, road coupling and traffic management, can have far reaching effects by enabling urban and arterial road revitalisation to occur.
- The network is also a framework for movement by other modes, including pedestrian, bicycle and bus, and so plays a vital role in supporting neighbourhoods and town centres.

Roads and streets help form the underlying built structure of an area.
Case study one

Contributing to urban structure and revitalisation

Hume Freeway Project, Albury-Wodonga (South-West Region)

The NSW section of the freeway was planned and designed adjacent to the rail line through Albury. As such, it replaces a previously unused and derelict area with a high speed road and rail corridor that fits in with the original grid layout of the town. The through traffic on the bypassed main route through the town is reduced, creating improved amenity and opportunities for urban revitalisation.

The east-west Dean Street axis runs from Memorial Hill to this plaza which connects with the Dean Street cable-stay pedestrian bridge. This design has revitalised the east end of the street.

The north-south linear park in East Albury – with a wide, pleasant shared cycle and pedestrian path into town, and strong architectural connections – has revitalised a former derelict strip of land by the railway.

This shows the approach from the north with the Dean Street cable-stay pedestrian bridge and old railway station and yards in view. The terraced retaining walls and noise walls align with the town grid and complement the station.

The new road along the rail corridor (horizontal north-south axis in picture) lies perpendicular to Dean Street (vertical east-west axis in picture) and fits with the grid structure of Albury.
3.1.2 Consider both transport and community needs in planning and designing road networks and hierarchies

“It is short sighted to think that significant changes in land use and regional structure can be realised without fundamentally reordering our circulation system. Only an integrated network of urban places and multi-use street systems can support the change we need for the next century of growth.”

PETER CALTHORPE 2002

As the above quote from Peter Calthorpe emphasises, we need to think beyond the notions of the suburban arterial grid and the system of functional street types, each of which serves a single function in a linear hierarchy of capacities. Such thinking has the propensity to produce the urban sprawl characteristic of modern suburbia in developed countries.

Instead, we should envisage a more diverse and complex road and transport pattern. Such a pattern should provide:

• Greater choices in the modes and scales of movement.
• New types and forms of land use with mixed activity and high densities.
• Urban infill and revitalisation which can transform undeveloped or obsolete sites.
• The support of future local activities and neighbourhoods that are walkable places.

There is a need to find alternatives to large numbers of trucks moving at speed through town centres, and to town centres creating major congestion and environmental problems along arterial routes.

The road network structure and character in Lane Cove: The east-west Lane Cove Tunnel beneath Epping Road is part of the Sydney orbital road network. The north-south Pacific Highway is a connecting urban arterial road serving the north shore. Epping Road has been turned into a secondary arterial in the form of a transit boulevard with bus lanes, cycle facilities, a new bus interchange and landscaping. Off this, Longueville Road is a connecting sub-arterial route that provides the environment for retail activity, cafes and community facilities.
The transportation network therefore requires an interconnected regional road hierarchy, within which there are network and corridor characteristics which are clearly distinguishable.

There are broad road types that can be categorised by the relative importance of their transportation and land use function. Each road type can be placed along a functional and urban design continuum, with freeways serving the greatest levels of traffic movement and local roads tending towards greater liveability and community activity.

Differentiation of road types in strategic road network planning can help the overall design of an area and thereby help avoid the noise, visual, and safety conflicts between traffic and communities.

When planning and designing road networks, the following should be considered:

- Freeways and motorways are the high speed, high volume roads whose access is controlled. They primarily link regional hubs and cities. As the major transport networks and corridors accommodating regional truck movement, commuter traffic and regional bus services, they accordingly have their own character. They allow other roads to have a greater public transport and community function and different character.

- At the other end of the spectrum are roads that provide local community access and which interface with frequent intersections and pedestrian crossings. Such roads have lower speeds, allow easy bus access and accommodate walkable environments. They form a more fine-grained street network that provides circulation between and within neighbourhoods and supports community activities such as local cafe life.

Bonville upgrade: A major freeway as part of the north coast Pacific Highway, only providing a traffic transport function.

Bourke Street, Sydney: A local street in its scale, form and character conducive to community activity.

The Great Western Highway in the blue mountains: A major or principal arterial providing a strong transport function but also local access.
• Positioned between motorways and local roads on the spectrum, are the main arterial roads. These are diverse and range from higher speed principal arterials to lower speed, lower volume arterials. They constitute the majority of the State road network for which the RTA is responsible and must be carefully considered in terms of transport, urban structure and character.

• Principal arterials generally connect with freeways and motorways. Despite their relatively high speeds, they need to respond in character to the places through which they pass. Access is generally controlled and intersections are spread out at key locations.

• Lower speed arterials have more of a community local access role. They make better public transport corridors for bus and cycling, are more walkable than the busier arterials, and have a higher degree of property access and parking. They are better suited to being tree lined boulevards and walkable environments. It is along such routes, rather than the busier major arterials, that town centres could be organised.

• These different road types need not be isolated, and roads can change in function and character along their length in response to context.

• Rail relationships to this road network hierarchy must also be considered. The road network needs to link to the train stations. Stations, terminals and transport interchanges have traditionally formed urban development nodes and have the potential to become foci for ‘transit-oriented’ development.

Anzac Parade – a main road, but with a strong public transport transit function, community facilities, parking and landscaping giving it a boulevard character.
3.1.3 Create streets and boulevards that provide a sense of place

Roads should be designed according to their role and the character of the areas through which they pass. It is possible for roads to have a distinctive character along their length, with a defined public domain and recognisable adjacent development and activity. They are one of the principal means of experiencing a place visually, socially and economically. Distinctiveness of route and sense of place helps give the urban environment clarity of physical form and sense of place. It helps inform our understanding of towns, cities and regions.

For people – both pedestrians and vehicle users – it is, to a great degree, the roads and streets that make cities and regions liveable and attractive. It is important to bear this in mind when planning roads and streets.

Depending on their context, city streets can form a three-dimensional space for strolling, shopping, resting and meeting. The immediate adjacent built fabric both demarcates and forms the road space three-dimensionally within which activity occurs. The quality of the street as a public domain is defined by: building forms, uses and architectural detail; trees and planting; lighting and street furniture; the ability to park cars and bicycles; and all of the footpath and associated activity that gives it life.

A boulevard is a special form of street that gives cities great distinction due to its greater width and grandness of space, and the larger scale of the buildings and trees that tend to line it. Boulevards serve a structural function, improving comprehension of an area by linking important destinations, large monumental buildings and major public spaces. They also provide places for social and commercial activities. Although boulevards are often formed on major axes or diagonals, some boulevards are formed on a lesser scale or in more informal contexts.

Tree planting can transform both urban arterials and local roads into streets and boulevards with character and charm.

Anzac Parade through Moore Park in Sydney (top) and The Grand Parade in Brighton Le Sands (bottom) are tree lined boulevards that contribute to the character of the local areas through which they pass.
3.1.4 Consider the potential opportunities of a reduction in traffic volume

As well as the benefits of simply reducing traffic volumes, the bypassing of areas, tunnelling beneath them, or the spreading out of traffic, provides an opportunity over time for the road to evolve as a better place for people, with a strong public transport focus and good urban character. This can occur through such means as:

• Reducing speeds through traffic management measures.
• Reducing the number and width of lanes and correspondingly widening and improving the footpath.
• Reallocating road space for bus transit, providing facilities for cyclists and allowing greater integration of parking into the corridor.
• Providing more frequent, convenient and safely designed pedestrian crossings.

• Creating a well designed interface between footpaths and adjacent buildings.

Bypassing can also result in adverse changes if there is insufficient consideration of the need to allow ease of access to the bypassed area. Therefore:

• Views of bypassed areas should be provided where desirable, with straightforward access associated with the view.
• Access to the bypassed area should generally remain on the same alignment as the original route unless change to the structure and function of the area is desirable. Because land uses such as shopping, housing, schools and open space evolve over time to fit with the main traffic routes through an area, changing these routes can have effects on the community.
CONCLUSION

These considerations in road network planning and design can help iron out conflicts between busy roads, town centres and nearby communities. They can help create road environments that are safe and fit for their intended purpose, and can help make cities and towns more liveable and sustainable.
INTRODUCTION

This section addresses the problem of designing road infrastructure that is in, or immediately abuts, urban areas in the least disruptive and most beneficial way for communities and the quality of the built environment.

GUIDELINES

The built environment is the three-dimensional assemblage of architecture, infrastructure and public spaces. Part of its quality is determined by the relationships between built and natural elements. This is the setting in which communities live and interact and, in turn, reflects community lifestyles and needs. The built environment provides a sense of place and identity for the community.

Urban life and character differs in NSW – from the built form and fabric of small towns and their main streets to the precincts and corridors of metropolitan areas.

The character and functioning of the built and community environment needs to be understood and incorporated into road design. Road design works best when it leaves the features, character and scale of the built environment as intact as possible and is in scale with it. The following guidelines aim to achieve a sensitive fit between roads and the built environment.

3.2 Principle two – Fitting with the built fabric

Arterial road upgrades can involve the lateral expansion of an existing roadway. An upgrade may disturb adjacent properties, buildings and spaces, and vegetation within and adjacent to the road. In such cases, the scale and quality of the existing road corridor is altered. Motorways make by far the largest footprint in urban areas, and are usually out of scale with the historic built fabric. Reducing the impact of the footprint and integrating motorways into the built environment is a special challenge.

Whatever the type and function of a road, the road footprint should be minimised as far as possible to be in scale with its context and least damage the built environment. Consideration of the footprint is, however, a complex matter. For instance, a relatively large land take for a road corridor can sometimes:

- Allow split carriageways.
- Accommodate more vegetation.
- Reduce the perception of hard pavement.
- Allow for batters instead of retaining walls.
- Allow the road to be joined with the adjacent built and community environment.

At the same time, account needs to be taken of the possible need for unavoidable future road augmentation and also maintenance requirements.

The ways in which physical design helps to achieve a minimal footprint are through:

- The variation of horizontal and vertical alignments of carriageways: this should be done in a manner which suits the scale and character of each particular context, diminishes the need for high, long and obtrusive road cuttings, and maximises the potential for corridor improvement.
- The use of vegetation as part of design to integrate the road with the built and community environments (as opposed to simply using vegetation as a way to reduce visual impacts).
- Avoiding, where possible, overly wide intersections that remove corner buildings, significant vegetation and open space, and create uncomfortable environments for pedestrians.

3.2.1 Keep the road footprint to the minimum possible to achieve a good design outcome

The location and design of roads should avoid overpowering the scale of the urban and community fabric and affecting its uniqueness. A road’s footprint is the area or mark it makes on the land. Footprints are becoming larger because of increased engineering and safety standards as well as the multiple requirements of road corridors, including the accommodation of buses, bicycles, pedestrians and utilities over and above general traffic.
Case study two

Fitting with the built fabric

**Eastern Distributor, Sydney**

The Eastern Distributor motorway provides a link between the Cahill Expressway at Woolloomooloo and Southern Cross Drive in Sydney from the airport. As well as extensive tunnelling under the city, the motorway is grade separated through the Moore Park precinct at Surry Hills and forms a vastly different footprint to the original engineering design. It leaves the existing urban fabric intact. Lowering the motorway in an open cut reduces noise and visual impacts, ensures continuity of the street and pedestrian networks and improves the design and outlook of the surrounding park and housing. The architecture and landscape of the project has been designed to complement the area and build upon the character and quality of the public domain.

**CONCEPT PLAN**

As shown in this elevation, the existing built form is considered and the motorway designed to fit into the character of Surry Hills, with the pillars of the retaining walls reflecting the design of the terraces.

An architectural model was prepared to demonstrate the benefits of an integrated engineering and urban design solution.

The depressed motorway is hidden from the houses and park. Its retaining walls minimise its footprint and are designed to complement the form of the Victorian terraced houses of Surry Hills.

The motorway set into a cutting protects South Dowling Street from noise and visual impacts and allows it to act as a service road for residents. The road has been retrofitted into a pleasant landscaped street with parking.

Adjoining land and streets, like Bourke Street, have undergone a renaissance. With traffic impacts removed and additional traffic management in place, a better street life and development opportunities have occurred.
• As far as possible, intersection design should allow developers to build out to the corner lines of properties, emphasise public spaces and provide walkable intersection areas. Opportunities to reconfigure corner properties and re-create the built environment should be explored. Safe street tree planting can also be a useful element to help create a greater sense of enclosure of the intersection space.

3.2.2 Integrate noise control into road corridor and project design

The proximity of busy roads to community environments results in traffic noise levels that need to be attenuated. Protecting community environments, including critical institutions such as schools, hospitals and nursing homes, requires noise mitigation measures, most commonly noise walls. The communities may request noise walls, even when other options are available and despite the potential for visual intrusion, reduction of sunlight, loss of character and social alienation that noise walls can bring.

Noise walls can create a ‘tunnel’ effect on the road environment and can have a barricading effect around communities. They can also be intrusive in appearance if not designed well. Road location and design should endeavour to reduce potential traffic noise levels so as to avoid or reduce the need for walls at all. This approach should apply right at the route selection stage of a project.

Opportunities should be explored with councils, developers and other interest groups for compatible land use policies, development setbacks and layouts. Consider the feasibility of architectural treatment of properties affected by traffic noise, and the creation of so-called ‘noise barrier buildings’ in terms of their orientation and architectural design. Less noise sensitive land uses and developments near major roads should be encouraged, as far as possible, through mechanisms such as rezoning and master planning.

Once a preferred route or project is selected, ways to address the attenuation of noise levels include:

• The design of the road to reduce noise generation through changes in horizontal and vertical alignment and the choice of pavement.

• The consideration of earth mounds to reduce noise, whilst addressing issues of corridor width, development setback and the privacy of residents. Where this is not feasible or practicable then a combination of mound and low noise walls should be considered.

Intersection improvement at Kirrawee in Southern Region: The intersection radius was reduced and the residual land was combined with adjacent property to provide a retirement housing development. As well as being a useful and profitable use of adjacent land, the built form of the development helps create a well defined space at the intersection and a landmark on the route. The development incorporates quiet courtyards that are sheltered from the noise of traffic.

The use of a simple noise mound to protect a small residential development.
If it is not possible to control noise levels within the road alignment and barriers are required, then the barriers need to be designed so that:

- They are consistent and integrated with the road design.
- There is space for a sustainable landscaped buffer.
- Noise walls are considered an architectural element in their own right.

Often, the most effective design solution involves a combination of approaches.

Noise mounds are an effective and visually acceptable solution. Here a carefully scaled and well sculpted and landscaped noise mound adjacent to the City West Link in Sydney allows views of the harbour, blocks noise from traffic and provides an attractive frontage from the road, which has been realigned. The old road went through this area.

Where required noise walls need to be considered as highly visible objects that need careful design in proportion to their prominence and site content. These walls along the M7 motorway form a unified architectural composition with well thought out transitions and heighten the experience of travel.
3.2.3 Avoid adverse visual impacts when planning and designing roads

Designing roads to fit into the built environment will help avoid visual impacts. There may be instances where this is not always possible and certain measures should be considered:

• Using mounding and false cuttings to help hide the road behind landform.

• Allowing space for screen planting where necessary and where appropriate for the landscape and built character of the area.

• Considering off-site planting, beyond the road corridor's width, subject to agreement with stakeholders, funding availability and maintenance arrangements.

3.2.4 Consider the potential use of adjoining land

Following the completion of a road project there may be land left over within the road reserve. Putting this land to a useful purpose can greatly enhance a project's urban design outcomes. It can help to provide a continuous urban environment along and across a route. Over and above this, it can help to minimise maintenance costs and yield better financial returns for the RTA. Such benefits, which should be considered early in a project's planning and concept design, can be usefully documented in a project's environmental assessment. In order to address these issues the following should be kept in mind in road design:

• The examination of opportunities to make better use of residual and other sites along a corridor for landscaping and public open space, public facilities, adjacent urban development or redevelopment (especially along bus corridors) and works to restore the urban fabric.

• The possibility of designing and developing such parcels simultaneously with the road infrastructure. Such an integrated approach represents best practice.

• The creation of a pleasing interface between the road corridor and property fence lines when making property adjustments to accommodate road widening. Community consultation is vital on this matter. It is desirable that the RTA has a say in the quality of the design of boundary fences and walls by developers that impact on the road corridor.

• Avoidance of awkward, unsightly, and difficult to maintain parcels of residual land.
3.2.5 Design road boundaries in response to local character

Along non access controlled roads with frequent subdivisions, driveways and individual built character, the RTA should endeavour to provide a sensitive interface between publicly and privately controlled land:

- When property adjustments occur, consider with landowners the best relocation, alignment, re-use or new design of fences, gates and walls.
- Between the kerbside of the road and the ultimate property fence line explore opportunities to create terracing (depending on topography), vertically separate the footpath, and incorporate bicycle paths and also native vegetation.

All of this helps to create a human scale, the individualisation of property frontage and a good neighbourhood image along the corridor.

CONCLUSION

The widening of roads and their intersections and the building of new roads can be conspicuous, erode the existing built environment and affect its character. Road design therefore requires a sensitive response to the built contexts through which roads pass. The character of the built environment needs to be understood and responded to. The scale, footprint and alignment of the road can then be dealt with in a manner which protects that character as far as possible, whilst also protecting communities from visual and noise impacts.

In this regard it is important to avoid, as far as possible, the need for noise walls.

Putting adjacent parcels of land to a useful purpose is an important way in which new or upgraded roads can be integrated with the existing built fabric. Planting and seeding can play a supporting role. Such an approach can avoid unnecessary and difficult to maintain residual land whilst being publicly and financially beneficial.

All of this should be considered from the early stages of road planning and design.

The retrofitting of Epping Road includes a feature design of boundary retaining walls in sandstone, a material repeated at the bus interchange (see photo at left).

The wetland area adjacent to the Five Islands project at Lake Macquarie is formed as a public place with shared path and boardwalks (Hunter Region).

At Faulconbridge, as part of the upgrade of the Great Western Highway, fence lines were relocated, designs personalised and driveway entrances and vegetation negotiated.
3.3 Principle three – Connecting modes and communities

INTRODUCTION

This section deals with the need to integrate all patterns and modes of movement when planning and designing roads. It is important to achieve good physical connections within and between communities and between all modes of movement. This can improve community neighbourhoods by providing greater opportunity for areas to be serviced by bus and create more walkable and liveable urban environments.

GUIDELINES

How streets join up with each other – their ‘connectivity’ – allows physical connection of communities and bus, as well as car, access. The functionality, social interaction and quality of life of communities is also helped by the degree to which streets, urban environments and developments allow pedestrians and cyclists to travel, take short cuts and select alternative routes – area ‘permeability’. These urban attributes can be diminished by roads that:

- Divide areas or neighbourhoods.
- Are difficult to cross.
- Deliberately block throughflow, such as cul de sacs.
- Spread urban development over long distances.
- Make walking and cycling difficult.
- Deny access into neighbourhoods by the continual prohibition of right-hand turns.

Maintaining traffic efficiency needs to be weighed up against community needs for access. Network connectivity and area permeability – related to pedestrian, bicycle, bus and other movements – can be achieved by considering the following guidelines.

3.3.1 Consider connectivity into and through surrounding urban environments

“Street patterns of most residential areas … are based on the discontinuous cul de sac or loop pattern rather than the interconnected grid. Block sizes are too large to permit a range of route choices, and land use patterns are course, with activities widely spaced and segregated by type.”

ANNE FORSYTH AND MICHAEL SOUTHWORTH 2008

Street layouts with frequent cul de sac type terminations of roads make it difficult to provide good permeable connections. Such layouts can make it difficult to access shops and activities and be serviced by bus, and can therefore generate unnecessary car use. An interconnected layout on the other hand can penetrate areas and accommodate bus as well as bicycle and pedestrian movement. This however may not be enough and smaller scale, short cut and alternative penetration of the urban environment may be required, specifically for bicycle and pedestrian movement. In this it should be remembered that people follow their natural desire lines for movement whether or not paths are provided, therefore what is important is the nature and quality of the whole movement environment:

- Geometric, grid-type layouts usually achieve a high level of connectivity – physical and movement connection within and between environments.
- The needs of pedestrians and cyclists are different to those of motorised road users. Short cuts, laneways and contra-flows are highly desirable to encourage walking and cycling and make places accessible.
Case study three

Connecting modes and communities

Liverpool to Parramatta Transitway, Bonnyrigg

The Liverpool to Parramatta Transitway is a 31 kilometre bus route with 21 kilometres of dedicated bus lanes, two ‘park and ride’ facilities and 35 bus stations. It connects a string of suburbs and centres between Liverpool and Parramatta providing clean, fast and safe public transport. The bus station at Bonnyrigg is situated adjacent to the shopping centre car park. It is well connected with shared paths to the south and north, and with a local road connection since local bus services run alongside the transitway. Precincts such as Bonnyrigg are attracting developer interest focussed around bus stations. A shared bicycle and pedestrian path runs along the entire length of the transitway.

The dedicated transitway has a major bus station at Bonnyrigg town centre which forms part of a larger station precinct design.

The northbound and southbound bus stops, platforms and shelters are aligned on either side of a shared path axis connecting the shopping area to the housing areas, places of worship and public open space to the west.

Cyclist facilities are provided as well as ramps and steps for ease of access. The bus station is clearly marked with signage and planting. Robust surface materials have been used.

The Liverpool to Parramatta Transitway provides quick connections from the small shopping and business areas at Bonnyrigg to the larger facilities at Prairiewood at the next stop and on to Parramatta. Bus stations have a distinctive architectural design, however transparent plastic products should in future be used instead of glass to reduce the opportunity for breakage.
• Footpaths, bicycle paths and shared paths should be integrated into the existing local pedestrian and cyclist network and can be used to connect communities.

• In all cases pedestrian and cycle facilities should be designed to fit with the local character, have a human scale and be neat in appearance. They should offer good passive surveillance and be safe, convenient and legible for all users, including people with disability.

• The design and provision of footpaths, bicycle paths and shared paths by the RTA should link with similar facilities for which councils are responsible. Where the RTA provides matching funding for the design and implementation of a council’s bike plan and access mobility plan, the facilities should achieve connectivity with and match the design quality of those built by the RTA (and vice versa).

Fernleigh track, Newcastle (Hunter Region): The track is part of a regional cycleway and walkway in a unique bushland setting between Adamstown and Belmont near Newcastle.

3.3.2 Consider connectivity between modes

As well as good connections between destinations, connectivity between modes should be smooth, safe and pleasant:

• Rail stations and bus stops should, wherever possible, be accessible for cyclists and pedestrians as well as vehicles.

• Bus stops should be located where pedestrian desire lines are greatest, at obvious focal points and reasonably close to street crossings. Additionally, they should have benches and preferably provide shelter from within which approaching buses can be seen. In general, bus stops should be near road intersections and at mid-block crossings.

Shady cyclist contra-flow lanes fit neatly between parking and plane trees on the footpath in this section of Bourke Street, Sydney. They provide a useful connection along the otherwise one-way street.
3.3.3 Consider where people want to cross and the quality of crossing points along a busy road

Road location and design should minimise cutting through and severing the built and community fabric. The severing of communities is often caused by the upgrade of existing arterial roads and provision of new corridors. Freeway-standard infrastructure can completely separate communities from one another and from other parts of a city or town. Severance of areas as a result of upgrading roads or building new roads is usually a matter of serious concern to the affected communities, but busy roads need not be barriers between them. A well-designed road can provide good connections to the local street system and allow crossings that maintain or enhance the grain of the neighbourhood and its built fabric. Good design increases the physical links to shops, jobs, community facilities, access to bus services and improves opportunities for walking and cycling. In order to ensure that road upgrades and the provision of new roads do not sever communities the following points need to be addressed:

- Adequate crossing points for cyclists and pedestrians should be provided along all roads and at regular intervals where possible. Street crossings should be at intersections. The frequency, location and nature of crossings should consider existing and future desire lines. This potentially avoids pedestrians taking risks and crossing roads in dangerous locations. It furthermore gives structure to town centres and community environments.

- Roundabouts, especially the proliferation of small ones, can make it inconvenient for pedestrians and cyclists to cross roads. They tend to push crossings for pedestrians and cyclists well away from their desire lines and the intersections where they naturally want to go. Roundabouts should be used circumspectly, preferably in low speed environments, and scaled appropriately to their purpose and urban context. There should be suitable road surface treatment to make all crossings self-evident for pedestrians, cyclists and drivers and this should be reinforced by reduced traffic speeds.

- The design of bicycle routes along a corridor and at intersections should reflect the network functions for both the road and the cycleway, and also the built and community environmental context. This influences, for example, whether the crossing is at grade or grade separated.

- On more transit orientated arterials (those with higher densities that can support road based public transport), crossing points for cyclists and pedestrians should connect with bus stops, and be provided at signalised intersections. Ideally, crossings should be spaced every 400 metres (approximately five minutes walking distance). Their location should take into account the preferred pedestrian routes and expected levels of pedestrian activity.

The pedestrian crossing of this main street in Goulburn is on a natural desire line and on the axis of a prominent building. It is attractive, safe and comfortable due to well integrated design and choice of surface materials, plants, road safety elements and street furniture.

This wide pedestrian bridge above the Eastern Distributor is at grade with surrounding streets and footpaths, to connect the residential area of Surry Hills with Moore Park.
Parts of the shared path around the Bay Run at Iron Cove, Sydney, were improved as part of the City West Link. This section of the path adjacent to Marine Drive and implemented by the local authority, clearly delineates cyclists and pedestrians and is pleasant to use.

- While pedestrian crossings at grade with surrounding streets are generally preferable, being more direct and flat, pedestrian and cycle bridges are sometimes unavoidable for specific topographic, safety and traffic efficiency reasons. They are usually built at select locations along busy corridors such as at schools, or to cross major roads. In these instances:
  - The lengths of access ramps should be kept to a minimum.
  - Lifts should be included depending on funding and maintenance constraints.
  - Adequate landings should be created at footpaths.
  - Designers should ensure that there is the best possible passive surveillance.
  - The bridge should be visually pleasing.
- The use of pedestrian and cycle bridges should be implemented only where most appropriate. Bridges are generally better than pedestrian underpasses as the latter do not have passive surveillance and are subject to vandalism. Bridges should be designed in accordance with the RTA’s Bridge Aesthetics: Design guidelines to improve the appearance of bridges in NSW guidelines.
- Where advertising is used to fund the bridge this should be integrated into the bridge design in accordance with the RTA’s Bridge Aesthetics guidelines.
Beatrice Bush Bridge in Sydney provides connections from the inner west to Blackwattle Bay and Glebe for pedestrians and cyclists. Its location makes good use of the road gradient, providing a shallow slope for users. The design is simple and elegant.

CONCLUSION

Connection, access, modal choice, convenience, and ability to walk and cycle are key attributes of a community’s quality of life. They should be fundamental in guiding road patterning and design. An interconnected and multi-modal road network hierarchy can contribute substantially to connecting modes and communities, and provide structure to urban environments.

The RTA should seek alternatives to cul de sac models with poor connections for communities and reduced opportunities to be serviced by bus.

Where they are not access controlled, main roads should be made as easy, comfortable and safe as possible for pedestrians and cyclists to cross and access bus stops, shops and neighbourhoods. Continuity of bus patterns along and across a corridor and into adjacent areas is important. Not only should pedestrian and bicycle networks permeate and connect neighbourhoods, but they should be integrated with regional networks as part of road corridor planning and design.
INTRODUCTION

This section addresses the need to least disturb the natural topography and, as far as possible, design the road and its earthworks to respond sensitively to landform.

GUIDELINES

The landform includes topography, geological character, coastlines, rivers, creeks and other water bodies. All road infrastructure traverses or intrudes into such terrain, and is subject to the constraints of that terrain. Landform has even broader implications. It is the defining feature of the landscape, whether this landscape is rural, coastal, escarpment or urban. Familiar landscapes with their landform, vegetation, human settlements, built structures and special sites are part of a region’s culture and visual quality. In all cases, road location and design should be in sympathy with this. Well designed roads flow and respond to the topography, lakes, rivers and coastlines, to the natural and farmed vegetation patterns and to the forms and patterns of built settlement in the landscape. They move with the topography and skirt sensitive and difficult areas. In this way, a more physically appropriate and aesthetically pleasing road is produced. Additionally, roads formed in this way have the potential to be cost-effective. This design approach need not pre-empt using road infrastructure creatively within the landform to transform a landscape or provide a new experience that is physically and aesthetically appropriate for the context.

3.4.1 Form a road in response to topography and landform

After route selection, the vertical and horizontal alignment of a road is the most fundamental decision that can be made in a project. As well as being a large factor in influencing the impact of a road and its traffic on the natural, built and community environment, road alignment affects subsequent earthworks, slope stabilisation, walling and bridging. Consequently, a road should be formed three-dimensionally, that is, in relation to topography and to the landscape as a whole. The key ways to form a road three-dimensionally — and these are subject to the particular context — are as follows:

- Work with contours, in addition to cross-sections, to mould the road into the landscape and minimise disturbance on natural landform.
- Where possible, create gently curving alignments in undulating, natural landscapes.
- Independently grade carriageways on hillsides to minimise earthworks, reduce deep cuttings and fit the road more comfortably into the overall topography and landform.
- Grade out cuttings to a gradient slope that is no steeper than a 1:2, and less where possible, unless stable rock is present and the objectives of the design support rock cuttings.
- Avoid cutting through spurs and ridgelines but follow hillsides and, if necessary, aim for saddles.
- Consider curving the road alignment in cuttings to avoid a notch on the skyline.
Case study four

Fitting with the landform

**Pacific Highway Upgrade Projects**

The Pacific Highway corridor traverses the landscape between the Pacific Ocean and the Great Dividing Range. It travels nearly 700 kilometres between Newcastle and Tweed Heads and crosses wide rivers, skirts valleys, meanders across wide plans and undulates over ridgelines and hills. It is a vast program and the constraints of integrating the individual project earthworks with the natural topography have produced some lessons in fitting roads into the landform.

**Concept Sections Through the Landform**

- **Karuah to Bulahdelah:** Rounding off and grading out the slopes to 1:4 creates an almost seamless integration with the natural slopes.

- **Karuah Bypass:** Independently grading the carriageways helps minimise earthworks, provide a more interesting journey and reduce the wide terraced effect of roads on hillsides. Note the gentle gradient of the embankment.

- **Yelgun to Chinderah:** Avoiding cutting through spurs and aiming for saddles and valleys reduces earthworks and creates a more flowing, responsive alignment.

- **Bonville upgrade:** Extra wide medians and independent grading allows the retention of woodland, helps fit the road into the topography and landscape, avoids headlight glare and provides better opportunities for wildlife crossing.

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URBAN DESIGN PRINCIPLES SECTION 3
• Consider varying median widths in keeping with the context. For example, adopt narrower medians in more constrained contexts and wider medians where the landscape is more expansive.

• Consider varying earthworks grades in keeping with the context. For example, use shallower grades with flatter undulating landform and steeper grades with hilly landform.

• Round off the tops, bottoms and ends of cuttings and embankments to help integrate earthworks with natural landform.

3.4.2 Consider slope stabilisation design as part of the project

Embankments that cross valleys and low-lying land should not be intrusive. Unsightly cuttings and stabilisation treatments, such as those extensively covered with shotcrete (sprayed concrete and mortar), should be avoided or not be visible from within a road corridor or from its surroundings.

If the road is not built at the same level as the adjacent land then some form of cutting or embankment between the road pavement and natural ground is necessary. Slopes are subject to erosion which cannot be allowed to damage the road or affect its use. Some form of stabilisation is therefore required; the appearance of which, if not thought about carefully, can have a serious visual impact for road users and from surrounding regional viewpoints.

The following are ways to ensure that the appearance of stabilised slopes is in keeping with the overall landscape context of the road:

• In open, rural areas a relatively shallow grade and vegetated slope are the most appropriate ways to achieve sensitive environmental fit and, furthermore, to minimise maintenance. Cuttings should ideally be graded to a maximum slope of 1:2 and revegetated and embankment slopes graded to 1:4.

On small scale improvements to rural roads, the best approach is to create simple cut face batters with space at their base to collect debris and allow a grassed verge and table drain. This minimises the footprint and the visual impact of the works (Oxley Highway, Northern Region).

• Sometimes it is necessary to steepen cuttings. Where shallow grading is not possible, steep exposed rock faces are acceptable and can provide a distinctive landmark. Where rock is stable consideration should be given to retaining a visible rock cut, especially where the rock is dramatic and its geology interesting.

• Where space is restricted, where contexts are highly sensitive or where there are geological constraints, panelling or walling may be appropriate. Panels can be used to cover unsightly piling or large areas of shotcrete used in the retention of cuttings.

• The need for shotcrete as a stabilisation method and finish should be avoided, or at least minimised.

Further information on the avoidance, minimisation and design of shotcrete is contained in the RTA’s Shotcrete Design Guideline.
The application of shotcrete was minimised on the F3 and precisely applied. Together with the colour match and natural staining, the shotcrete is practically unnoticeable.

The use of architecturally designed panelling to cover large piled and shotcreted slopes and concrete barriers provide a significantly better design outcome in terms of appearance and road safety, as shown in this example on the Pacific Highway at Brunswick Heads.

Cuttings on the North Kiama bypass were, in places, stable enough to be vertical with space at the base to catch any debris and to accommodate suitable clear-zones. The effect is distinctive and geologically interesting.

CONCLUSION

A good fit with the landscape should be a fundamental tenet of road infrastructure location and design. Forming a road in response to topography, and considering slope stabilisation as part of the landform, can produce many desirable outcomes whilst overcoming a whole range of issues.

This approach can help avoid cutting across the landform and bisecting or intruding into valued landscapes. The location, scale and design of earthworks and structures should be kept in character with the existing landscapes and neither intrude into views from key sites and nearby properties, nor affect sites which may be of significant heritage or conservation value, or that have visual prominence or value. Cuttings that create awkward notches on the skyline, scars on hillsides and unsympathetic junctions between new and existing landscapes, should be avoided.

Importantly, it should be realised that a sensitive fit between road infrastructure and landscape and cost-effectiveness are not mutually exclusive. When slope fits with the landform, long term safety and maintenance liabilities are minimised.
3.5 Principle five – Responding to natural pattern

INTRODUCTION

This section provides guidance on the value of incorporating natural pattern – the character created by the natural forms, materials and processes in the environment – into road design and thereby protecting underlying ecological systems and biodiversity.

GUIDELINES

The landscape architect Ian McHarg argued that engineers need to consider much more than commonplace road engineering criteria if they are to make engineering good. He especially expressed the need to ‘design with nature’ and to understand and conserve the ‘intrinsic values’ of an area. His clear message was that roads should not cut swathes through neighbourhoods and landscapes, and should not destroy the ecology upon which life depends.

**SUMMARISED FROM: IAN MCHARG 1969**

In designing road infrastructure it essential to think about the patterns and characteristics of the natural environment and underlying ecosystems and biodiversity that will be affected. This is the case in both in urban and rural environments. A road, by its very nature, has a linear corridor character. It will therefore almost inevitably pass through a number of different types of terrestrial and aquatic ecosystems. These ecosystems develop their physical patterns and specific characteristics in response to terrain, soil types and hydrology. Since ecosystems extend well beyond the immediate road corridor, road location and design can have impacts that are regional in scale.

Road corridors can act as barriers to wildlife. This can however be minimised by medians that are adequately wide, crossing points that fit with natural patterns, and the use of local provenance native vegetation.

As well as being important for the sustainability of the natural environment, natural systems and ecology are an attribute of the landscape, and hence an essential part of the urban design of infrastructure. They contribute to the structure, character and sense of place of an area and provide a visual experience of value to the community and travellers.

Additionally, the natural environment, natural systems and ecology have recreational use and value as part of the outdoor life of the community. Roads that are sensitive to their context should be designed to respond to, rather than diminish or destroy, natural patterns deemed to be of value to the community. The implication is that roads should no longer be considered simply in terms of traffic movement and engineering. Instead, they should be considered in the context of ecological values that sustain life and enhance human settlement. This section provides guidelines for appropriate design responses to these issues.

3.5.1 Integrate natural patterns and systems into road design

All places have their own unique natural character based upon the interplay of geology, topography, vegetation, water courses and climate. For example, the Illawarra region is characterised by the proximity of the escarpment, foothills, flame trees, fig trees and the many bays and peninsulas which abut the ocean. The north coast of NSW is characterised by the great rivers crossing the coastal plain and the tall eucalypt forests which clothe the undulating topography. The New England tableland is characterised by steep sided gullies, open plateau grasslands and heavily forested valleys and escarpment edges. The mid west is characterised by long plains punctured by vegetated rises (see photographs on page 64).
Case study five

Responding to natural pattern

**Yelgun to Chinderah Freeway**

The Yelgun to Chinderah Freeway in the Northern Rivers area of New South Wales was planned and designed to avoid and minimise impacts on the local ecology and agricultural land uses. The road footprint is minimised as far as possible with steep cuttings and the alignment closely skirts the cane fields and woodland on the edge of the valley. A tunnel under Cudgen Road was built to preserve the wooded ridge line and habitat corridors. With these measures the natural landscape and ecological patterns have been protected, impacts minimised and a better design outcome produced.

**CONCEPT PLAN**

The sinuous freeway skirts the edge of the cane fields and woodland, avoiding disruption of the natural vegetation patterns.

The freeway is located in the flatter land, avoiding the ecologically valuable ridges and woodlands.

The Cudgen Road tunnel allows the wooded ridge line and wildlife corridor to cross the road and extend down to the edge of the Tweed River. Native planting and seeding is provided to revegetate the edges of the portal. Use of gabion facing is suitable for the natural context.
It is necessary to understand and integrate the natural characteristics of each place into road design—particularly in terms of landform and planting and seeding decisions. This will help to ensure that the road fits the landscape and the ecology and will help make the road feel a part of the landscape.

The diverse landscapes of NSW are broadly represented in these images.
3.5.2 Ensuring physical continuity of natural systems

Route selection and design should endeavour to achieve sustainable outcomes and restore or replace natural system linkages. Such objectives lead to better, more fitting, design outcomes and an improved road user experience. For example, continuous tree canopies provide cover for wildlife movement as well as habitat in their own right. They also offer a windbreak for farmers, shade for cattle and recreational benefit for bush walkers. In light of these concerns, the following guidelines should be taken into account in road design:

- Select and design landscape planting and vegetation to help reconnect natural systems and habitat.
- Avoid severance of natural systems in road design especially when crossing rivers, creeks and waterways.
- Use landscaped medians where appropriate to incorporate or continue habitat, subject to road safety considerations.

The fauna overpass for the Bonville upgrade of the Pacific Highway connects both sides of the forest with a wide landbridge. It also provides an attractive, interesting landmark (Northern Region).

3.5.3 Use natural characteristics in the road’s landscape design

In road design, particularly concerning the landform and landscape aspects, much can be learnt from the local natural characteristics of an area. Watercourses and wetlands show us how to locally channel and cleanse water. Forests and woodlands indicate how trees and shrubs best propagate themselves in terms of their spacing and groupings, and reveal which species work well together and naturally suit the area. Rock outcrops and general ground conditions show us what the local fauna have adapted to and depend upon. It is important to create conditions in the landscape design which support local biodiversity and help establish and perpetuate natural processes. These conditions include:

- Diverse ground conditions with variable gradients and materials, from rock to deeper soils.
- Seeding and planting of native species of local provenance, improving plant survival, reducing water consumption and supporting local fauna.
- Natural plant spacing which reflects the need to out-compete weeds but also provides space for the plants at maturity.
- Plant groupings that capitalise on the species which are mutually supportive and thrive in the particular environment.
- Open drainage channels with native wetland and riparian plants, and rocks and gravels, to help cleanse road storm-water runoff – a ‘water-sensitive design’ approach.

A well designed detention basin that uses rock sourced from the locality. (Windsor Road upgrade, Sydney).

- Use of excess local natural materials such as rock and timber can help recover biodiversity and create habitat.

Where a project has biodiversity requirements in the project’s conditions of approvals, such as the need to revegetate areas, this should be considered as part of the project’s design.

CONCLUSION

The closer the design outcome is to the natural landscape the more ecologically valuable the road landscape will be, and the more likely the natural systems will be to survive without costly intervention. If they are not designed well, roads can seriously damage the natural environment. By designing roads in accordance with the guidelines in this section and other environmental documents, it is possible to both minimise ecological impacts and create a more sensitive and interesting design outcome.
INTRODUCTION

This section addresses the need to understand the heritage and cultural context of a road and outlines ways to incorporate this understanding in its design.

GUIDELINES

“it is now accepted that the best of what has been handed down to us should be protected…”

SCOTTISH EXECUTIVE: A POLICY STATEMENT FOR SCOTLAND 2001

The heritage that road location and design is concerned with includes: places of Aboriginal cultural and historical significance; sites, buildings, ensembles and structures of European cultural and historical significance; and cultural plantings which are part of urban and rural settings. Our heritage provides continuity, a unique sense of history and tradition, visual distinction and a sense of local and state identity. Heritage often contributes to landmark features along a route. Roads not only provide access to and views of our heritage, making it part of the road experience, but may themselves be of heritage significance and worthy of preservation in some form. All these aspects of heritage have meaning for the community, can never be replaced and should be respected. Because heritage is a complex issue that requires some objectivity, urban designers and project managers should use the experience and work of heritage specialists in developing appropriate responses to cultural and heritage issues. Furthermore, they should draw on as much local knowledge as possible. It is especially important to consult with Aboriginal communities who might be affected. Indigenous people are the primary source of information on the value of their heritage and how this is best conserved. This section sets out the design guidelines that should be taken into account in the consideration of heritage issues.

3.6.1 Integrate historic buildings and precincts into road design thinking

Heritage ‘items’ generally receive attention in the planning and design of roads. State and Commonwealth legislation ensures that heritage items are protected or, if approval is granted for their removal, that they are recorded. It is often the case that the value of the heritage or cultural context in which a heritage item sits is at least as important as the item itself. Heritage items should therefore be considered as part of the history, physical environment and visual quality of a place. The integrity of a heritage entity, for example, a heritage building and its entire curtilage, should be protected in the road location and design. Road location and design should avoid cutting through and severing heritage sites and their structures, destroying buildings and items of heritage importance (whether or not they are ‘listed’). Road location and design should not unnecessarily disturb or destroy intact cultural plantings and building groupings that define the character of a place. With respect to these issues, the following points should be taken into account:

• Maximise the incorporation of historic buildings and precincts as landmarks along a route by protecting them in road location and formation and ensuring that they are visible from the road.
• Where appropriate, deviate the proposed route at least beyond the curtilage of a building or ensemble of buildings, including the associated vegetation that contributes to the composition and character of the site, subject to funding.
• In built-up environments, consider depressing the road by forming it in open cut or cut-and-cover alongside the heritage context, subject to engineering and funding constraints.
Case study six

Incorporating heritage and cultural contexts

Upgrade of Great Western Highway at Leura

The Great Western Highway follows the original explorers route over the Blue Mountains. The corridor is tightly constrained following ridgelines and bounded by steep wooded slopes. By necessity the rail corridor and the towns of the Blue Mountains are also located on this ridge. Leura is one of the towns of the Blue Mountains that attracts many visitors due to its natural and historic character. Upgrading the highway past Leura required some innovative design approaches including a wide landbridge, preserving the ridgeline and safeguarding the curtilage of the historic ruins of the Chateau Napier hotel.

To help understand the complex three dimensional qualities of the project and to demonstrate the design thinking to the community, a model was built illustrating the key aspects of the project.

The historic and attractive mall through Leura extends past the rail station and crosses the highway on a landbridge.

The gentle ruins of the old hotel Chateau Napier are protected and provided with an appropriate sandstone boundary adjacent to the road. With the landscaped roundabout, centred on the landbridge, this forms an integrated precinct.

The pleasant, sweeping geometry of the underpass continues the ridge line. The design draws a distinction between the new road and the older town, providing an attractive outcome overall.
The old church hall in Faulconbridge was protected and physically moved away from the highway upgrade, but its prominence was retained on the highway.

- Design access to such sites in a way that is both sensitive to and reinforces the curtilage, by giving consideration to:
  - the use of service roads which can keep the upgrade of a road or new road away from the site while keeping it visible, allow vegetation of the corridor, accommodate walking and cycling along the frontage and accommodate parking and tourist buses.
  - the preservation, or introduction, of a formal axis or causeway into the site.

- Keep the footprint of the road to a minimum, or at least, mitigate its potential impact on the quality of the corridor, for example, by carriageway separation and planting. All together, the road and historic buildings and ensembles need to be brought into a compatible and balanced composition.

- Vegetation is usually an integral part of the heritage context, therefore:
  - retain the vegetated backdrop and surrounds of heritage buildings and ensembles.
  - vegetate the corridor to fit in with or otherwise complement the pre-existing vegetation.

- Select road elements which are sympathetic to the heritage involved. Such elements should be simple and complementary in character. They should not appear ‘fake’ or attempt, for example, to replicate the detailed design of the item, but should be compatible.

- Design and locate signage to minimise the visual impact on heritage buildings and ensembles, as well as structures of heritage significance, such as bridges, Aboriginal heritage and culture, historic roads and the broader landscape of which these are part.

The Mean Fiddler Hotel was protected in the upgrade of Windsor Road and its location retained as a ‘tavern by the historic road to Windsor’. This is a good example of place-making using the whole heritage context.
3.6.2 Adaptively re-use heritage infrastructure in projects

The opportunity should be taken, where possible, to re-use heritage infrastructure in the planning and design of a road, cycleway, transitway and other projects. This may include redundant infrastructure for rail, water supply and road.

Re-using heritage infrastructure links us with our past, brings character into a contemporary context and is a wise use of resources.

Project Management Services have built a cycleway in Sydney that sensitively utilises the abandoned Lower Prospect water supply canal from Prospect Reservoir to Guildford. The heritage listed Boothtown Aqueduct has been included in the design.

Hunter Region used the abandoned rail lines and tunnel to re-form and integrate the Fernleigh cycle track. This picture shows the cycle track entering the parabolic shaped portal of the heritage railway tunnel.

The existing farm house building at Abbotsbury Park, on land purchased as part of land required for the Sydney Orbital and its approaches, was refurbished into a building suitable for café use.
3.6.3 Protect and incorporate Aboriginal heritage in projects

Road location, planning and design should not disturb or destroy places and sites of Aboriginal cultural and historical significance in the landscape. Aboriginal heritage must be thought about as part of the total design. RTA policy advocates an awareness of the cultural value of Aboriginal heritage and its consideration in the route selection, concept design and environmental assessment of a project, as well as the detailed design and implementation of the project. Road location, planning and design should be guided by the following points:

• It is important to look beyond the road corridor into the surrounding area. The broad landscape may have profound meaning for Aboriginal culture and therefore should not be impacted.

• Incorporate whole sites into the road design response: for instance, important gathering sites typically occur at creek crossings and hilltops. The integrity of areas such as these should be maintained as a whole.

• The commissioning of Aboriginal artwork on road, roadside and bridge elements should be considered to mark and celebrate Aboriginal heritage. Promoting these artworks in the community can be effective in protecting structures from graffiti vandalism.

The median on the Brunswick Heads bypass was widened in the design process to accommodate a scarred tree identified as an item of Aboriginal heritage.

3.6.4 Recognise European cultural plantings

• There may be particular plantings in towns, cities and the countryside or along roads that can be considered to have heritage value, even if their heritage value has not yet been assessed and formally listed on an environmental plan or register. They should be preserved and respected in road design.

• New culturally appropriate plantings can be created to serve as landmarks in different local contexts.

The oak plantings alongside the Great Western Highway in Faulconbridge are becoming an important and recognisable feature with their distinctive fastigate form and autumn colour.

The Sea Cliff Bridge, north of Wollongong in the Southern Region, was aligned and designed to protect the valued Norfolk Pines.
3.6.5 Protect bridges of heritage significance within their setting

Bridges of heritage significance are both a community and area asset. An urban design approach to the protection of such bridges recognises the contribution they make to the character, history and cultural environment of areas and communities. This recognition needs to be put in the context of current policy and scarce funding resources.

The protection and rehabilitation of classes of bridges, as well as specific bridges, of heritage significance is part of the RTA’s asset management strategy. Of the numerous bridges listed on the SI 70 Register the RTA makes a special effort to protect and rehabilitate bridges of heritage significance (in accordance with its timber truss bridge strategy). Bridges of heritage significance are selectively protected and rehabilitated in a manner sensitive to their particular heritage values, through which their useful life can be extended another 20-30 years. The process is to establish the status of the bridge regarding its use, possible re-use or redundancy, and the structural, maintenance and cost issues involved.

The following urban design guidelines should be considered in relation to bridges of heritage significance:

- Where it is intended to duplicate a bridge that is considered to have heritage value and be suitable for contemporary use, the new parallel bridge should either duplicate its form and proportions (more suitable with concrete structures), or else provide an acceptable contrast in keeping with the original bridge and setting of which it is part (for example truss type bridges). In all cases the paired structures should read as a unified whole.
- Uphold the vistas and viewpoints to the old bridge and its curtilage, as far as possible.
- Integrate and reinforce the quality of the precinct in which the bridge sits, including river embankments and precincts on either side, as far as possible.
- Consider the integration into the urban design of themed rest areas with good access where this is compatible with the overall nature of the site. (This concept can apply equally in section 3.6.1.)
- Modify the design of a heritage bridge to strengthen it and accommodate re-use in keeping with heritage guidelines so that it retains its working value to the community as a working asset.
- Accommodate access to walking trails at heritage bridges and encourage users to learn about the heritage of the bridge and its context through, for example, the provision of signage and heritage interpretation panels.

The Hinton bridge over the Paterson River near Maitland is one of the oldest Allen truss bridges in Australia built in 1901 to accommodate expanding settlements. It was repaired sensitively in 2006 using timber, steel and concrete composites thereby preserving its heritage value and attractiveness in the landscape.

The bridge over the Murray River at Corowa was bypassed by the new road to accommodate high load freight vehicles. The old bridge was retained for local traffic, thus preserving its value as a crossing of the river.
3.6.5 Preserve roads that provide a sense of history

NSW has a history and legacy of historic roads, including many of the oldest in the nation. Their identification, preservation, management and promotion recognises that historic roads guide us through our history, helping to us to experience places that make the state unique. Their transformation into roads which meet current day use requirements needs to be done with care. It is not simply the issue of removing or replacing them that is at stake: there is also their vulnerability to ‘improvements’, such as widening, straightening, the removal of old roadside trees, the removal of original walls and the addition of contemporary signage. The character of a historic road is furthermore affected by changes to the larger setting and community through which it passes, for example, through inappropriate zoning and development. We must also consider that what we create and build today will become the heritage of tomorrow. Our constructions are not simply for this generation; although of course, they are subject to modification in the future. With regard to these issues, the following guidelines should be taken into account:

- Align the road to move responsively through the historic and cultural landscape, both European and Aboriginal.
- As it can be difficult to preserve everything, endeavour to at least keep a thematic sample of the cultural landscape.
- Recognise the benefits of historic (and generally scenic) roads to regional and local tourism.
- Whilst still meeting road safety needs, select suitable lane width and road footprint, including shoulders and clear zones, in terms of the historic character of the road and its corridor.
- Consider the design of all elements – including edges, vegetation, signage, lighting, drainage features, retaining walls and bridges and use of materials – as part of an historic road.
- Elements, forms and colours of the landscape can be incorporated in the road corridor as themes of design.
- Rest areas lend themselves to the placement of interpretation sign boards which can serve to emphasise the sense of place for both the community and road travellers.

A deviation of Windsor Road was created to protect Rouse Hill and the extensive surrounding precinct. The original Windsor Road (shown in this picture) that runs through the site has been reinstated at its original level, with original materials and without kerbs and gutters.
In upgrading Windsor Road the RTA prepared a Conservation Plan of Management setting out the RTA’s conservation policies, physical proposals and actions to retain items, sites and places of heritage significance in relation to the road project. This plan has influenced all projects on Windsor Road such as the North West Transitway alignment along the old road corridor.

**CONCLUSION**

Not only should heritage be protected as far as possible, but it should also be recognised as an attribute of the road environment. The process of incorporating heritage and other valued cultural contexts into road design should make use of heritage experts in the advisory and design fields so that all viewpoints and concerns are integrated into road and bridge design. Advice from the RTA’s Heritage Committee can be particularly useful because of the range of interest groups included and the depth of knowledge they collectively possess. All dealings with Aboriginal heritage should comply with the special protocols set forth by the RTA.

In general, it is not simply the heritage item but also its context and setting that is important to address and retain where possible. The RTA has a legislatively defined role to play in relation to heritage and needs to be strategic in the way it uses scarce funding to protect and maintain the heritage assets for which it is responsible, particularly when it comes to bridges of heritage significance, as these present unique difficulties. Urban design consultants need to be aware of all these interrelated issues. Despite the complexities, as the guidelines in this section suggest, it is possible to achieve a great deal in the area of heritage preservation and incorporation into road design.

**WESTLINK CYCLEWAY AND WALKING PATH**

**Bernera Homestead Site**

Bernera Road is named after an early estate granted to Dr. Donald McLeod, staff surgeon to Governor Brisbane. McLeod named the grant ‘Bernera’ after his former home on the island of Bernera, Scotland.

In 1856 a timber homestead was built on the estate. Subdivision of the estate began in 1889 and the house was destroyed by fire in April 1986. Today archaeological remnants, trees and garden remnants provide information about rural living conditions and the homestead’s extent.

The Bernera Homestead Site is one of a series of heritage interpretation panels that have been installed at carefully located and designed rest stops along the M7 cycleway and walking path to enhance the experience of path users.
INTRODUCTION

This section underlines the need to design road infrastructure that provides a physically and visually stimulating travel experience, avoids boredom, assists in wayfinding and best allows an appreciation of the values of the landscape through which the road passes. The following guidelines put forward ways to meet these needs.

GUIDELINES

“...the expressway should offer the traveller a stimulating, coherent, and developing experience.”

APPLEYARD LYNCH I964

Roads are a principal means by which we reach our destinations as motorists and travellers. This can be over large distances, such as a corridor through a metropolitan area, along an entire coastline or between towns. It can also be over relatively short distances, such as getting to the city from the airport or travelling between suburbs. Urban design recognises that travelling to a destination is not simply a matter of getting from A to B. It is a journey through areas and landscapes in different contexts and at different scales and speeds. This journey should be visually and physically stimulating for the traveller; make travellers aware of the environments through which they pass and allow travellers to recognise and find their whereabouts and anticipate their future direction.

A number of key issues are discussed and elaborated below. These serve as a useful prelude to the guidelines that follow.

Loss of visual perception

The changing scale and speed of travel has reduced our visual perception of the landscape including that of the built environment. Good urban design should make places more visible, legible and memorable under varying experiential conditions. Until the mid-twentieth century, as we travelled we were able to build up a mental ‘map’ of familiar landmarks, vistas, spaces and architectural details. Our experience was primarily at the scale of the pedestrian, the tram or slow moving traffic. This level of detail and richness has changed with the scale and speed of contemporary travel. Once we leave the pedestrian scale, which is the case most of the time, our experience is much coarser; fleeting and regional, especially along highways and freeways. Our awareness and recognition of the qualities of places and commensurate sense of whereabouts is being lost in the process. There is an opportunity to reverse this somewhat in road design.

Boredom during travel

Long stretches of monotonous views and daily repetitive driving with low visual stimulation is not conducive to good driving and can lead to a loss of concentration. Road design should not deprive the traveller of visual stimulus but rather endeavour to heighten the travel experience, although in a manner that avoids distracting the driver. Over and above the implications for the quality of the built environment, particular consideration should be given to the possible loss of concentration and driver error that can result when continuous straight roads of constant width and spatial cross-section occur within a corridor or across a road network; when travelling in one direction feels just like travelling in the opposite direction; when there are repetitive movements at similar curves; when views are restrictive or monotonous; and when continuous landscaping encloses the visual field of the driver over long distances.
Case study seven

Designing roads as an experience in movement

North Kiama Bypass (Southern Region)

The North Kiama Bypass upgrade of the Princes Highway is approximately 10 kilometres long yet traverses a diverse landscape that includes agricultural lands, industrial areas, woodland, river valleys and hilltops. The views are also diverse including the Illawarra escarpment, the Pacific Ocean and Kiama. The project has been designed to capitalise on these aspects. It provides an appreciation of the area for the road user and also a sequence of events — through distinctive bridges, rest areas, cuttings and noise walls.

The bridges and barriers are designed to allow panoramic views of the Illawarra escarpment.

The occasional noise wall has had input from local artists with textures, included denoting the local tree species.

The arched bridge and rock cuttings frame views of the Pacific Ocean.

The approach to Kiama takes in views of Kiama itself and the Pacific Ocean and beach at Bombo. The alignment of the edge of the quarry provided opportunities to steepen cuttings. Local dry stone walling was used at many locations on the project.
Legibility of the road environment

There is a need for the internal road environment – its internal physical three-dimensional design as opposed to internal traffic management devices such as line marking – to be clearly understood in order to avoid driver, and indeed passenger, stress. Stress may result from such factors as confused decision points, unexpected off-ramps and unexpected tunnel locations. Stress may result from glare, visual flicker and the visual clutter of roadside elements, including billboards. Furthermore, stress may result from billboards obstructing the landscape, particularly at axial locations. Unwanted distractions and surprises should be avoided as far as possible and ‘built out’ of the design. Road design should have clarity. It should ensure that the travel experience is one in which the road environment is legible and easy to anticipate, especially at speed.

Design approach

To avoid these problems – loss of visual perception, boredom during travel and stress from travel – and achieve a stimulating journey, roads need to be thought about and designed, or ‘choreographed’, as an experience in movement. In order to achieve this, engineers, traffic planners and urban designers need to work together and collaborate with road safety experts, particularly in the area of driver behaviour. They need to examine the landscape through which a road passes in order to identify the various landmarks, elements and qualities that characterise it and that can form part of the journey experience. This would include topographical features and structures as well as natural and developed patterns.

This approach, involving what has been termed sensuous criteria for highway design, emphasises the effect of design on the visual sense. Meeting these sensuous criteria is sometimes thought about as ‘choreographing’ the experience of travel – the designing of the visual and physical aspects of movement.

3.7.1 Enhance the view from the road

The principal features and symbols of the landscape, as well as the activities which take place in it, should be visible from the road and visibly related to its design. A road needs to be vertically and horizontally aligned and detailed in order to expose these characteristics – with the objective of heightening the journey experience through the landscape and consequently the traveller’s perception and sense of place, culture and history. This enlivens the journey and makes it pleasant and memorable. The following principles of physical design should be adhered to:

- Consider variations in curvature, differentiation of lanes, separation of levels and alignments and use of super-elevation. Independent grading of carriageways allows views to be opened up for travellers from the carriageway in each direction and varies the effect of a constant road width on long sections of highway.
- As well as enhancing the view from the road the formation of the road can shape movement in a way that enhances the physical sensation of travel.
- Expose interesting and valued views not only through road alignment but the ‘transparent’ design of roadside elements, particularly noise barriers and parapets.
- Avoid obstructing views with plantings, yet consider framing views through landscape design where appropriate and subject to road safety and maintenance criteria.

The road bridge over the Pacific Highway at Nambucca is designed to frame the view of Mt Talawahl (Pacific Highway/Hunter Region).
3.7.2 Provide visual stimuli within the road corridor

Thought should be given to heightening the journey experience by creating additional landmarks and points of interest within and across the road reservation. This can be especially important over long distances which require extra visual stimulation and driver orientation. The addition of such elements can assist when the surrounding landscape is homogeneous and potentially boring.

A strong sense of whereabouts can be evoked by such design measures as:

- Distinctive over-bridges, interchange ramps and roadside elements.
- Opening up and allowing views of natural features, rivers, mountains and the ocean.

Sometimes the use of sculpture is appropriate to signify a special place or event. If the sculpture is the product of the manipulation of a road element, such as in this case the lighting column in the centre of the Light Horse Interchange (M4/M7), the effect can be dramatic.
• Distinctive landscape designs.
• Median treatments and median variation.
• Feature lighting.
• Selective usage of materials and colour.
• Large scale sculpture – as endorsed and assisted financially by the community or government.

Elements such as these can complement our visual experience of the broader external landscape. It is important that the employment of such design devices is not simply used as a ‘gimmick’, and that such design devices do not come across as architectural statements with no relevance to the overall road environment. Creating landmarks and interest within the road reserve must be thought about as part of the total road composition in space and time.

3.7.3 Create a progressive sequence of events

The view from the road and the view within the road corridor contribute to the total experience in movement and should be incorporated into a fully ‘choreographed’ road. Each route should provide a sequence of events that, whilst distinct and memorable, are in sum progressive and flowing, calm, and coherent to the driver. This can be achieved as follows:

• Through contrast between a sinuous flowing route and straight passages.
• By considering visual events that occur or need to be designed at logical intervals and critical points.
• By using a considered palette of design elements, materials and colour.
• Design should be thematic and vary with context, rather than be repetitive.
• Short sequences of interest may occur within larger ones, for example, the approach to a city centre or the experience along a short stretch of shoreline within a longer journey.

The Light Horse Interchange with its multiple flyover ramps is an excellent example of experience in movement, both physically and visually.
Not only should a highway and its parts be interrelated, but they should also be related to other highways and circulation systems on some systematic design basis.

All decision points and interconnections should be visually distinct and capable of being anticipated: visual clarity of decision points is essential for good driving. Changes should not be sudden, jolting or stressful but part of a ‘planned’ event. Road safety should not rely on line marking, safety barriers and engineering design standards alone. The choreography and engineering should be mutually reinforcing.

Useful ways to alert drivers to changes and potential dangers ahead might include visual clues such as creating transitions in the road character when approaching a different environment.

Deep cuttings and other changes, which momentarily isolate the traveller from the wider landscape, provide a distinct visual experience within the road corridor at suitable locations.

Create a distinct frontage to town centres and developments, that is, give them an ‘address’.

Major rural intersections should be designed to provide a milestone along the journey and indicate the presence of towns or communities: culturally and locally important trees can be used to highlight the intersection and mark the journey.

Trees are the most memorable aspect of a roadside planting design and are clearly noticed when travelling; species selected should have an appropriate scale for a road corridor.

Trees should be provided (located outside clear zones) along arterials roads that pass through a city or town to reduce the expanse of the road, create a boulevard, provide a sense of place and define crossing points and ‘gateways’ into town centres and villages.

CONCLUSION

Instead of being a monotonous experience, travel along roads can be turned into an interesting one. This can help to make the journey feel shorter, and potentially keep drivers alert. The road design should provide visual stimuli and lead to a progressive sequence of ‘calm’ events involving the road, its elements and views of the landscape.
INTRODUCTION

It is important to design roads so that their appearance signifies their function (within the road hierarchy) and their intended speed posting. This section deals with the potential of road environments to influence driver behaviour and sets out appropriate guidelines.

GUIDELINES

“The road should be designed so that driving above the speed limit is uncomfortable and obvious to the road user.”

MICHAEL DE ROOS 2008

Achieving a safe outcome for all road users and the community is fundamental to the way the RTA does business and is therefore an important consideration in urban design policy and associated guidelines. The RTA adopts a safer roads approach addressing speed, engineering standards and vehicles.

The principle of self-explaining (or self-evident) roads is one aspect of the safer roads approach. Self-explaining roads naturally encourage drivers to adapt their behaviour in a way that is compatible with the design, function and speed of a road. To put it another way, through the road conditions, drivers should feel uncomfortable exceeding the speed limit, and should be aware of the type of conditions ahead without excessive prompting from road signage. Additionally, a self-explaining road can potentially reduce the need for a large number of traffic devices to control behaviour.

Such a concept is not new. It can be argued that designers have long been dealing with this issue of legibility. For instance, buildings generally represent their function. The church, home, library and office are types of buildings, yet they are generally all recognisable for their function; where they are not, there is some discomfort or confusion.

Road planning and design should therefore strive to avoid situations such as drivers being unaware, or un-warned, of changing conditions ahead – for example, where there is a high level of pedestrian use such as at a town centre or school, where drivers are taken by surprise at the appearance of pedestrians and cyclists along routes, and where road users are unaware of moving into different speed zones at any point along the road.

Urban design has an important role to play in bringing this sort of legibility to the road corridor. An integrated team in which relevant disciplines collaborate can be instrumental in implementing the principle of self-explaining roads and assist in making roads more legible and self-explanatory for road users.
Case study eight

Creating self-explaining road environments

Bangor Bypass

Bangor Bypass was designed and built to link the existing high speed arterial across Woronora bridge to Alfords Point Road. In so doing it bypassed the stretch of Menai Road through Bangor with its busy pedestrian orientated environment of schools, residential areas and shopping activity. Being designated a major arterial, the bypass had to be designed to accommodate heavy traffic at speeds up to around 80-90 km/h with appropriate road curves, setbacks and clear zones. Menai Road, on the other hand, was no longer required as a major road. Measures were taken to transform its appearance to that of a more local route. Car parking bays were created, the road was narrowed, footpaths were improved and the landscape enhanced to create a more pleasant environment conducive to safer driver behaviour.

The function of the Bangor Bypass as a major arterial road is clear. While drivers would feel comfortable travelling at certain speeds, the particular sight distances and setbacks would make motorway type speeds feel uncomfortable. The whole project has been designed in such a way to clearly give the appearance of a major road.

Menai Road, formerly a much busier road, has been transformed to suit its new purpose for local traffic and pedestrian access to shops, schools and housing and as conducive to cycling. The design is simple, low cost and easily maintainable.

Bangor Bypass (left) contrasts with Menai Road (right). Both clearly indicate what their function is, and both would make drivers uncomfortable exceeding the applicable speed limits.
The diverse approach to the design of new property boundaries retains the ‘village feel’ at Faulconbridge and helps make the road look less like the higher speed environment outside the village. The curved geometry of the road also reflects the 60 km/h speed through Faulconbridge rather than the 80 km/h speed through rural areas.
3.8.1 Distinguish between the different functions and speeds of roads by differentiating their appearance

Subject to the principles set out in section 3.1, road design should clearly differentiate between classes of road, making each class distinctive – so that people are able to subjectively categorise them to match their function and use. This may be achieved by:

- Developing road hierarchies and differentiating these by their corridor widths, landscape approach, adjacent land uses and environments. Within each class, road engineering and traffic features, such as width of carriageway, road markings, signage, use of street lighting and clear zones, should be mostly consistent throughout the route. (A good example is the appearance of a motorway. This class of road leaves the driver with no doubt about what sort of road it is – several wide lanes, one-way traffic, no cross roads and no pedestrians.)
- Differentiating roads in this manner requires transport planners to work with urban designers early in the network and corridor planning process.

3.8.2 Improve the legibility of roads

It is beneficial to improve the legibility for road users and provide drivers with clues as to how to drive and what to expect on a particular road. Hard (built) and soft (planted) design devices can be used as additional indicators to influence driver behaviour, as follows:

- Visual clues such as alignment variation, planting or views of structures to warn of such environments as bends or built up areas, can assist the driver in recognising the type of road they are on.
- Vegetation types to differentiate the width of the clear zone (which varies with design speed), for example, low ground covers within and taller frangible plants at the edge, will clearly differentiate design speeds.
- The appearance of the whole road design concept can assist. On higher speed roads, the elements should naturally display unity and consistency along the corridor. At lower speeds there should be a greater recognition of the adjacent context and local landform, with a finer grained design approach emphasising the need for slower speeds.
- It is important to consider changes in road character at the edges of a town and to ensure that the change in speed zone coincides with the change in character.

CONCLUSION

A self-explaining approach to road design can assist in improving driver behaviour and road safety. It is not possible to retrofit the design or speed limits of the state road network to achieve comprehensive self–explaining systems. However, it is a principle to be considered on new projects, modifications and upgrades.
3.9 Principle nine – Achieving integrated and minimal maintenance design

INTRODUCTION

This section deals with the need to achieve well designed projects that require minimal maintenance. It reinforces that these two goals are complementary.

This chapter is not comprehensive but sets out some key guidelines related to selected aspects and elements of road design. The intention is to highlight some important issues and design directions.

More detailed amplification of particular aspects and elements of design are set out in the supporting documents listed in section 1.8.1, p14.

GUIDELINES

Considering maintenance is an essential component of an urban design approach to an RTA project. The state road network is extensive and growing. Maintenance is consequently a large and costly component of expenditure by the RTA and must be a serious consideration in design, in both major and minor projects.

Ensuring a project outcome is low maintenance is not an add-on aspect of design, it is something that needs to be considered at all design stages and integrated with the look and functioning of a project. For example low maintenance and good aesthetics are both served by high quality design that is:

- Neat, uncomplicated and coordinated.
- Robust and durable in material and form.
- Accessible, easy and safe to maintain where maintenance is required.

Consequently road elements – within a corridor, alongside or in proximity to the road – should not be planned and designed as separate entities each according to their own standards and unrelated to the design of the whole. Rather, there should be a unified design of road elements integrated with each other, fit for purpose and context and requiring little or no maintenance.

An urban design approach can help ensure that good aesthetics and low maintenance are complementary. Indeed, durable, robust and low maintenance design is good design.

The following guidelines summarise the approach required by the RTA.

3.9.1 Use robust and durable materials fit for purpose and place

Road environments are harsh places subject to damage from vehicles, transported freight, the weather, bushfires and vandalism. They need to last a long time and remain safe and sturdy. In doing so, they need to transcend the fashions of the day and look as good as when they were built, for many years.

Design materials should be suitable for this environment and context. In some cases a higher capital cost may be justified to reduce long term maintenance. Examples of this include:

- Light, fragile materials such as glass and aerated concrete should be used sparingly and protected if necessary.
- Planting should be long-lived, hardy and planted at densities which out-compete weeds.
- Timber should be used only where other materials are unsuitable, especially in bushfire prone areas.

Concrete panels of one panel type provide a durable and easily replaceable noise wall. This wall has a simple, refined appearance. It is robust and hard to damage. The texture adds interest and helps deter graffiti (Bonville Upgrade, Pacific Highway).
Case study nine

Achieving integrated and minimal maintenance design

**M7 Motorway**

The M7 motorway forms a major 40 kilometre section of the Sydney orbital. It was designed by an integrated engineering and urban design team with full control over the detailed design and implementation. The resulting project is coordinated and unified in all its elements. The multitude of bridges are organised into a hierarchy of design types. Materials with high quality finishes are used throughout. The project is a good example of the repeated use of bold elements which provides a powerful architectural effect, a strong sense of place and facilitates repair and maintenance.

LOCATION OF M7 WITHIN THE SYDNEY ORBITAL MOTORWAY NETWORK

Clear walls always overlap solid walls and primary colours are used to emphasise different character zones along the M7 Motorway. Experience is showing that laminated and toughened glass is best substituted by transparent plastic products in future.

Precast concrete noise walls are designed to serve different purposes and suit different locations. These panels, at a location close to the road, are repetitive and easy to replace. Overpainting is carried out in the event of graffiti vandalism.

The design of the 40 kilometre shared path is unified with the rest of the project and built with durable materials as in this concrete decking over a creek.

All vehicular bridges have similar properties in terms of coordinated lighting locations, spill-through abutments, tapered safety screens and night lighting. Names of overbridges are neatly integrated with principal designs.
3.9.2  Provide a self reliant and minimal maintenance natural landscape

Landscape can require highly intensive maintenance if not designed and constructed properly. To avoid this, landscape must be self reliant and hardy, and as close to its natural state as possible, while considering the objectives of the design and its context: For example:

- Planting must be dense enough to withstand weed invasion. It must be looked after in the establishment period.

- Ground conditions must be suitable for plant growth with the proper soils and drainage systems.

- Plants must be selected for hardiness and suitability to the locality. Native species grown from local provenance seed are often the best solution.

- Native seeding applied at the correct rates should be used in rural areas, and planting and turfing in urban areas.

- Vegetation should be selected to avoid growing into the path or dropping excessive leaf litter that requires continual maintenance.

For further information see The Landscape Guideline: Landscape design and maintenance guidelines to improve the quality, safety and cost effectiveness of road corridor planting and seeding, April 2008.

3.9.3  Avoid opportunities for vandalism

In the planning and concept design stages of a project, the opportunities for vandalism should be considered and avoided:

- The need for noise walls, retaining walls, underpasses and other large areas prone to graffiti vandalism should be avoided as far as possible in built up and secluded areas. Where they cannot be avoided they should be designed to deter graffiti vandalism.

- Glass noise walls and glass panels for bus shelters should be avoided, with clear plastic panels or other translucent or transparent materials used instead.

- Surfaces which are accessible to graffiti and lack passive surveillance should be minimised and planted over where possible. Textured finishes look attractive, help provide an identity to an area and deter graffiti vandalism.

- Ledges providing access to walls, and spaces able to be graffiti vandalised, should be avoided.

- Exposed fittings, or fragile additions or artworks, should be avoided.
Where walls are required they should be designed to deter graffiti as well as provide a valuable addition to the built environment. The use of artist-designed panels (also used elsewhere in the precinct) has created an attractive and integrated backdrop to a bus interchange built by the RTA in Parramatta.

Rough textured surfaces such as this sandstone pitching have a distinctive appearance and also deter graffiti vandalism. (Narellan Road, South-West Sydney).

By grading the landscape and adjusting the road levels a retaining wall, with its associated costs and graffiti opportunities, has been eliminated in the detail design stage of this project (Windsor Road upgrade through Baulkham Hills, Sydney).

Plastic clear noise walls can be damaged by graffiti vandalism, but they are resistant to breakages (Bangor Bypass in Sutherland, Sydney).

Glass is easily and quickly damaged and costly to repair. In this picture the panels have been vandalised with a hammer (Ewingsdale, Northern Region).
3.9.4 Create a simple, coordinated and neat composition of road elements along a corridor

The design of all elements – including retaining walls, noise walls, bridge elements, guard rails, fences, median barriers, shared paths, traffic and directional signs and lighting – needs to be integrated into the overall design of the road, with elements fitting together and fitting in sensitively with the context through which the road passes.

Simplicity is often the best approach to a given design issue. Designs that are more complex than the constraints dictate are harder to build and maintain and lack refinement and elegance. They are also often more expensive than they need to be.

The following guidelines set out the general requirements for coordinated design:

- Consider the number and placement of all road elements relative to one another and in relation to the road design as a whole – how the elements contribute to the unity of the road corridor, and how the proliferation of different road elements can be avoided.
- In general, minimise the number of design solutions to a given problem, for example a range of noise wall panel types raises far more difficulties in repair and replacement than one type. The same can be said for paint colours, fencing types, railings and so forth. There can still be scope for variety and contrast of panel forms and colours in selected locations.
- Avoid dead empty spaces and clumsy connections by considering where these things may occur and providing ‘fail-safes’ in the design, such as planting along the bases of all walls to avoid weedy, unmaintained areas and graffiti vandalism.
- All elements that humanise the built environment – seating, lighting and all other elements of the outdoor landscape – must be durable, simple and refined and fit in with the character of the built environment and public spaces in regards to materials, colour and compatibility with plantings. Again, there can still be potential for contrast in selected locations to enliven an environment.

3.9.5 Consider the design quality and maintainability of major road components and individual road elements.

Major road components (such as bridges, interchanges, tunnels, rest areas) and individual road elements (such as walls, barriers, lighting, signs) must not only be thought about as part of the architecture of the road as a whole. They must also be thought about as durable and aesthetically pleasing designs in themselves.

Noise walls

Noise walls need special consideration due to their extent of use and their high visibility from and towards the road:

- Road design should seek to avoid a proliferation of differently designed noise walls. Such outcomes appear thoughtless and uncoordinated, and are difficult to maintain and replace when damaged.

The residential view of the pre-cast concrete noise walls for the Albury upgrade in Western Region is acceptable for the lower height sections, but where higher walls are required the appearance has not been well thought through.

Dense planting along Avoca Drive on the Central Coast fills the space between wall and path and deters graffiti vandalism. Enough space needs to be allocated to provide a self reliant and worthwhile planting area that is aesthetically pleasing.
Noise wall guidelines have been developed by the RTA which cover:

- The need for landscape to screen walls.
- Wall design as a consistent, smooth and flowing element.
- Noise wall location at the top of cuttings or parallel and adjacent to the road.
- Noise wall colouration preferably either in the natural material or a dark grey colour.
- Noise wall texture to deter graffiti and facilitate painting.

*For further information in relation to noise wall design see Noise Wall Design Guideline: Design guidelines to improve the appearance of noise walls in NSW, February 2007.*

**Bridges**

“Major infrastructure [bridges] will serve the community for many decades. It should not just last, but also provide a lasting legacy of excellence for future generations. Minor bridges at the least should have good manners, a low maintenance objective and a degree of finesse.”

**BRIDGE AESTHETICS 2004**

A bridge can be made as unobtrusive as possible to hide within the landscape, as distinctive as possible to contrast and stand out in the landscape or as simple and elegant as possible to complement the landscape. Bridges should be designed with consideration of their context and role in accordance with the following guidelines:

- Locate, align and design bridges to fit in with other elements of the landscape and built elements or alternatively, create a counterpoint.
- Major structures (such as bridges) associated with the entry to country towns or particular settings should be planned and designed with special care as they can form ‘gateways’ and signature landmarks in the landscape.

A simple overbridge with spill-through abutments and wall type piers: Local rock has been used to stabilise the slopes around the abutments and the whole effect is open and aesthetically pleasing as well as low maintenance (North Kiama Bypass, Southern Region).

The Light Horse Interchange on the M7 Motorway forms a total architectural composition in the landscape and incorporates a complex lighting system making the interchange easily recognisable at night.
The triple bridges over the Brunswick River on the Pacific Highway in Northern Region are formed together in a simple elegant design that complements the landscape and will be aesthetically pleasing for many decades.

- Design bridge elements and families of bridges in terms of a unified bridge architecture.
- Additional non-structural elements on bridges should be avoided. Where necessary, they should be designed as a fitting part of the whole structure.

For further information in relation to bridge design see Bridge Aesthetics: Design guidelines to improve the appearance of bridges in NSW, January 2004.

Tunnels and portals

- Tunnel portals should be distinctive and elegant, address their rural or urban context and clearly and safely mark the transition between open road and enclosed tunnel.
- Where possible there should be limited physical or visual clutter at portals from directional, speed or variable message signs.
- A design transition into the tunnel through colour, texture and lighting should be considered.
- The tunnel journey and elements such as safety bays and emergency exits should be clearly marked by means of shape, colour and texture.
- Panelling of tunnel walls should be neatly aligned with barriers with a consistent gap.

The design of tunnel portals can take many forms. They are often seen as an opportunity to create a landmark but they should respect their context and be simple and legible in form (Clockwise from top left – Tugun Bypass, Yelgun to Chinderah Freeway, Lane Cove Tunnel, Great Western Highway Upgrade at Leura.)
Signage and advertising

In terms of signage and advertising, the optimum is:

“The fewest possible signs of the smallest adequate size in the clearest simplest form.”

DAME SYLVIA CROWE 1955

Signage (including advertising) along road corridors must be considered in urban design terms. The proliferation, inappropriate location and poor design of signage can diminish the quality of a road corridor’s public domain. Signage and advertising therefore need to be considered early, as part of the task of road design and corridor management. The RTA should, as far as possible, encourage the following:

• The overall number of signs that add to the clutter along a road corridor should be minimised where possible.

• The location of signage within a corridor should not undermine the scale and character of the area, dominate the skyline or block significant views for road users and the community.

As in this typical suburban scene, uncontrolled, excessive signage is distracting, spoils the character of an area and creates landscape maintenance issues. Overhead transmission wires can add further clutter in the road environment.

• Variable message signs should be located carefully away from good local views of the landscape and valued structures; they can be particularly visually intrusive and obstructive due to their scale, design and prominence of the messages. This occurs because variable message signs (and often traffic and directional signs as well) are implemented when a project is completed without considering the design of the whole project and without regard for the broader context through which the road passes.

Variable message signs need to be placed so that they are clear and visible but also so they do not block views of notable landscapes and structures. The location of the VMS in the top example on Southern Cross Drive obscures a bridge that has been designed with some care and attention. The lower example on the Pacific Highway causes no such visual concerns. A visual impact assessment should be carried out and flexibility in signage location used to its fullest where necessary.

Along this neatly designed street a multitude of signage has been inserted which impairs pedestrian flow and dominates the street space (Argyle Street, Parramatta).
• Minimise the number of traffic signals and directional signs as far as possible to reduce the visual impact of these elements – while taking traffic and road safety considerations into account.

• Consideration should be given to the scale and form of advertising in relation to the nature and quality of the landscape, townscape and buildings, and the quality of road design being sought.

• Any safety devices, platforms, lighting or logos should be considered and assessed as part of the signage proposal.

• The signage structure and composition should be of a high quality design and finish.

See Transport corridor outdoor advertising and signage guidelines, Assessing development applications under SEPP 64, State of New South Wales through the Department of Planning, July 2007 (and its updates).

Artworks

There is occasional public and institutional pressure to provide artworks in road projects, and sometimes a call from government to do so. Sometimes a genuine opportunity may present itself in the course of designing a road project or in a tender bid. It is not the fundamental purpose of urban design to ensure that artworks are provided or that a project is decorated, and artworks should certainly not be used to offset badly designed elements such as noise walls. However, artworks can have their place and the case can be made for legitimate artworks to become part of the scope of a road project and a useful adjunct to the public domain. In these cases:

• The selected artworks should be part of a coordinated road design rather than an add-on decoration. For example, artworks should be used thematically and integrated with the whole project.

• The scale of the artworks should be relevant to the speed environment and be able to be observed without undue distraction of the driver.

• Above all, artworks must be durable and robust, without exposed and easily damaged elements.

• Where it is agreed to decorate existing structures, decoration should have purpose and presence. Indigenous murals on bridge substructures in the west of the state are a wonderful example of public art that has social and place significance.

Project managers are encouraged to include artists in the project team to assist in achieving these goals and developing the design and design themes appropriate for the type of project. There should ideally be participation from community on the location, design and provision of artworks.

This large scale illuminated Coca Cola sign can be considered acceptable in urban design terms. It is simple and well designed, does not obstruct views, creates a backdrop, is integrated with the building and complements the character of the Kings Cross area. It is not easily repeatable and helps form Sydney’s equivalent of Times Square.

The red poles on all four approaches to the M7-M4 interchange together with the 55m tall central mast form the Australian Light Horse Brigade sculpture requested by the community. It is designed to be experienced in motion and to mark the importance of the site.
Where artwork is to be incorporated into noise wall projects, the more robust outcomes occur when the artwork is integrated into the design and is an embedded part of the wall. In such cases, artists have been involved right from the start of the design process (Clockwise from top left M4 motorway, Gore Hill Freeway, West Charlestown Bypass, City West Link).

In Cowra, beneath the Lachlan Road bridge on the Midwestern Highway, the piers are decorated by local artists and school children with indigenous designs that reflect the local history and fauna (Western Region).
Rest areas

A simple, attractive and shade-providing landscape design is one way to encourage road users to stop and relax at rural road rest areas. Rest areas in these instances should be designed as small parks, ideally with good views and allowing good natural surveillance around, and to, the site. They should have well located and designed seating and toilet facilities. Interpretive panels and signage relating to site significance and cultural heritage can add to the quality of a rest area. A pathway circuit to allow stretching of legs can be an attraction.

- The location of rest areas should be strategic. As well as travel distance criteria requiring stop-revive-survive facilities, consideration should be given to scenic spots and views, historic and cultural significance of sites, and visibility on approach.
- There should be some consistency in rest area design where there are a few along a route.
- Layout of rest areas should avoid conflicts between trucks, cars and pedestrians, and vehicular access and egress should be carefully located to be visible and safe.
- Rest areas should not be secluded, private spaces. They need to be as open and visible to the road as possible to avoid security issues and vandalism.
- Rest area facilities need to be durable, robust and easy to use avoiding frustration and ultimately damage and vandalism.

As well as providing durable and clean facilities, the best rest areas have good views (North Kiama Bypass).

Rest areas should be attractive and safe. They should be designed for day and night use with good surveillance and lighting and, if possible, recreational facilities (Yelgun interchange Pacific Highway).
Utilities, lighting and other elements

- Facilities for services – including power, water, sewerage, telecommunications, gas and street lighting – should, where possible, be designed in common or combined trenches and be compatible with planting and shared paths.
- The placing of overhead power lines underground reduces clutter and significantly improves the simplicity and neatness of a corridor.
- Lighting should be simple, resistant to vandalism and selected to minimise fixtures. The street character or historic character of an area should be respected in the selection of lighting types.
- Utility boxes and fencing should blend into the background as far as possible by being discreetly located and finished in a dark unobtrusive colour. This will help avoid vandalism.
- Shared bicycle and pedestrian paths should have dark, receding colouration to avoid being visually obtrusive and creating glare that can result from use of plain concrete. They should have clean edge lines and be well articulated at crossing points and bus stops.

CONCLUSION

Elements in the road corridor should look as though they have been thought about as part of the road's architecture. The random distribution and proliferation of disparate elements with incompatible designs is untidy and can be visually confusing. Such elements are hard to maintain and potentially easy to damage. The resulting visual blight diminishes the quality of the corridor as a public domain.

A road corridor must be designed to be low maintenance as well as aesthetically pleasing. To achieve this, design should be robust and self reliant and opportunities for vandalism avoided. Simplifying the design and appearance of the road corridor not only improves its appearance but can have dramatic effects in minimising maintenance costs.
Conclusion: Synthesising the principles

It is the bringing together of all of these principles of urban design that makes a project good. The degree to which these principles can be unified depends on the context and dictates of the project.

These principles constitute key directions of design and are therefore only the start. They are a point of departure into the exploration of design on each project, which will take its own course as the context and issues demand and as imagination is applied.

The RTA urban design team will continue to develop these principles and to produce supporting guidelines that address particular aspects.

Use should be made of the References and further reading set out in this document on pages 108-110.
This project in Sydney is a good example of how the nine key principles combine to make a whole. The bridge, as part of the improvements to Menai Road in the south of Sydney, restructures the road system by separating high volume regional traffic from local movements through the Woronora village, whilst preserving the old low bridge across the river, the old winding road alignment and local connections.

The new structure is an imposing 522 metre curved bridge with ten spans and approximately 30 metre high piers. It has a 740 metre long eastern approach and a 560 metre long western approach cut into the opposing hillsides. All of this is formed to fit in with the river, the topography and the sandstone and bush landscape of Sutherland, and to minimise disturbance to the area’s ecology. The design produces a sweeping, dramatic and elegant built form, restores a sense of tranquillity to the valley floor and provides a stimulating journey across the river for motorists. A linking pedestrian and cycle footbridge is hung below the road deck of the bridge to catch the northern sun and afford wind protection, and it provide spectacular views over the tree tops and down to the river.

As part of the project, the foreshores of the river have been improved and a local park has been created out of the acquired land and water quality ponds, built to enable construction water to be cleaned. Selected plants were preserved and later transplanted. All removed trees were mulched on site and used in the landscaping. Boulders from site construction were re-used for constructing retaining walls. The bridge has a one hundred year ‘design life’ and the project as a whole has a minimal need for maintenance.

A significant public domain and sense of place has been produced through integrated urban design and engineering.
In the last decade there has been a renewed interest globally in the urban design of road infrastructure projects. In the USA, this renewed interest was given expression in a national Thinking Beyond the Pavement workshop. This workshop was organised in 1998 by the Maryland State Highway Administration and others, at the same time that the RTA was formulating its own approach to urban design (the RTA adopted the title of this workshop for its own document). The USA workshop developed a number of key principles around the theme of integrating highway development into communities and the environment while maintaining traffic performance.

The workshop participants agreed that for any transportation project to be judged ‘excellent’ it has to include the following qualities:

- The project satisfies the purposes and needs as agreed on by a full range of stakeholders. This agreement is forged in the earliest phase of the project and amended as warranted as the project develops.
- The project is a safe facility, both for the user and for the community.
- The project is in harmony with the community and preserves environmental, scenic, aesthetic, historic and natural resource values of the area (ie it exhibits context-sensitive design).
- The project involves efficient and effective use of resources (ie time, budget and community) of all involved parties.
- The project is designed and built with minimal disruption to the community.
- The project is seen as having added lasting value to the community.

There has been relevant research, writing and practice long before the Maryland workshop. For example, Man Made America, published in 1963, was a seminal work well ahead of its time. This incorporates the aesthetics of freeway design, as part of an inquiry into the selected problems of design in the urbanised landscape. Many of its principles were incorporated into the design of the Sydney Newcastle Expressway (F3).
Thinking Beyond the Pavement has subsequently taken practical shape under a Context Sensitive Design USA Federal Program of which Maryland is one of six trial states. By 1999, the RTA had already adopted the idea of ‘context-sensitive design’, and this was the key principle underpinning its 1999 Beyond the Pavement document. Under the context-sensitive design umbrella, in 2006 the Massachusetts Highway Department revised its road design guidelines and the Department produced a Project Development & Design Guide which integrates engineering and urban design principles in a single document.

The Commission for Architecture and the Built Environment in the UK has been established to encourage better design of the public realm, including public buildings, parks and public spaces and highways and streets. This commission has expressed concern with typically low cost solutions that ignore local character and blight the environment, believing that while bad design can be expensive, good design will always deliver value for money. The central mechanisms used by the commission to ensure good design include design review; the preparation of various kinds of design guidelines; a regional network of architectural centres to inspire good design; the appointment of design champions within government organisations to ensure that design issues remain a priority in the organisational agenda; and the provision of appropriate advice and training, including to highway departments.

In European countries, such as France and Spain, governments and motorway companies have been working on road and rail projects aimed at achieving significant improvements to the public domain, promoting redevelopment opportunities and producing high-quality infrastructure design.

The New Zealand Urban Design Protocol, to which Transit New Zealand is a key signatory, is aimed at improving the urban design quality of the nation’s towns and cities. It stresses the importance of thinking about whole settlements, transport networks and all scales of development. The urban design focus of Transit New Zealand recognises that state highways have a large influence on urban form and quality of life. An urban design approach to road infrastructure is seen as leading to long term savings. The right design solution can be found in the first instance without the need for adjusting projects later to mitigate unnecessary environmental impacts.

The Scottish Office and the Convention of Scottish Local Authorities advocate a balanced approach to road planning and design and have published criteria which address issues of function, economics and environment. These criteria are applicable to rural route selection, assessment and design with the aim of fitting roads, bridges and traffic in with the countryside in which they occur.

There has been outside recognition for the RTA’s contribution in the urban design of infrastructure. In February 2001, the RTA’s 1999 Beyond the Pavement publication received a Royal Australian Planning Institute Commendation for Excellence in Planning in the category of Urban Design. The RTA has subsequently received numerous government and industry planning and design awards for both its projects and urban design guidelines.
Much of the urban design input into projects flows from the private sector, working to standards set in contract documents and in accordance with this publication. Some innovation and freedom in the development of urban design solutions is encouraged. It is, nonetheless, important that projects are guided by a rigorous and transparent urban design methodology.

When such methodology is lacking urban design can appear overly subjective and theoretical, impractical and even confused. This section sets out a preferred method of approach. It in no way pre-empts creativity but means, for example, that where preconceived design ideas are proposed, they be tested as to urban design outcomes and performance themes (set out in section 1).

**General urban design methodology**

Design is developed in increasing detail from the initial strategic work, through the development stages, and then into detailed design. By the time detailed design occurs the scope of a project is pretty well set. The potential scope for urban design input into a project is most open at the strategic stage.

Within each stage, as can be seen from the loop-back arrows in the following flow diagram, design is not strictly sequential and linear; it is by nature a cyclical and iterative process.

The contextual analysis starts broadly and hones in on more detail. It informs the vision and objectives of the project which help refine the focus of analysis. The vision and objectives are consistent but develop in more detail through each stage with addition of detailed principles. Design informs assessment and assessment improves design – the positive feedback loop becoming more detailed through each stage of work.
1. Appreciating transport role

A project’s transport purpose and objectives – the role that the road will play in an area and as part of a network – must be clearly articulated by the project team. If possible, this should occur at the outset, prior to the commencement of contextual analysis. There needs to be an appreciation by the whole design team, including consultant urban designers, of the project’s intended purpose, function and scope, scale and road design standards.

2. Contextual analysis: analysing local character and community functioning

Analysis of context is fundamental to all urban design. The analysis and understanding of context is the foundation of a good design outcome and must therefore occur at each stage of a project. The purpose of such an analysis is to develop a full understanding of the character and functioning of a place or the places impacted by a project. Any project should start with an analysis of context: the characteristics of the landform, the nature and quality of the built, natural and community environments through which the road passes, and how these environments function for communities.

Identification of values

It is important not to simply go through the checklist of contextual issues, but rather to understand the values of the area, what it is about the area that is appreciated, and what in that area is important to protect and respect. The objectives for the design will naturally flow from this work.

Landscape character and visual impact assessment

Landscape character and visual impact assessment is usually a specific environmental assessment requirement of the approval authority, but should not be carried out in isolation. It is only one part of a project’s environmental assessment in terms of urban design.

As with all other factors, the landscape character and visual impact assessment of a project must be an integrated part of the whole design process. It can nonetheless be recorded objectively as a clearly identifiable component of the overall assessment.

With the visual importance of a project in mind, design can in fact contribute to the quality of the built environment, rather than create a visual blight that requires additional mitigation treatments.

Visual impact assessment is often carried out by specialist urban designers, usually landscape architects who adopt well accepted methodologies and techniques.
Identification of urban design opportunities

Urban designers need to identify and assess not only contextual constraints, but also opportunities that could inform road design. For example, urban designers can be aware of future development plans and anticipated future movement levels and patterns, as well as concurrent and future opportunities associated with the corridor’s public domain, and future and concurrent opportunities for the provision and integration of different modes of movement, including road-based public transport, cycling and walking.

Consultation on analysis

Contextual analysis should ideally be discussed with communities and stakeholders early in a project’s consultation process. This can add useful local knowledge and insights to the work. There should be agreement on the following issues:

- That the analysis represents a clear statement of existing conditions.
- That the values placed on key attributes of the place such as views, landscape quality and special places or buildings are in accordance with community views.
- The ways in which the proposed road is likely to change the existing character of the place.

Documentation of analysis

At each project stage contextual analysis should be properly documented; this is to ensure that it captures the strategic issues and can contribute to the project’s environmental assessment, as described in Section 2.2.6: Integrate urban design with environmental assessment and project approval (p22).

Do not reinvent the wheel

Contextual analysis must not repeat the work of other disciplines and should be cross-referenced to the work of other disciplines. It should contain only that information which will affect the project’s urban design outcome.

Fit for purpose analysis

Although the analysis of context is an essential part of the design process, it needs to be kept in perspective. Too often, analysis is overly detailed and complicated, and effort is expended that is inordinate for the problem at hand. Many urban designers fall into the trap of ‘analysis paralysis’ – pursuing analysis that is interesting but not particularly relevant to a project’s design. Sometimes urban designers simply follow their own design interests irrespective of their necessity; for example, by vastly expanding the heritage and history component of the context for its own sake, which can be very tempting. All of this can lead to unnecessary escalations in project time and cost.

Analysis should be tailored to the size and complexity of the project and the nature of its setting. Small projects may only require a basic review of the locality. Large projects (and corridor urban design frameworks) that cut across a range of environments may require a systematic analysis of the structure and character of areas, broken down into layers and character zones. Analysis should moreover be strategic: that is, analysis should only be developed to the level that informs the key aspects of design at each project stage.

Judgement is required and urban designers should be held to the overall urban design cost estimate which is inclusive of analysis, unless there is a change in scope to the project.

3. Vision, objectives and principles

Once the vision and objectives – the desired direction of design – have been understood and agreed upon, the design principles for realising them can be worked out. These design principles can then generate – or be translated into – concept design work for the project.
Vision
A project’s vision is essentially a statement of the desired future character based on both the contextual analysis and consideration of the project’s transport purpose; how we want the road to function, to look and to fit into its built, natural and community environment, and how we want the road to contribute to the future of the corridor.

Objectives
Urban design objectives articulate what it is that needs to be done to achieve a project’s vision. They are a response to the constraints and opportunities drawn from the contextual analysis, the transport purpose and requirements of the project, and community expectations, and they govern the overall quality of the outcome. Objectives should be broad and few in number; there should be no more than five or six key urban design objectives for any project, under which a wider range of principles can be developed.

Design principles and criteria
Urban design principles in general link a project’s vision and associated urban design objectives to its concept design development. The purpose of these principles is to develop a high level urban design response to the urban design objectives by setting down the broad design approach, ideas, composition themes and design guidelines which will define both the proposal and further design development. Urban design principles for the whole project and parts of a project should be worked out and described by means of concise text and images.

The development of specific urban design criteria can be a useful means to measure how well urban design objectives are being met and to test a range of options and design solutions.

4. Design development
Concept design translates the urban design principles into a site-specific and integrated urban design and engineering solution. There may well be different design solutions that meet the stated urban design principles and criteria. The concept design process should nonetheless lead to a preferred solution.

Although urban design is only one of many inputs to design and engineering considerations, it is important that there is an integrated process in which engineers and urban designers work together.

Link between concept design development and environmental assessment
Understanding the link between concept design development and environmental assessment is critical to sound urban design methodology. Environmental assessment is not a separate process which occurs subsequent to a proposed design. The key constraints of the topography and landform, and the built, natural and community environment should be identified as a design constraint in the first instance. In this way concept design can fundamentally ‘mitigate out’ the potentially undesirable impacts of a project proposal, leaving only residual impacts to be dealt with. There should be clear mitigation design proposals for any such envisioned residual impacts.

5. Implementation
Once a preferred concept design is accepted and approved, the work can proceed to implementation. Implementation (and the necessary design refinements it entails) should remain aware of and build upon all that has gone before to ensure that the concept design is, by and large, carried through and delivered ‘on the ground’.

The process of implementation should:
- Be a joint effort between engineers and designers incorporating urban design principles.
- Be an appropriate response to the type of contract.
- Involve a continuing interface between the designers and the construction contractors or teams, and involve continuing review and decision making by the RTA’s contract managers with suitable advice from the RTA’s urban design team. It is important that these consultations be carried out on all design variations.

For further information refer to the RTA Guidelines for landscape character and visual impact assessment (currently unpublished but available from the RTA).
GLOSSARY

Aesthetics
Relating to the sense of the beautiful or the science of aesthetics, that is, the deduction, from nature and taste, of rules and principles of beauty.

Arterial roads
The main or trunk roads that make up the majority of the State road network for which the RTA is responsible. These range from higher speed arterials that have a greater level of access control, to lower speed arterials that have a higher degree of property access and are more conducive to supporting parking and commercial and community activity.

Beyond the Pavement
Term applied to the need for road engineers to think more sensitively about the context (the cultural, natural and built surrounds) of the infrastructure they plan and design.

Clear zone
The area that begins at the outer edge of the lane next to the shoulder of the road and extends for a set distance. This zone is available for emergency use by errant vehicles. (Road Design Guide, Glossary of Terms, December 1989).

Connectivity
The degree to which streets join with each other – allowing community and modal integration.

Cost-effectiveness
Refers in this document to infrastructure investment and design that, within budget constraints, provides value for money for the community and meets its economic and transport objectives. The former relates to such things as connectedness, access and convenience to public transport, community safety, the architectural quality of the infrastructure and improved public domain. The latter relates to the efficient and safe movement of people, goods and services.

Curtilage
The land area around a bridge, building or any structure or object which is essential to the value, function and enjoyment of that object. For example, a heritage building and the surrounding buildings and trees that relate to it and that form an entire setting.

Design development
The concept design stage of a project on an agreed route alignment [as set out in section 2.3.3: The development phase (p28)].

Design structure
Design structure in relation to the built environment is “an organising principle through which parts and pieces are brought together into a unified shape and form.”
Dober, 1969.
Footpath
An area open to the public that is designated for pedestrians or has one of its main uses for pedestrians (from NSW Bicycle Guidelines).

Footprint
The scale, extent or mark a road makes on the land in relation to its surroundings.

Freeways and motorways
Fast, high volume, access controlled roads of large scale that primarily link regional hubs and cities. A motorway is simply a tolled freeway, usually under private ownership for a set period of time (the ‘concession period’).

Guidelines
These are a series of requirements, objectives, principles and processes which define the policy. At another level, guidelines may also be specific criteria, models, principles and rules for the design, selection and use of standard roadside components (such as noise walls) and also major elements of a project (such as bridges).

Historic roads
Roads having historic importance in terms of their construction, period in history and provision of access to environments that are part of our culture and history. The historic road movement in the USA is an attempt to recognise and preserve such roads.

Impact
Influence or effect exerted by a project or other activity on the natural, built and community environment. For example, visual impact refers to the impact on views and landscape impact refers to the impact on landscape character.

Landform
The type and shape of terrain, usually including topography, geological characteristics, coastlines, rivers and water bodies.

Landscape
A tract of land. Also taken to mean a prospect or piece of scenery or land, which includes buildings, villages, towns and cities and infrastructure.

Landscape character
The aggregate of built, natural and cultural aspects that make up an area and provide its unique sense of place. Landscape in this context is taken to include all aspects of a tract of land – the built, planted and natural topographical and ecological features.
Legibility
How recognisable or ‘readable’ an environment through which a road passes is, or how visible elements of the road such as bridges or interchanges are. This visibility can be enhanced by good design.

Local roads
Roads that have a low speed limit, have a small footprint, serve local communities and should be conducive to walking and cycling.

Mode
A type or method of movement – including trucks, cars, buses, bikes and pedestrian – applicable to road corridors.

Natural pattern
The overall character created by the natural forms, materials and processes in the environment. It is the product of geology, terrain, weather, water and living organisms.

Permeability
The degree to which streets allow pedestrians and cyclists to take short cuts and select alternative route options.

Public domain
The community’s public space, functionally and visually.

Security
The degree to which people walking or cycling are perceived, or perceive themselves, to be safe from personal attack.

Shared path
A pathway used for both cyclists and pedestrians, usually located on the side of the road.

Streets and boulevards
A street in urban design terms is not only for cars and parking but is a three-dimensional space for strolling, shopping, meeting and cycling. It has a substantial community (‘street life’) character. A boulevard is a special form of street defined by its greater width, buildings and substantial trees that line it and can be a major element of city structure.

Sustainability
Considering present and future needs and costs.

Surveillance
Overlooking of streets, laneways, pedestrian bridges and open space areas by people either using these spaces or within adjacent buildings. Surveillance generally improves security.

Self-explaining roads
Roads which through their appearance signify their purpose and the safe speed to travel.

Transport interchange
A station or other transport node that offers transferability between modes – such as train, bus, taxi and ferry. These stations usually act as a regional or urban hub of high density development.

Transit-oriented development
Urban development that is of a higher density and mixed use, providing high patronage levels within walking distance of public transport, primarily rail and bus.
Urban design

The process and product of designing human settlements, and their supporting infrastructure, in urban and rural environments.

Urban design vision

An expression of the desired outcome – what the RTA would like a corridor or project to be like physically, functionally and visually.

Urban design objectives

The particular ends that need to be pursued to achieve the vision. Objectives govern subsequent principles.

Urban design principles

These are the design rules and processes by which the objectives will be realised and which inform a project’s design. Different designs may equally satisfy the same set of objectives and principles.

Urban design policy

This is the direction and course of action to be followed to achieve the urban design outcomes that the RTA wants from its infrastructure projects.

Urban design strategy

This is a high-level and critical approach to urban design. An urban design strategy defines an urban design vision and urban design directions to guide the future development of a road corridor. It includes key strategies and measures that need to be taken to implement the vision, which may take the form of an action plan. Potentially, it provides the basis for future road infrastructure planning and design, how this might relate to the planning and design of adjacent urban development, and how both might relate to different systems and modes of transport.

Urban design framework

This sets down a consistent design approach and forms the basis for a project’s design. It should be included in the project’s environmental assessment. An urban design framework may be prepared for an entire corridor or a specific project. It typically includes: a contextual analysis of the area through which a road passes; an urban design vision statement for the road; key objectives to meet the vision; and principles by which the objectives can be met and the vision delivered. It may also include guidelines for the design of specific components and elements of the project.

Urban design master plan

This involves a similar process to the preparation of an urban design framework but the end product is more of a ‘blue print’, or over-arching scheme, to be implemented, and for which future more detailed designs are to be carried out. It typically contains a complete layout for a corridor or project, and plans for the individual precincts that make it up. It can be a plan in its own right and therefore may or may not be preceded by an urban design framework.

Water-sensitive urban design

A sustainable approach to the design of stormwater drainage systems that can be incorporated into project design. This approach integrates natural systems such as open swales, bio-infiltration and wetlands with the public domain in a constructed environment to improve stormwater quality and management.
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# List of Figures and Case Studies

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