Land Use
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BOULDER COUNTY
BOARD OF COUNTY COMMISSIONERS AND PLANNING COMMISSION
STUDY SESSION ON TELECOMMUNICATIONS

Wednesday, November 20, 2019, at 1:30 p.m.

Commissioners' Hearing Room, Third Floor
Boulder County Courthouse, 1325 Pearl Street, Boulder, CO

Staff: Kathy Sandoval, Planner II, Land Use
Jacey Cerda, Assistant County Attorney
Nicole Wobus, Long Range Planning Manager

AGENDA

1. Summary of outcomes and next steps following October 15 PC/BOCC Joint Study Session on Telecommunications, presentation by staff
2. Planning Commission discussion and guidance

INTRODUCTION

Recent telecommunications dockets and a review of proposed small cell wireless-related Land Use Code updates spurred questions from the Planning Commission (PC) and a joint PC – Board of County Commissioners (BOCC) study session was held on October 15, 2019 to address topics of focus through presentations and discussion with expert panelists.

There was insufficient time at the study session for PC and BOCC to provide guidance to staff based on what they heard at the session. The purpose of this November PC discussion item is to provide PC an opportunity to review staff's summary of outcomes and actions taken since the session, and provide any further reflections, guidance and/or recommendations related to the topics in question. Staff also welcomes any PC requests for items of consideration to pass along to BOCC, either for their consideration of the small cell wireless-related Land Use Code update or regarding broader telecommunications-related topics.

ACTION REQUESTED

No action is requested. This is a discussion item only.

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I. SUMMARY OF STUDY SESSION OUTCOMES AND FOLLOW UP ACTIONS

Based on the outcomes of the session staff does not propose any near-term Code updates aside from the small cell wireless-related Code update already underway. Staff views the study session outcomes as valuable information to inform how we interpret our existing regulations. For example, staff is now better positioned to develop internal best practices for how planners set expectations with telecommunications providers for preparation of their site alternatives analyses. Staff welcomes any additional interpretations and guidance from PC regarding the topics of focus for the study session.

A key outcome from the study session was a recognition that the county would benefit from staff gathering more information on the potential role of third-party verification in evaluating alternative locations for proposed telecommunications facilities. Vantage Point Solutions (VPS), a third-party verification firm that has done work for other Colorado communities was invited to the study session but was not able to attend. Staff met with Laurie Sherwood, a representative of that firm on November 7. Based on that conversation staff believes there may be opportunities for VPS or other companies with similar capabilities and positioning (e.g., that do not also serve the telecommunications providers) to provide services that will enhance the county's ability to effectively review telecommunications applications, particularly as it relates to evaluating potential alternative tower locations. Third-party verifiers could not entirely replicate the same location analysis a telecom provider could conduct due to the propriety nature of some technical specifications. However, there are steps a third-party verifier could perform that would help ensure the quality and effectiveness of telecommunications providers' analyses. Ms. Sherwood is following up with her company's technical staff to address specific questions from staff to help inform future steps toward potentially implementing third-party review support.

Study Session Summary

The objectives of the study session were to:

- Gain a better understanding of the interrelationship between telecommunication-related topics (e.g., tower height, co-location and density of infrastructure) to inform decision making and to determine whether potential additional Land Use Code changes may be warranted.
- Provide PC and BOCC with an opportunity to jointly discuss how to address challenging topics related to telecommunications infrastructure decision making, and the proposed Design Requirements and Guidelines for the small cell wireless-related Code update.
- Determine what, if any, role third-party verification can play in review of telecommunications infrastructure decision making.

Summary of conclusions:

Interrelationship between height, density and emissions

- Additional research is necessary to better understand the potential health and environmental impacts of RF emissions from telecom facilities. Colocation does not affect the maximum

limits set for each facility. Local governments may not regulate telecom facilities based on potential environmental or health effects of RF emissions.

- The necessary density, height, and width of telecom facilities will depend on the network requirements for each telecom provider. Small cell towers will need to be more dense and closer together, whereas macro towers will remain less dense and much farther apart. Staff finds this information supports the recommended design requirements and guidelines previously set forth in the DC-19-0001 Code update and the current criteria for Macro-cell Facilities outlined under 4-602 (D) of the Land Use Code.

Co-location: feasibility, analysis guidelines, incentives

- The current telecommunication facility regulations and the proposed Code update continues to support co-location. Staff will explore ways to improve how this policy is implemented during the land use processes for these types of facilities.

Third party verification

- Staff will continue to explore whether third-party verification services are available for Boulder County to use or require as part of its land use processes.

Design Requirements and Guidelines

- Staff will move forward with the current Telecommunication Facility Code update and the Design Requirements and Guidelines for Small Cell Wireless Facility. Staff will use the study session information as background for Macro-cell tower facilities as it relates to future projects and applications.
- Staff is aware that the telecommunication field is evolving with new technologies coming on line and will continue to monitor and review information to inform potential future decisions regarding changes to our Telecommunication policies and goals.

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Meeting Summary:
Board of County Commissioners and Planning Commission Study Session on Telecommunications
October 15, 2019

Kathy Sandoval, Planner II for Land Use, and Assistant County Attorney Jacey Cerda led a study session to discuss Telecommunication Facilities in Boulder County. Recent telecommunications dockets and the review of the proposed Small Cell Wireless Land Use Code update predicated questions from the Planning Commission (PC) related to: (1) the interrelationship of height, density and radio frequency (RF) emissions; (2) the feasibility and appropriateness of co-location; (3) third party verification; and (4) appropriate design requirements and guidelines for Small Cell Wireless Facilities (SCWF). PC recommended a joint study session with the Board of County Commissioners (BOCC) to review the topics.

The study session consisted of presentations by staff and expert panelists, as well as clarifying questions from PC and BOCC. Staff presented background on the existing Telecommunication Infrastructure in Boulder County and summarized the current Land Use application processes for various telecom facilities.

Assistant County Attorney Jacey Cerda provided an overview of the current state and Federal laws related to local government regulation of telecom facilities, including limits on application processing times, fees, location and aesthetic requirements, discrimination among providers, and regulation related to radio frequency (RF) emissions.

Staff then opened the study session to the panelists: Dr. Kevin Gifford PhD from the University of Colorado Technology, Cyber security, and Policy program; Michael Cotton Division Chief of Telecommunications Theory Division, Institute for Telecommunication Sciences, National Telecommunication and Information Administration; and, David Born, Principal RF Engineer with Verizon Wireless. The panelists presented background information and their perspectives on the study session's focus questions, according to their areas of expertise. A wealth of technical background information and a recording of the study session is included in the presentations and associated background materials provided by the panelists, all of which are available on the docket webpage for the Small Cell Wireless Facility Land Use Code update: https://www.bouldercounty.org/property-and-land/land-use/planning/land-use-code-update/dc-19-0001/. A review of those materials is encouraged to understand the context of the discussion and inform decision making. A table summarizing basic information about the relationship between generations of cellular technology and frequency bands is provided here to aid in understanding the discussion points included in this meeting summary.

Generations of Cellular Technology

Generation	Technology	Band (MHz) (VZW)
1G	Analog	850
2G	Digital	850
3G	EVDO (Data Only)	850 + 1900
4G	LTE (Voice & Data)	700 + 1900 + 2100
5G	5G (Really Fast Data)	27,000

Source: October 15, 2019 study session presentation by Verizon

Dr. Gifford highlighted colocation feasibility between carriers and how it works with the bandwidth allocated to telecom carriers, the FCC monitoring process, and other resources available on design guidelines. Mr. Born covered how RF is measured and the documentation that is required by the FCC, as well as highlighting height/density studies Verizon has completed with other local jurisdictions. Mr. Cotton presented information on his organization's research activities, including propagation modeling, RF measurement, and electromagnetic compatibility studies. Several members of the PC and BOCC then questioned the panelists on the focus topics.

The BOCC and PC requested that staff obtain additional information on the following topics: (1) information regarding the relationship between co-location and RF emissions in terms of public health from Dr. Jonathan Samet, Dean of the Colorado School of Public Health; (2) information from third party verification companies regarding the services they provide and data they use to do so; (3) additional review of other local government regulations regarding telecommunication facilities (e.g., with regard to treatment of siting facilities along visual corridors); and (4) more analysis of the staff's proposed administrative review process for Small Cell Wireless facilities to explore mechanisms for including opportunities for public comment.

KEY OUTCOMES

Interrelationship between height, density, and emissions

- Does encouraging colocation or consolidation of towers inappropriately increase RF emissions in terms of FCC rules and potential health or environmental impacts?
    - Dr. Gifford's presentation stated: "No. There are per-band emissions (power) level specifications from the FCC that manufacturers must meet. Co-locating multiple bands on a siting tower does not violate any FCC regulation. The FCC, with many others, have examined the potential for cellular, including 5G health effects and there is no evidence of any scientifically-substantiated cellular/5G health concerns to date (all parties agree more research is beneficial)."
    - Additional discussion points:

- The FCC sets the maximum limits for RF emissions at each facility. This standard does not change with colocation; when evaluating whether a site can accommodate additional equipment each carrier's emissions must be added together to ensure that the cumulative emissions is still below the FCC limit. Panelists did not think carriers would risk exceeding the limit because they may face FCC enforcement penalties.

Conclusion: Additional research is necessary to better understand the potential health and environmental impacts of RF emissions from telecom facilities. Colocation does not affect the maximum limits set for each facility. And, as staff previously noted, local governments may not regulate telecom facilities based on potential environmental or health effects of RF emissions.

<u>How does the relationship between height, density, and emissions change for macro-towers versus small cell towers?</u>

- Dr. Gifford's presentation stated: "For small cells the tower height will be lower (3-15 meters), the density will be greater (small cell every 100m-500m depending upon user density and local regulations), and emissions (transmit power) will be lower (5-10 W Tx for a small cell) versus (50-100 W for a macro site). Note that 5G small cell build out is primarily an urban (high user density) mobile broadband provision strategy. In suburban and rural county areas, using current existing cellular infrastructure (1 GHz – 2 GHz) for low-band 5G (<1 GHz) and mid-band 5G ("CBRS" 3.4 – 3.9 GHz) is an option."
- Additional discussion points:
  - 5G is a network modification of cellular systems. LTE and 5G is frequency agnostic and can run at any frequency band. 5G is going to play out everywhere but it's only going to play out in small cell version in urban areas.
  - 5G will be rolled out at low-band (sub 1GHz, long propagation + lower user density: perfect deployment for rural areas. Just put some macro towers out there), mid-band (suburbia, around 3.5 GHz (CBRS) – sweet spot for decent data rate and decent data range)), and high-band (aka millimeter wave, 24 GHz and higher – high bandwidth, but only 200-500-meter distance).
  - 5G on small cell for rural – can use on existing infrastructure.
  - Macro towers (traditional towers built to support 4G and earlier technology) will be a couple miles apart, small cells will be a couple hundred meters apart.
  - Macro towers can support 5G with low frequency. Microcell towers with 5G under 1Ghz would work in large farmed areas, as it gets further range, but has less user density. Running 5G on low band would not require a lot of additional antennas because a lot of the low band antennas are already up.
  - The taller the tower, the fewer sites you will need. With a bigger diameter base, you can use higher power radios, which would require fewer cell sites. Low band equipment (typically built to support 4G and earlier technology) will be physically larger – the lower the frequency, the bigger the antennae gets (taller). Lower

frequency bands enable coverage with fewer cells, but the network can only support a small number of users in the coverage area (good for rural).

- High band or millimeter wave is 24 GHz or higher. Its coverage will only go a couple hundred meters.
- Radios are getting smaller over time, but this could be offset if/when we keep buying new bands and come up with new technologies that we're trying to squeeze in there
- Other factors related to colocation:
  - When collocating equipment there needs to be a gap (" guard interval") of 5-10 MHz between the frequency bands of the different carriers' equipment.
  - Interference between overlapping frequencies is less of an issue than it used to be, mainly because Nextel dropped out of the market – they quit using frequencies other carriers were using. The biggest problem is making sure frequencies don't get in front of each other (blocking signals). They have good filters on their own frequencies they can use, so it shouldn't be an issue anymore.

Conclusion: The necessary density, height, and width of telecom facilities will depend on the network requirements for each telecom provider. Small cell towers will need to be more dense and closer together, whereas macro towers will remain less dense and much farther apart. Staff finds this information supports the recommended design requirements and guidelines previously set forth in the DC-19-0001 Code update and the current criteria for Macro-cell Facilities outlined under 4-602 (D) of the Land Use Code.

- <u>How do carriers monitor their RF emissions?</u>
  - Dr. Gifford's presentation stated: "Carriers have intelligent software reporting and finely-calibrated radios (Tx/Rx power, frequency band, channel plans). Importantly, the FCC regulates and strongly enforces RF emission limits. Any carrier that exceeds transmit power, and is detected, will be subject to extreme penalties and associated loss of market share resulting from consumer (and jurisdictional) backlash."
  - Additional discussion points:
    - Carriers monitor their RF emissions precisely. They would be strictly fined if went out of range. If there is any concern of harmful interference, the FCC will hire contractors like NTIA to do RF site surveys to look at energy levels and ensure compliance.
    - Carriers also have a software that monitors their power outputs. Their equipment is also lab rated to specifications by the manufacturers.
    - Consumer cell phones can give fairly accurate power level read outs as well.

Conclusion: Given the limits on the County's authority to regulate RF emissions, staff specified in the proposed Telecommunication Facility Code update, an additional provision that Telecommunication facilities shall comply with FCC's requirements.

- What can the County do make sure emissions are meeting FCC requirements?
  - Dr. Gifford's presentation stated: "Drive tests are easy to perform and provide a decent 1st-level assessment: A user can access the radio Tx/Rx power levels in real-time on Apple and Android cellphones; bring in highly-sensitive equipment only when needed Can investigate network analytic platforms such as Ookla/Mosaik for lots of detailed cellular 4G/LTE/5G network assessment data (may be a subscription fee) Mandate (set a standard) that radio vendors must send transmit power reports (carriers have this data) for review/compliance by the County"
  - Additional discussion points:
    - Consumer cell phones can assess signal levels however there are significant differences in accuracy from phone to phone, but the County can also use third parties (network analytic platforms) such as Ookla or Mosaik.
    - Boulder County can request reporting from carriers, as they already have finely grained data.
    - IoT monitoring software to detect emissions maybe an option.

Conclusion: Staff will explore requesting this information from telecom providers.

Co-location: feasibility, analysis guidelines, incentives

- Should the County be encouraging/requiring silo (or other similar) structures for co-location, particularly for macro-towers?
  - Dr. Gifford's presentation stated: "(small cells): Recommend specifying aesthetic guidelines for small cell siting purposes, and, for the co-location of small cell radio transmission equipment on poles in city/county right of ways"
  - Additional discussion points:
    - In the future, providers are going to want to use towers for IoT to avoid having spaghetti wire towers. In urban areas, 5G is going to play out everywhere but only in small cell version.
    - From the industry's perspective, their first preference is a monopole with antennas on the outside, then the monopine with antennas out in the open. Their third preference is a silo, due to the constrained space where frequencies would have to shoot through the fiberglass, making it difficult for higher frequency. The least preferred is a canister, as it is difficult to put more than one carrier in them, leaving no opportunity to expand.
    - Wind loading seems to be the biggest challenge of adding more equipment onto a tower. From an engineering standpoint (versus professional), towers are built with a fair margin of safety, so they could likely accommodate more equipment.

Conclusion: The current telecommunication facility regulations and the proposed Code update continues to support co-location. Staff will explore ways to improve

how this policy is implemented during the land use processes for these types of facilities.

- What guidelines should the County use for analyzing and requiring/encouraging co-location?
    - Dr. Gifford's presentation stated: "[1] Small cell siting challenges and recommendations Issue date: 13 August 2018, Version: 1.1 [2] Imagining Future Cities: Design Guidelines for Wireless Small Cells in Urban Landscapes, Irena Stevens, University of Colorado Boulder"
        - Irena Stevens (student of Dr. Gifford) studied the topic of colocation on macro and small cell towers for her PhD thesis and would likely be a good source of information.
    - Additional discussion points:
        - The County can regulate tower height and aesthetics.
        - The County should set some aesthetic guidelines and could also use third parties to analyze options available to accommodate colocation.
        - Interior design could be used to optimize space in towers

Conclusion: These comments support the County's Telecommunication Code updates with the proposed Design Requirements and Guidelines for Small Cell Wireless Facilities and the alternative analysis requirements listed in 4-602.D of the Land Use Code.

Third Party Verification

- Is it feasible for the County to use third party verification for every tower application?
    - Yes, a third-party verification could help understand if the carrier has appropriately analyzed alternative sites. However, it may not always be feasible or practical for a third-party provider to provide a comprehensive assessment without potentially proprietary data from the telecom provider.
- What types of third-party verification services are available?
    - The NTIA – National Telecommunications and Information Administration, but it is unclear if carriers use their models.
    - Staff will continue to do more research on 3rd party verification.
- Are third party verifiers able to acquire and analyze data presented by carriers to determine whether carriers' alternative sites analysis is adequate and accurate?
    - The NTIA has a history of these types of analyses but they are kept private. Boulder County could obtain speed test data to determine potential coverage issues; however, the telecom provider may in the best position to provide this information.

Conclusion: Staff will continue to explore whether third-party verification services are available for Boulder County to use or require as part of its land use processes.

Design Requirements and Guidelines

- How should the PC and BOCC weigh the different requirements of the BCCP?
    - Per the FCC, requirements must be reasonable and no stricter than other structures. Requirements also need to be objective and published in advance.

  - Boulder County currently has reasonably strict requirements, but some requirements may require the balancing of different aspects of the BCCP. Telecom providers prefer more specific guidelines, but with such a large County it is important to balance different aspects of the BCCP as necessary.
- Based on the discussion today, should the DRG change in any manner?
  - PC previously recommended that the BOCC approve the Small Cell Wireless Facilities Design Requirements and Guidelines as previously written. PC and BOCC confirmed that a hierarchy of preferred locations, including colocations remains with the requirements and guidelines.
  - One member of the PC indicated that even though Small Cell Wireless Facilities will be reviewed under an administrative process that public have some input. Given the very limited review local governments may engage in of these types of facilities, Staff finds that the currently proposed review process is the most appropriate.

Conclusion: Staff will move forward with the current Telecommunication Facility code update and the Design Requirements and Guidelines for Small Cell Wireless Facility.

OTHER IMPORTANT INFO

- In terms of 5G rollout, Verizon is initially aiming for areas with dense populations, then going to migrate to lower frequencies and bandwidths. Then they will start putting it on towers everywhere. Throughput speeds won't be as high but still 5G. Within a year, it should be coming to rural areas.
- There is a concern about towers under 50' being converted to administrative approvals only. We would like to still have hearings and public comments.
- There aren't as many people in rural areas, but they are high data users. The plan is to look at where data usage is highest and that's where 5G will go. It will eventually migrate to all frequencies.

OUTSTANDING QUESTIONS

- Would like to know more about third party verification and how they do analyses.
- Health risks still need to be evaluated. Shouldn't be encouraging collocation if it heightens those risks.

Conclusion: Staff is aware that the telecommunication field is evolving with new technologies coming on line and will continue to monitor and review information to inform potential future decisions regarding changes to our Telecommunication policies and goals.