Building Canada's Advanced Wireless Networks: The Future is Here

Meeting with Markham Development Services Committee

October 18, 2011

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A Paradigm Shift

- **Changing technology and growing competition** are creating a paradigm shift in the wireless industry.

- 2010 marks the year when mobile data transactions eclipsed traditional voice.
  - **Data traffic is expected to double every year** through 2014.
  - **Data requires exponentially greater broadband capacity** than voice.
  - As demand for CAPACITY increases at a cell site, the COVERAGE area decreases.

- This is compounded by the growing number of entrants in the wireless industry.
  - 3 incumbent providers: Bell, Rogers and TELUS.
  - new entrants actively building networks in Ontario: Globalive, Public Mobile, Dave Wireless.

- The only **solution** that will meet the escalating growth in demand for wireless service is construction of **additional wireless facilities**.

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The Town of Markham and Wireless Connectivity

- Expansion of multiple high-speed wireless networks is a powerful economic enabler that supports:
  - Markham's projected population growth of over 50% in next 25 years;
  - Markham's goal to increase employment by 75% over the same time period;
  - The goals and objectives set out in the Markham 2020 Strategic Directions report, such as becoming a "Networked Markham", a "Global Markham", and an "Infrastructure Markham".

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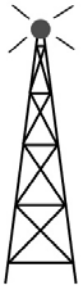
Wireless Telecommunications: Networks

1 Line Supports
1 Customer

Wireline Switch

Public Switched Telephone Network

1 Radio Link Supports 25 Customers



1 Site Supports 1000 Customers

Wireline Switch

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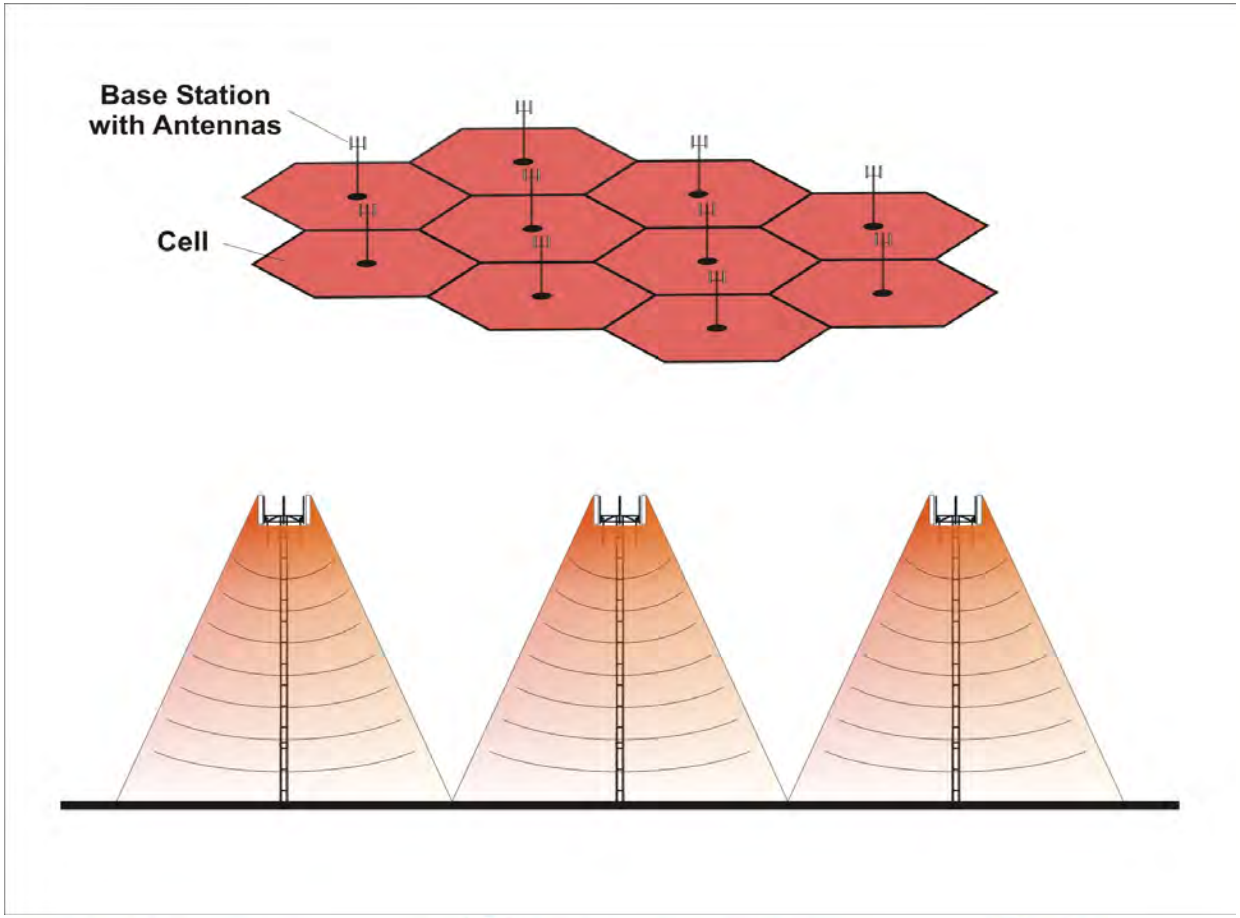
What is a Cellular Network?

A network is a series of interconnected parts.



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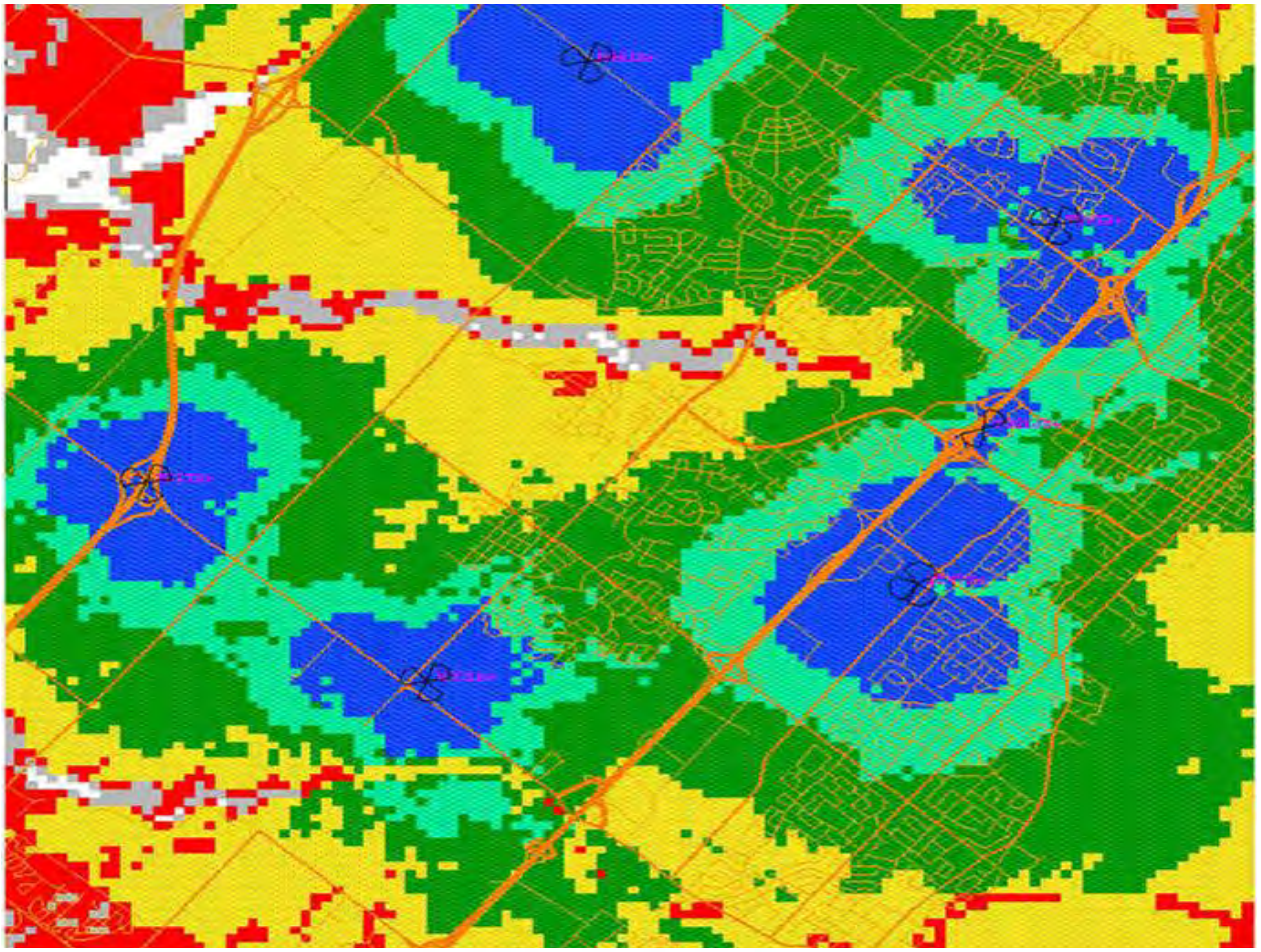
Wireless Telecommunications: Existing Coverage Example



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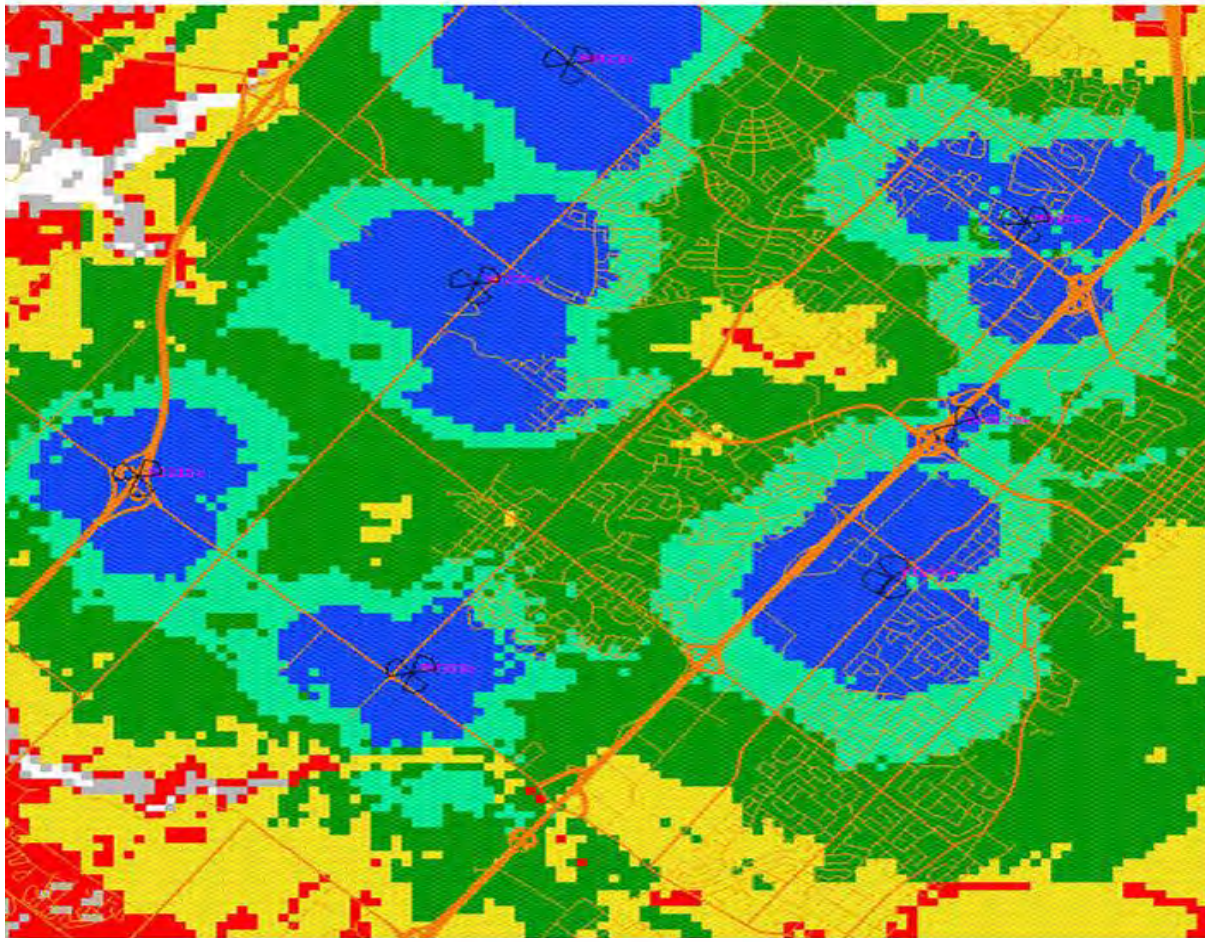
Wireless Telecommunications: Coverage with New Tower Example



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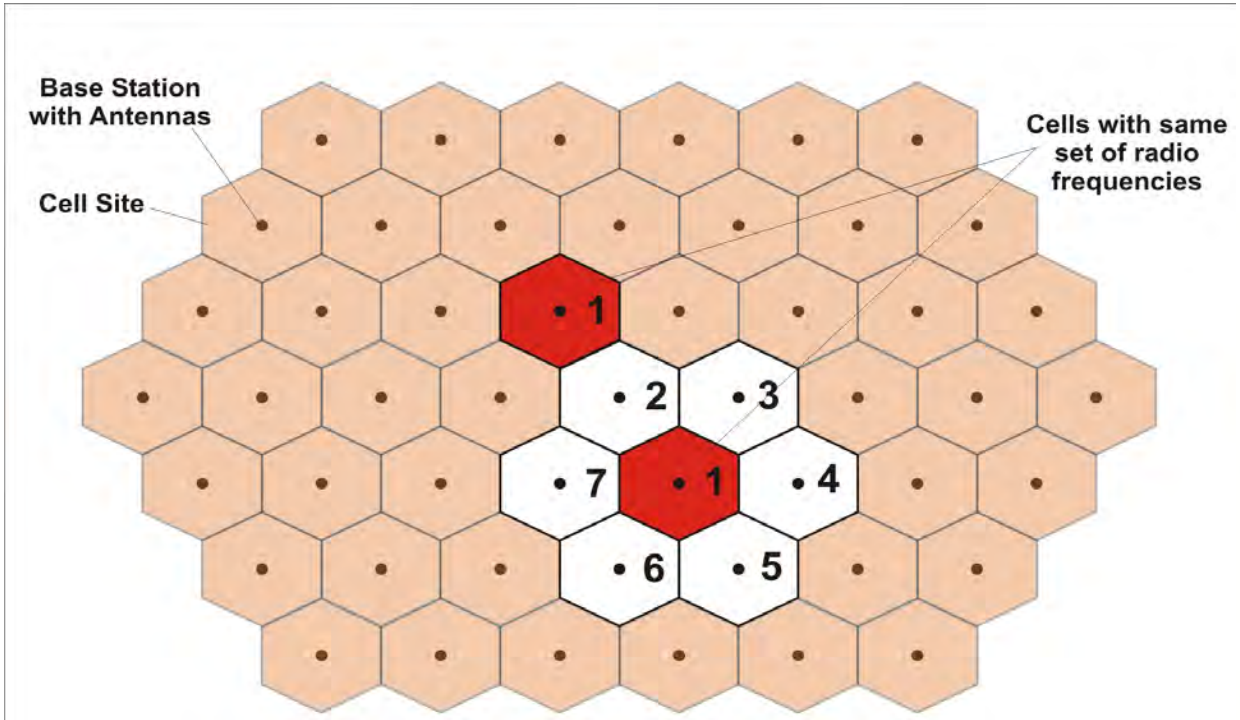
What is a Cellular Network?

Frequencies may not overlap



Each number in the Cell represents a different set of radio frequencies.
To avoid interference of radio frequencies the same set of frequencies can not be located adjacent to one another

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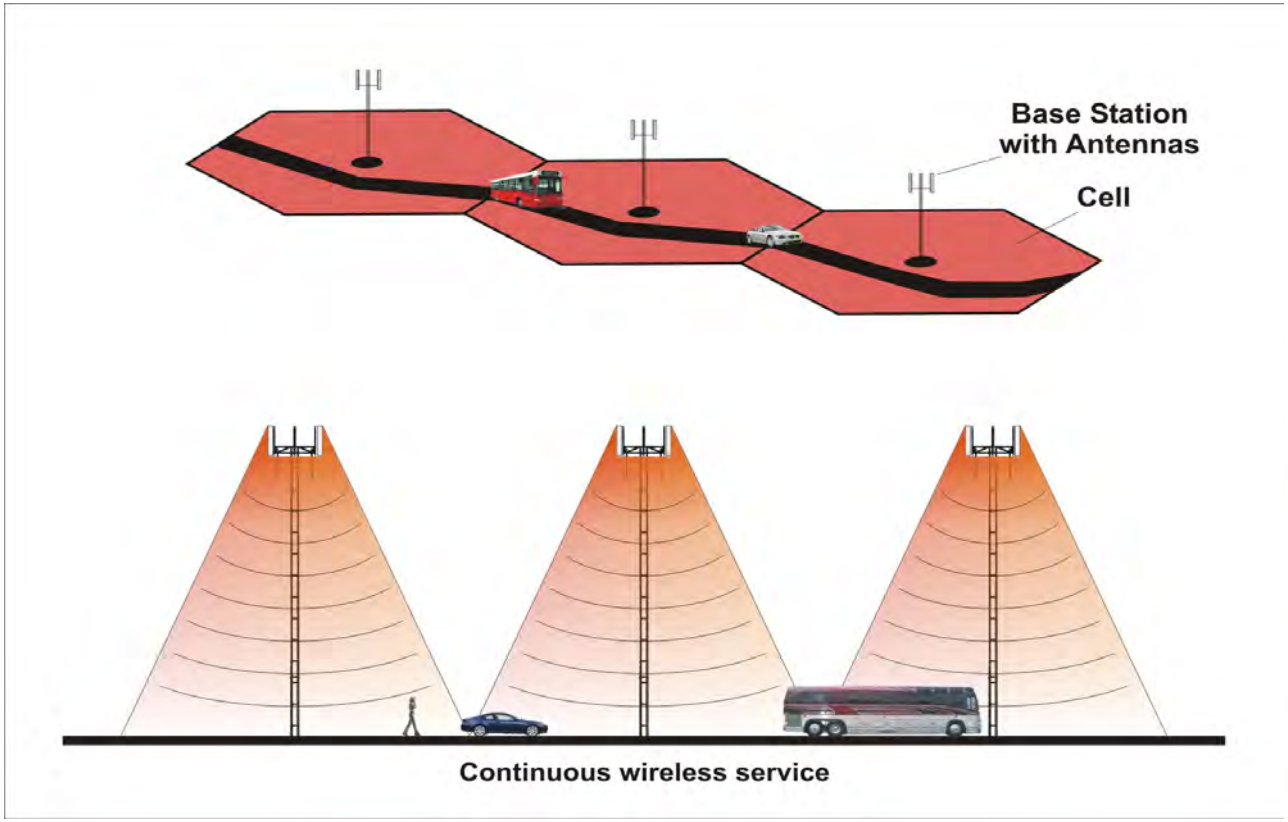
Evolution of the Cellular Network

A continuous cellular service network



Each cell only serves a fixed number of calls

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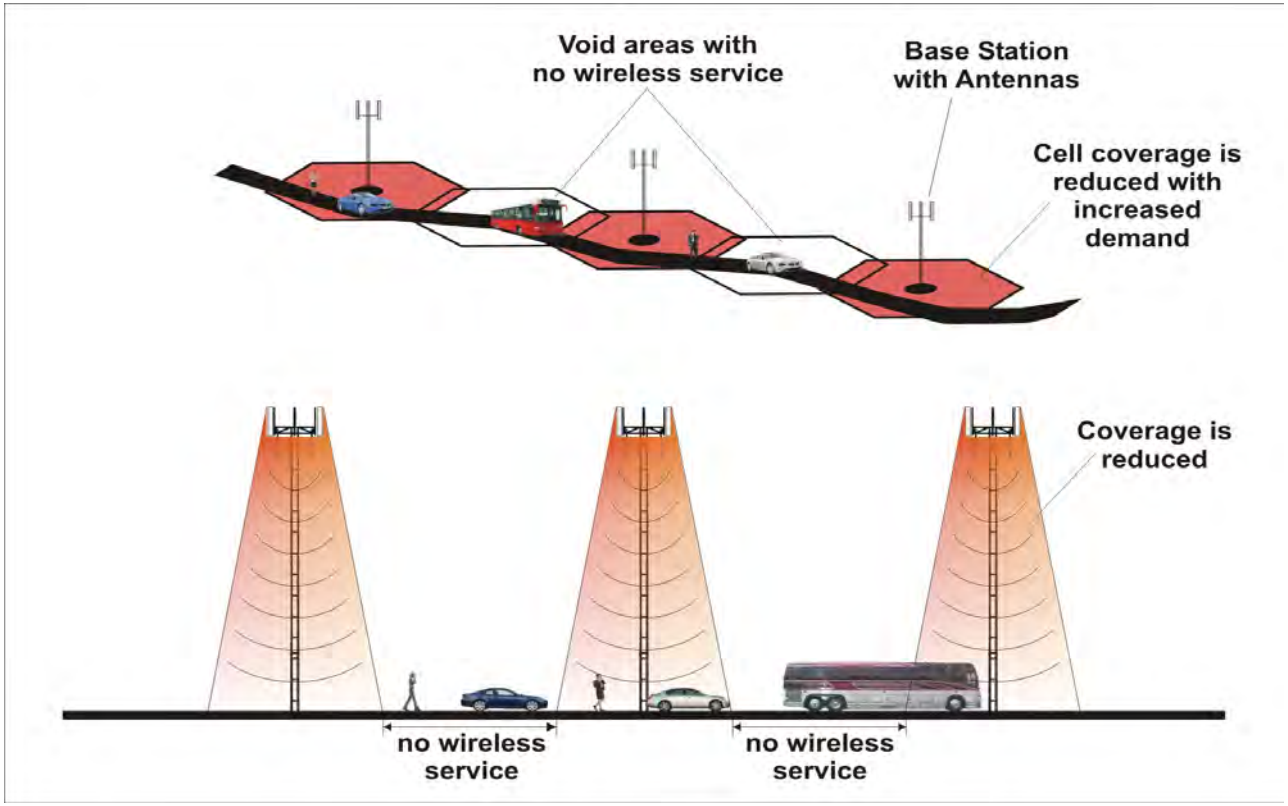
Evolution of the Cellular Network

Increased users creates gaps in service



Number of calls in a cell is limited. When a cell reaches its maximum capacity it reduces its footprint in order to provide service to the strongest (closest) signals.

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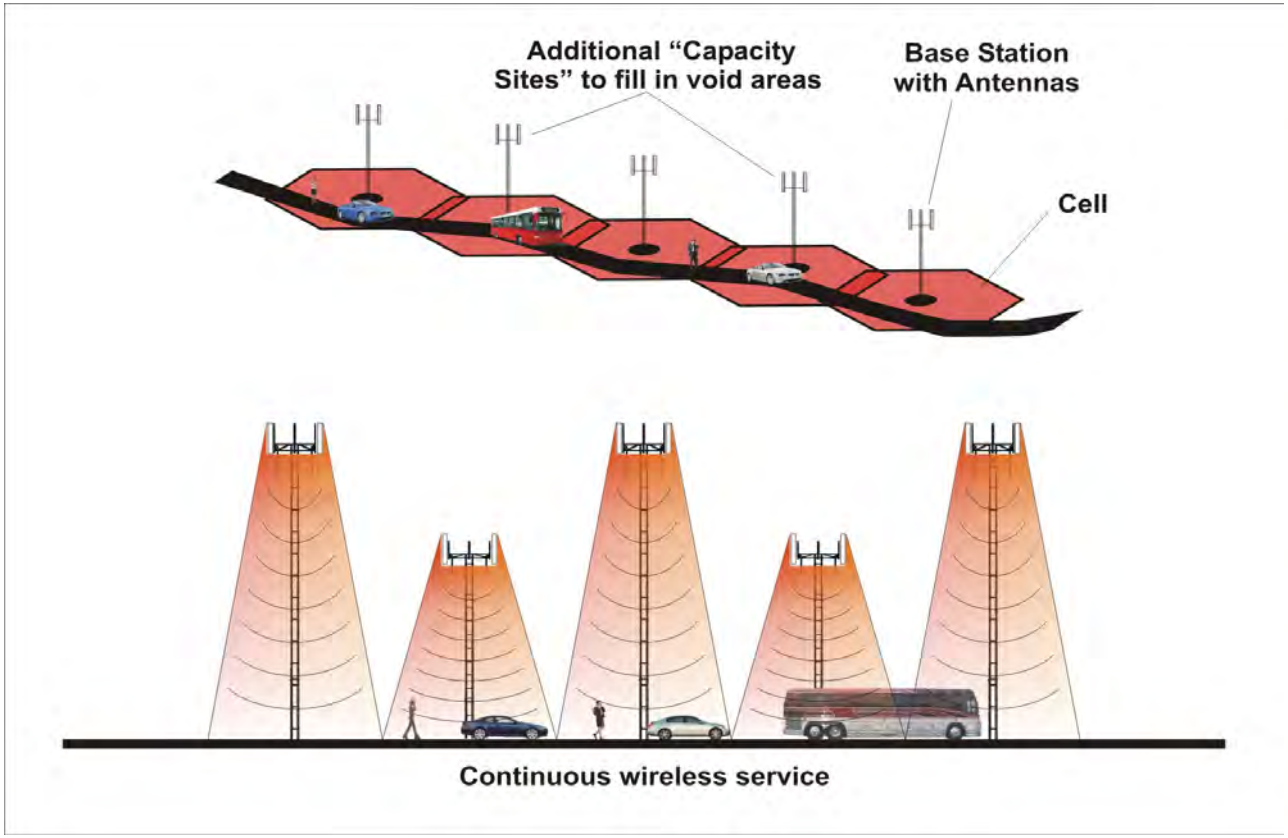
Evolution of the Cellular Network

Continuous cellular network restored by filling gaps



New towers constructed to fill in the void areas, restoring continuous wireless service

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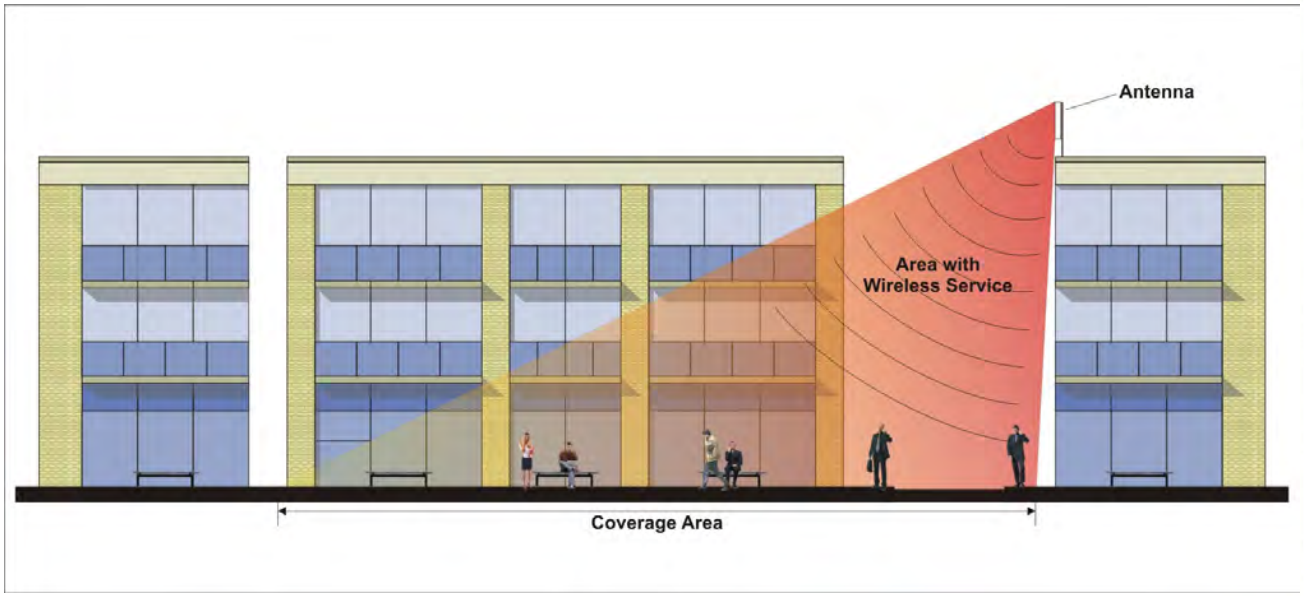
EVOLUTION OF THE CELLULAR NETWORK

Cellular Service at Street Level



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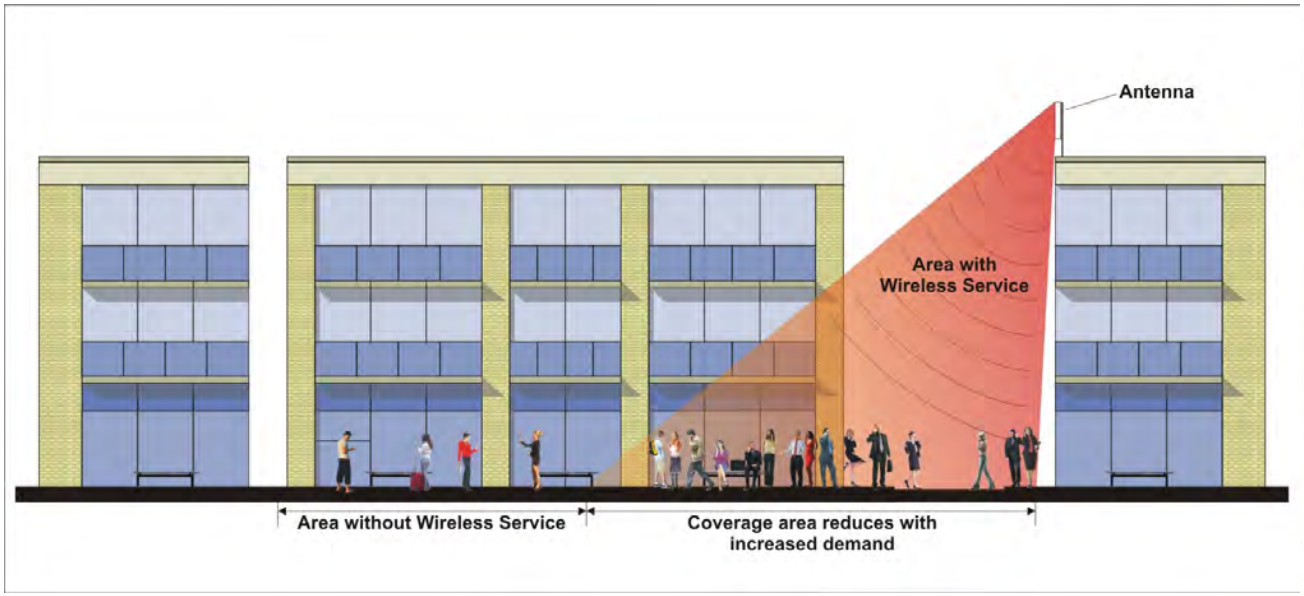
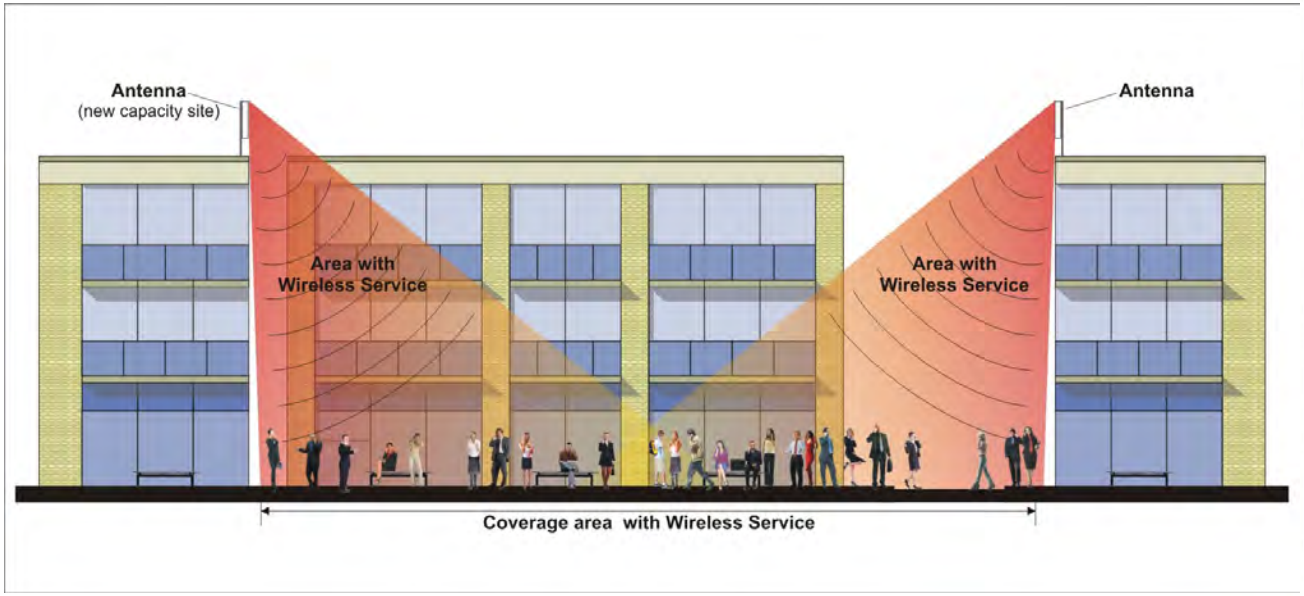
EVOLUTION OF THE CELLULAR NETWORK

Cellular Service coverage reduces with increased demand



EVOLUTION OF THE CELLULAR NETWORK

Continuous Cellular Service Restored



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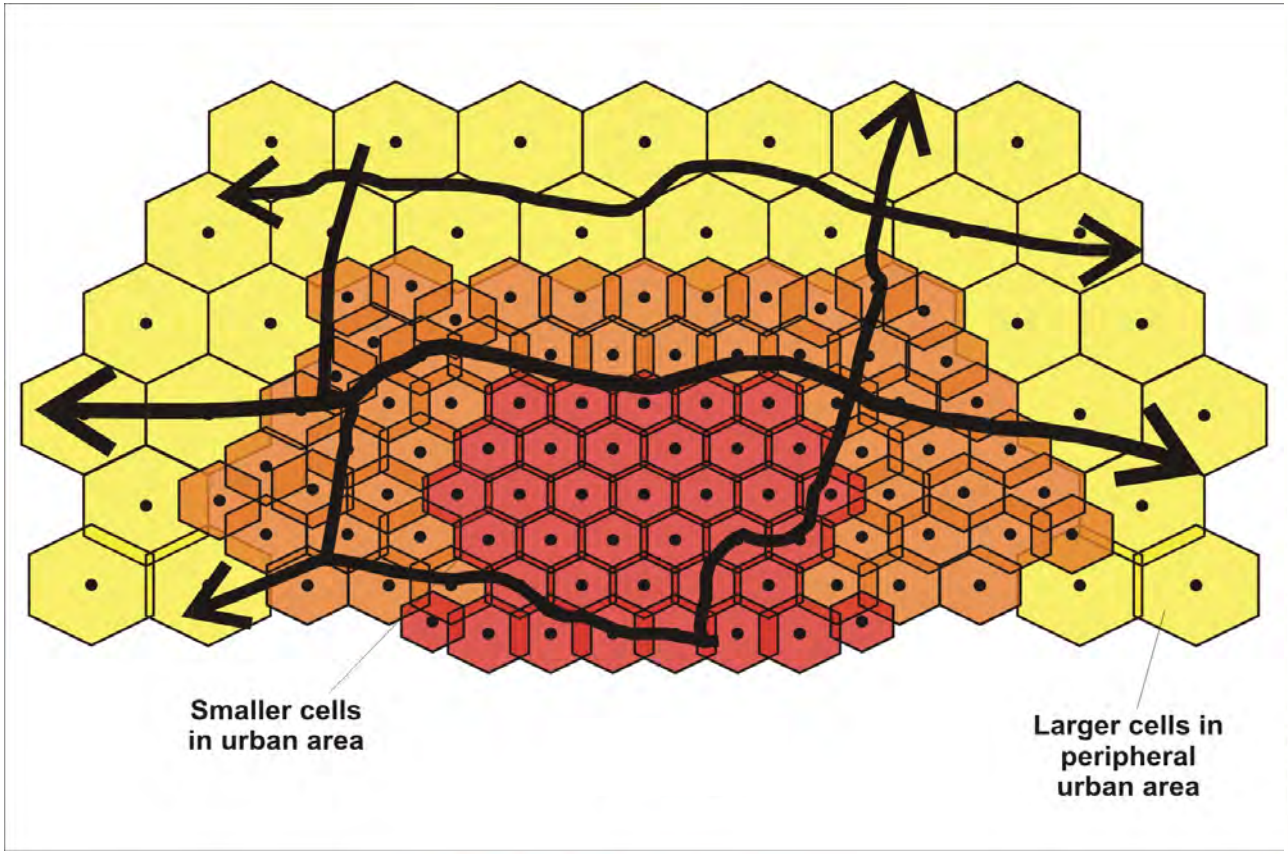
What is a Cellular Network?

The number of cell sites is related to the concentration of use and increasing public demand.



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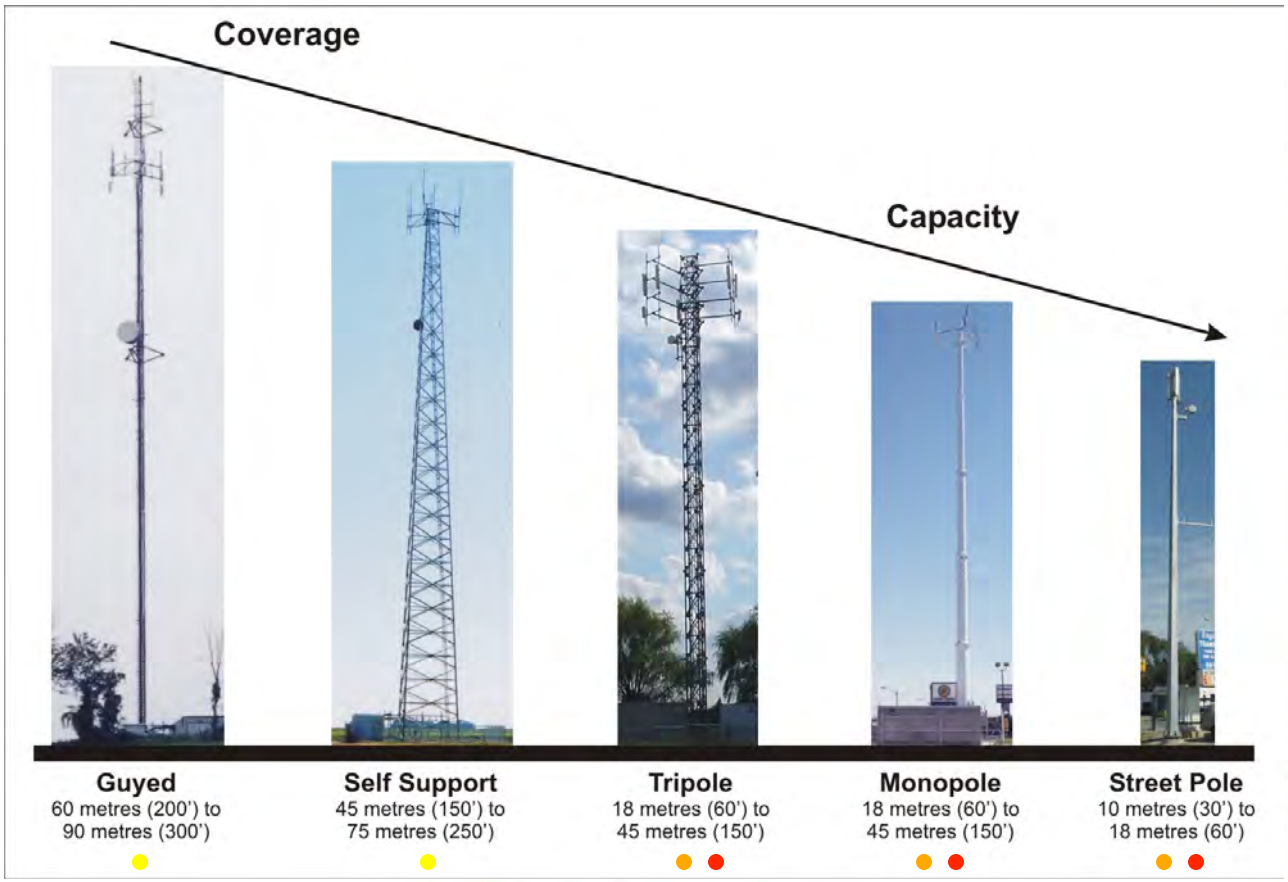
WHAT IS A CELLULAR NETWORK

Coverage and Capacity



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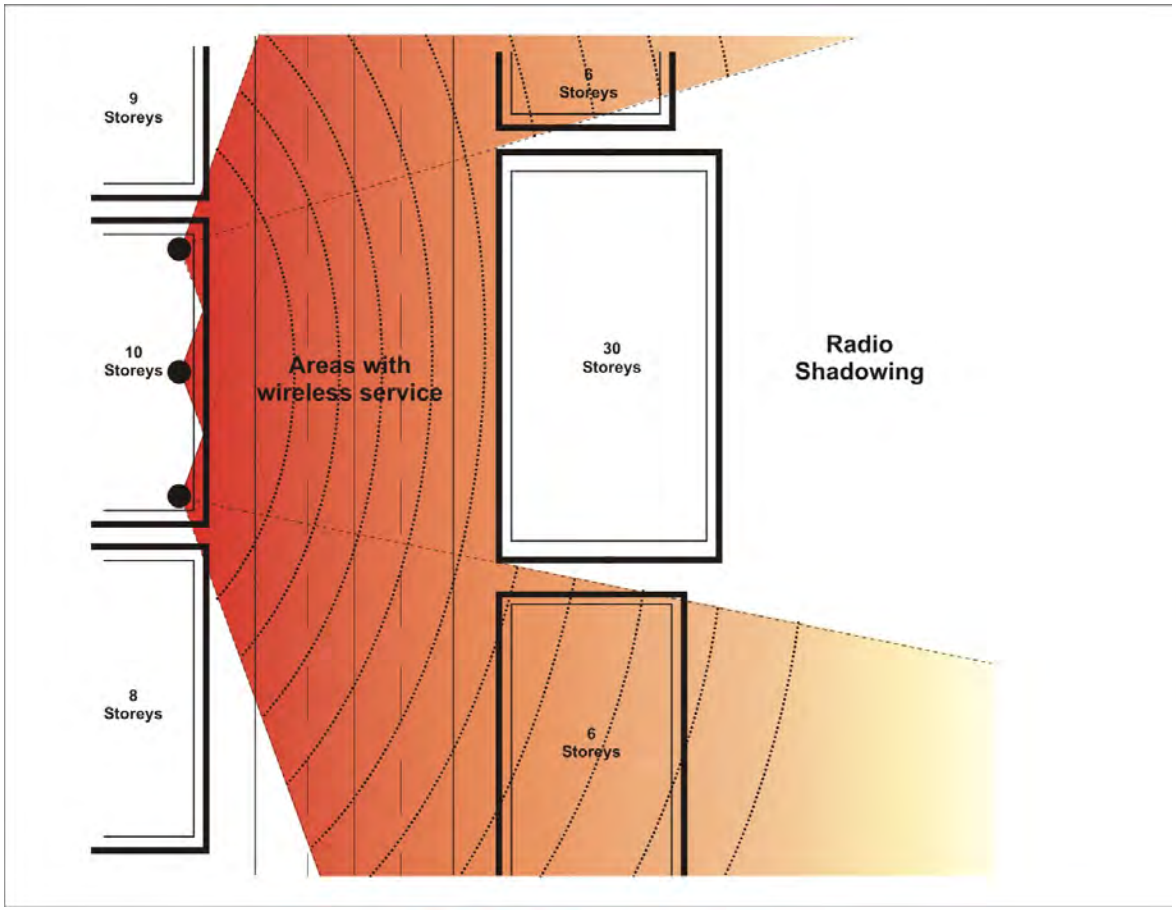
LIMITATIONS OF CELLULAR SERVICES

Radio Signals are much like the light from a lamp



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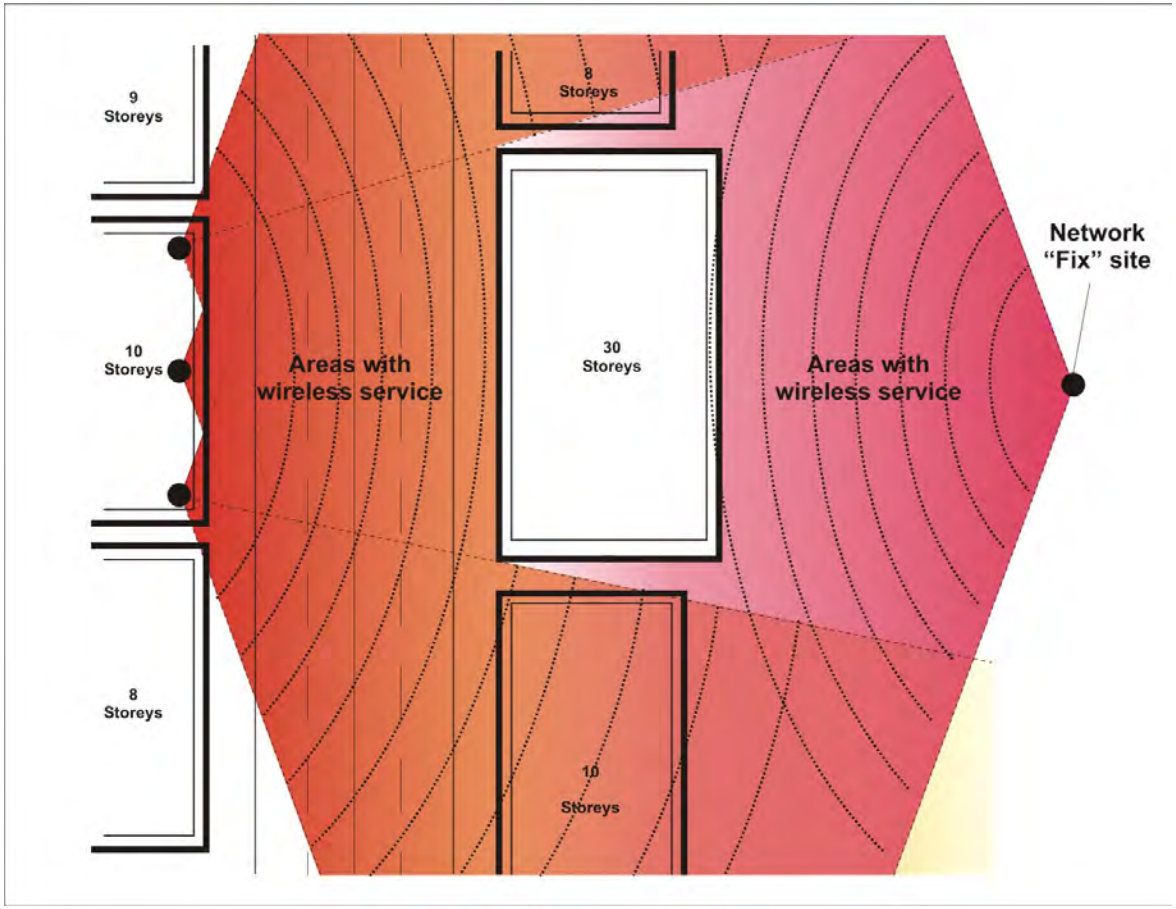
LIMITATIONS OF CELLULAR SERVICES

Continuous wireless network restored by filling gaps



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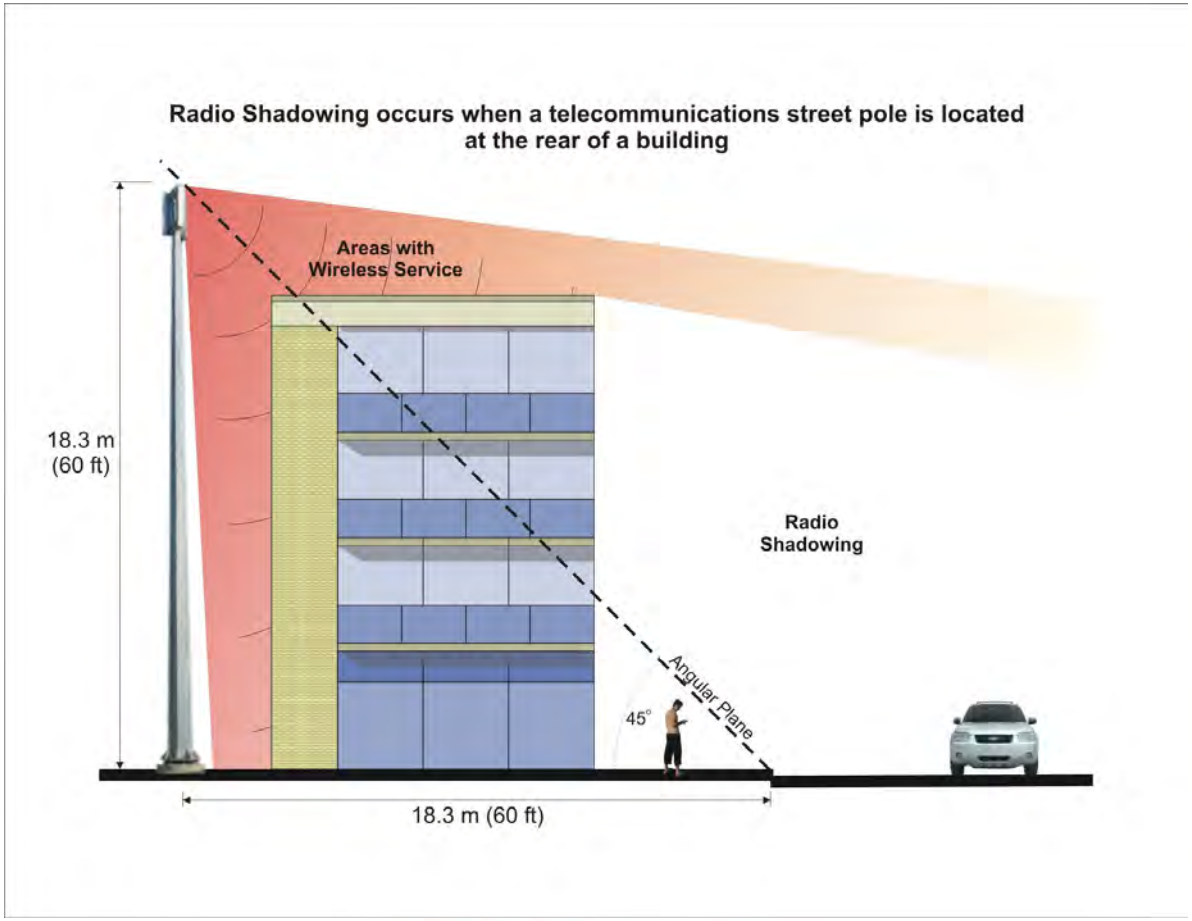
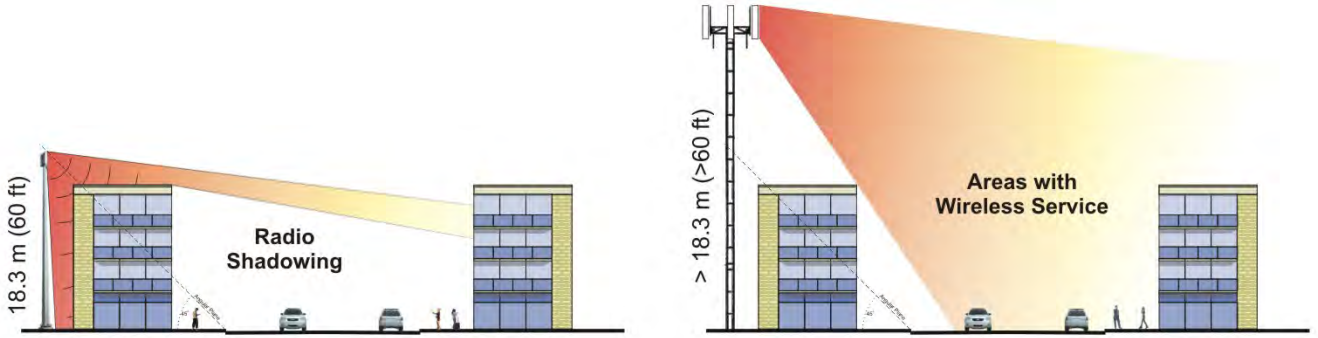
SHADOWING

Radio Shadowing at street level created by building



SHADOWING

A higher installation will eliminate Radio Shadowing at street level



The antenna must have a clear line-of-sight path to the street in order to provide coverage at street level. However, a higher installation will reduce network capacity and cause interference with adjacent cells.

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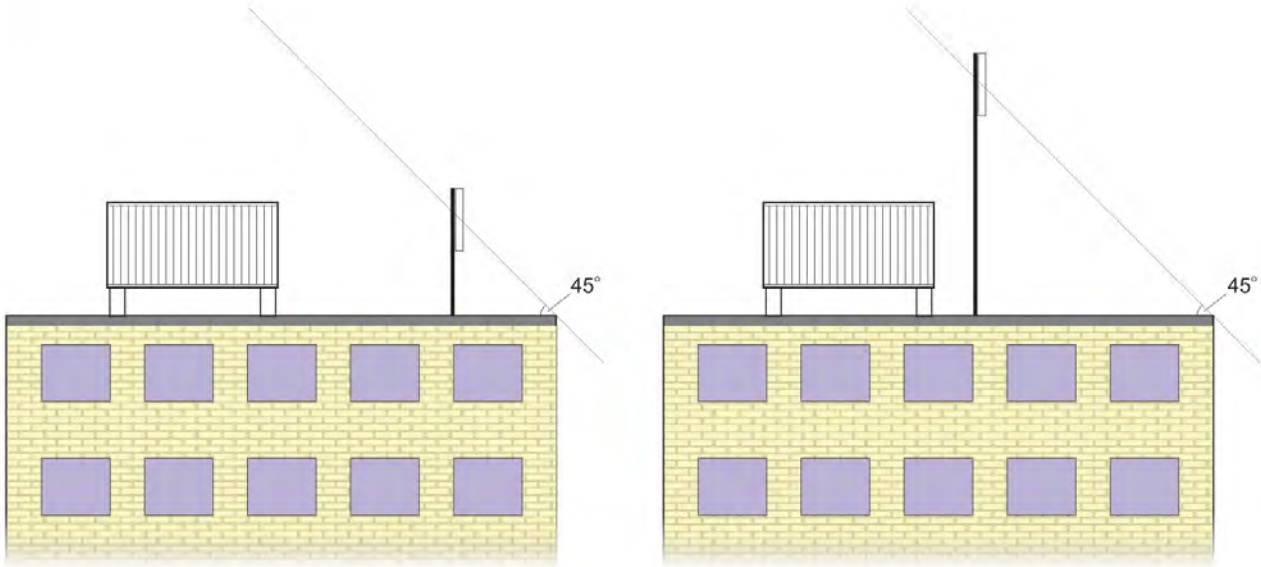
ANTENNA HEIGHT

Height of antenna increases with setback from building edge



The centre of the roof mounted antenna must be above a 45 degree plane from the building edge to provide radio signals at street-level

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LIMITATIONS OF CELLULAR SERVICES

- Antenna height must be above building roof lines to avoid “Radio Shadowing”
- Antennae mounted on rooftops must be located at edge of building to provide wireless service at street level
- Existing buildings or structures may not be of appropriate height for optimal wireless service

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SITING CONSTRAINT SUMMARY

- expected usage patterns of wireless service including proximity to users;
- local terrain and building types which can be a significant challenge as a result of shadowing;
- interaction with existing radio base stations;
- line of site requirements for high quality communications;
- opportunities to use existing structures;
- the availability of a willing landlord; and
- the industry's commitment to high service standards and customer satisfaction.

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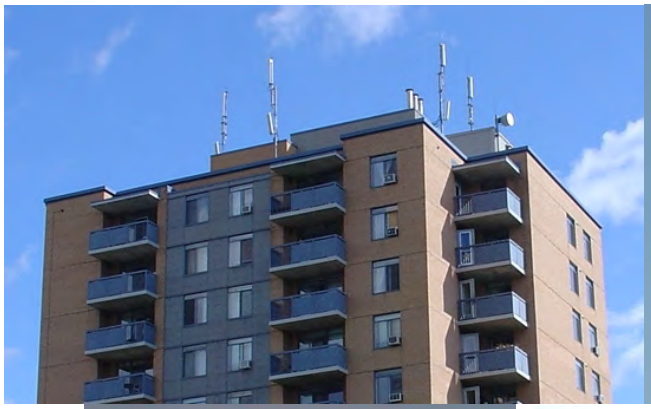
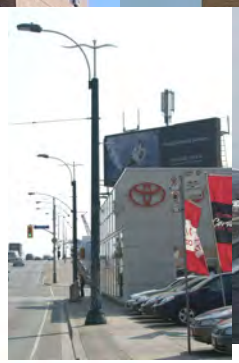
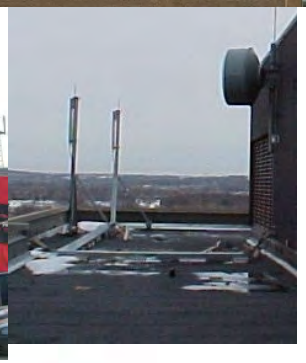
TYPES OF INSTALLATIONS

Antennas can be mounted on roof tops of buildings or on towers.

Roof Mount Antennas:







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TYPES OF INSTALLATIONS

Monopole

Street Pole

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TYPES OF INSTALLATIONS

Flush Mounted Antenna

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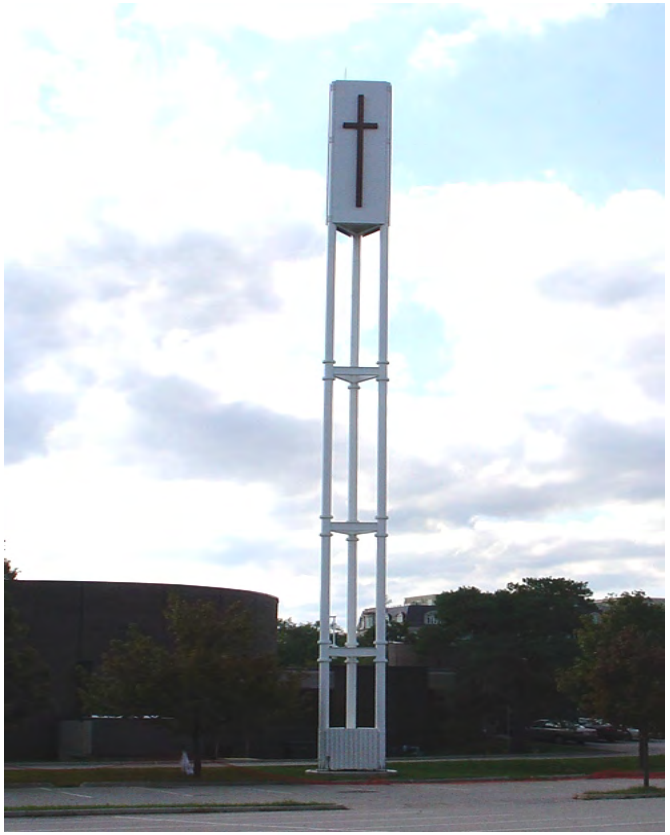
TYPES OF INSTALLATIONS

Stealth Designs and Camouflaged Sites



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TYPES OF INSTALLATIONS
More Camouflaged Sites

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TYPES OF INSTALLATIONS

Micro Sites on Utility Poles (limited capacity and coverage)

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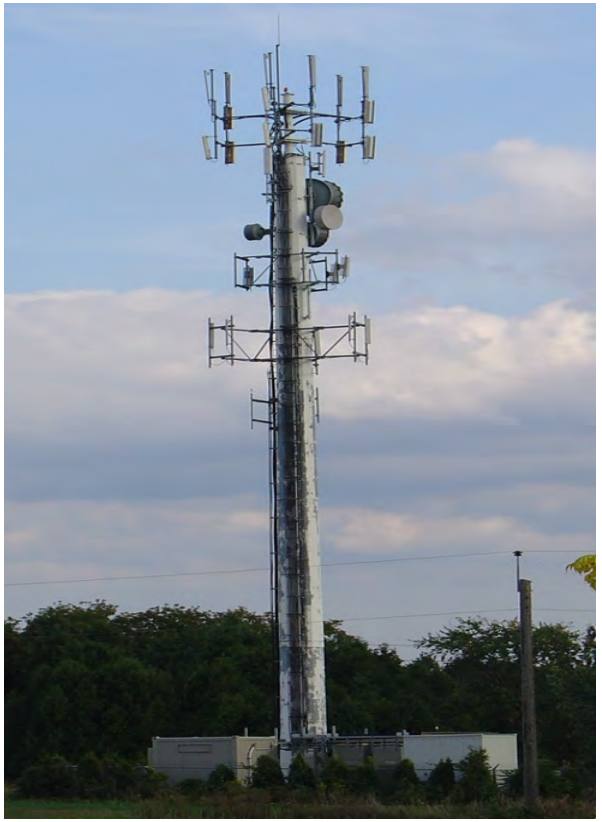
CO-LOCATION

Visual Impact of Single-Carrier tower vs. Co-location tower

Single-Carrier Tower



Co-location Tower

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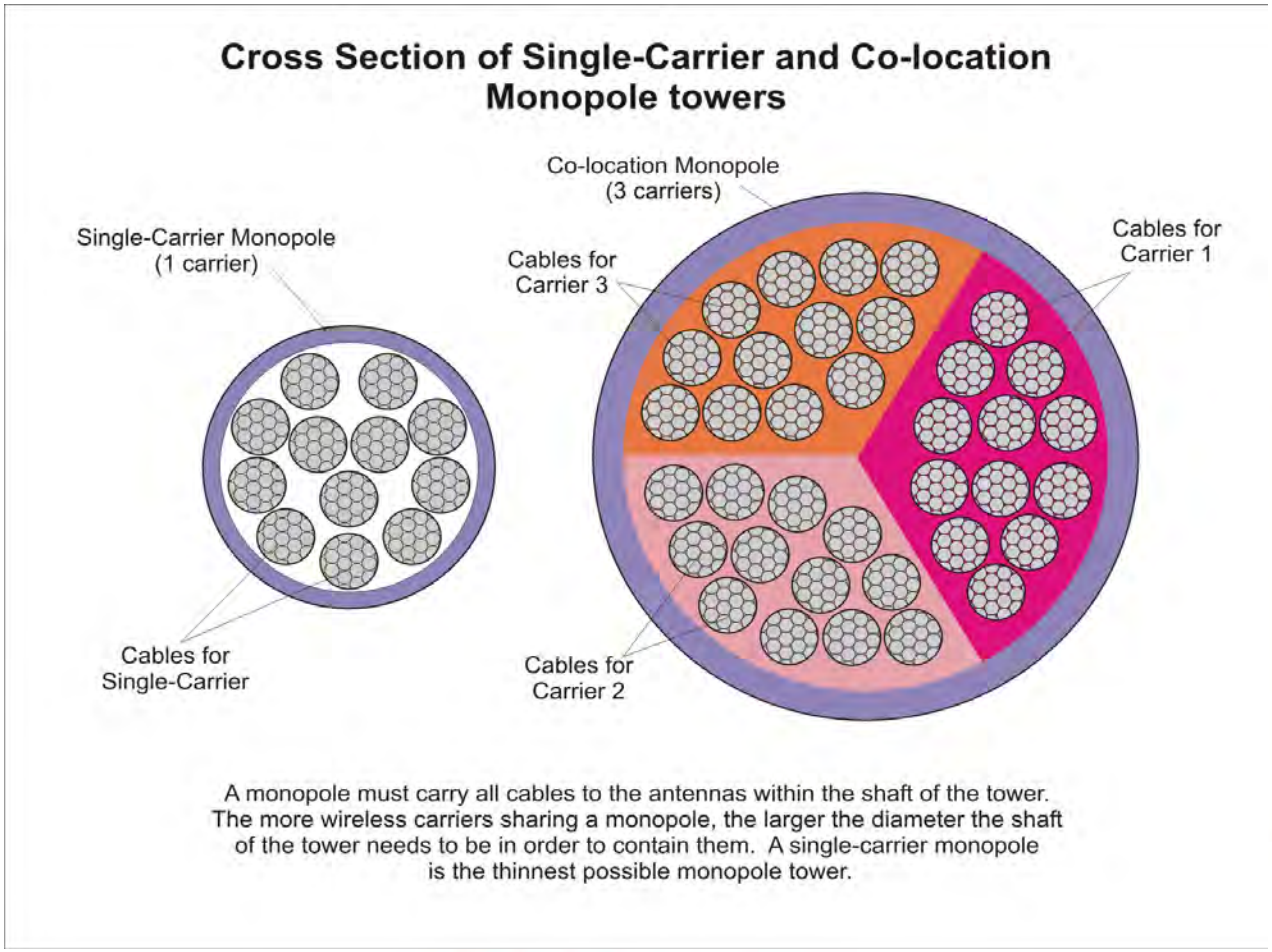
Single Carrier
Co-locate
Co-locate

CO-LOCATION


Cross Section of Single-Carrier and Co-location Monopole towers
Co-location Monopole (3 carriers)
Single-Carrier Monopole (1 carrier)
Cables for Carrier 3
Cables for Carrier 1
Cables for Single-Carrier
Cables for Carrier 2
A monopole must carry all cables to the antennas within the shaft of the tower. The more wireless carriers sharing a monopole, the larger the diameter the shaft of the tower needs to be in order to contain them. A single-carrier monopole is the thinnest possible monopole tower.

EMERGING TECHNOLOGY - LTE

- The wireless industry constantly needs to upgrade network coverage and capacity to maintain momentum with new and emerging technologies
- LTE (Long Term Evolution 4G) is the latest upgrade to the HSPA UMTS 3G technology wireless networks
- Massive demand for high-speed wireless mobile data services have created capacity issues for all carriers' networks.

Windows Phone

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EMERGING TECHNOLOGY - LTE

- LTE (4G) brings about unparalleled data transmission speeds (download, upload, video-streaming) as well as new services (mobile gps, mapping, high-speed wireless internet etc…)

- Many homes, businesses and community services will take advantage of the option to become completely ‘wireless’ without sacrificing service quality

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EMERGING TECHNOLOGY - INFRASTRUCTURE

- The Wireless Carriers will need to convert existing roof-top and tower locations to LTE as a preliminary step
- The networks will also require a good number of ‘capacity’ sites in order to handle the high volume of users on the network
- Capacity sites *typically* require less height than regular coverage sites and less antenna loading
- Capacity site placement needs to be close to its users.

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Carriers and the Federal Government

- The Federal Government has exclusive and comprehensive jurisdiction over radio communications and telecommunications.
- Industry Canada policy governs the way carriers consult with land use authorities with regard to antenna systems (Client Policy Circular CPC-2-0-03).
- This policy identifies a number of circumstances under which carriers are excluded from the requirement to consult with land use authorities in recognition of their low impact including:
  - New antenna systems less than 15 m
  - Addition or modifications to existing systems
- The exclusions are designed to encourage low-impact sites.
- The policy also stipulates that building approvals are no longer accepted as evidence of land use authority concurrence.

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Municipal Approval Process

- The wireless industry wants to work with local government to develop protocols that enable us to meet the needs of your community...our customers...and the regulator (Industry Canada).

- ***Clarity, certainty*** and ***timeliness*** are key elements of any approval process.
  - With these in place, industry can focus its resources on securing successful sites, sensitive to their surrounds and land uses.

- We recognize and are mindful of community concerns with regard to site aesthetics.
  - Wherever possible, wireless providers will share (co-locate) facilities and/or locate infrastructure on existing structures
  - For sensitive locations, we implement customized, unobtrusive or stealth design options to minimize visual impact.
  - We will partner with local government to leverage existing infrastructure and where possible will work with the development community to ensure new buildings are designed to accommodate wireless communications equipment.

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Thank you.