



MCF Design and Innovation Programme
Mobile Network Base Station Deployment
Technical Paper



Prepared for the Mobile Carriers Forum and the
Design and Innovation Programme Taskforce
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1.0



What is the aim of this
Technical Paper?

This Technical Paper has been prepared in response to investigations and consultation undertaken by the Mobile Carriers Forum (MCF) Design and Innovation Programme project. It is a resource and instruction guideline which Carriers and their consultants may consider when designing and implementing mobile phone base stations to achieve better visual outcomes.

This Technical Paper comprises:

- The Mobile Network Base Station Design Guide which provides a structured process to assess the landscape context of a proposed mobile phone base station. This assessment process generates a design framework that can guide the design of mobile phone base stations that are more visually compatible with their location; and
- Design Opportunities which can assist with the design of mobile phone base stations.

This Technical Paper has been prepared for use by Mobile Telecommunications Carriers and their consultants/contractors. It does not replace any existing legislative requirements identified under the Telecommunications Act 1997, the Telecommunications (Low Impact Facilities) Determination 1997 (as amended), or the ACIF Code for Deployment of Mobile Phone Network Infrastructure (2004) nor are Carriers obligated to adopt and implement the processes and recommendations identified in this Technical Paper. The processes and recommendations identified are intended for use in the future deployment of mobile phone base stations. It is not intended that they be applied retrospectively to existing sites.

1.1 What was the Aim of the MCF Design and Innovation Programme Project?

The aim of the MCF Design and Innovation Programme Project was to identify techniques and guidelines which can be applied and supplement everyday mobile phone base station site design processes and assist telecommunications Carriers and their consultants to determine “what to do where” when deploying mobile phone infrastructure in order to achieve better visual outcomes.

1.2 Why was the MCF Design and Innovation Programme Project Initiated?

The visual effect of mobile phone infrastructure is an issue of concern to some sectors of the community, however, 94% of Australians expect to be able to make a call on their mobile phone from anywhere at anytime. With the increased demand from the community and business sectors for access to reliable mobile phone technology and network coverage, comes the need for the deployment of more mobile phone base stations. More base stations will result in the continued visual effect on our urban and rural landscapes.

In response to the need to better address the visual effect of mobile phone infrastructure the Mobile Carriers Forum initiated the MCF Design and Innovation Programme and established the Design and Innovation Taskforce to oversee the project. The Taskforce was comprised of members of the MCF National Council and representatives from other organisations with a stake in the industry including Ericsson, Argus Technologies, the Property Council of Australia, Truman Hoyle Lawyers and Engineers Australia. Urban & Regional Planning Solutions in association with Wax Design was engaged by the MCF to undertake the project.

The MCF Design and Innovation Programme is another example of the telecommunications industry proactively initiating projects which aim to improve consultation and communication with local government and the community and continually improve the deployment of mobile phone base stations. Other examples of projects initiated by the industry include:

- ACIF Code Guidelines for Local Government; and
- Low-impact Facilities Guidelines for Better Visual Outcomes.

1.3 What was the Scope for the Project?

Essentially, the MCF Design and Innovation Programme project aimed to address the following two key issues:

1. **The equipment**—that is, the design of the different elements which comprise a mobile phone base station including the antennas, antenna mounts and cabling, support pole or towers and equipment shelter or cabinet; and
2. **The location**, or site suitability assessment—that is, identifying what issues need to be taken into account in what location in order to understand and address the visual effect of proposed facilities through appropriate design responses.

Importantly, the underlying basis of the project was the understanding that achieving better visual outcomes is not necessarily about disguising or camouflaging a facility, but rather about improving the compatibility of the mobile phone base station with its surrounding environment by considering all factors that contribute to its visual effect.

Innovative designs or camouflage designs are not always necessary or offer the only way of reducing the visual effect of mobile phone infrastructure. For the majority of sites, a similar outcome in terms of the resulting visual effect may be achievable by taking other design issues into account. For example, using vegetation to screen a monopole, colour matching antennas or setting back rooftop antennas from the edge of a building's roof.

1.4 How was the Project Undertaken?

The methodology used for the project is summarised in the following flow-chart. A number of opportunities for consultation were provided by this process and included consultation with both representatives from within and outside the telecommunications industry. The project team consulted with Carrier site acquisition teams and antenna manufacturers, Local Government, community groups, property owners, utility owners, legal representatives, engineers, urban designers and planners.

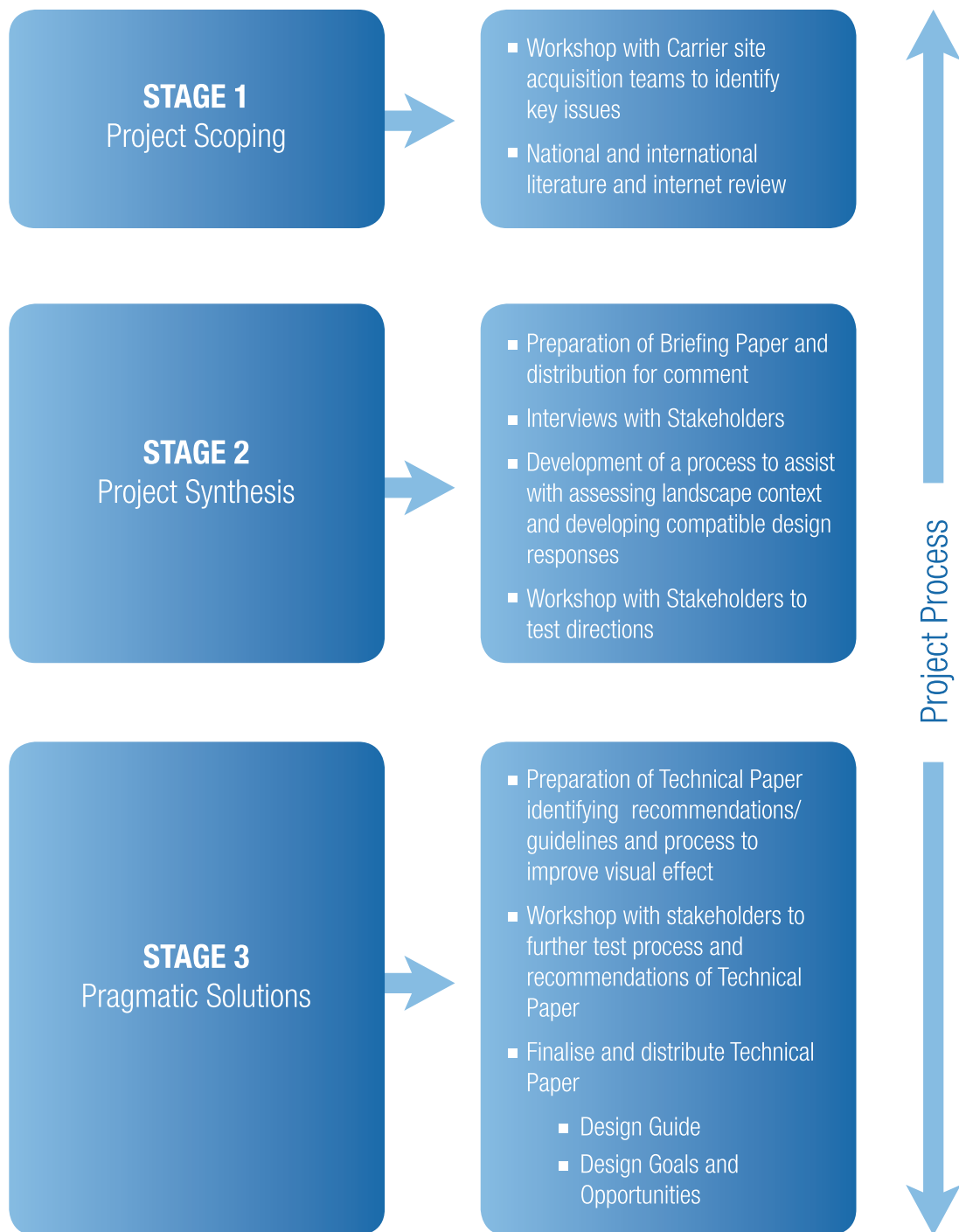


Figure 1: Project Methodology



2.0



Considering and
assessing visual effect

2.0 Considering and Assessing Visual Effect

Similar to all forms of development, mobile phone base stations have a visual effect. This visual effect can be attributed to two unavoidable characteristics of mobile phone base stations:

- (i) They are structures which generally protrude from other structures; and
- (ii) They need to be located at suitable heights in order to operate effectively.

These characteristics mean that by necessity, mobile phone base stations may be and often are highly visible in urban and rural landscapes.

2.1 Designing for Better Visual Effects- Development of the Mobile Network Base Station Design Guide

As the MCF Design and Innovation Programme Project has progressed it has become increasingly evident that the key to better addressing the visual effect of mobile phone base stations involves:

- Undertaking a detailed assessment of the landscape in which the mobile phone base station is to be located; and
- Designing the facility to respond appropriately to this landscape setting.

In this way, a mobile phone base station can be designed that is compatible with the landscape setting. The higher the level of compatibility of the mobile phone base station design with the landscape, the less significant or intrusive the visual effect. Conversely, the less compatible the mobile phone base station is with the surrounding landscape, the greater its visual effect (refer Figure 2).

Visual effect is either caused or ameliorated by the degree of visual change that occurs as a result of development within any environment. Understanding the contextual setting is paramount to developing a design response that is appropriate and in turn compatible. Figure 3 summarises this relationship.

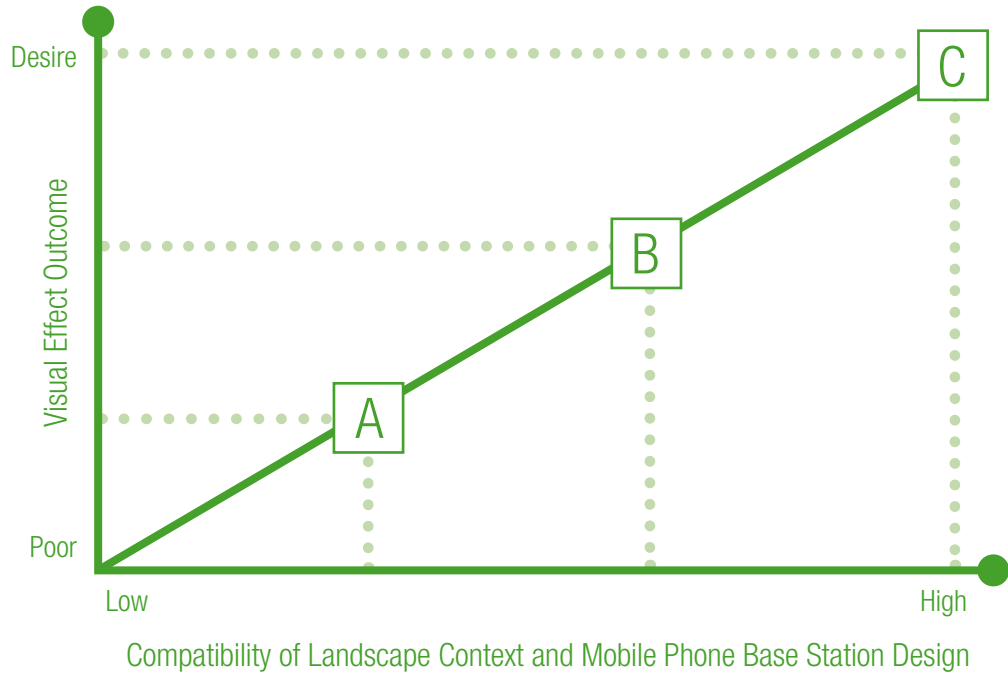


Figure 2: Relationship between Compatibility and Visual Effect

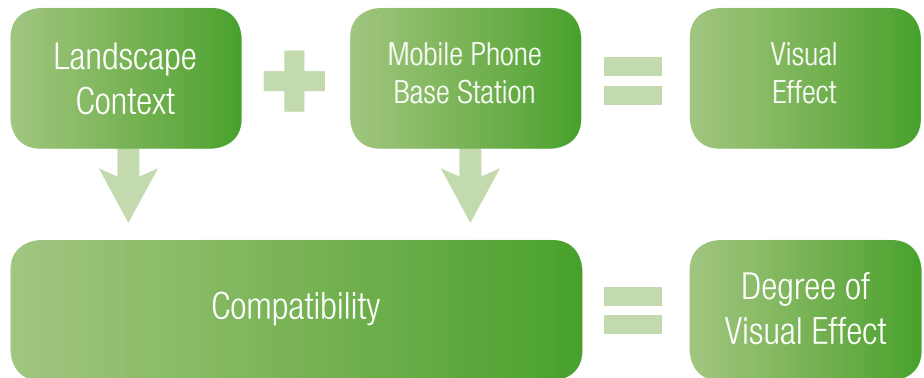
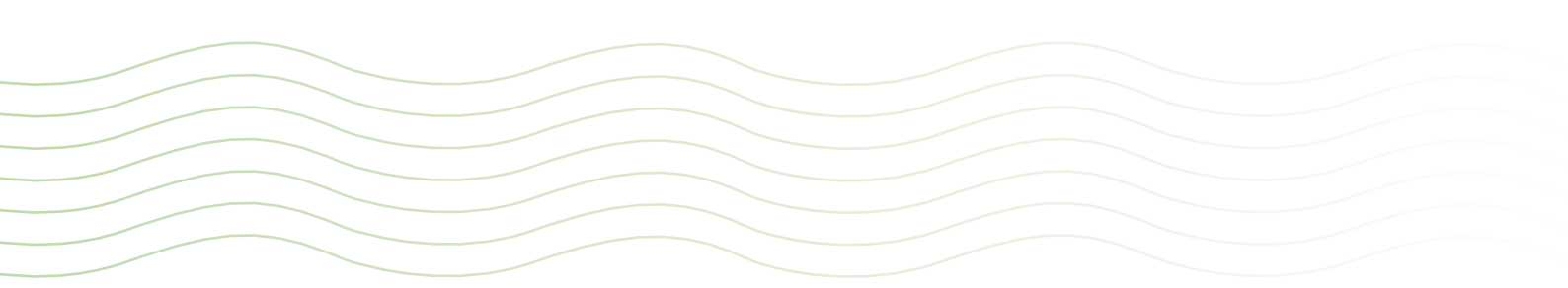


Figure 3: Understanding Visual Effect



In response to this clear relationship between the landscape context, the design and the resulting visibility, the Mobile Network Base Station Design Guide has been developed.

The Mobile Network Base Station Design Guide provides a process which can assist Carriers to determine “what to do where”. The Mobile Network Base Station Design Guide documents and assesses the landscape context of a proposed mobile phone base station and identifies a framework that can be used to design a mobile phone base station that is responsive to its locational context. Section 3 of this Technical Paper explains the Mobile Network Base Station Design Guide and provides guidelines that explain how to use it.

2.2 How does the Mobile Network Base Station Design Guide Differ from Past Approaches to Addressing Visual Effect?

In 2001, the Mobile Carriers Forum commissioned the Low-impact Facilities Guidelines for Better Visual Outcomes which provided a series of guidelines regarding the design of Low-impact facilities. The Low-impact Facilities Guidelines were prepared in response to concern from some members of the community that Low-impact facilities are not subject to Local Council planning policy and assessment procedures which can influence the visual outcome of proposed developments.

The information provided by the Low-impact Facilities Guidelines for Better Visual Outcomes continues to be relevant when considering ways to better address the visual effect of mobile phone base stations, and this Technical Report has had regard to these Guidelines. However, the “Low-impact Facilities Guidelines for Better Visual Outcomes” is a high level strategic document. It does not provide practical guidance regarding how to design mobile phone base stations that deliver better visual outcomes, nor does it provide a process to assist with the documentation and assessment of the landscape context.

The MCF Design and Innovation Programme project has established that there is a clear relationship between the landscape context and the proposed development and that the resulting visual effect is influenced by the level of compatibility between the two. There is no other transparent, structured process that is available to Carriers and their consultants which enables the documentation and assessment of the landscape context of a proposed mobile phone base station and results in the identification of a framework that can guide the design of the proposed facility in response to this assessment process.

2.3 How Does the Mobile Network Base Site Design Guide Relate to Current Carrier Site Acquisition Processes?

Carriers and their consultants undertake a range of investigations when identifying and assessing proposed sites for mobile phone base stations. These investigations include consideration of the potential visual effect of the proposed base station. However, it appears that currently there is no transparent, structured process which documents and assesses the surrounding environment of a proposed site for a mobile phone base station and assists with determining how the mobile phone base station should be designed to respond to this context. It is acknowledged that this process is undertaken intuitively by planners during the site acquisition process.

The Mobile Network Base Station Design Guide can be integrated into current site acquisition processes and does not replace any of the current practices undertaken by Carriers. ***It does not replace existing information gathering, consultation and assessment processes, but rather provides an additional layer of information that can be fed into the site acquisition process*** and assist in the design of mobile phone base station sites for construction. In addition, the Mobile Network Base Station Design Guide provides the opportunity to review mobile phone base stations once constructed to determine their “visibility” and enables Carriers to review and evaluate the designs of individual sites once constructed.

It is recognised that there are a range of other objectives that influence site selection including the availability of land, requirements of the landowner, occupational health and safety, cost, access for maintenance purposes, construction issues and radio frequency requirements such as coverage objectives, capacity, network design constraints, line of sight and height of surrounding building, trees and other structures.

The Mobile Network Base Station Design Guide can be used to meet some of these objectives. For example, negotiations with a landowner who takes a particular interest in the compatibility of the design with the property can be supported through the use of the Mobile Network Base Station Design Guide during the negotiation process.

The Mobile Network Base Station Design Guide can be used at any stage of the site acquisition process, but it is anticipated that it will be most useful, cost effective and time efficient once a preferred site candidate is confirmed having regard to all the other factors that influence the site selection process.



3.0



Mobile Network Base
Station Design Guide

3.0 Mobile Network Base Station Design Guide

The Mobile Network Base Station Design Guide (the Design Guide) aims to assist Carriers and their consultants during the site acquisition process to assess the landscape context and develop a mobile phone base station design that is responsive to this context.

The Design Guide provides a structured process which:

- Assesses the landscape and determines the sensitivity of the visual environment;
- Identifies mobile phone base station design considerations appropriate to the landscape context;
- Provides direction regarding how to reduce the visual effect of mobile phone base stations through design development; and
- Provides a framework that allows a range of objectives to be balanced against visual outcomes.

The Design Guide can be used to demonstrate to local government, property owners and the community how the proposed mobile phone base station may impact on the visual amenity of the location and design strategies that can be used to enhance design compatibility and ameliorate the visual effect.

The Design Guide is an interactive tool and can be accessed via the following website link <http://www.mcf.amta.org.au/>.

3.1 How Does the Mobile Network Base Station Design Guide Work?

The Design Guide is an interactive analysis and design tool that operates in five stages. It is envisaged that the Design Guide proposed by this Technical Paper will be further developed to operate as a web enabled tool.

This five stage approach provides a complete analysis and design tool for Carriers and consultants. The interactive format of the Design Guide enables tailored design recommendations to be generated in response to on-site assessment. Each selection creates a specific design response for the mobile phone base station. The Excel spreadsheet and potential web-based format of the Design Guide provides simple drop-down selections making the assessment process user-friendly. This system provides site acquisition teams with a combined landscape architectural and urban design analysis tool.

The final engineering design can also be evaluated against the Design Guide's 'best practice' recommendations. The greater the compatibility with the design recommendations the greater the reduction or mitigation of the visual effect. Conversely, if the engineering design has not been able to achieve the recommendations, the greater the potential visual effect of the proposed mobile phone base station.

Finally, an assessment can be made as to what level of design compatibility may be associated with the proposed mobile phone base station in terms of site selection, design recommendations and final engineering design. The assessment and analysis process that the Design Guide provides is an invaluable insight into what is required in relation to any site to limit visual effect. The Design Guide also highlights when unique design solutions may be required including screened and camouflage design. The electronic format of the Design Guide allows it to be continually updated or modified as new assessment criteria are considered, or new technologies and design solutions become available.

The potential Web based development of the Design Guide provides future opportunities for users to access the guide via web enabled phones while on site.

3.1.1 Stage 1: Site Assessment

Once a preferred site option is identified by the Carrier site acquisition team through negotiation with the property owner, a detailed analysis of the landscape character is undertaken using defined evaluation criteria. This develops a baseline measurement of the existing landscape context. Aspects critical to visual effect are assessed, including topography, built form and vegetation.

The site acquisition team uses prompts to select and assess the site and the surrounding landscape context. The selections provide a detailed picture of the landscape and visual character, which can be supplemented with photographic surveys. Attachment A provides a checklist that can be used on-site to document the site context and be inputted into the Design Guide at a later time. The property owner may be a valuable source of information in completing the site assessment as they may be able to provide information regarding issues such as visitation to the area, particular local sensitivities, views to be preserved and engineering constraints which may impact on the base station design.

Figure 4 shows how a drop down box is selected identifying key landscape characteristics such as “land use” and “topography”.

3.1.2 Stage 2: Design Guide

The selection of landscape characteristics (Stage 1) generates detailed design recommendations that respond directly to the site analysis providing a contextual and visually compatible design response. These recommendations then provide a design brief for the engineering development of the mobile phone base station design. Design recommendations are provided for the four main components of mobile phone base stations including poles and towers, antennas mounts, equipment cabins and antennas and cables (refer Figure 5).

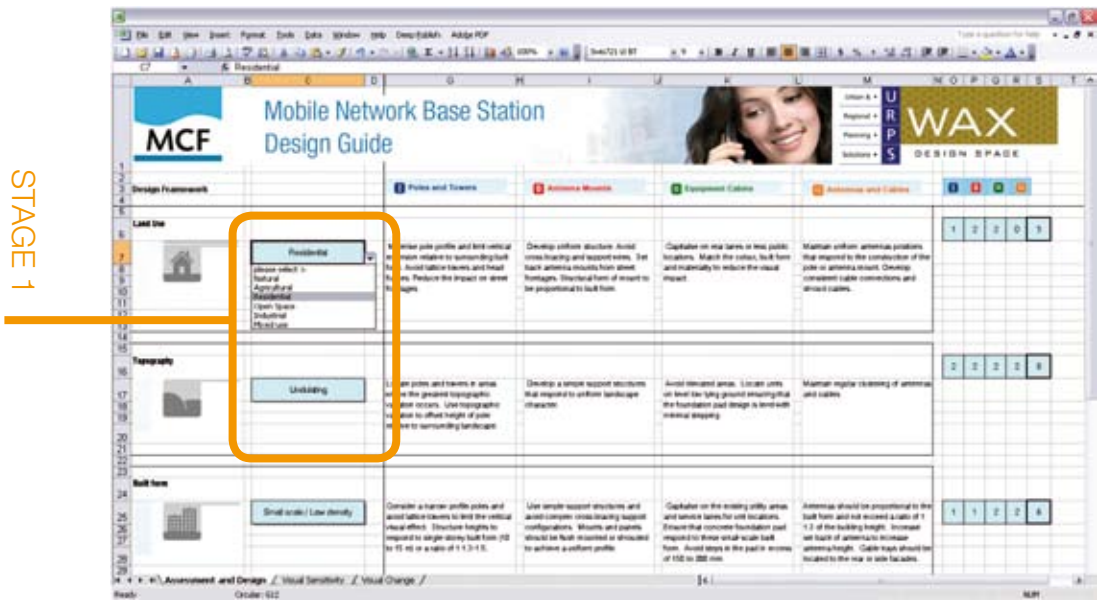


Figure 4: Identifying Key Landscape Characteristics

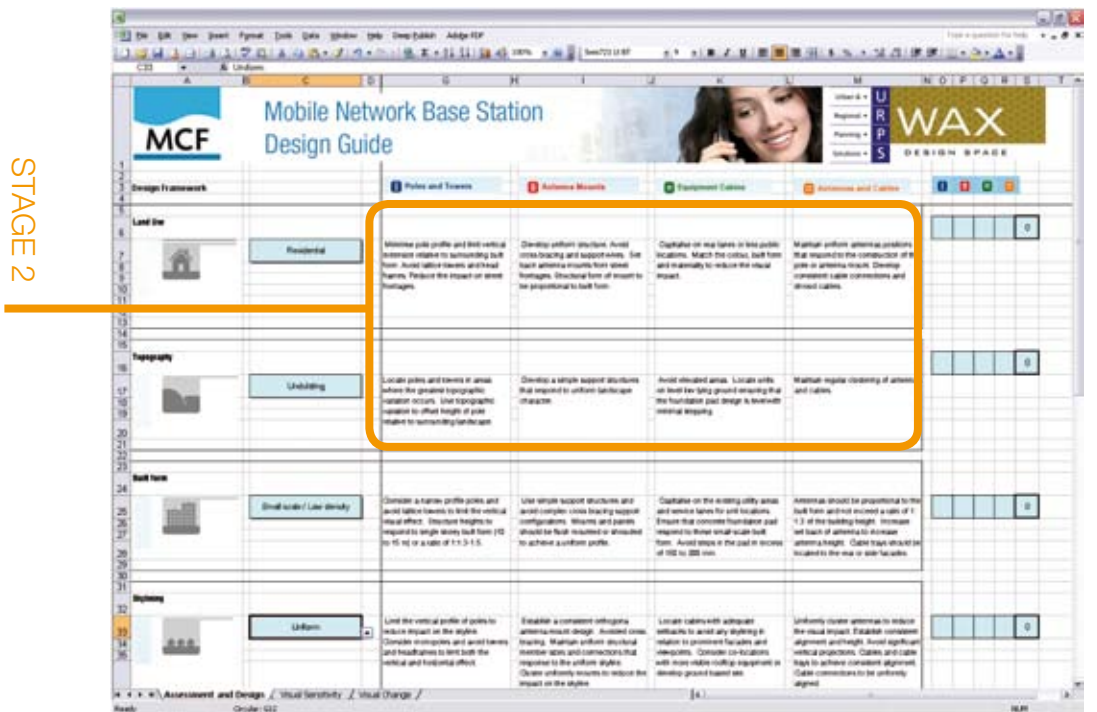


Figure 5: Generating Design Recommendations

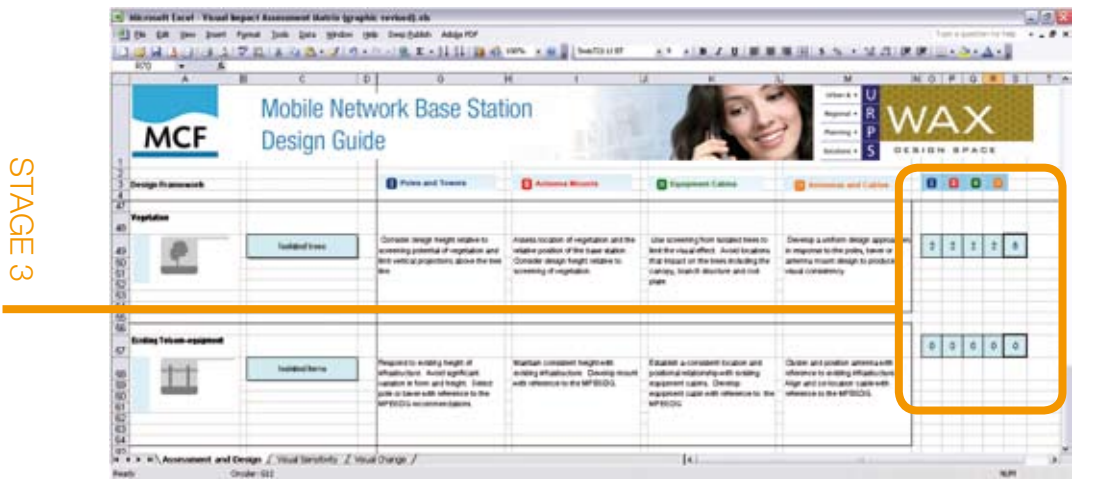


Figure 6: Assessing Design Compatibility

3.1.3 Stage 3: Measurement of Compatibility

The Design Guide includes an assessment of the proposed engineering design against the Mobile Network Base Station Design Guide recommendations (the best practice). The assessment considers whether the recommendations have been achieved, either fully, partially or not at all. The less compatible the engineering design, the greater the potential for visual impact (refer Figure 6).

3.1.4 Stage 4: Visibility

The Design Guide also analyses the visual sensitivity of the site and surrounding landscape. The site acquisition team is able to develop an understanding of where the proposed base station will be seen, by whom and how many people are likely to be effected. This assessment directly influences the potential visual effect that may be generated by the project (refer Figure 7).

3.1.5 Stage 5: Degree of Compatibility

Finally, a measure of the design compatibility of the engineered design for the mobile phone base station is assessed relative to its visibility and the anticipated visual effect. This assessment considers whether the engineering design matches the recommendations of the Design Guide with reference to the sensitivity of the site. The greater the sensitivity of the site, the greater the need to achieve compatibility (refer Figure 8).

STAGE 4

Assessment	Rating	Description	Survey
Visibility	4	Highly visible site (open)	<input type="checkbox"/>
	3	Large vistas and avenues to and from the site and surrounding landscape	<input type="checkbox"/>
	2	Views and Vistas to and from the site and surrounding landscape	<input type="checkbox"/>
	1	Clipped views between building and vegetation	<input type="checkbox"/>
Prominence (eyeline)	4	Prominent within the line of sight	<input type="checkbox"/>
	3	Elevated within the line of sight	<input type="checkbox"/>
	2	Above the line of sight	<input type="checkbox"/>
	1	Out of the eyeline	<input type="checkbox"/>
Access (duration)	4	Continuously visible in the surrounding area	<input type="checkbox"/>
	3	Partly visible, some screening	<input type="checkbox"/>
	2	Brief views when travelling within the landscape	<input type="checkbox"/>
	1	Specific views from static locations	<input type="checkbox"/>
Community (visitation)	4	Highly visited site (2000+ per day)	<input type="checkbox"/>
	3	Increasing visitation (1000-2000 per day)	<input type="checkbox"/>
	2	Moderate visitation to the site (500-1000 per day)	<input type="checkbox"/>
	1	Low visitation (0-500 per day)	<input type="checkbox"/>
Existing Infrastructure	4	None	<input type="checkbox"/>
	3	Isolated items (street lights, small scale distribution lines - services)	<input type="checkbox"/>
	2	Groups of elements (road lighting, large scale distribution lines - services)	<input type="checkbox"/>
	1	Large infrastructure (transmission lines, freeway lighting, major pipelines)	<input type="checkbox"/>
Cultural Representation	4	Designated cultural precincts	<input type="checkbox"/>
	3	Distinct Landmarks and recognised features	<input type="checkbox"/>
	2	Notable features within the landscape	<input type="checkbox"/>
	1	No significant elements	<input type="checkbox"/>
Visual Sensitivity			0

Figure 7: Understanding Potential Visual Effect

STAGE 5

Compatibility/Visibility	1 to 5	6 to 10	11 to 15	16 to 20
75 - 100%	Low	Low	Low	Medium
51 - 75%	Low	Low	Medium	High
25 - 50%	Low	Low	Medium	High
0 - 25%	Low	Medium	High	High
Visibility				12
Compatibility (%)				54.3

Figure 8: Understanding Compatibility



4.0



Mobile Network
Base Station Design
Opportunities

The Mobile Network Base Station Design Guide (the Design Guide) provides a structured process to document and assess the landscape context for a proposed mobile phone base station. Once all of the information has been inputted describing the landscape context, the Design Guide generates a framework that provides design considerations to be used in order to minimise the visibility of the proposed mobile phone base station at the identified site location.

The Design Guide provides a framework to inform the design of mobile phone base stations. It does not provide specific details regarding how the proposed mobile phone base station should be designed and implemented. A number of design opportunities however, have been identified as a result of the research, analysis and consultation undertaken by the MCF Design and Innovation Programme project. These design opportunities can provide practical guidance regarding how the design framework generated by the Design Guide can be implemented.

These design opportunities range from practices that can be readily deployed with minimal change to current equipment or Carrier site acquisition processes, to requiring a significant shift in current Carrier approaches.



Antennas colour matched to the bricks of the church.

Design Goal A

Integrate the Facility-Colour match, flush mount and achieve clean lines

Discussion

One of the easiest and most effective ways of reducing the visual effect of mobile phone base stations is to integrate the facility into an existing structure or building. Integrating the facility does not necessarily mean constructing a purpose built facility such as a fake chimney or church steeple. It can be as simple as colour matching and flush mounting antennas to a building to reduce their visibility.

Colour matching and flush mounting antennas was the most common design opportunity identified and supported by the consultation undertaken for the MCF Design and Innovation Programme project. By colour matching and flush mounting antennas, clean building lines can be maintained and antennas are more likely to “blend” in and appear to be part of the existing building/structure.

It is acknowledged that where antennas are flush mounted this can make access for maintenance difficult. Specific site constraints can limit access. For example, some sites will not be able to be accessed using a cherry picker so flush mounting would not be viable.



Antennas colour matched and flush mounted to an existing building.

Design Opportunity

- Colour match and flush mount antennas wherever possible.



Use existing vegetation to screen the facility.

Design Goal B

Integrate the facility-All associated equipment

Discussion

All components of the mobile phone base station including cabling, cable trays and equipment cabins and cabinets should be integrated with the building/structure they are attached to/associated with.

Feeder cables are visually prominent as they are typically black in order to maintain UV stability. Colour matching is one of the simplest ways of integrating such components.

Aligning cable trays and cable runs also reduces visual effect. These feeder cables are not solid elements like power cables and are easily damaged by impact. It is acknowledged that feeder cables have a specific bending radii and cannot be bent beyond a certain point otherwise they will not function. For some sites, cable runs cannot run flush to an existing structure for their entire length and will protrude at an angle at some point. This adds to its visibility. Consideration should be given to how this issue can be addressed. One way of doing this is to investigate core drilling through the parapet of a building to enable the cable run to be better aligned. Other solutions could include co-location with other infrastructure or cable runs, or locating cable trays on less visible facades.

It may be appropriate to consider using different materials to construct an equipment cabin to better match its surroundings. For example, it may be appropriate to construct a brick cabin adjoining a brick building rather than using a standard metal clad cabin or painting it a different colour.

Landscaping and vegetation can also provide opportunities for reducing the visual effect of mobile phone base stations. Where appropriate, landscaping around equipment cabins and/or the equipment compound should be considered. Locating a monopole within existing vegetation can also assist in screening portions of the monopole from view. It is acknowledged however, that the location of sites within vegetation needs to be balanced against radio frequency objectives as vegetation can interfere with the effective operation of the site.



Investigate integrating antennas into existing structures such as flagpoles or light poles.

Design Opportunity

- Investigate the availability of cabling that is not black.
- Investigate the possibility of encasing black cabling to colour match it to existing structures. One possibility may be to use UV stable heat shrink material on visible portions of cabling colour matched to the building/structure.
- Investigate the possibility of using antennas that have “grey tails”, that is the portion that protrudes from the bottom of antennas or the end of the cable tray.
- Investigate opportunities for antennas to be designed to minimise visible cabling. One way to address this issue may be design a “collar” that covers the bottom of the antennas concealing the cabling.
- Investigate ways of reducing the visual effect of cable runs. For example core drilling through the parapet of a building to enable the cable run to be better aligned, co-location or positioning the cable run to minimise visual effect.
- Investigate opportunities for integrating equipment into existing buildings or structures. For example, locating the equipment cabin inside a pavilion or toilet block at a Council reserve or locating antennas on light poles at a community oval or tennis courts.
- Consider using existing vegetation to screen monopoles and landscaping to screen equipment cabins and compounds.



Housing used to screen antennas, cabling and equipment cabin.



Installing translucent screening can reduce the visibility of antennas against the skyline.



Where appropriate use creative design solutions to screen antennas. in this example, an additional chimney was created on a heritage building.

Design Goal C

Integrate the facility-Screened Solutions

Discussion

Screened (or camouflaged) designs have a role to play in reducing the visual effect of mobile phone infrastructure, but in reality will only be appropriate for a small number of sites. Screened designs work best in situations where there are particular sensitivities such as heritage and character issues or significant views or vistas. Endless opportunities are available to screen mobile phone base stations and make them look like something else. Literally the imagination is the only restriction. Examples include fake chimneys, palm trees, church crosses and steeples and clock towers. Factors such as cost and the potential trigger of a Development Application can limit the use of screened designs.

Other forms of screening include shrouding tuft antennas and using back and front screening of antennas (refer Design Goal D)

Screening does not necessarily need to be complicated and expensive but can be as simple as installing radio transparent material in front or behind a mobile phone base station to reduce its visual effect by making its profile less visible against the skyline.

Design Opportunity

- Utilise creative screening solutions where appropriate to disguise or camouflage.
- Utilise back or front screening of facilities where appropriate.
- Shroud tuft antennas where possible.



Backscreening can reduce the visual clutter of multiple antennas when placed in relation to primary viewpoints.



Tuft antennas result in clean lines and a better visual effect.



Shroud antennas so that they appear as a chimney or exhaust stack.

Design Goal D

Shrouding (tuft antennas) and Back Screening

Discussion

Tuft antennas result in a better visual effect than antennas mounted to poles, headframes and numerous single antennas on a rooftop and should be used wherever technically possible. It is acknowledged that this can restrict co-location opportunities or the upgrade of sites with additional antennas.

Mobile phone base station equipment can look “untidy” particularly where the cabling feeds into the antennas. One way of addressing this is to shroud tuft antennas wherever possible so that clean lines are produced. Shrouding tuft antennas whether on a monopole or rooftop installation is a very effective way of producing a better visual outcome as it results in a neat, tidy facility.

Design Opportunity

- Use tuft antennas wherever technically possible.
- Shroud tuft antennas so that they appear as a chimney or exhaust stack or use pipe antennas wherever possible.
- Utilise front and back screening to reduce visual clutter. Consider the location of the screen in relation to visibility and primary viewpoints.



Where multiple Carriers are co-siting, establish a consistent overall height alignment and colour of antennas.

Design Goal E

Reduce sky lining

Discussion

Where antennas protrude from rooftops, they can result in “sky lining” which means that they are more visibly prominent against the backdrop of the sky. One way of reducing this effect is to set the antennas back from the edge of the rooftop so that they are less visible from below. It is acknowledged that this can result in the need for antennas to be raised higher on support structures in order for the radio frequency to transmit over the building rooftop. Providing that support structures are appropriately designed having regard to minimising visual effect, this may be an appropriate design solution.

Where antennas are installed on and protrude from building rooftops or other structures (eg water towers) consideration should be given to colour matching. In some cases colour matching to the existing building/structure will be appropriate, but generally, the best visual effect where antennas protrude from a rooftop can be achieved by using a non-reflective grey finish.

When multiple Carriers locate antennas on a rooftop or other built structure, consideration should also be given to achieving a consistent effect in terms of the overall alignment of antennas. A consistent approach to the maximum level of antennas will result in a better overall visual effect, than a range of antenna levels which create a fragmented or disorganised sky line.

Design Opportunity

- Set back antennas from the edge of rooftops to reduce the effect of sky lining. However, it is acknowledged that this may create an unnecessary radiation hazard zone in front of the antennas and diminish performance in some circumstances.
- Where multiple antennas are installed on a rooftop, establish a consistent overall height that all future installations align with.
- Where appropriate, consider colour matching antennas to the structure/building they protrude from or select a “common” neutral colour to reduce the visual effect.



The common alignment of multiple antennas and consistent colour matching produces a better visual effect.

Design Goal F

Implement a more consistent and cooperative approach to co-location and co-siting

Discussion

Co-location and co-siting of mobile phone base stations adds to the visual bulk and scale of a facility and depending on the particular circumstances of the site may not be appropriate.

Co-located and co-sited facilities can look unbalanced and inconsistent as:

- Each Carrier's equipment looks different. There is limited standardisation of the different components that comprise a mobile phone base station.
- Different technology results in equipment being different sizes and of a different appearance.
- Carriers are contracted to different equipment manufacturers which means there is limited uniformity to essentially the same equipment.
- Carriers have different network imperatives and site needs and therefore it can be difficult to co-ordinate co-location and co-siting. Few sites are designed with all potential Carriers involved, and often Carriers co-locate months and even years after the original site was built. This can result in sites looking untidy.
- Some Carriers reserve space for future equipment which results in empty mounts being installed and in some cases, uncommissioned antennas. This adds to the cumulative visual effect of co-located facilities.

There are examples where Carriers have devised standard design solutions for specific components of mobile phone base stations for deployment in specific locations. For example, both Telstra and Optus have developed a standard design for street cell equipment cabinets that have been deployed along the streets of the City of Melbourne.

Design Goal F (continued)

Design Opportunity

- Where tuft antennas are installed on a slim line pole, investigate alternative locations rather than strapping additional antennas below the tuft.
- Use consistent colours, finishes and designs for equipment cabins including their installation on co-location and co-siting sites. This includes details such as the depth and size of the concrete pad for the equipment cabin, the position and relationship of cabins relative to each other and surrounding infrastructure/built form.
- Utilise consistent colours, finishes and designs for perimeter fencing and use razor wire only where necessary.
- Utilise new technologies where possible (recognising that there are significant cost implications and other constraints) which reduce visual effect.
- Investigate opportunities for the standardisation of poles and other equipment across Carriers with minimal design requirements. For example, it may be possible for Carriers to install monopoles which have two or three feeder windows at the top and bottom and be a maximum of 500mm at top to ensure other Carriers can co-locate and run feeder cables through the centre of the pole rather than strapping cabling to the outside of the pole.
- Consider the design of concrete footings to accommodate future loading on towers, including potential pole swap outs.
- Establish a consistent overall height alignment of antennas on rooftops (refer Design Goal E).

Design Goal G

Consider the visual effect of Occupational Health and Safety Requirements

Discussion

All Carriers are required to comply with Occupational Health and Safety (OH&S) standards. Given that telecommunications facilities by their very nature have to be located on high structures, access and maintenance must be undertaken in safe conditions.

OH & S requirements result in additional built structures on sites which contribute to their overall visual effect. These structures include ladders, climbing pegs, handrails and rooftop walkways. Cable trays are also required to cover exposed cabling.

Occupational Health and Safety issues result in the need to ensure that antennas are located so that they can be accessed and maintained safely without people walking in front of antennas or requiring other Carriers to switch off their equipment. This often means that antennas are located close to the edge of rooftops which increases the visibility of a facility.

Design Opportunity

- Investigate the installation of collapsible climbing peg mounts or remove them altogether
- Situate OH&S equipment such as ladders, handrails, climbing cages and walkways to minimise their visual effect.
- Consider alternative design opportunities for OH&S equipment to minimise visual effect.

Design Goal H

Minimise Design Variation During Construction Phase

Discussion

Built elements which are required to ensure that a site is structurally sound are sometimes not foreseen when a site is designed and are not known about until the site is constructed.

For example, support struts can be required to ensure antennas are stable but may not be known until a site is in the construction phase. Engineering requirements of existing buildings and structures can also require a minor change in the site design once it is in the construction phase.

Like any developer, Carriers outsource many elements of the site acquisition process including the construction of sites. Sites can be built 18 months to three years after the original site design has been signed off and adding additional elements such as support struts which are necessary for the structural integrity of the facility are not necessarily checked off with the original site acquisition team, nor governed by the same parameters or operating procedures such as ensuring visual effect is minimised.

Design Opportunity

- Plans need to be annotated in the early stages of the process to ensure that the intent of the site is clearly translated throughout the entire process including its construction.
- Undertake preliminary structural engineering investigations at the design stage to identify possible structural requirements which may impact on the visual outcome.
- Consider variations to the design which are required as a result of structural engineering requirements in relation to the site context such as the built form, roof-scape and land use.

Design Goal I

Use Public Art and Create a Feature

Rather than disguising mobile phone base stations there are situations where making them “stand out” can result in a better visual outcome. It may be appropriate to make a public art feature out of mobile phone base stations and there are numerous examples where different forms of infrastructure have been treated in this way. It should be noted that where such methods are used, co-location opportunities are restricted and other Carriers should respect the design intent of the original design.









- Investigate ways to make facilities into features or opportunities for public art, rather than trying to make them invisible.



Consider making a feature out of the facility.

Attachment A

Site Survey Proforma

Landscape Assessment Proforma	Select	Comments
Land Use  Natural Agricultural Residential Open Space Industrial Mixed use	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/>
Topography  Flat Undulating Moderate variation Steep variations	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<hr/> <hr/> <hr/> <hr/>
Built form  Small scale / Low density Medium scale Large scale / Industrial City scale	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<hr/> <hr/> <hr/> <hr/>
Skyline  Uniformity Variable	<input type="checkbox"/> <input type="checkbox"/>	<hr/> <hr/>
Containment  Open Fragmented Boundaries Enclosed	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<hr/> <hr/> <hr/>
Vegetation  None Isolated trees Tree groups Woodlands and Forests	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<hr/> <hr/> <hr/> <hr/>
Existing Telcom Infrastructure  None Isolated items Groups of elements	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<hr/> <hr/> <hr/>
Colour  Uniformity (harmony) Mixed (complimentary) Mixed (contrast)	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<hr/> <hr/> <hr/>

Visibility Analysis Proforma

Assessment	Rating	Description	Survey
Visibility	4	Highly visible site (open)	<input type="checkbox"/>
	3	Large vistas and avenues to and from the site and surrounding landscape	
	2	Views and Vistas to and from the site and surrounding landscape	
	1	Glimpsed views between building and vegetation	
Prominence (eyeline)	4	Prominent within the line of sight	<input type="checkbox"/>
	3	Elevated within the line of sight	
	2	Above the line of sight	
	1	Out of the eyeline	
Access (duration)	4	Continuously visible in the surrounding area	<input type="checkbox"/>
	3	Partly visible, some screening	
	2	Brief views when travelling within the landscape	
	1	Specific views from static locations	
Community (visitation)	4	Highly visited site (2000+ per day)	<input type="checkbox"/>
	3	Increasing visitation (1000-2000 per day)	
	2	Moderate visitation to the site (500-1000 per day)	
	1	Low visitation (0-500 per day)	
Existing Infrastructure	4	None	<input type="checkbox"/>
	3	Isolated items (street lights, small scale distribution lines - services)	
	2	Groups of elements (road lighting, large scale distribution lines - services)	
	1	Large Infrastructure (transmission lines, freeway lighting, major pipelines)	
Cultural Representation	4	Designated cultural precincts	<input type="checkbox"/>
	3	Distinct Landmarks and recognised features	
	2	Notable features within the landscape	
	1	No significant elements	
Visual Sensitivity			<input type="checkbox"/>

