4.0 In the Street
Street Elements

The inclusion of street furniture together with planting, lighting and signage in the streetscape is probably the most direct way that we can influence how a street is used. The placement of such items as seating, rubbish bins, bollards and cycle racks can and will provide signals on how a space is to be used and how it is intended to function.

As in our living room a street is an uncomfortable and unattractive place without seats to sit on and other pieces of furniture to make it a more welcoming and inhabited place. As in our homes the furniture we chose should fit with the existing character of the place and the elements already there to make a coherent and comfortable suite of furniture for the street.

This coherence in design is also needed for the region to be seen as an integrated whole with the use of similar items across the region providing for an image of quality and consistency. The use of standard suites of furniture and other elements also provides opportunities for purchasing and maintaining furniture at optimum levels.

This does not mean that we use the same furniture throughout the Region but that we keep a consistency and integrity to items in our streetscape that reinforce a regional identity without damaging the qualities inherent in individual localities. The family of furniture that is chosen for inclusion in our streets needs to be capable of being adjusted and added to, where appropriate, to ensure that it contributes to the character of the street in which it will be located.

The design of street furniture and public art can play an important part in the quality of a street, the sense of place and ownership people feel for a place. This has a lot to do with people's attitudes to a place, their attachment to the place and therefore the level of care and the levels they will go to, to protect the values the place.

A street can become cluttered if individual pieces of furniture are placed within it without an overall design or without consideration of the use and location of other street elements. The number of individual items in the street can often be reduced by combining items and providing for the multifunctional use of individual items. Coordination between the various elements in the street such as lighting, traffic signals, tree planting, planning and traffic signs will need to take place in order to identify the opportunities for placement of new elements in the street.

Street elements should therefore be selected to fit well with their immediate surroundings and in response to a coherent vision.

Care needs to be taken in the proliferation of street furniture (e.g. bins, signs, bollards, utility boxes, light columns etc.) as this can result in a cluttered public domain, one that is visually intrusive especially if there is no cohesion in design, materials or layout.

Clutter in the street should be considered a hazard, a barrier to the visually and mobility disabled.
Streets may become cluttered over time with unrelated elements that may detract from its overall quality and the functioning as a public space.

These items are often the responsibility of different agencies and sectors in the community. A more collaborative approach to the placement of items in the street may need to be considered.

**Design Principles:**

- Design street furniture as a cohesive group and locate at focal points.

- Ensure a sense of visual harmony across the region.
  - develop a suite of street furniture that provides consistency in the use of materials, colours, fonts, styles and/or positioning.
  - Provide for flexibility in any or some of these attributes to reinforce for ‘sense of place’ and uniqueness for individual localities.

- Establish visual integrity and continuity for the streetscape through the use of street furniture that is appropriate for the place.

- Individual items in the streetscape should relate in terms of siting, design and colour.

- Place street furniture to enhance orientation and movement through spaces.

- Where possible reduce the amount of clutter in the street.
  - Co-locate or integrate individual elements in the street such as furniture and lighting.
  - Minimise the proliferation of elements of street furniture by avoiding unnecessary/redundant items through periodic monitoring and through the use of multifunctional elements.
  - With the exception of seating, install new street furniture only when considered absolutely necessary and then of a direct benefit to users.

- Retain and refurbish existing items in the street if they reinforce ‘sense of place’ and/or a viable and useful function.

- Elements in the street should be designed to be as vandal resistant as possible, being easily cleaned and replaced and placed to minimise risk of damage by vandals and vehicles.

- Avoid the use of ‘defensive’ street furniture such as fences, railings and bollards in the street.
Planting can create a ‘sense of place’ and increase the aesthetic values of the street while improving the comfort of pedestrians. There are many benefits to vegetation in the streetscape. These include the provision of shade and shelter, colour and vibrancy. Vegetation can act as part of the stormwater system, an architectural element and soften the appearance of hard landscapes.

Vegetation can provide connection with the natural environment, add visual and sensory interest, while adding to the ‘sense of place’ of the locality. Trees can provide an intimate human scale and richness to a place that is difficult to achieve through the use of other elements.

Planting can be used to provide barriers, both visual and physical that are far less intrusive than fences or walls. Trees especially can define a space, providing spatial confinement and separation or act as a landmark or a gateway. Planting can be used to control driver behaviour in the street by limiting forward visibility and thereby slowing vehicles.

Plantings can be as individual or groups of trees or plantings in the street, they can be considered in conjunction with other elements, or they can work as surfaces and materials to enliven and enrich the streetscape. Trees, especially those existing or aged, need to be seen as living components of the public realm, not just as decorative and functional items in the streetscape but as part of the collective assets of the region.

The location, species selection and method of placement are critical to the ability of any planting to survive and thrive, and must be achieved without impact on sight and desire lines, surfaces and other items in the street. Plantings, as they are living infrastructure, need to be provided with healthy growing conditions that recognise the change in needs and size as they grow to maturity. As such a long-term maintenance regime needs to be developed early in the design process.
Design Principles:

• Create streetscapes and landscapes that respect local identity, variety and distinctiveness.

• Choose appropriate species for the character and context of a place, their intended function and to suit the site conditions.

• Provide tree lined streets as a fundamental streetscaping feature.

• Integrate planting with other design elements (e.g. furniture and paving) to enhance identity of place.

• Ensure planting is considered at the beginning of the design process and to the full maturity to accommodate all elements including above and below ground services, access, parking and street furniture without compromising planting needs.

• Plant trees and vegetation that responds to local conditions in type and layout.
  • Use trees that are the appropriate shape and size for the location.
  • Consider the immediate environmental impacts when choosing and placing vegetation (e.g. micro-climate and physical impacts and damage from vehicles buses at bus laybys).
  • Where possible preserve existing trees as they are hard to establish, take time to mature and are important to the existing context.
  • consider the impact on adjoining buildings, footpaths, buried services and lighting when designing for new plantings.

• Provide shelter and shade to a level commensurate with the surroundings, such as shaded trees on neighbourhood paths and awnings over footpaths in town centres.
  • Plant trees that at maturity will touch, thereby providing continuous shade in the street.

• Carefully site tree planting to avoid creating concealment places or obscuring views, sight lines, vistas and landmarks throughout its growth to maturity.

• Consider the hazards and maintenance regime of different species such as limb drop, sap and fruiting when considering appropriate species.
Art in the Street

Art in the street can enliven, intensify and enhance the unique qualities of diverse visual and cultural environments. It also can aid in the interpreting and understanding of the structure of a place.

Public art can enhance our experience of using and enjoying the public realm and therefore the economic and social value of new and redefined places. Public Art in the street can be the catalyst for challenging and generating a cultural debate about art and the public space and aid in the development of a sense of pride in our community.

Design Principles:

• Provide a coherent design framework for the street that incorporates public art from the outset and integrates well into the streetscape.

• Integrate art and involve artists in the overall vision of a place’s design from the outset, ensuring the artist/s are involved in all aspects of the design of public space (e.g., lighting, furniture, signage etc.).
  • Identify ways in which an artist can contribute to the development of public space through the introduction of art and good ideas.
  • Enable the artist/s to create original and sustainable artworks that can be maintained over long periods.
  • Identify opportunities for integration of artist’s work in the street scene as functional components or as artworks in their own right.
  • At the construction phase of new development look for opportunities for artists to be used to animate the street scene (e.g., hoardings, temporary plantings etc).

• Enable art that contributes to cultural identity and creates a distinctive sense of place.
  • Artworks are to be appropriate to community context by being sited well and responding creatively to the local area and social history of the locality.
  • Develop public art that engages and involves people of different ages and cultural backgrounds, including young people.

An artist can infuse common functional objects such as street furniture, paving and railings with a symbolic meaning and beauty. This introduction of delight and creativity in the street can engender a ‘sense of place’ and reinforce local identity. Artworks should be prominent but not obstructive, to a scale that suits its context and of materials that are easy to maintain.

Art should be well integrated into the street and compliment the character of an area. Art should never overwhelm the inherent qualities of the street but bring focus to the place.
• Provide opportunities for communities to participate in cultural activities to aid in the reinforcing a sense of belonging and identification to a place.
  • Create opportunities for community involvement in the development of art projects and the creative process itself where appropriate.

• Place public art work in locations that will generate visual interest by creating focal points, meeting places etc, where the local and regional identity of a place can be enhanced.
  • Use artworks to provide sensory cues to understanding the public realm.

• Aim for the highest aesthetic standards by integrating public art into the street with attention to design, materials, construction and location.
  • When considering the integration of art into the public realm consideration should be given not just to standalone art pieces but also to the opportunity to incorporate work into lighting schemes, signage, furniture, paving etc.
  • Artwork in retail streets and developments will need to be viewed in relation to existing signage, planting, street furniture and shop frontages.
  • Artwork in privately owned developments should be fully integrated into the development’s design, in the most accessible and visible locations.

• Provide places that allow for spontaneous and programmed performance and temporary art, not places that hinder it.

• Artworks are designed to be structurally sound under an anticipated range of uses and conditions with permanent artworks designed to be durable and able to be maintained over their full life.
  • Designs and specifications to be provided for repair and replacement with the finalisation of the artwork.
  • Special care should be made to avoid locations where artworks may be damaged, such as the vehicular right of way.
Signs in the Street

A clear and well thought out signage system can enhance the level of experience of all street users by providing quality information and guidance in the street. Outside of traffic signage the reason for signs in the street is to provide location, identity, direction and information.

With signage in the street less is certainly more. The more signage in the street, especially if it has little logic or hierarchy, can be harder to understand and result in less comprehension than no signage at all. It can also reduce the visual quality of the street through the proliferation of clutter.

Signage is key to the legibility of a place and essential to the visitors, if not the residents experience. It facilitates mental mapping by signalling the location of key landmarks, buildings and vistas. It is also important in providing the cues for the correct use and activities that are acceptable to the local community.

Signage can aid in the techniques of using a place more efficiently and improving the level of social and economic exchange in the community.

Care must be taken in the scale and quality of signs. Signs should be commensurate with their context and surroundings. Signs such as sandwich boards can be clutter forming, obstructive on footpaths and dangerous for the visually impaired. They should only be used where legally permitted, only if necessary and then as not to obstruct, the visual or physical access through a place.
Design Principles:

• Signage of all types should provide simple, clear and unambiguous messages and have a direct relationship to the user and/or uses of a place.

• Regardless of function, signs need to be compatible and fit well into the street adjoining buildings and the general context and character of a place.

• Keep signage in the street to only that necessary for the efficient and effective functioning of the community and that needed for interpreting and understanding a place.
  • Where appropriate use other cues to signal how to use the environment e.g. public art, planting etc.

• Signs must be legible and visibly accessible by all intended users and satisfy their intended purpose or they should be removed from the street.
  • Provide easily understood signage on pedestrian and cycle paths that provide destination information relevant to residents and visitors alike (e.g. public transport stops and public amenity) with route quality and distance information.
  • Unnecessary and redundant signs in the street should be removed and the logical integration of signs with other signage or with other elements in the streetscape instituted.
  • Reduce street clutter by using existing posts, columns, and structures to mount signage thereby reducing the proliferation of individual posts in the streetscape.
  • Start with no signs and only add when necessary.

• To reduce visual pollution, night sign illumination should be kept to a minimum especially in residential areas.
A good lighting system lessens the risk of night time accidents, discourages crime and vandalism and can be used to enhance the after dark appearance of a place. With lighting residents and visitors alike feel more secure and therefore use the street more. The more use of the public realm increases the numbers of people in the street for a greater period thereby improving the real safety of the street.

Lighting needs to be more than an illumination device in the street. It has a major impact on the appearance and qualities of the street and needs to be considered for its merits as another element in the street. Its column, lamp design, its location, its fit with other elements are all important to the part it plays in the street. It must be integrated into the overall design concept. Lighting should be of a quality and location that responds to other elements in the street such as landscaping, street furniture and signage.

Lighting columns are often large and repeating elements in the streetscape and as such can have a substantial impact on the character and appearance of a place both during the day and at night. The size of the lighting columns needs to be considered so as they are not out of scale with pedestrians and the surrounding buildings.

Lighting should illuminate both the carriageway and the footpath. It should be designed to ensure that any obstacles are seen and the faces of other users are easily recognised after dark. It is important to avoid shadows as the contrast between light and dark can be considerable in highly lit places.

Care must be taken in the positioning of lighting to ensure that trees or other items do not prevent enough light access to the pedestrian. Separate lighting for pedestrians may be required where the street is too wide, the lighting too far away or too high for the pedestrian.

Under awning lighting and light spill from shop fronts and buildings should be considered in any lighting system design for pedestrians. When including this form of lighting as part of the lighting scheme it should be considered that there is no guarantee of continuity.

The level and type of lighting should be determined through a good understanding of the type of usage, location and the proximity to the use or user. The colour and intensity of light is an important ingredient in the creation of connection and identity at night. White with good colour rendition is essential for quality streetscapes. A more intimate lighting environment needs to be provided for pedestrians by bringing the lighting lower, ensure good colour rendition and controlling light spill.

Lighting spill and pollution should be considered, taking care with the level of lighting to ensure that adjoining properties are not impacted by nuisance lighting and energy is wasted in the process.
Design Principles:

• Lighting should always be of a high quality and targeted to the type and level needed.
  • The quality of the light fitting becomes more of an issue as the height of the light is reduced as it becomes more visible.

• Use lighting to provide continuity to pedestrian routes and destinations to assist in night legibility.
  • Lighting should be used at night to highlight landmarks, quality buildings, streetscapes and significant trees.

• Lighting in the street needs to be considered as an element in the street and therefore needs to fit with the character and context of a place and the existing street furniture.
  • Lighting at or near ground level should be integrated into street furniture and pavement.
  • Consider the placement of lighting on tree lined streets to avoid conflict with uniform light distribution.
  • Reduce clutter by using the minimum number of light columns necessary to achieve optimum lighting levels.

• Illuminate both the carriageway and the pedestrian pathways in a street.
  • Pedestrian lighting should be conceived as a thread of neutral softer white light through the streetscape.
  • Low level lighting is more vulnerable to anti-social behaviour and must be designed robustly and with easy maintenance in mind.
  • Where appropriate provide continuous lighting to pedestrian pathways and public spaces used or traversed at night.

• Light fixtures are to be designed to minimise unnecessary light spill and intrusion to adjoining properties and general light pollution especially in low lit residential and rural areas.
  • Consider the impact on wildlife when developing lighting plans.

• Use lighting in conjunction with casual surveillance to minimise crime and anti-social behaviour.

• Consider the use of alternate light sources to replace and reduce the need for lighting columns such as internally lit, sculptures and street furniture, up-lit, structures and trees.
Seating design should form the basis for consistency in street furniture for the region, together with bins, seating is the most ubiquitous of the street elements. Where appropriate however opportunity should be taken to allow flexibility in the design of the seating to provide diversity in materials or colour to reinforce local ‘sense of place’.

As with all street elements the occasional use of an individual one-off item such as a seat designed specifically for the location by an artist should be considered to heighten the vitality and distinctiveness of a place. The opportunity to incorporate and integrate art and signage with seating should also be exploited where possible.

The provision of places to sit and relax, refresh and watch is a prime requirement of successful streets. There is often opportunity to design other elements in the street to provide comfortable seating as a part of their functions e.g. steps, low walls and planter edges. Seating should be positioned to relate to the pedestrian movement corridor, the built edge, the kerb face, the paving layout and/or other furniture elements in the vicinity.

Seating should also be placed with a prospect, a view out or to something. Where there are other seats in the immediate location thought should be given to the juxtaposition of the seating. Seating can be placed to facilitate social exchange or private viewing, intimate conversation or group discussion. Whatever the arrangement other items in the street and pathways must be considered with the design of the seating layout.

Seating can provide for numerous needs such as rest stops on journeys, a refuge from the bustle of the street, a place to sit and watch others, a place to gather and meet, and a place to eat lunch to name just a few. Seating is particularly important for the aged in the community. The level of the provision of seating can have a considerable impact on increasing the mobility of older people by providing places to rest.
Design Principles:

• Provide seating at regular intervals along paths, in quiet spaces in urban streets, at destination and waiting points.
  • Place seating at waiting places such as outside school entrances, aged homes and office blocks to provide the opportunity to have lunch and talk to others.
  • Seats should be located where they contribute to the street scene or at the top of hills, but must not cause obstruction to the footpath.

• When placing new seating in the street the opportunity to locate it to make the most of the existing qualities of the place should be exploited.
  • Consider the micro-climate when choosing where to place seating e.g. in the shade for sunny days or sun for winter or mornings.
  • Place seating to make the most of a view or a prospect, no-one likes to look to a wall when there is a street to look at.

• The introduction of seating into a street must consider its ability to fit with the existing character of the locality and other street elements.
  • Avoid causing obstruction to main lines of movement or sight.

• When providing new elements in the street such as low walls and planter boxes consideration in the design should be made for the opportunity for comfortable seating.

• The collocation of other furniture items such as bins, lighting and trees etc, with seating, should be considered to make the most of the facilities.

• When considering locations for seating especially against walls to private property consider any possible security implications.

• Avoid seating in isolated locations with low levels of casual surveillance and where there is a poor view of those approaching.

• In busy pedestrian areas or areas of confined space provide space near seating where wheelchairs can be positioned.
Floorscape

Verges need to be wide enough to cater for the activities, services and volumes of pedestrian traffic that can occur in the street. Wide verges can be attractive however care must be taken to ensure that they are not of a width that is out of scale to the other parts of the street and the adjoining buildings and uncomfortable and bleak because of their expanse.

Consistency and cohesion to the street can be provided by using a limited palette of colours and materials for paving surfaces. This can also be useful for maintenance with the ease of replacement of worn or broken surfaces and the understanding of efficient maintenance procedures.

The surfaces of the street can play a considerable role in how the street as a whole is perceived by the pedestrian. The careful use of quality materials especially at focal points can help in developing a strong ‘sense of place’ in the street.

The texture and smoothness of the materials used in footpaths and the quality of the installation can have considerable impact on the comfort of pedestrians, cyclists and the disabled.

The use of concrete slab and bituminous materials can provide cost effective, practical and durable surfaces that are easy to clean and maintain. When using utilitarian material such as these it will be necessary to provide diversity in the surface with the use of richer, higher quality materials at focal points such as intersections, major spaces and routes, and/or the manipulation of the paving by the use of additives such as colour or pebbles in the material itself to create variety and a richer look to the surface. Bituminous surfaces and concrete can stain and discolor over time especially if dug up for utility installation and servicing.

The use of paving concrete and clay can add considerably to the richness and personality of a street and can easily be manipulated to show change in a street. Care however needs to be taken in ensuring the smoothness and permanency of the surface.
Design Principles:

• The change of surface materials should coincide with features such as party walls, kinks in the street face of buildings, changes in the width of footpaths or to designate a boundary or edge to precincts.

• The change to, edge of or jointing of, different surfaces and materials needs to be well demarcated visually.

• Too much mixture and fussiness in the street surface needs to be avoided.

• Carry the material of the footpath out into any buildout islands etc to ensure consistency in the street, too many materials can reduce the coherence and visual qualities of the street.

• Avoid breaking up surfaces with poor placement or too many items, at odd angles and of poor quality installation of utility access covers that do not fit well in the street.

• Material selection to concentrate on high quality materials at focal points.
Maintaining the cleanliness of a place is an important factor in its success as a place where people feel comfortable and safe. Bins aid in reminding the user of their responsibility to maintaining the streets quality.

Bins should be placed to be unobtrusive in the streetscape yet at the same time easily located. This may mean that the bin is taken out of the main pathway and placed in a less obtrusive location and/or to the edge of the space. The preference however is to ensure that rubbish and recycling receptacles are part of the design of the place and fit well with the other street furniture found in the vicinity. This allows for them to be easily located, used and maintained.

**Design Principles:**

- Rubbish and Recycling receptacles are to be part of and relate to the design of the space and the street furniture of a place and not be the focus.

- Place rubbish and recycling bins in locations that will generate heavier volumes of rubbish e.g. takeaways, school entrances etc.
  - Where possible co-locate bins with other street furniture especially seating and bubblers.
  - Rubbish bins should not be placed too near seating so as to lessen impact of unpleasant odors and insects.
  - Position bins near to and at regular intervals along pedestrian pathways.
  - Care must be taken in the siting of bins to ensure that sight lines, views and pathways are not obstructed.
  - Not all localities are appropriate for bins, isolated locations may lead to poor and anti-social behaviour and maintenance difficulties.
  - Bins should be placed near uses that generate waste e.g. bus stops, near school entries, rail stations, takeaway food outlets and event spaces.

- Consideration should made of the ease of access for servicing from collection vehicles when choosing bin locations.
The role of bollards in the street is generally to restrict or guide vehicle access and/or signal pedestrians of changing conditions in the street. They can also be used as a medium for pedestrian and cycle wayfinding and signage. Used in this way they are controlling elements and should only be used when absolutely necessary.

Both pedestrian safety barriers and bollards prevent or limit movement, however, bollards are usually not linked and are usually for the management of vehicles and therefore far less intrusive and preferable in the street to fencing.

Pedestrian barriers by their nature are restricting to pedestrian access and as such can result in places where the pedestrian is in danger with little ability to escape. They should never be used in urban streets where pedestrians are the dominant user e.g. main and mixed-use streets.

In centres pedestrians should be able to safely cross the street at any location with relative ease. Pedestrian safety barriers can also add considerably to clutter in the street and reduce the quality of the sight lines of vehicles and pedestrians (especially for children and those in wheelchairs).

**Design Principles:**

- Bollards should fit well with and relate to other street furniture items in the street.

- Care should be taken in the use of bollards to ensure the numbers do not reach a point where they are seen as single dominating elements in the street.

- Consideration should be given to using alternative street elements to also carry out the role of bollards. This can be achieved through the placement of trees, seating etc to act as barriers to vehicle movement.

- Pedestrian Safety Barriers (e.g. fences) should only be used at locations where there is considerable proven danger to pedestrians and then only when the use of the barrier will considerably reduce that risk and when all other avenues for reducing the risk have been exhausted.

- When considered appropriate pedestrian barriers should only be used for very short distances.
Badly placed utility boxes or those located on narrow verges can obstruct the free movement of pedestrians, reduce vehicle sightlines and have negative impact on the visual quality of the street.

Inspection covers should be as unobtrusive as possible. Those that are even slightly off alignment with the kerb can have a marked visual impact to the pedestrian.

**Design Principles:**

- **Minimise the above ground distribution of utility boxes, power lines etc to:**
  - preserve street character; and
  - minimise impact on pedestrian pathways.

- **Utility boxes/cabinets and inspection covers should be unobtrusive and fit well into the street environment.**
  - Utility boxes/Cabinets:
    - be at a scale commensurate with the street context;
    - placed unobtrusively to the back of the verge off the footway;
    - at a location that does not obstruct driver view to small children; and
    - painted in dark colours that relate to the street furniture in the area.
  - Inspection covers:
    - Inspection covers should be placed so as they are either to be aligned to the back of the kerb or the building frontage.
    - Where possible inset covers with surrounding surface materials that create a continual paved surface.

- Inspection covers and utility boxes can be used as platforms for public art thereby adding to the ‘sense of place’ (e.g. painted or indented surfaces).

- Where possible CCTV is to be mounted on buildings, light poles or integrated with other elements in the street.

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**Utility Covers/Boxes & CCTV**

Close Circuit Television (CCTV) devices are being used more extensively in the street for surveillance. They can be very obtrusive and increase the level of clutter in the street and send a negative message to the perceived qualities of the place.
Street Trading & Markets

Pavement Cafes, Charity Stalls, Street Markets

Street trading can mean more vitality and colour in the street. Care must be taken in the positioning of the stall/s or van/s to ensure that pedestrian paths are unobstructed and sightlines are not breached.

For long term street trading the quality of the stall must be commensurate with the street, fit well with the other elements of the street and not dominate the streetscene. The trading facility must be moved at the end of the days trading.

Design Principles:

- Stall/s or Vans to be placed so as not to obstruct or obscure the pedestrian pathway.
- Do not display strident advertising.
- Must be designed well to fit into the street or be of very temporary nature.
Materials & Details

Materials and details provide much of the richness and variety in a street.

The use of standard elements and materials can result in efficiencies and a higher quality across the region. The application of a corporate standard therefore should be tempered against the need for a local 'sense of place' through variation in materials and colours to the corporate pallet and the need to use landscaping that responds to local conditions.

Design Principles:

• Adopt a pallet of materials and furniture for use across the region that provides for ease of maintenance and management and allows for flexibility and creativity in design as a response to individual localities.

• All materials chosen need to satisfy the following requirements:
  • easy to maintain;
  • safe and fit for purpose;
  • durable;
  • sustainable;
  • appropriate for local aesthetic and character; and
  • fits well with context and integrates well into street and with existing and proposed street elements.

Maintenance

The level of maintenance can have considerable impact on the perception of the quality of a street.

Good design can significantly reduce the level and cost of maintenance required. Materials selected on the basis of the whole of life of a project combined with a design that considers such maintenance issues as the ability to clean and replace will aid in this reduction in cost.
Water Sensitive Urban Design (WSUD)

WSUD is the integration of urban water cycle with urban planning and design.

The concept of WSUD is to utilise urban stormwater as a resource while protecting the receiving ecosystems. Within streetscapes, WSUD integrates road layout, vehicular and pedestrian requirements with stormwater management needs.

WSUD elements applicable at street scale are:

- swales and buffer strips;
- porous pavements;
- sand filters;
- on-site infiltration measures;
- bioretention systems such as swales, basins or planter boxes; and
- other elements such as oil/grease separators, gross pollutant traps (GPTs), litter baskets, litter (trash) racks.

Design Principles:

Design should:

- consider using various WSUD elements in combination in order to maximise the range of possible solutions;
- ensure that natural features and topography of the site are incorporated along with enhancing the visual amenity of the street;
- aim to integrate public open space with stormwater drainage corridors, maximise public access, passive recreational activities and visual amenity;
- ensure that all road safety standards are met and the needs of all road users (pedestrians, vehicles and residents/landowners) are addressed;
- aim to replace where possible, impervious surfaces like car parks, driveways, pathways and courtyards with porous materials such as porous pavements. Where the impervious material can not be replaced, the stormwater runoff should be channelled to swale and buffer strips, bioretention swales, bioretention basins, on-site infiltration measures or other treatment devices such as rain gardens or planter boxes.

- To capture road run-off, bioretention swales, or a combination of swale and buffer strips can be located in the median strip or footpath. Alternatively on-site infiltration measures can be placed.

- Maintenance of WSUD systems should be considered in all the four key phases namely design, construction, establishment and operational phases.

- As WSUD integrates various innovative urban water management technologies, good strategic planning with sound engineering practices in design and construction are required for its successful implementation.