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THE FUTURE OF 5G:
A FIRESIDE CHAT WITH FCC COMMISSIONER BRENDAN CARR

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Moderator:

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Featured Speaker:

THE HONORABLE BRENDAN CARR
Commissioner
Federal Communications Commission

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P R O C E E D I N G S

DR. TURNER-LEE: Good morning, everybody. So happy to have you here at the Center for Tech Innovation. I see so many new friends and old friends that are here. My name is Dr. Nicol Turner-Lee. I'm a fellow here at CTI at Brookings in our Governance Studies department. And my portfolio of work encompasses everything from regulatory and legislative policies in addition to algorithmic bias, automation, AI, and everything in between. I have a book coming out, hopefully next year, on the digital divide.

I'm so excited to have Commissioner Carr with me. We like just reminded ourselves how far we go back. We were in high school. No. (Laughter) I just actually said to him we've aged ourselves through the system.

COMMISSIONER CARR: Yeah.

DR. TURNER-LEE: He has a better job than I do as a commissioner.

COMMISSIONER CARR: It's been a dozen years, yeah. I used to have hair when we first met.

DR. TURNER-LEE: I know, exactly. (Laughter) Well, I still do. Don't wish that on me, Commissioner. (Laughter) I still have my hair.

Well, let me give you a little bit of background about you. Somebody caught that, right? I don't have my eyes, but I do have my hair.

So let me just give you a little background and then we'll jump into this conversation. And our goal is to actually open it up for Q&A so that, you know, we can really talk about where we're going with the state of 5G.

Commissioner Carr was nominated to serve as Commissioner of the FCC under President Trump and confirmed unanimously by the United States Senate last year, August 3rd. He was sworn in August 11th. He brings to the position over a

dozen years of experience in both the public and private sector, in technologies and communications law and policy. Most recently, he was the general counsel of the FCC, where he served as the chief legal advisor on all of the issues at the Commission related to just about anything across the different departments.

Before that, he was actually in the office of Chairman Ajit Pai. I spent a lot of time in his office, so we actually reminisced about that, before coming to Brookings. And prior to that he was at Wiley Rein doing litigation, the firm's appellate work in telecom practices.

He's got a robust career. He's smart as heck. I've always admired that about him over the years. We have known each other for more than 15 years. So very honored to have him actually join me over here at Brookings, particularly on an issue like 5G. Right? We've actually talked about, we've heard about it. Many of us in this room have worked on issues related to it. But really what does this mean?

So the goal of this conversation is to really dig a little deeper and to have this intimate moment with the Commissioner to answer some of the questions that some of you may have as to how the regulatory processes are going to go forward, as well as some of the legislative processes.

So let's give a round of applause to Commissioner Carr for actually showing up and being here. (Applause)

So let's start out. I mean, I'd like an update on what is 5G? I mean, let's start with the basics because here at Brookings we have people a variety of learning curves. But why don't you start by giving us a sense of, you know, what is fifth-generation technology? Why should we be excited about it? And just update us on where we are with accelerating its deployment.

COMMISSIONER CARR: Yeah. Well, thanks so much for having me

and congratulations on your position here. And I really appreciate the chance to get a conversation going with you on these issues.

5G is really a transformative technology change for communities across the country. Everyone's familiar with 3G and 4G. I think the best way to describe it for me is when you think about all these new, cutting-edge innovations that we're about and seeing about, from connected cars to new remote healthcare applications, IOT, remote monitoring in terms of the industrial Internet of Things. All these new, interesting, cutting-edge innovations, 5G is the upgrade to our wired and wireless networks that's necessary to enable all of that innovation.

We talk about it a lot from a wireless perspective, but it's equally as much a wireline play, as well, in this sense: 5G is going to involve -- about 80 percent of all new deployments are going to be what we call small cells. And so they're not going to be these 100-foot, 200-foot towers that put signals over 30 or 40 miles. They're going to be small cells that are going to be putting signals over blocks. And so not only do you need a lot of capacity in terms of spectrum to do that, you need a lot more wired infrastructure to connect all of those new antennas, as well. So I'm really excited about the technology and what it holds.

At the same time, to the other part of your question, there's a lot of work we have to do on the regulatory front to make sure that the U.S. is what I call 5G ready because this is a very, very different network deployment. Again, it's not a relative handful of 200-foot towers, it's a 10- to 100-fold increase in small cells.

And our regulatory approach had been assuming that every new antenna is a 200-foot tower, so the cost, the timeline, the regulatory red tape was threatening to be the bottleneck that could slow U.S. leadership in that space. So we've been systematically looking at that at the FCC to make sure the U.S. does win this race.

DR. TURNER-LEE: I mean, let's talk about that for a little bit. So I think you've actually said a couple things I want to sort of unpack.

So the assumption of 5G is that it's a wireless play. You said something it's also a wired play, right?

COMMISSIONER CARR: Yeah.

DR. TURNER-LEE: And why is that? Can you explain that to people, why there's wired component of that?

COMMISSIONER CARR: So, again, we're pushing to this small cell world, but you need high-speed wired connections to all these small cells to carry that traffic. So while we talk about a 10- to 100-fold increase in the number of small cells, we also need many, many miles of new fiber and other high-speed connections to make the network function.

DR. TURNER-LEE: And so I want to unpack the second piece, right, making the U.S. 5G ready, right. So there's a lot of reports that are out there, China, Korea are sort of beating us in the United States when it comes to 5G roll-out. And I'm writing a piece on this. I think a lot of that has to do with the fact that they get the applications of IOT, you know, machine-to-machine enablement, et cetera, as the reason why they need faster networks.

Can you explain like where do we fit? I mean, China has already done trials. They are already testing. You know, they're freeing up spectrum, which we'll talk about in a moment. But can you say why it's important that the U.S. sort of stay on top of this?

COMMISSIONER CARR: Yeah. So the U.S., to say something that's obvious, we have a very different regulatory and governance structure than China and a lot of other countries that we are in this race to 5G. But winning this race is going to be

critically important, and at the FCC, we're committed to doing that. And we're actually in pretty good shape right now.

On the spectrum side, we have freed up at the FCC about 4 gigahertz more spectrum that China has in terms of this spectrum as we need it for 5G applications. And that's why it's so important that we're taking these reforms at the Commission right now with respect to our infrastructure deployment proceeding. We did a big order in March that exempted small cells from certain historic and environmental procedures that were geared toward these tall towers. Those are the steps that we need to take to win this race and I think we're actually in good position right now if we keep the momentum going. Because, again, there's lessons learned.

We in the U.S. won the race to 4G. A lot of people view Europe and Japan as having led in 2G and 3G, and we really made some progress on 4G. It was because of two things. One, we freed up more spectrum faster than other countries when it came to 4G use cases. And we reformed our infrastructure rules, including the ability to swap out 3G antennas and replace them with 4G antennas.

So we know the playbook for winning when it comes to next-generation technology in the U.S. It's beating other countries in terms of freeing up spectrum and it's making sure that our infrastructure deployment rules facilitate the deployment. We did that for 4G and we're right in the process right now of replicating that for 5G, but on a much more massive scale.

DR. TURNER-LEE: But the thing about the infrastructure, so let's go there for a second, I mean, these small cells are sizes of pizza boxes from what I've seen in demos. And it's going to put some more strain, right, on cities to actually do the zoning and permitting process. What's the FCC -- I mean, is this an FCC play? Is it a federal play? How are we going to ensure that cities that already are strained have the ability to

actually permit these pizza boxes? You know, for those of you who look at the poles in your community, we're talking about adding additional hardware to some of these things. I'd like you talk a little bit about that, as well.

COMMISSIONER CARR: Yeah. Well, I think it's going to require partnership across the board, the federal level, the state level, the local level, and that's the process that we're engaged in right now. I mean, look, 5G is going to happen in places like New York and San Francisco really regardless of what we do at the FCC from a regulatory perspective. Just the business cases, the population density demand it. But there are thousands of other communities.

I've spent a lot of time in the last year in the Commission traveling to those communities to see what is it going to take to get 5G deployed there? Because to me, winning this race to 5G is about making sure that every community gets a fair shot at 5G, that it's not just sort of big cities that have the 5G use cases.

And we're seeing a lot of states, a lot of localities that are very forward-thinking on this. There's around 20 states that have adopted small cell bills that can enable these new pizza box-sized antennas to go up. We're hearing at the Commission from local elected officials, as well, that are encouraged by some of the steps that we're considering at the Commission because they realize that capital is finite. And if you have an outlier city that's charging significant amounts of money to attach a small cell, that's going to suck up the capital that could otherwise go to a smaller community to make sure that they get 5G, as well. So we've been meeting with mayors, we've been meeting with elected officials, and we have a proceeding at the Commission that's looking at are there some guardrails that we need to put in place, so that every community gets their fair shot at 5G.

DR. TURNER-LEE: Right, because the challenge would be, let's say -- I

mean, I live in Alexandria. If Arlington decided they didn't want that, we'll see, what, disparate service or I guess we won't be 5G ready for real, right?

COMMISSIONER CARR: Right, right, could be.

DR. TURNER-LEE: If that happens. I want to go to the spectrum question. And, you know, I'm not sure of the audience's knowledge of spectrum, so sort of give us like the ABCs of spectrum building blocks.

The spectrum is the fuel for all of this that we're actually talking about. And so I'd like you to talk a little bit about why is the releasing of spectrum, particularly like China has released, made it easier for higher frequency spectrum bands to actually enable 5G? Things are happening in Congress: the bipartisan Airwaves Act, we saw in the omnibus bill the Mobile Now Act. What is the problem with us freeing up spectrum so we actually accommodate I think what we're talking about today?

COMMISSIONER CARR: Yeah, we're working on that. So historically, traditional cellular mobile technology relied on what we call low-band spectrum, a lot of times below 1 gigahertz. We've also been pretty active in what we call mid-band spectrum. One of the great things about 5G is it's opening up what we call these higher-band spectrum, these millimeter wave spectrum that had never really been able to be used before for mobile, that that can be a key piece of 5G, as well.

So a lot of this legislation, the Airwaves Act, the Mobile Now bill that passed, those are looking at how we can free up a lot of this high-band spectrum. That's what the small cells are going to be using at first. It's going to be a capacity play. And so that's why the spectrum is so important. It's going to be a mix.

Ultimately, 5G is going to get pushed down from the high-band spectrum to mid-band, to low-band, as well. But a lot of the early test cases we're seeing is in the high-band spectrum.

DR. TURNER-LEE: Are we going to do anything similar for fiber? I mean, we're going to need the fiber to terminate and to sort of jump-start I think the spectrum that will run the airwaves in terms of our mobile devices, et cetera. What's going to be done on the wireline side?

COMMISSIONER CARR: Yeah, we're looking at that, as well. How do we look at the permitting the process, the federal processes, as well, to make it easier to get fiber connected to all these small cells?

DR. TURNER-LEE: Right.

COMMISSIONER CARR: And we have a proceeding that's looking at some regulatory red tape that we could help reform, as well.

DR. TURNER-LEE: Yeah, because it seems like you'll probably have to do both, right? Because we have too much spectrum and not enough fiber.

COMMISSIONER CARR: Right, right.

DR. TURNER-LEE: Which can be somewhat problematic. I wanted to also ask on spectrum, in the Airwaves Act there is also actually conversation about unlicensed spectrum, as well. Can you speak a little bit about that in terms of will we just rely upon commercial spectrum or will we look at unlicensed spectrum as one of those bolster facts for 5G?

COMMISSIONER CARR: Yeah, it's going to require a mix. So we rely a lot on exclusive use, licensed spectrum. Unlicensed spectrum has been a great benefit for consumers and the economy.

DR. TURNER-LEE: And maybe we should explain what an unlicensed spectrum is.

COMMISSIONER CARR: Sure.

DR. TURNER-LEE: We're assuming that everybody speaks -- you know,

we're in our living room talking about this topic and everybody kind of gets it. So why don't we talk about it?

COMMISSIONER CARR: Well, and the third piece of it is, you know, shared. So licensed spectrum is one of the original licensing models the Commission uses. You give it to a provider, they purchase it at auction, for instance, and they have the exclusive right to use that spectrum. Historically, we've viewed that model as good for investment because there's certainty about you're going to have the spectrum, it's going to be free of interference.

Unlicensed, on the other hand, is a commons model. Low barrier to entry, you don't need to pay to use it, anyone can use unlicensed spectrum. Wi-Fi is one application we see in unlicensed spectrum; we see others.

And then increasingly, we're looking at shared models, either shared between the private sector and the federal government or shared in the sense that you can have some essentially lightly licensed use and some unlicensed use and some capability there. So we're looking at all kinds of different licensing models that can be part of the solution going forward.

DR. TURNER-LEE: So will the Commission be able to handle like this stack of responsibilities that we have to actually do to get 5G ready? (Laughter)

COMMISSIONER CARR: Yeah, absolutely. We're working hard. You know, we have auctions teams that are looking at auctioning spectrum. We've got teams on the regulatory reform side. It's really a top priority for us is making we do get 5G ready.

DR. TURNER-LEE: Because the Airwaves Act is bipartisan, so that's actually a promise, right, that people are actually getting it on Capitol Hill.

I want to talk about, before we switch tonight, we're going to do a little

show-and-tell here at Brookings, which is a little different for us because I want to talk about this 1,200-mile tour that you're taking.

COMMISSIONER CARR: Yeah.

DR. TURNER-LEE: I'm a little jealous, right? But I want to talk about 5G with regards to the applications of the use cases, right? So, you know, we're seeing healthcare as one of the use cases. The work that I do and Darrell West, our VP over at Governance, artificial intelligence, connected cars, are actually going to run over these networks. And I'm actually excited about the possibility of 5G being able to keep very sustainable connections. Precision medicine, you know, you'll actually be able to do remote surgery without missing a signal or dropping a signal.

Talk to us about, you know, those applications because that's really the Internet of tomorrow.

COMMISSIONER CARR: Right.

DR. TURNER-LEE: I mean, what we've been talking about today is the Internet of yesterday.

COMMISSIONER CARR: Yeah. Yeah, I'm particularly excited about 5G in the healthcare space. A couple months ago, I was in Mississippi with Senator Wicker and went to the University of Mississippi Medical Center. And they had an interesting essentially pilot program that they were running where they're takin patients, principally diabetes patients, low-income in the Mississippi Delta, and they were sending them home with a tablet and a wireless connection. And they could daily check in with this tablet and it was having improved results in terms of their conditions.

And one of the challenges there is how do we make sure we have the wireless connectivity for these remote patient monitoring activities? We heard about one patient who literally has a four-wheeler that they would drive to the top of a nearby

mountain and that's where they would get their wireless signal.

If you step back, I think healthcare might be one of the most interesting and important applications for 5G. If you look at the trends in the healthcare industry generally, and we're going from a world maybe in the distant past of low-cost, low-tech, low-access healthcare systems. We've moved now into a world of high-cost, high-tech, but still limited access. 5G has the potential to bend that cost curve, so can you get high-tech, low-cost, and something more ubiquitous, healthcare access everywhere.

And the healthcare IOT space is interesting. You have patches that can monitor glucose levels remotely, some really interesting spaces, particularly when it comes to chronic illness management. So I think the statistics show something about the -- around about 80 percent of the total direct cost for healthcare spending is sort of chronic illness management.

DR. TURNER-LEE: Right.

COMMISSIONER CARR: So diabetes, asthma, COPD, heart conditions, so that's a tremendous potential benefit for consumers and also economically, as well. I mean, we've got 300 billion in cost savings that we could get with healthcare-enabled IOT that 5G can enable. So that's one reason why I think it's so important that we continue to look at the FCC, at how can we support that movement. Again, this movement from brick-and-mortar hospitals, which will always be there, we have programs at the Commission that are supporting essentially hub-and-spoke models where you can have big institutions and have skilled nursing facilities and other sort of distributed clinic time.

I visited some of them when I was in Lennox, South Dakota. I visited a skilled nursing facility that's using the FCC's Rural Healthcare Program funding to essentially create a connection with a doctor in a larger town. But I think the healthcare industry's continuing to move forward and it won't just be brick-and-mortar or sort of this

distributed model. But it's this home healthcare, as well, where you have these IOT devices that are with you, you have access to healthcare everywhere.

And so my team at the Commission, we've been doing a lot of time thinking about that trend, that movement to remote patient monitoring and what more can we do at the FCC to help support that movement. And so we're doing a lot of thinking at the Commission right now about efforts we can do in that space.

DR. TURNER-LEE: Yeah, I mean, it's an interesting topic. I see Larry Irving and people out there are like we've been talking about this for a long time, right, 15, 20 years about telehealth. Now we just have to get the legislators to give us rules like, you know, reimbursement, life insurance, to be able to do it, right, because it just hasn't worked well. But I like the fact that we're actually seeing technologies that can enable it in a different way.

Which brings me, I mean, I have to say, and I'm pointing at Larry -- I've picked on him because I just actually saw him when I popped my head up, right -- 2005, he was at NCIA and he coined this term the "digital divide."

COMMISSIONER CARR: Yeah.

DR. TURNER-LEE: And the digital divide has really taken on a different -- you know, at that point, in 2005, it was about the haves and the have-nots, right. It was who had a computer and who didn't. It was a very binary approach to digital access. Now I see it used where it's about infrastructure, you know. That's a different way to think about the digital divide. You and I were at South by Southwest sort of talking about this.

COMMISSIONER CARR: Yeah.

DR. TURNER-LEE: Can you talk about how that term got co-opted a little bit, talk to us about infrastructure, you know, and how that actually contributes to

solving the digital divide?

COMMISSIONER CARR: Yeah. Yeah, broadband connection now is so integral to so much. You know, we talked a lot about healthcare, but economic opportunity, as well. And we see the differences in communities that have a broadband connection and those that don't. And it's across, you know, every single sector of the economy there's a tremendous difference here.

A couple weeks ago, I was in a small town, Moline, Michigan, and there was a crop supply company that was there. And through a quirk of history there's a railroad track that runs through this no-stoplight town and there was fiber that had been deployed along the railroad track. And because of that, this crop supply company was able to connect into that fiber connection and it transformed the way they were doing business in this farming operation.

Now they're in the business of collecting essentially silos' worth of data. They've connected tractors, connected combines, drone-based images that are detailed enough to pick up, you know, the changes in the spots on one leaf of a plant. It's changing the trajectory of economies of just that one agricultural application.

On the other side of the divide we were in West Lafayette, Indiana, talking with someone. They said, you know, if you look on the desk of a lot of these farmers now you'll see these old coffee mugs full of USB drives because they're collecting this data, but they lack the broadband connection to upload it to where it can then be crunched and put to productive use.

So in these travels we've seen both sides of the issue and it's really reinvigorated our need to help close this gap. And we see it in urban areas, as well, in terms of affordability and accessibility, and so we're working across all those issues.

DR. TURNER-LEE: Yeah, and, I mean, I bring it up, I was in Lincoln,

Nebraska, I was mentioning to you, and a guy from the Farm Bureau gave this analogy. He said, you know, a guy can invest in a John Deere million-dollar tractor that could probably speed up the productivity of the crops that they're cutting and all this other stuff, and it could be broadband-enabled and actually be able to measure the amount of water. He said, but if it doesn't have broadband, it's just still a tractor.

COMMISSIONER CARR: Right.

DR. TURNER-LEE: Right? It hasn't changed. It's just still a tractor.

COMMISSIONER CARR: Yeah.

DR. TURNER-LEE: So I guess the question on the digital divide, should we also be looking at people, though? You know, like is there something else we should be looking at along with infrastructure?

COMMISSIONER CARR: Yeah, we got to work across all those pieces. Infrastructure is a big focus right now, it's a big topic in D.C., and there's work that we're doing. We have to make sure, again, that it's sort of accessible, that it's affordable, and there's work that we can do across those fronts, as well.

DR. TURNER-LEE: Okay, perfect. Well, I want to go to this tour that you've been talking about.

COMMISSIONER CARR: Sure.

DR. TURNER-LEE: Okay. He's going to fix me. That's like a little nice segue. (Laughter) I need to re-mic myself up. That's why I could never be Oprah because, you know, my hands. I'm from New York, my hands just go all over the place. (Laughter)

Okay, so you've been talking about this tour. I am not doing nearly half the miles that you're putting on, you know. And you're actually going to these places that are really hard to get to.

COMMISSIONER CARR: Right, yeah.

DR. TURNER-LEE: So I wanted to actually show some of these folks that you're actually meeting.

COMMISSIONER CARR: Yeah.

DR. TURNER-LEE: Who is this dude?

COMMISSIONER CARR: So I'm actually real life-size in that picture even though it looks like I've been shrunk down. (Laughter) So this is Bear. This is in -- outside of Beatty, Nevada. I think Pahrump, Nevada, is where we are in this picture. And he's someone that works deploying broadband and this is very typical. I mean, we talk in D.C. about broadband and broadband deployment and the policies that are important to it, but there's real nitty-gritty hard work that goes into bringing broadband to communities across the country. And it's great -- you know, essentially an honor as part of this job, we get to go out and see these deployments, meet the people that are doing the hard work.

And we talk about the real estate agent as part of this conversation, talking about the economic difference that it makes for just home prices when they finally get broadband and fiber pulled through to communities. But it's hard, challenging work.

DR. TURNER-LEE: All right. What about this meeting? Where were you at here?

COMMISSIONER CARR: So this is a fire station in Mountain Springs, Nevada. And this is a community that is surrounded by federal lands. You know, the further west you go, an increasing percentage of federal lands, and they have a challenge getting broadband because of the permitting process associated with deployment on federal lands. And it's important not just for economic opportunity and home values, but public safety, as well. They were telling a story about some car

accidents that happened in a canyon not far away and there's a lack of cell service that could help out in that situation.

So we've heard about that challenge of deployment on federal lands and we've been working. And there's a lot of work at different federal agency levels to try to help solve that problem, as well.

DR. TURNER-LEE: Yeah, I mean, the FCC adopted the rule that you put out, right, in terms of exemption of federal lands.

How about this lady?

COMMISSIONER CARR: Yeah, so this is Theresa. This is also in Beatty, Nevada. So Beatty, Nevada, is a small town. It is I guess about 120, 130 miles from Las Vegas, and it feels all of 130 miles from Las Vegas. And it's an interesting story.

So the Beatty Medical Clinic was going to shut down due to the economics of trying to serve such a rural, remote community. And the health clinic was able to get a new broadband connection and what it enabled them to do is Dr. Reiner, who runs the clinic, is based in a bigger town, Pahrump, where that first picture was from. And instead of shutting down the clinic, because of having this broadband connection, you're now able to go in and Theresa's there full-time, she takes your blood pressure, your vitals, and then loads you up to have a virtual visit, which is what we're showing in this other picture, with Dr. Reiner located in Pahrump. And they've kept the clinic open and it's saved people a potentially 80-mile drive to Pahrump to the facility or otherwise enabled them to have healthcare in their community where they might not otherwise have it.

So it changed -- you know, that one clinic stayed because of this and it changed outcomes for members of the community. Again, I think this is one area where

healthcare is going to be particularly important.

My mom's a doctor, she used to be a nurse. She's now a psychologist and she's worked a lot with veterans and PTSD. And again, these are applications where with either tablets or other sort of remote applications we can drive down the cost of healthcare in ways that we have -- we've many, many efforts in the country to do that. 5G might be one way that can do it.

And when you have a remote visit it's about 75 percent of the cost of an in-hospital visit. So we really have the chance to drive costs down and improve patient outcome with 5G.

DR. TURNER-LEE: You know, I think that's so right. I mean, I've been trying to tell people I think when we look at 5G, for many of us who are consumers, we see this as, oh, we're moving up from 4G, you know, just the same way that you no longer see the 3G. But this is really just not about a consumer output, right? It's not about how much better my service is to actually download the Internet on my phone. This is about this, right?

COMMISSIONER CARR: Right.

DR. TURNER-LEE: And that's the layer, the indirect benefits I think that will go back to communities.

COMMISSIONER CARR: That's right. Again, 5G is not a faster version of 4G. There will be certainly some elements of that, but there's these entire other use cases. You know, connected cars is one we didn't talk about, but you have 30-, 40,000 highway deaths a year that we can cut down or eliminate when we get to connected cars; the healthcare applications in terms of the cost savings and the lives that are improved. It's different than going from 3G to 4G.

DR. TURNER-LEE: Right.

COMMISSIONER CARR: I don't know, maybe it's like going from 1G analog to 4G today. But it is a big leap in terms of what it's going to enable.

DR. TURNER-LEE: Oh, yeah. I mean, the analog world is gone, you know.

COMMISSIONER CARR: Yeah.

DR. TURNER-LEE: Like I tell my kids, I could beat them in Pac-Man any day, but I can't find the game. (Laughter) So it's not a competitive edge I have, right?

And then what are you doing here?

COMMISSIONER CARR: Yeah, so this is in Sioux Falls, South Dakota. And there was a new tower-climbing safety training facility that was set up there, and it was a lot of fun. So this is Brandon on my right over here and Leland over here, and just two really great, good guys. And they showed me the ropes and took me up there. And I personally am very afraid of heights.

DR. TURNER-LEE: I was going to say did your wife let you do this? (Laughter)

COMMISSIONER CARR: They claimed that it was only a 50-foot tower, although it felt like they left a zero off of that when you're on top. And Brandon and Leland started trying to rock it. They're like we need to understand what it feels like on top of a real tower, so they were trying to rock to get the motion.

But, again, a great appreciation for the hard work that goes into actually bringing broadband out there. It certainly changes the perspective. We need to make it easier for these guys to get these jobs done.

DR. TURNER-LEE: I was going to say, you're a regulator, aren't you, with a law degree? (Laughter) You're sitting up here, oh, my goodness gracious, I think I got the selfie where you actually were (inaudible).

COMMISSIONER CARR: Yeah, Brandon's doing the bicep move here to juxtapose his fitness next to my regulatory structure that I've got. (Laughter)

DR. TURNER-LEE: I follow you on Twitter and Facebook and I just see these pictures pop up. You know, there's just a different conversation going on outside of the Beltway.

COMMISSIONER CARR: It really is true. I mean, look, I love being in D.C. and having this job in D.C., but getting outside of D.C. it changes the perspective. A lot of the debates and the conversations that we have in D.C., as important as they are, oftentimes when you get outside of D.C. it's not really the same issues that are jamming up the small broadband provider. They talk about how do we get across this railway? How do we get the rights and the permitting rights? It's a different debate.

You get outside of D.C., people want a better, faster, cheaper broadband. There's a lot of work that we have to do, you know, real hard work to help enable that. But it's so beneficial to get out of D.C. and talk to people and see as a real practical matter what's stopping broadband from getting here. What's stopping a new competitor from getting into this space? And then we'll come back to D.C., what can we do from a regulatory perspective to help address that?

DR. TURNER-LEE: And I think you're so right. I've had the opportunity to go to Staunton, Virginia, for my book, as well as Hartford. I'm headed to Cleveland, headed to Tribal Nation. It's a different conversation. But what you're actually starting to see is that it's become the lifeblood of what people have come to realize is no longer just a privilege. Right? That they need it for all of these things from healthcare to employment, et cetera.

Which brings me back. We're having a 5G conversation. Shouldn't we be really talking about we got to get in any way to people? I mean, some of these rural

communities, it's tough.

COMMISSIONER CARR: Yeah.

DR. TURNER-LEE: You know, I'm a city girl. I look out, I don't see anything. I'm like that's why I did not go to my relatives in the summer and stay that long.

COMMISSIONER CARR: Yeah, right, right.

DR. TURNER-LEE: Because I needed to see some buildings, right, because you're just looking across at land. I mean, isn't it going to be tough if we don't try to figure out ways to deploy broadband at any way necessary?

COMMISSIONER CARR: Yeah, we need all the technology. So, you know, fiber's going to be important, that's a piece of it. New cellular technologies are important. Fixed wireless is another application.

Not far from here in a small town, Parker, South Dakota, we met with a small WISP, wireless Internet service provider, a really scrappy startup group. And we started literally 180 feet above Parker, South Dakota, on top of a water tower, climbed right up through the middle of a water tower. Got up there and they showed me their 11 gigahertz backhaul that they're using. And they showed me their other antenna on the other side of the water tower that's shooting nine miles away to a farm with an antenna that's on the silo of the farm.

I mean, it's going to take a lot of technology. It's going to take a lot of modern-day duct tape and baling wire in some of these communities to get the job done. And so it's why it's important that at the FCC that we make the job easier for everyone, whether it's new satellite providers that are going to be competing in this space, we're working to improve those applications; whether it's fixed wireless, making sure that they can get their antennas up there without going through unnecessary regulatory hoops. There's a lot for us to do. And I'm optimistic about the future in terms of broadband

deployment now.

DR. TURNER-LEE: And is it required, and I think I saw Maureen Lewis from NTIA, is it going to require some coordination with the agencies, though? You know, the FCC has traditionally sort of been the pallbearer [*sic*] for this, right? The FCC has led all of this. But isn't it going to require other people to get involved if we're trying to be 5G ready?

COMMISSIONER CARR: Yeah, we're working hard with a lot of agencies, NTIA for one. Agriculture is another one. They have a lot of jurisdiction when it comes to forest and federal lands issues. So we're working across the board from a regulatory perspective, from a funding perspective to coordinate this roll-out of 5G.

DR. TURNER-LEE: We're about to go into questions very shortly. I have just a couple more questions to ask of the Commissioner. And if you have a question we will recognize you and someone will come and give you a mic. We just ask that you speak loudly into the mic.

So I have a big question. It's sort of a futuristic question because you're a pretty straightforward guy. Is this your legacy at the FCC?

COMMISSIONER CARR: This right here, this picture? (Laughter)

DR. TURNER-LEE: To be the best regulator that can climb a tower? No. What do you think is your legacy? Is it 5G? Is it spectrum? What do you want to leave the FCC knowing that you did?

COMMISSIONER CARR: Yeah, we'll see. I mean, I'm right now at the end of what was sort of an initial short term and a second term is pending before Congress. If they should see fit to move that forward, happy to continue serving for a number of years to come.

5G right now is one of the top focuses of mine. And I think it's a wireless

play, it's a wireline play, and I think it's going to be transformative for the economy and for communities. So my principal focus as a substantive matter right now is making sure that the U.S. is 5G ready. And I think if that's a legacy that we end up being able to establish, that we took the regulatory steps now to enable U.S. leadership, whether it's 2020 or 2021, I'd be very proud if we played a small part in making sure the U.S. wins that race.

Also I think what we do inside the building matters a tremendous amount. And I've tried through my time on the Commission, look, I started at the agency as a staffer in 2012. You know, I love the building, the people. And I think the collegiality that we have inside the building is an important legacy that we all have some ownership in and delivering that forward whenever we leave.

I think Commissioner Clyburn was a great example of that. We had very regular meetings and we were able to talk about every issue from the mundane to net neutrality. And I think being willing to at a bare minimum talk to each other, bring some collegiality, bring some bipartisanship inside the building would be a great legacy, you know, again, for anyone in the building to get to have. And it's just a tremendous honor to serve.

Right now I'm in a new office at the Commission, physical office, and it's interesting, it's the same office that Commissioner Abernathy had in 2002 and when I interned for Commissioner Abernathy at the Commission. And the path from there to here is never something that I sort of would have aspired to back then or thought possible, but it's just has been a really rewarding run up to this point. And I think the agency is an important place. The people are hardworking. And I think continuing to build on that is important.

DR. TURNER-LEE: Wow, you just blew my whole mind about the collegiality at the FCC on certain issues. (Laughter) Some of you actually understand

that comment. I'm glad you all get along. (Laughter) Reel it back, Nicol.

So at least on the 5G issue, you think we're actually have some bipartisan consensus among the FCC when it comes to this?

COMMISSIONER CARR: Oh, absolutely. We're moving ahead and we're all committed to seeing the U.S. win this race. There's a tremendous amount of common ground with respect to the goal. I mean, how we get there, the exact regulatory measures we take, we'll see how all that pans out. But I think winning this race, making sure that we are 5G ready, and then letting the private sector take it from there, that's sort of the focus.

COMMISSIONER CARR: Yeah. No, I mean, I completely agree and I think for all the use cases that you actually have laid out it will be important. I mean, for those of you that are watching this debate, this is a serious debate, right, because this is the turnkey solution between what we're able to do in terms of those layered benefits that go back to communities, how we're able to accommodate the next generation of technology -- Internet 5.0 essentially -- and what we'll be able to do with communities.

And I know you went to rural and I just want to ask this question. The urban is going to be particularly important, as well. You know, it takes a single mother of a child with asthma three bus routes to get to a hospital for care, you know, specialty care for her child. Whereas it sounds like 5G could help rural in terms of the nurse that you showed, but it could also help that mother. Right?

COMMISSIONER CARR: Yeah, there's no question about it. So a couple weeks ago we were in Philadelphia on a small cell walking tour. And later that night we went to the Philadelphia Housing Authority was opening up -- reopening a high school. And we spoke to a woman there, her name was Tomi. She's a single mother of five. She grew up in public housing in Philadelphia and credits her success -- I mean,

she was just over the moon about the role that broadband played and what she was able to do. So she ultimately was able to go to school. She was able to complete her classwork she said, thanks to the broadband connection she had at her home.

And she's now just recently purchased her own house. She works now at the Philadelphia Housing Authority. She's getting an advanced degree now in essentially mental health services, trying to bring some of that back to her community, as well. A tremendous success story that she was over the moon and crediting the role that her online access to school and other opportunities brought to her.

So, you know, we're going to see this across the board.

DR. TURNER-LEE: Yeah. No, it's important. That mother and all the things that she was able to do, she represents the 11 percent of Americans that don't have access or didn't have access. But now that they actually have it, they're able to do things in their life that are so transformative that we couldn't do when we were growing up, right?

COMMISSIONER CARR: Yeah.

DR. TURNER-LEE: They can actually do much easier and quicker and better. And I think it's important that we just ensure that we stay on that track to make sure everybody gets it.

COMMISSIONER CARR: Yep.

DR. TURNER-LEE: All right, I want to open it up for questions. So I'm going to start -- I'll start with you, Talib. We'll start here in terms of questions to the Commissioner. Please I would like to entertain as many questions as possible, so keep your questions brief and we'll be able to get around the room without sort of creating a logjam. So be brief.

MR. KARIM: Well, I want to thank you, Dr. Nicol Turner-Lee, who's

proudly, I can say, our chairwoman for STEM4US, an organization that's committed to not only making sure we have access, but training. As you mentioned the young mother who's from the Philadelphia housing projects, without the type of training that she obviously got, she would not have been able to open the doors.

And I'm asking you, Commissioner, what more do you think that the Commission and you yourself can do to join the chorus for making sure that we have increased funding for STEM training and perhaps vocational training as the combination of the Department of Labor and Department of Education takes place? I don't hear a lot of conversation from those in the telecom sector and even investments in the telecom sector for STEM festivals and other things that, you know, we do here at STEM4US. What more can we do to encourage the folks that you regulate to get the message?

COMMISSIONER CARR: Yeah, it's a tremendously important issue and I have always sort of spoken of this in a sort of three-part way, which is moving forward for next-gen is going to require regulatory reform. It's going to require new spectrum. And I tend to think about the third piece to the same point that you're talking about, which is how to make sure that we have the skilled workforce and that everyone has the ability to get a fair shot, taking advantage of these new networks.

And I've done a couple events in Baltimore on this issue. I've been working with the Department of Labor in terms of the apprenticeship side and what we can do in that space. And I think you're exactly right that this has to be a piece of the conversation. There isn't necessarily a direct regulatory role all the time for the Commission here, but we certainly need to be talking about this.

It's infrastructure reform, spectrum, and then the skills necessary so everyone gets a shot at taking advantage of those new networks in the digital economy. So I think you're right to make the point.

DR. TURNER-LEE: Okay, next question? We'll just go like this.

SPEAKER: Thank you very much for the opportunity. I've been working in the IT space for about 20 years and I'm in the public school system. I implement software for them.

My question was that now that a lot of things are being pushed to the Cloud and people are just understanding that at our level, is there an established priority of who will get this technology first? Also, if there is or if there isn't, is there opportunities for people to get into testing of it and kind of like what you did in your tour and whatnot?

COMMISSIONER CARR: Yeah, so right now in terms of 5G in particular there are trials, there are pilots. The technology's rolling out. From my position at a government level our job, as I view it, is to lower the barriers to deployment everywhere. And success ultimately in my mind is measured by, again, not whether a few communities get these opportunities, but whether every community gets a fair shot at that. And our position principally is removing regulatory barriers.

Funding is another key piece of this. We have a $10 billion a year universal service program that we've been in the process of reorienting to support next-gen deployments in communities where the private sector business case may not be there. So that's where we have a role to play.

And again, I think on the healthcare side, as well, we've been taking steps in that direction to support new healthcare-related trials and deployments.

DR. TURNER-LEE: Howard?

MR. BUSKIRK: Howard Buskirk, Communications Daily. I wanted to ask if you had an update. One of the things we're waiting for out of your office is something more on sort of the next big infrastructure item that's going to deal with I believe state and local issues. Do you have any update on when we can expect something or just the

latest thinking on that?

COMMISSIONER CARR: Yeah. No new news in terms of specific timing on that. What I can tell you is that this is something that we've been actively engaging with all stakeholders on. I was up in Boston meeting with the U.S. Conference of Mayors on this issue, had really productive discussions with them on it. Gave a speech last week updating a little bit about some of the thinking, but nothing new in terms of timing. We're working pretty diligently on it.

DR. TURNER-LEE: The gentleman behind and then we'll flip to the other side.

MR. KIRBY: Paul Kirby with TR Daily. You mentioned some localities. You say some localities favor what the FCC has done. So a lot of localities and the groups that represent them have made a case in the current proceeding that they feel the FCC doesn't have the authority to do deem granted, to do preemption, and other things the industry wants. And then recently, in some of your other proceedings dealing with tribes, the tribes as well as the Advisory Council for Historic Preservation felt that even though in the order you listed all these meetings you had with tribes, you didn't do actual consultation, direct consultation with them.

So I wanted to see if you wanted to comment on that.

COMMISSIONER CARR: Sure, yeah. No, I've been really happy with the discussions that we've been having with all stakeholders on these issues, including local governments. As I've traveled I've met with a lot of mayors. I've met with county officials. I've met with state governors. Again, met with the U.S. Conference of Mayors a couple weeks ago in Boston. And I've had really good, productive discussions with all these groups.

And again, I think there's common ground here in terms of where we're

trying to get to because we want next-gen opportunity in every single community. And in order to do that, we have to make sure that there aren't outlier situations where permitting fees and attachment costs could be sucking up capital that would otherwise then go to outlying communities that really need their fair shot at this. So I think there's actually a lot of common ground with respect to that.

And we're seeing mayors that have been filing in our record in support of the steps that we've then proposed taking. And to your point we've seen those that have filed in opposition and that's the way it goes. And hopefully, we'll strike a balance that serves the public interest at the end of the day.

DR. TURNER-LEE: Okay. No, go ahead. You go ahead. I'm just trying to direct traffic.

SPEAKER: Okay. First of all, thank you very much for being here. This was wonderful, informative, and I have to be a little bit of a downer when I --

COMMISSIONER CARR: Oh, no.

SPEAKER: -- when I ask --

COMMISSIONER CARR: Oh, time's running out. We got to go. (Laughter) Leave on a positive note.

DR. TURNER-LEE: Can you stand up when you ask your question? Just because we're a packed room here.

SPEAKER: Okay. All of this is wonderful.

COMMISSIONER CARR: Yeah.

SPEAKER: But on the consumer level how do you regulate the cost of the Internet service? We pay $80, $100, X-number of dollars a month. People can't afford that. Most of us can in this room, but there's a lot of people, including that lady in Philadelphia, I don't know how she afforded the Internet service that gave her those

opportunities. So how do you regulate the carriers and the cost at that level?

COMMISSIONER CARR: Yeah, it's a good question. I mean, to your point, as I've traveled this is something that we've heard a lot of. People want better, faster, and cheaper broadband options. And the Commission has not been in the business over even the past couple years in the prior administration of regulating rates that are charged.

But we do have a role to play with respect to rates, which is this: How do we bring down the barriers to entry and increase the chances that you're going to have competition for your broadband dollar? In my mind, that's the best path forward to addressing rates is making it easier for someone to come in and compete with Comcast, compete with AT&T. And so that's what we're focused on.

The other piece about your point is we do have this $10 billion a year universal service program that does go at trying to address affordability in certain cases. A couple weeks ago, we adopted a regulatory reform that's going to cut $5 to $10 a month off of the bill of certain rural customers, which, to your point, makes a big difference across the country is to take 5 or 10 bucks off. But it's an important part of the discussion and we're working on it.

DR. TURNER-LEE: And if I can, just to the young lady's comment, we're not going into it here, but I think that's where programs like the Lifeline program are very critical, right, to ensuring that these remain very affordable for people. So many of us who have advocated on the side of Lifeline or are watching the way that it's actually transpiring, we really want to make sure that this becomes a lever for people to actually get engaged.

COMMISSIONER CARR: Yeah.

DR. TURNER-LEE: Because the cost of broadband service, particularly

it's no longer the call, it's the data.

COMMISSIONER CARR: Right, right.

DR. TURNER-LEE: That can be very expansive, becomes the deal-breaker for many people, and that's something I'm seeing in my own work.

Back here and then we'll move over.

MR. GREEN: Thank you. That was actually a perfect setup to my question. Ethan Green with EveryoneOn. I was curious about your thoughts on, you know, if we take a nuanced approach to defining the digital divide, those who have access to 5G will be able to progress faster and have access to more services than those that don't. So there's a risk without guaranteed or ensured ubiquitous access or implementation and roll-out of 5G, there's the risk that we may actually see the digital divide grow instead of shrink.

What are the Commissioner's strategies for looking at possible ways that we might be able to ensure a broad, affordable, ubiquitous access? Is that a shared 5G network? What is the Commission's actions going to be to really make sure that this digital divide closes and doesn't expand? Thank you.

COMMISSIONER CARR: Yeah, I think, you know, you've hit on something that's really important, which is as transformative as 5G is going to be, it's that more important that we ensure that every community has a fair shot at it because it is going to be transformative. And so, again, that's why I don't define success in 5G as New York and San Francisco getting 5G. I define success as every community getting it.

And so one of the key drivers here, not all of it, but one of the key drivers is regulatory reform. If you look at a decision we made last March, which excluded these small cells from federal, historic, and environmental review, the records show that cut 30 percent out of the total cost of deploying a small cell. You think about all those

communities where the private sector case wouldn't have been there if you had 30 percent more cost in terms of deployment. So got to drive down the cost of deploying this.

We also have build-out obligations. People get spectrum to make sure you are building out and not just a single, small part of your licensed area, but everywhere.

And I think we're going to increasingly see technologies competing, which is going to help. We have fixed wireless, we have new satellites coming online. I think that's going to be the best path. Plus our universal service program, which is targeting these rural unserved areas and funding deployments in those areas.

I think that's going to be the path forward because you're right, the stakes are too high to have this be a play in just a few communities.

DR. TURNER-LEE: That's right. Which, Commissioner, I mean, on that point, this is moderator privilege -- I'm sorry, you're just bringing up things -- but it's sort of like it's been kind of crazy, right, because there are a lot of funds going towards rural communities, but we're sort of creating this superimposed urban-rural divide, right, which, in many respects, we probably need to move past. Because I think to the question we really don't want to see any divide. Wherever you live, we want everybody to have access to new technologies.

COMMISSIONER CARR: Yeah.

DR. TURNER-LEE: Wouldn't you agree?

COMMISSIONER CARR: Yeah.

DR. TURNER-LEE: Okay on that. Okay, all right. Let's get the question back there, the young lady behind you in the gray. She's had her hands up for a while. Just right behind you, yep. And then I'll work my way up here. We have room for a

couple more questions.

MS. SANDOVAL: Thank you. Shelly Sandoval, Ph.D. student at Texas State University, adjunct to UDC.

DR. TURNER-LEE: Can you say it a little louder? Okay, thank you.

MS. SANDOVAL: Shelly Sandoval, Ph.D. student at Texas State University adjunct to UDC. My question is about disaster preparedness. If you can speak a little bit about how the 5G network can help in this regard, especially that we're seeing now a lot more disasters, more frequent, and they're more severe.

And secondly, what about speaking about regulation, looking at states having more control maybe is not a good word, but the states having input into that regulation, as well?

COMMISSIONER CARR: Yeah, good questions. So at the FCC, generally, we do have a role to play with respect to resilience and reliability of communications networks. And we've been looking at, in particular, our experience over the last year, whether it's the California wildfires or the hurricanes and other issues in Texas all the way over to Puerto Rico and the Virgin Islands. And we do a couple things.

We're looking at funding improvements in terms of network resilience and reliability, which we're doing in part in Puerto Rico in one example. And I think to your point 5G can help here, as well. And part of this is because we're moving into a small cell environment, so instead of having one 200-foot tower that's serving a 50-mile radius, and if there's an issue with that, if the tower goes down, you lose service across the area, we're layering in sort of this mesh network. We have the big tower still, but smaller distributing antennas, as well. So hopefully, that can help improve robustness when we have storms and other issues.

DR. TURNER-LEE: Doug?

MR. BRAKE: Hi, Doug Brake with ITIF. Nicol, Commissioner, this is a great conversation. Thank you very much.

So I'm curious to have your thoughts on sort of competitive dynamics and how they impact the deployment reform, the siting reform that you all are considering. I mean, it seems to me, I hear very smart people I respect say that we should look towards the sort of Google fiber model where the city and the carriers sort of negotiate directly the terms on how deployment would play out. But it seems to me when you have three or four carriers, trying to deploy these 5G networks at the same time, that it's a very different dynamic than like the old franchising model when you're just looking to get one more wired network. Right?

But on the other side of the coin, you don't want to create a new silo, right, where you have the Title VI guys and then a whole different section of regulatory process. I'm just curious how you see these sort of competitive dynamics if you have three people trying to get into every city across the country, how that changes things.

COMMISSIONER CARR: Yeah, it's a good question. There's always going to be an important role for state and local elected officials when it comes to deployment of these technologies. And one thing that's interesting with 5G is in a lot of ways we're seeing some privately deployed shared infrastructure.

I was in Iowa a couple of week ago, went to this manufacturing facility, Sabre. You know, it's a big manufacturing facility, you know, iron plates come in one side of the facility and on the other side come out these new towers and antenna structures.

One of the things that they're ramping up production of is what they call a smart stack utility pole. And on top of it, it has room for essentially a shared antenna so you can put all three providers or however many providers are in that area on that one facility. And that may not be a solution everywhere, but it's an increasing option that

we're seeing in terms of deployment on shared infrastructure. So that's a piece of it.

MS. MANIS: Thank you.

DR. TURNER-LEE: Can you stand up?

MS. MANIS: Oh, sure. Hi, Eleni Manis. I'm the Google fellow this summer at the Center for Data Innovation.

You've made the need for broadband in rural regions vivid. I'm wondering given the way you've described 5G technology whether its small cell model can be adapted in some way for low population density areas or, if you prefer, what's the best way to get broadband into areas where the small cells might not work?

COMMISSIONER CARR: This is a good point. So in D.C., over the last couple months, there's been what I call a micro debate about where is 5G going to take place? Is it purely an urban, affluent play or is it for everyone everywhere? And I'm coming -- what's that?

MS. MANIS: And how?

COMMISSIONER CARR: And how? And I'm coming down on the it's for everyone everywhere. I've been Woodstock, Virginia, a small town, Shenandoah Valley, and a new small cell was going up outside a high school to add capacity there. I mean, small cells are going to be a Main Street play, it's not just going to be a play for downtown areas.

The other piece of 5G to remember is that as important as small cells are, and I do think we need to see small cells, you know, as ubiquitous as we can get them, that's a piece of 5G. 5G's ultimately fixed wireless, which is what we talked about in terms of at Parker, South Dakota, where you can shoot essentially a wireless fiber 9, 10 miles. Satellite technology is also going to be moving into the 5G space.

And 5G technology is also going to be pushed down through the

spectrum bands into sub-1 gigahertz. You're going to get those traditional 100-foot, 200-foot towers that are also going to have 5G capacity that can cover a larger geographic footprint.

So I'm very bullish on getting 5G everywhere. I think regulatory reform is going to push small cells further out. I mean, to your point, population density makes a difference for small cell, but the cost of deployment is a key piece of that, so we can drive it down. But then again, more broadly, 5G's going to be a mixed of technologies, so we're going to push those, as well, in low population density areas.

DR. TURNER-LEE: We'll go here and then work our way back and I think that will be our last question with the gentleman with the jacket. Not yet. We'll go -- there are about two questions because I don't want to wear the Commissioner out.

COMMISSIONER CARR: I've got time.

DR. TURNER-LEE: Okay, you got time?

COMMISSIONER CARR: Yeah, let's keep going.

DR. TURNER-LEE: All right. He's been very good.

MR. HEMMING: My name's Alex Hemming. And a large part of getting coverage to rural areas is smaller carriers. And I was wondering what steps the Commission's taking in the 5G auction whether -- to prevent spectrum aggregate, whether that be through spectrum screens pre or post auction or just kind of how you felt that worked with the 5G auction.

COMMISSIONER CARR: Yeah. No, you're right. In D.C., the debates tend to be dominated by people talking about Comcast and AT&T and Verizon. But when you get outside of big metro areas there's literally thousands of essentially mom-and-pop providers that are working hard, that are competing, that are ones that are serving a lot of these rural communities. And we can make it easier for them to compete in this space,

and some of that is on the forefront of our minds.

When we look at auctions, we do have designated entity benefits. For instance, if you're a small rural provider you get a discount on the spectrum you purchase at auction, which makes them easier for them to compete to get that 5G spectrum.

DR. TURNER-LEE: Okay, I'm sorry, I got to add. So, you know, the last time I saw at the Commission we were talking about the designated entity program for more minority suppliers.

COMMISSIONER CARR: Right.

DR. TURNER-LEE: Okay. Are we going to see some of that pushed, too, to make sure there's diversity in the pipeline when it comes to participating in some of these auctions?

COMMISSIONER CARR: I would hope so. It's important.

DR. TURNER-LEE: Okay. That was the right answer. (Laughter)

Question back here?

MR. SHAW: Hi. I'm Veir Shaw. I represent Ford Motor Company.

I was wondering if you could elaborate a little bit more on how it's going to -- how 5G's going to affect V2X or, in other words, connectivity to infrastructure between cars and how that is going to look for consumers let's say driving on freeways. Are tolls going to go up because of this connectivity that's placed within highways, freeways systems? If you could elaborate on that, that'd be great. Thank you.

COMMISSIONER CARR: Yeah. This is another area in addition to healthcare where I'm excited about 5G. One of the big benefits of 5G is what we call in the industry low latency, so low lag or delay in sort of the transfer of data. And it's cutting down on latency that is the key to enabling a lot of the connected car applications you talked about. So there's going to be a mix when it comes to connected cars.

To some extent, you're going to be going, as you pointed out, vehicle to some sort of infrastructure, but a lot of the technologies are also vehicle-to-vehicle. So even if you're in an area -- hopefully, there aren't, but if you're in an area that doesn't have great coverage, a lot of the benefits of connected cars can happen from the vehicles communicating with each other and not necessarily have to always go back to a physical network every mile on the road. So that'll help potentially drive down the cost of some of these deployments.

DR. TURNER-LEE: This lady in the back with the white shirt, let's do her. And then we'll have time for one more question.

SPEAKER: Thank you both so much. This conversation has been great. So I have a question in terms of security. We're talking about building up infrastructure and I'm very aware that a lot of the private sector is looking to foreign capital to be able to build that infrastructure and to expand 5G. And I know mergers and acquisitions may not be under the FCC's jurisdiction. But given that we're at such a heightened time of security when it comes to foreign capital in American technology, what would be your advice to some of these private equity firms or smaller telecommunications companies that want to grow and want to expand and serve their customer base, but they need that foreign capital?

COMMISSIONER CARR: Yeah, so when you look at 5G deployments it's going to take about 275 billion in private sector investment to get these deployments cross the finish line. And in some ways, part of this global race is a global race for capital. And that's why it's so important that we move quickly in the U.S. because capital is smart and it will move to those countries and those parts of the world where it senses that the regulations are going to be ready for 5G deployments. And so we welcome investment in this space.

There are regulatory review and approval processes that are routine that run through with foreign investment in this space and those processes will continue to run. But we've had a lot of success with diverse investment in our telecom space. I think we're going to continue to want to see more investment here.

DR. TURNER-LEE: Okay. I think that's it that we have for questions. And I want to give the Commissioner a round of applause for participating today. Thank you. (Applause)

We at Brookings continue to follow this topic. At CTI we have a paper coming out on 5G and the indirect benefits you talked about, so I'm really excited about the work that you shared today, as well as the book that I'm doing. Continue to follow us at Brookings on the work that we're doing in this area. And thank you.

And as they say, as you've been out to the South, you all come back now, you hear? (Laughter)

COMMISSIONER CARR: That's right.

DR. TURNER-LEE: And visit with us again. Thank you very much.

COMMISSIONER CARR: Thanks. Thanks for hosting me.

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CERTIFICATE OF NOTARY PUBLIC

I, Carleton J. Anderson, III do hereby certify that the forgoing electronic file when originally transmitted was reduced to text at my direction; that said transcript is a true record of the proceedings therein referenced; that I am neither counsel for, related to, nor employed by any of the parties to the action in which these proceedings were taken; and, furthermore, that I am neither a relative or employee of any attorney or counsel employed by the parties hereto, nor financially or otherwise interested in the outcome of this action.

Carleton J. Anderson, III

(Signature and Seal on File)

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