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An Overview of Cell Phone Towers

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Abstract: In this paper we have presented the availability of electrical power & usage of conventional energy like diesel for cell-phone towers, Types of towers, its components, Hazards, Techniques to overcome.

Keywords: *Concealed Tower, Antenna, Port Holes, Plain Transmitter.*

I. INTRODUCTION

Cell phone towers are structures built on specific parcels of land that are designed to accommodate wireless tenants. Wireless tenants utilize cell towers to deploy various technologies to a subscriber base, such as telephony, mobile data, television and radio. Cell towers are typically built by tower companies or wireless carriers.

We receive many inquiries from property owners who confuse the actual tower with antennas that are placed on rooftops. These antennas are more accurately described as cell "sites", but the real definition of a cell site is: an area within a wireless service providers network that can be serviced by an antenna array. Thus, there can be multiple cell sites (and multiple tenants) on any one given tower (or rooftop).

II. TYPES OF TOWERS

The Monopole Tower is a single tube tower. It typically stands between 100-200 ft. with antennas mounted on the exterior of the tower. Its primary use is telephony.

The Lattice Tower is sometimes referred to as "self-support" or SST because it is free-standing. It stands 200-400 ft. tall with a triangular base and three-four sides. It is typically used for telephony. The Eiffel Tower is a lattice tower.

The Guyed Tower is basically a straight rod supported by wires that attach to the ground as support. It's cheapest to construct, especially at heights of 300 ft and beyond. Some guyed towers reach as high as 2,000 ft. Typical uses are: telephony, radio, television, and paging

Concealed and Stealth® Towers. Stealth ® towers are a particular brand of concealed towers. Another manufacture of concealed towers in Larson Camouflage. Concealed towers are deployed to satisfy zoning regulations, and can range in size to accommodate their surroundings. They are more expensive than other types of towers because they require additional material to create a "concealed appearance," yet at the same time, they provide less capacity to tenants than other towers do. Below is one of the more interesting concealed towers, located at a church in California.

Broadcast Towers provide mounting space for FM radio, AM radio, and Television (TV) antennas. Their antennas are massive, weighing anywhere from 1,000 pounds to 15 tons depending upon the type of service they provide and the coverage they are purposed to deploy. Most broadcast towers are guyed towers with three or more guy wires attached to grounded anchors. Broadcast towers can take up a great deal of ground space - up to300 acres, which is why they are typically found in rural areas or on mountaintops where natural elevation provides the best means of transmitting signals.

III. COMPONENTS OF A CELL SITE

1.Whip antenna

A stiff, monopole antenna, usually mounted vertically.

2. Antenna array

A platform (typically three sided) where tenants place equipment to provide signal transmission and reception to a specific area. The number of antennas necessary per array is determined based on a number of factors including:

- the number of active subscribers;
- the volume and type of network usage by subscribers (e.g.: average minutes of use, voice versus data);
- the technology being used (e.g.: CDMA, GSM, LTE, WiMAX);
- the type of spectrum currently utilized by the tenant.

3. Port holes

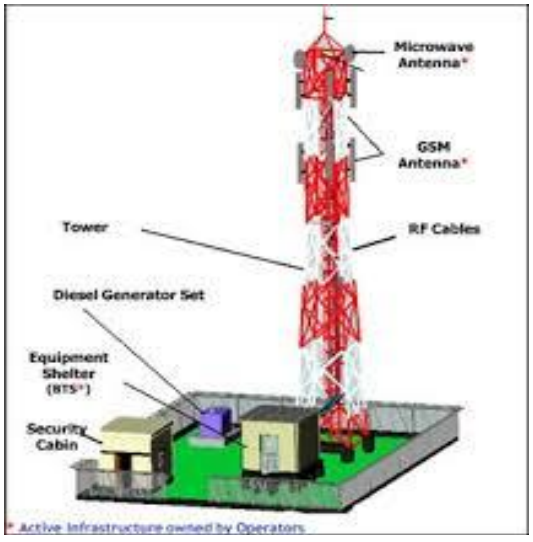
Holes cut into the base and top of tower to allow cables and wiring to pass through the tower structure, from the base station to the antennas.

4. Panel/antenna

Customer equipment which transmits a signal from the tower to a mobile device, or vice versa.

5. Microwave dish

A specific type of antenna, which is used in point-to point radio, television and data communications. Also commonly used by wireless carriers for backhaul.



How They Work:

Whether it's handling simple phone calls or 12Mbps WiMax data, cell sites are organized with more or less the same flow:

A cellphone or modem radios the nearest towers, saying, basically, "I'm here!" When you make a call or logon, your phone then sends a message via radio that's picked up by the antenna array.

A wire or fiberoptic line carries the call down to the wireless

access point, connected to a multi-port switch.

The call, along with many others, gets routed to a backhaul, usually down to an underground wired T1 or T3 line, but sometimes back up the mast to a powerful line-of-sight wireless microwave antenna. They resort to wireless either when they don't have a ground connection, or when the ground connection sucks.

The incoming call or data comes back from the backhaul and up through the switch to the antenna, where it then hits your phone wirelessly, presuming your phone is still communicating with the same site. If you are moving, then there's a handoff a new but more or less identical cell site transmits the data to your phone, once your phone checks in and says "I'm here." All of this happens in the blink of an eye.

IV. CONCEPT

In a cellular radio system, a land area to be supplied with radio service is divided into regular shaped cells, which can be hexagonal, square, circular or some other regular shapes, although hexagonal cells are conventional. Each of these cells is assigned with multiple frequencies ($f_1 - f_6$) which have corresponding radio base stations. The group of frequencies can be reused in other cells, provided that the same frequencies are not reused in adjacent neighboring cells as that would cause co-channel interference.

The increased capacity in a cellular network, compared with a network with a single transmitter, comes from the mobile communication switching system developed by Amos Joel of Bell Labs that permitted multiple callers in the same area to use the same frequency by switching calls made using the same frequency to the nearest available cellular tower having that frequency available and from the fact that the same radio frequency can be reused in a different area for a completely different transmission. If there is a single plain transmitter, only one transmission can be used on any given frequency. Unfortunately, there is inevitably some level of interference from the signal from the other cells which use the same frequency. This means that, in a standard FDMA system, there must be at least a one cell gap between cells which reuse the same frequency.

In the simple case of the taxi company, each radio had a manually operated channel selector knob to tune to different frequencies. As the drivers moved around, they would change from channel to channel. The drivers knew which frequency covered approximately what area. When they did not receive a signal from the transmitter, they would try other channels until they found one that worked. The taxi drivers would only speak one at a time, when invited by the base station operator (this is, in a sense, time division multiple access (TDMA)).

Cell signal encoding

To distinguish signals from several different transmitters, frequency division multiple access (FDMA) and code division multiple access (CDMA) were developed.

With FDMA, the transmitting and receiving frequencies used in each cell are different from the frequencies used in each neighbouring cell. In a simple taxi system, the taxi driver manually tuned to a frequency of a chosen cell to obtain a strong signal and to avoid interference from signals from other cells.

The principle of CDMA is more complex, but achieves the same result; the distributed transceivers can select one cell and listen to it.

Other available methods of multiplexing such as polarization division multiple access (PDMA) and time division multiple access (TDMA) cannot be used to separate signals from one cell to the next since the effects of both vary with position and this would make signal separation practically impossible. Time division multiple access, however, is used in combination with either FDMA or CDMA in a number of systems to give multiple channels within the coverage area of a single cell.

Biological effects of microwave radiation:

When a human body is exposed to the electromagnetic radiation, it absorbs radiation, because human body consists of 70% liquid. It is similar to that of cooking in the microwave oven where the water in the food content is heated first. Microwave absorption effect is much more significant by the body parts which contain more fluid (water, blood, etc.), like the brain which consists of about 90% water. Effect is more pronounced where the movement of the fluid is less, for example, eyes, brain, joints, heart, abdomen, etc. Also, human height is much greater than the wavelength of the cell tower transmitting frequencies, so there will be multiple resonances in the body, which creates localized heating inside the body. This results in boils, drying up of the fluids around eyes, brain, joints, heart, abdomen, etc.

There are several health hazards associated with cell phones and cell towers.

The Blood Brain Barrier:

The brain is protected by tight junctions between adjacent cells of capillary walls by the blood-brain barrier (BBB), which selectively lets nutrients pass through from the blood to the brain, but keeps toxic substances out. Experiments conducted on young laboratory rats found that RF from mobile phones can significantly open the BBB in animals and cause leakage of albumin from blood vessels in inappropriate locations (neurons and glial cells surrounding the capillaries) in the brain. Control animals, in contrast, showed either no albumin leakage or occasional isolated spots, as seen on the left side. The presence of albumin in brain tissue is a sign that blood vessels have been damaged and that the brain has lost some of its protection.

A closer look at the cells within the brain also revealed that exposed animals had scattered and grouped dark neurons often shrunken with loss of internal cell structures. Neuronal damage of this kind may not have immediate consequences but in the long run, it may result in reduced brain reserve capacity that might be unveiled by other later neuronal diseases. It must be noted that the blood-brain barrier and neurons are the same in a rat and a human being.

In another research, a single two-hour exposure to a cell phone just once during its lifetime, permanently damaged the blood-brain barrier and, on autopsy 50 days later, was found to have damaged or destroyed up to 2 percent of an animal's brain cells, including cells in areas of the brain concerned with learning, memory and movement. It is known that this barrier is damaged in Alzheimers and Parkinsons disease. So there is a risk that disruption of this protection barrier may damage the brain. Risk to Children and Pregnant Women Children are more vulnerable to cell phone radiation as they:

Absorb more energy than adults from the same phone owing to their smaller head and brain size, thinner cranial bones and skin, thinner, more elastic ears, lower blood cell volume, as

well as greater conductivity of nerve cells and the energy penetrates more deeply. Tumors in the mid brain are more deadly than in the temporal lobe,

Children's cells reproduce more quickly than adults which makes cancers more deadly, •There immune system is not as well developed as adults hence are less effective against fighting cancer growth, Children have longer life time exposure.

Absorption of electromagnetic radiation from a cellphone (Frequency - GSM 900 MHz) is by an adult, 10 year old and a 5 year old child. When radiation hits the head, it penetrates the skull. The yellow area at the bottomis the location of the cell phone by the ear. The radiation penetrates the skull of an adult (25%), 10 year old (50%) and a 5 year old (75%).

The younger the child, the deeper is the penetration due to the fact that their skulls are thinner and still developing. For these reasons it is critical that children under the age of 16 use cell phones only for short essential calls as they have much bigger danger of getting a brain tumor.

Brain tumor have now taken over leukemia as the biggest cause of death amongst children. Due to these reasons countries like Belgium, France, Finland, Germany, Russia and Israel have publicly discouraged use of cell phones by children. An Independent research in Sweden last year concluded there was an astonishing 420 percent increased chance of getting brain cancer for cell phone users who were teenagers or younger when they first started using their phones.

Radiation from cell towers in India not harmful: Panel

There is no cause of alarm with regard to possible ill-effects on human health by electromagnetic field (EMF) radiation from cellphone towers and cellphones because the limits adopted in India account for all biological effects of radiation. In fact, the limits set by India are much lower than the internationally adopted recommendations of the International Commission on Non Ionising Radiation Protection (ICNIRP), which account for thermal and non-thermal effects, said a report submitted by a 13-member committee constituted by the Department of Telecommunications (DoT) based on an Allahabad High Court order dated January 10, 2012.

"So far, no conclusive evidence has been found on adverse

health effects by EMF radiation from mobile handset by the World Health Organisation (WHO)…(and) so long as EMF radiation power levels in the vicinity of base stations of cellphone towers are below the prescribed limits, there should not be any cause of concern for adverse thermal health affects on human beings living close them," the committee said in its report.

Future Smartphones Won't Need Cell Towers to Connect

Qualcomm, Facebook, and other tech companies are experimenting with technology that lets smartphones use their LTE radio to connect directly to other devices up to 500 meters away.

new feature being added to the LTE protocol that smartphones use to communicate with cellular towers will make it possible to bypass those towers altogether. Phones will be able to "talk" directly to other mobile devices and to beacons located in shops and other businesses.

Known as LTE Direct, the wireless technology has a range of up to 500 meters, far more than either Wi-Fi or Bluetooth. It is included in update to the LTE standard slated for approval this year, and devices capable of LTE Direct could appear as soon as late 2015.

LTE Direct has been pioneered by Qualcomm, which has been working on the technology for around seven years. At the mobile chip manufacturer's Uplinq conference in San Francisco this month, it announced that it's helping partners including Facebook and Yahoo experiment with the technology.

CONCLUSION

Technology is the best when it connects people together and that is what a cell tower primarily does. It is one such amazing technology that has been implemented which connects people around the world just within a short period. They are bound with both advantages and disadvantages. And it is said that the technicians are working in order to get rid of its disadvantages, hoping for even more advanced cell site technology to be implemented

"The art challenges the technology, and the technology inspires the art "

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