

Antenna Siting Design Framework

Expert System

Technical Paper

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1



What is the aim of this
Technical Paper?

This Technical Paper has been prepared in response to investigations and consultation undertaken by the Canadian Radiocommunications Information and Notification Service for its Member municipalities and provincial government agencies.

It is intended as a resource for Member planners and as guidelines which Proponents and their consultants may consider when designing and implementing antenna systems to achieve better visual outcomes.

This Technical Paper comprises of:

- A description of the Antenna Siting Design Framework which provides a structured process to assess the landscape context of a proposed antenna system. This assessment process generates a design framework that can guide the design of antenna systems that are more visually compatible with their location; and
- Design Opportunities which can assist with the design of Antenna Systems.

This Technical Paper has been prepared for use by CRINS-SINRC Members and their planning staff, proponents and their consultants.

It does not replace any existing legislative requirements identified under the *Radiocommunications Act*, the *Telecommunications Act*, or Health Canada *Safety Code 6* nor are proponents obligated to adopt and implement the processes and recommendations identified in this Technical Paper except when the recommendations are deemed conditions of obtaining concurrence from a relevant land use authority. The processes and recommendations identified are intended for use in the future deployment of antenna systems. It is not intended that they be applied retrospectively to existing sites.

1.1 What was the Aim of the Antenna Siting Design Framework (ASDF) Project?

The aim of the Antenna Siting Design Framework Project was to identify techniques and guidelines which can be applied and supplement everyday antenna system site design processes and assist proponents and their consultants to determine “what to do where” when deploying mobile device infrastructure in order to achieve better visual outcomes.

1.2 Why was the ASDF Project Initiated?

The visual effect of antenna system infrastructure is an issue of concern to some sectors of the community, however, 89% of Canadians expect to be able to make a call on their mobile phone from anywhere at any time. With the increased demand from the community and business sectors for access to reliable mobile device technology and network coverage, comes the need for the deployment of more antenna systems. More antenna systems will result in a continuing visual effect on our urban and rural landscapes.

In response to the need to better address the visual effect of antenna system infrastructure, CRINS-SINRC initiated the Antenna Siting Design Framework (ASDF) Project and sought out best practices from other countries with a similar level of mobile device usage and regulatory regimes. CRINS-SINRC staff interviewed and posed questions to both existing members as well as municipal and provincial representatives and sought out practices from other organizations with a stake in the industry including Engineers Canada, Proponents, Industry Canada, and European operators and government agencies.

The Antenna Siting Design Framework is a project to proactively improve consultation and communication with local government and the community and continually improve the deployment of antenna systems. Other examples of projects initiated by CRINS-SINRC include:

- CRINS-SINRC Code of Best Practice; and
- the CRINS-SINRC e-Consultation system.

1.3 What was the Scope for the Project?

Essentially, the Antenna Siting Design Framework project aimed to address the following two key issues:

1. The equipment—that is, the design of the different elements which comprise an antenna system 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 antenna system 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, color matching antennas, or setting back rooftop antennas from the edge of a building's roof.

2



Considering and Assessing Visual Effect

2.0 Considering and Assessing Visual Effect

Similar to all forms of development, antenna systems have a visual effect. This visual effect can be attributed to two unavoidable characteristics of antenna systems:

- (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, antenna systems may be and often are highly visible in urban and rural landscapes.

2.1 Designing for Better Visual Effects- Development of the Antenna Siting Design Framework (ASDF)

As the Antenna Siting Design Framework has progressed it has become increasingly evident that the key to better addressing the visual effect of antenna systems involves:

- Undertaking a detailed assessment of the landscape in which the antenna system is to be located; and
- Designing the facility to respond appropriately to this landscape setting.

In this way, an antenna system can be designed that is compatible with the landscape setting. The higher the level of compatibility of the antenna system designs with the landscape, the less significant or intrusive the visual effect. Conversely, the less compatible the antenna system 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 summarizes this relationship.

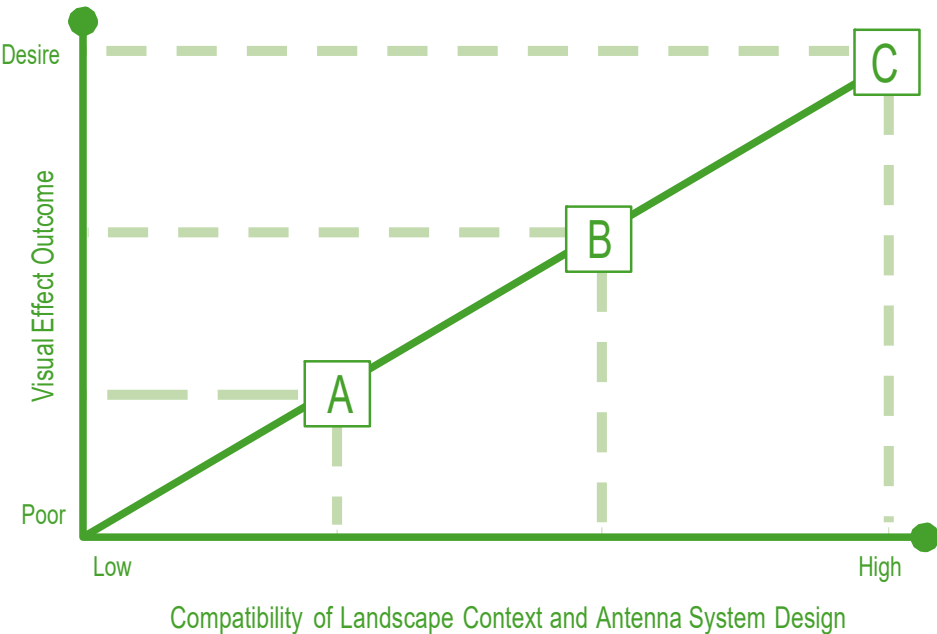


Figure 2: Relationship between Compatibility and Visual Effect

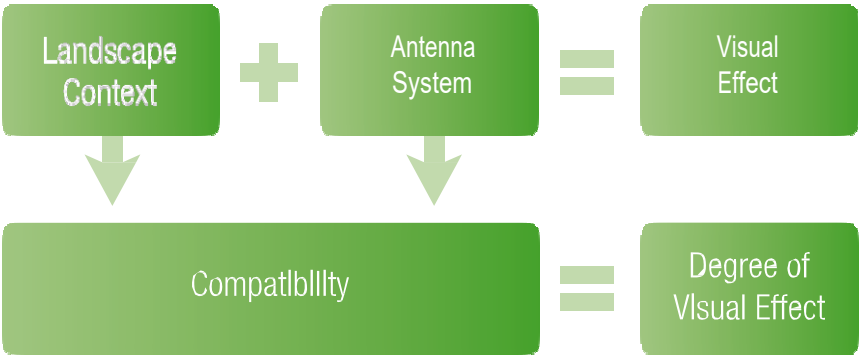
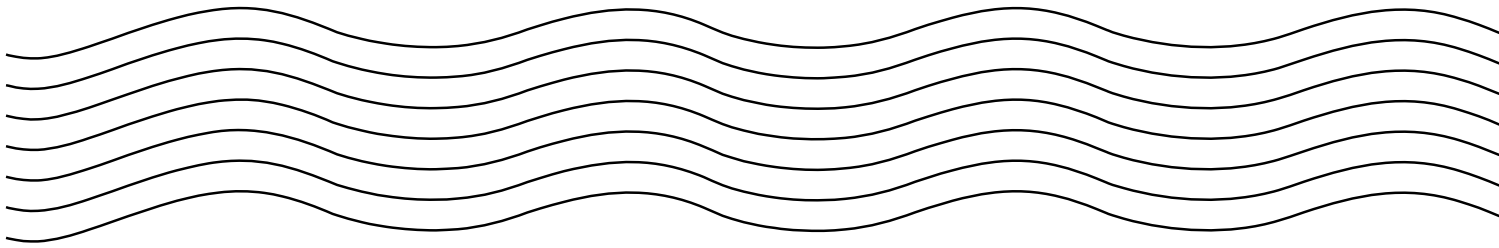


Figure 3: Understanding Visual Effect



In response to this clear relationship between the landscape context, the design and the resulting visibility, the Antenna Siting Design Framework has been developed.

The Antenna Siting Design Framework Guide provides a process which can assist Proponents to determine “what to do where”. The Antenna Siting Design Framework documents and assesses the landscape context of a proposed antenna system and identifies a framework that can be used to design an antenna system that is responsive to the public realm. Section 3 of this Technical Paper explains the Antenna Siting Design Framework Expert System and provides guidelines that explain how to use it.

2.2 How does the Antenna Siting Design Framework (ASDF) Differ from Past Approaches to Addressing Visual Effect?

In reviewing guidelines and policies in other jurisdictions it became apparent that Canada was well behind the approaches of European countries in their evaluation of both low-impact (i.e. Excluded) facilities as well as purpose-built antenna system structures. The Antenna Siting Design Framework when combined with the CRINS-SINRC Reference Protocol responses to concern from Members that low-impact or Excluded facilities are not subject to local government planning policy and assessment procedures which can influence the visual outcome of proposed developments.

The UK Traffic Light Model formed the preliminary foundation for the development of the ASDF. However, the Traffic Light Model was designed as a risk mitigation tool for Proponents and did not reflect the full breadth of potential proponents which in Canada include public safety, institutional, and private commercial facilities nor did it provide practical guidance regarding how to design antenna systems that deliver better visual outcomes, nor does it provide a process to assist with the documentation and assessment of the landscape context.

The ASDF 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 planners, proponents and their consultants which enables the documentation and assessment of the landscape context of a proposed antenna system 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 Antenna Siting Design Framework Relate to Current Proponent Site Acquisition Processes?

Proponents and their consultants undertake a range of investigations when identifying and assessing proposed sites for antenna systems. 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 antenna system and assists with determining how the antenna system 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 Antenna Siting Design Framework can be integrated into current site acquisition processes and does not replace any of the current practices undertaken by Proponents. *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 antenna system sites for construction. In addition, the ASDF provides the opportunity to review antenna systems once constructed to determine their “visibility” and enables Proponents to review and evaluate the designs of individual sites once constructed.

It is recognized 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 Antenna Siting Design Framework 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 ASDF during the negotiation process.

The Antenna Siting Design Framework 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



Antenna Siting Design Framework Guide

3.0 Antenna Siting Design Framework Design Guide

The Antenna Siting Design Framework Design Guide (the Design Guide) aims to assist Proponents and their consultants during the site acquisition process to assess the landscape context and develop an antenna system 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 antenna system design considerations appropriate to the landscape context;
- Provides direction regarding how to reduce the visual effect of antenna systems 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 antenna system 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 from the Proponent Information Portal located at <http://www.crins-sinrc.ca/>.

3.1 How Does the Antenna Siting Design Framework Guide Work?

The Design Guide is an interactive analysis and design tool that operates in five stages. The Design Guide proposed by this Technical Paper is available as a web enabled tool located within the CRIN-SINRC e-Consultation System, a simplified version is also available as an Excel spreadsheet.

This five stage approach provides a complete analysis and design tool for Proponents 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 antenna system. The simplified Excel spreadsheet and web-based expert system 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 antenna system.

Finally, an assessment can be made as to what level of design compatibility may be associated with the proposed antenna system 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 web-based format of the Design Guide within the CRINS-SINRC e-Consultation system allows it to be continually updated or modified as new assessment criteria are considered, or new technologies and design solutions become available.

The Web based development of the Design Guide provides the opportunity for Planners and CRINS-SINRC staff 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 Proponent's 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 effects 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 antenna system 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 antenna system design. Design recommendations are provided for the four main components of antenna systems including poles and towers, antennas mounts, equipment cabins and antennas and cables (refer Figure 5).

STAGE 1

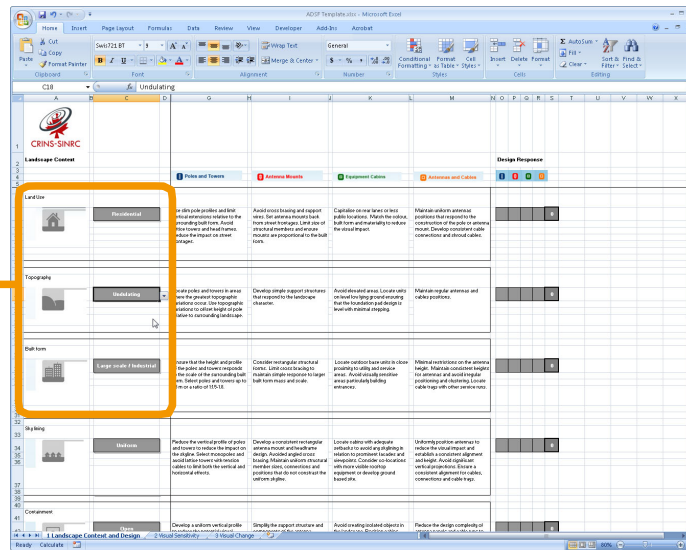


Figure 4: Identifying Key Landscape Characteristics

STAGE 2

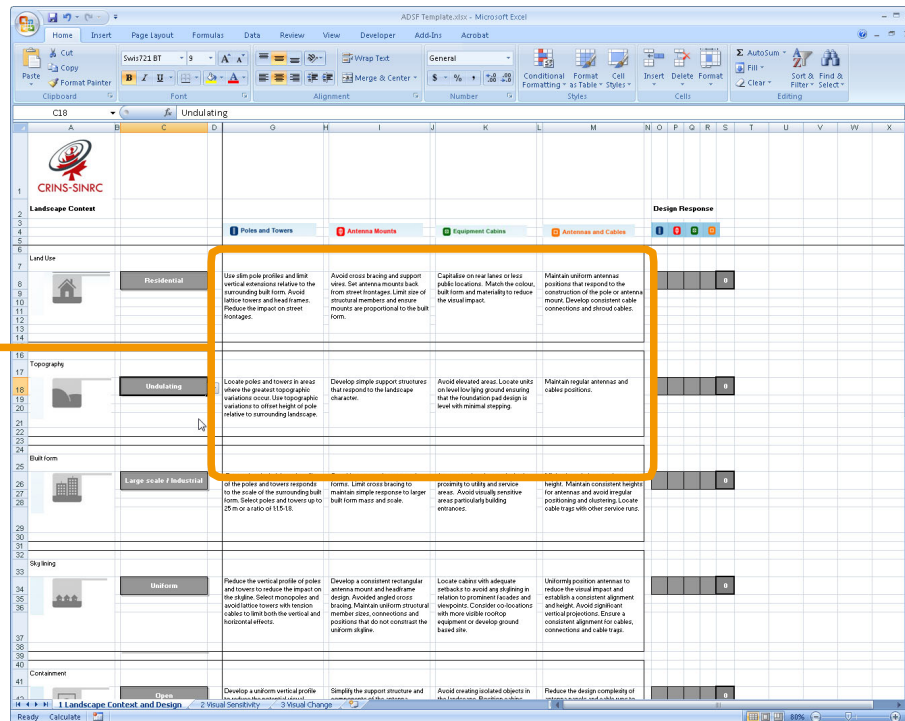


Figure 5: Generating Design Recommendations

STAGE 3

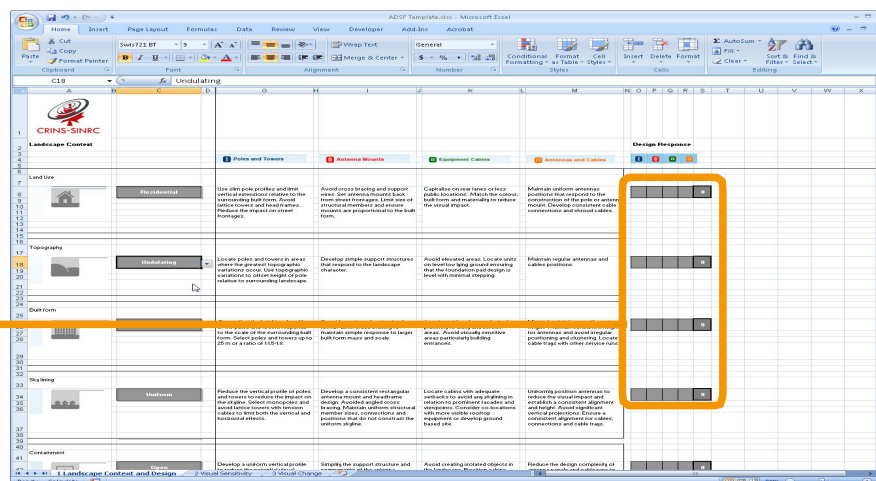


Figure 6: Assessing Design Compatibility

3.1.3 Stage 3: Measurement of Compatibility

The Design Guide includes an assessment of the proposed engineering design against the ASDF Design Goals (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 antenna system 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)	3
	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	2
	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	4
	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	1
	3	Moderate visitation	
	2	Low visitation to the site	
	1	Occasional visitation	
Existing Infrastructure	4	None	3
	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 (desktop review)	4	Designated cultural precincts or landscapes classifications	1
	3	Distinct Landmarks and recognised features	
	2	Notable features and significant landscapes	
	1	No significant elements	
Visual Sensitivity			14

Figure 7: Understanding Potential Visual Effect

STAGE 5

Design Compatibility/ Site Visibility	1 to 5	6 to 10	11 to 15	16 to 20	20 to 24
76 - 100%	Low	Low	Low	Medium	Medium
51 - 75%	Low	Low	Medium	Medium	High
26 - 50%	Low	Low	Medium	High	High
0 - 25%	Low	Medium	High	High	High
Visibility					14
Compatibility (%)					100.00

Figure 8: Understanding Compatibility

4



Antenna System Design Opportunities

The Antenna Siting Design Framework Guide (the Design Guide) provides a structured process to document and assess the landscape context for a proposed antenna system. 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 minimize the visibility of the proposed antenna system at the identified site location.

The Design Guide provides a framework to inform the design of antenna systems. It does not provide specific details regarding how the proposed antenna system 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 ASDF 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 Proponent site acquisition processes, to requiring a significant shift in current Proponent approaches.



Antennas colour matched to the bricks of the church.

Design Goal A

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

Discussion

One of the easiest and most effective ways of reducing the visual effect of antenna systems 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 color matching and flush mounting antennas to a building to reduce their visibility.

Color matching and flush mounting antennas were the most common design opportunity identified and supported by the consultation undertaken for the ASDF project. By color 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.

Design Opportunity

- Color match and flush mount antennas wherever possible.



Antennas color matched and flush mounted to an existing building.



Use existing vegetation to screen the facility.

Design Goal B

Integrate the facility - All associated equipment

Discussion

All components of the antenna system 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. Color 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 color.

Landscaping and vegetation can also provide opportunities for reducing the visual effect of antenna systems. 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 color match it to existing structures. One possibility may be to use UV stable heat shrink material on visible portions of cabling color 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 minimize 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 minimize 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 municipal park or locating antennas on light poles at a community track or tennis courts.
- Consider using existing vegetation to screen monopoles and landscaping to screen equipment cabins and compounds.

Design Goal C

Integrate the facility- Screened Solutions

Discussion

Screened (or camouflaged) designs have a role to play in reducing the visual effect of antenna system 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 antenna systems 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 an antenna system to reduce its visual effect by making its profile less visible against the skyline.

Design Opportunity

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



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.



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



Shrouded panel 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 and Back Screening

Discussion

Shrouded antennas result in a better visual effect than antennas mounted to poles, head frames 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.

Antenna system equipment can look “untidy” particularly where the cabling feeds into the antennas. One way of addressing this is to shroud panel antennas wherever possible so that clean lines are produced. Shrouding panel 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 panel antennas wherever technically possible.
- Shroud panel antennas so that they appear as a chimney or exhaust stack or use omni-directional antennas wherever possible.
- Utilize front and back screening to reduce visual clutter. Consider the location of the screen in relation to visibility and primary viewpoints.



Where multiple Proponents are co-siting, establish a consistent overall height alignment and color 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 minimizing 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 color matching. In some cases color 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 Proponents 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 disorganized 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 color matching antennas to the structure/building they protrude from or select a “common” neutral color to reduce the visual effect.



The common alignment of multiple antennas and consistent color 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 antenna systems 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 Proponent's equipment looks different. There is limited standardization of the different components that comprise an antenna system.
- Different technology results in equipment being different sizes and of a different appearance.
- Proponents are contracted to different equipment manufacturers which mean there is limited uniformity to essentially the same equipment.
- Proponents 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 Proponents involved, and often Proponents co-locate months and even years after the original site was built. This can result in sites looking untidy.
- Some Proponents 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 Proponents have devised standard designs solutions for specific components of antenna systems for deployment in specific locations. For example, European operators have developed a standard design for street cell equipment cabinets that have been deployed along the streets of a number of cities.

Design Goal F (continued)

Design Opportunity

- Where panel antennas are installed on a slim line pole, investigate alternative locations rather than strapping additional antennas below the panel.
- Use consistent colors, 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.
- Utilize consistent colors, finishes and designs for perimeter fencing and use razor wire only where necessary.
- Utilize new technologies where possible (recognizing that there are significant cost implications and other constraints) which reduce visual effect.
- Investigate opportunities for the standardization of poles and other equipment across Proponents with minimal design requirements. For example, it may be possible for Proponents to install monopoles which have two or three feeder windows at the top and bottom and be a maximum of 100mm at top to ensure other Proponents 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 Proponents are required to comply with Occupational Health and Safety (OH&S) standards. Given that radiocommunications 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 Proponents 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 minimize their visual effect.
- Consider alternative design opportunities for OH&S equipment to minimize visual effect.

Design Goal H

Minimize 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, Proponents 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 minimized.

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, roofscape and land use.

Design Goal I

Use Public Art and Create a Feature

Rather than disguising antenna systems 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 antenna systems 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 Proponents 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/>
Topography	 Flat Undulating Moderate variation Steep variations	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<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/>

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 eye line	
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 recognized features	
	2	Notable features within the landscape	
	1	No significant elements	
			Visual Sensitivity

