Opportunities and Challenges in Municipal 4G/5G Deployments

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My Bio

- B.Sc. Electrical Engineering, University of California (focus on communications theory/methods, and RF/microwave design)
- CEO & Founder, Oku Solutions LLC
- Joint Venture Silicon Valley
  - IEEE Future Networks (Co-Chair: Deployment Working Group)
  - Global City Teams Challenge @ NIST (Co-Chair: Wireless SuperCluster)
  - Calif. Emerging Tech Fund (Advisor)
- Fellow: Radio Club of America
- Sr. Member: IEEE
- Life Member: IEEE Microwave Theory & Techniques Society
Joint Venture Silicon Valley

Since 1993

Wireless Communications Initiative

- Convener and facilitator.
- Educate munis on the practicalities of telecom deployment.
- “Marriage Counselor”
- Educate the public.
- Speak to the big picture of telecom socio-economics.
Our Work

- WCI Steering Committee (teleconf every 6 weeks)
- Educational seminars & roadshows
- Council study sessions
- Silicon Valley Wireless Working Group (in-person roundtable)
- Track media, publish memos & papers
- Active with state, federal, and international stakeholder groups

Basic Requirements of 21st Century Life
Wireless-Only

- CDC Wireless Substitution (Biannual, June 2021)
- Wireless-only (U.S. wide)
  - 57 million children (79.1%) live in wireless-only households.
  - Renters: 81.9%
  - Poverty: 68.3%
  - Hispanic: 77.4%
  - Ages 25-29: 85.0%
  - Ages 30-34: 86.1%
  - Ages >44: 65.9%
- >80% of calls to 9-1-1 come from wireless phones

Why 5G, and why now?

- 4G
- 4G LTE
- 5G
4G Limitations

- Designed for personal devices
- Not optimized for Internet of Things
- Does not support fixed broadband
- Capacity limited (per radio-sector)
- Pandemic overload in many areas..

5G Evolution

- Designed for more than just devices
- Optimized for the IoT and other use cases
- Supports fixed broadband (Wired/Fiber ISP alternative)
- Capacity: Millions of devices per radio-sector
- Key point: 5G is data-focused, so it must be located near users in order to be useful
4G GDP Contribution

• 2020: North America mobile industry contributions:
  – GDP: $1.0 trillion (4.4%)
  – Public funding (before regulatory and spectrum fees): $100 billion
  – Jobs: 830,000 direct, 1.3 million

5G GDP Contribution (est.)

• 5G will invest $275 billion in public infrastructure
• Larger than the Apollo program, and just under the US Interstate system (in 2022 dollars)

Report: Accenture Strategy
Top 3 Concerns About 5G

- EMF Health Effects
- Property Valuation Effects
- Aesthetics
- *In my professional experience: Property valuation and aesthetics are often proxies for EMF health concerns.*

Is 5G Electromagnetic Energy Safe?
EMF Health Effects

• You can make almost anything sound scary and dangerous.
• You can publish a paper claiming health effects by suggesting a correlation, but reaching a solid, repeatable, and evidence-based scientific conclusion of causation is much harder.

EMF Health Effect Science

• EMF health effect studies began in the late 1950’s (post WW2, due to military radar injuries)
• International Committee on EM Safety (www.ices-emfsafety.org) links over 4,000 quality peer-reviewed studies
• FCC (OET-65) and ICNIRP were both updated or affirmed in 2019 after IEEE C95.1-2019 release
• Danish Cohort Study and SCENIHR - two of thousands of high-quality, peer-reviewed, no-harm conclusion studies
Anti-EMF “Science”

• BioInitiative Report (BIR) is widely cited by opposition groups, but was widely debunked in peer reviews. Notable reviews that found major issues with BIR:
  – Verschaeve’s work is especially notable because he looks not only at the BIR, but at 33 different reports on EMF health effects.
  – Verschaeve reviewed several of the major no-harm reports and scored ICNIRP, IARC, and SCENIHR at 10/10, and scored the pro-harm BIR at only 3/10.

EMF Health Effect Science

• Quantity of research done on low-band and mid-band EMF: 10,000+ studies
• Quantity of research done on millimeter-wave EMF: More than 100 studies
  • Millimeter wave is new to cellular, and is less studied, but the current body of evidence points to safety.
  • More studies are needed to reassure the public.
EMF Legal Decisions

• EHT vs FCC
  • D.C. Circuit Court of Appeals case
  • Robert F. Kennedy Jr.
• Argued that the FCC erred in issuing their updated EMF safety guidance
  • Outcome: DC Circuit allowed the FCC ruling to stand, but asked them to provide substantiation for their decision-making (records of meetings with other agencies, etc.)
  • “Show your work!”

Property Valuation Studies

• 2005 survey by a realtor in NZ
  • Claimed a 20% reduction in valuations – but this was a survey
• Scientific studies have not found this effect using objective data
  • JVSV 2012 (Macros – Data from MLS) : http://bit.ly/cellsiteMLSstudy
  • JVSV 2021 (Small Cells – Data from BKFS) : https://bit.ly/SCREstudy
  • Valbridge 2018 (Boston, Dallas, Phoenix*, and Raleigh-Durham) : https://www.valbridge.com/market-studies
  • Maennig (Hamburg DE) and others...

* Valbridge - Phoenix found one location with a nominal 1% reduction, but also found increases in valuation for nearby properties
Property Valuation Economics

- Shifting demographics and economics will favor homes with good coverage
  - Home buyers (esp. Millennials and Gen Z first-time home buyers) want better connectivity
  - In Santa Clara county, of the 16,000 connections created for distance learning during COVID – 14,200 used 4G hotspots.
  - 4G was a vital lifeline during the pandemic.

Aesthetics

- Ninth Circuit Court has held (T-Mobile v San Francisco, City of Portland v US/FCC) that local governments may control aesthetics via ministerial processes.
  - Assertion of aesthetics may not create effective prohibitions.
Resources

- www.jointventure.org/wireless
- bit.ly/jsvv-telecom-hbook-v2
- bit.ly/EMFMediaCoverage
- bit.ly/cellsiteMLSstudy
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