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Committee on Environment
and Public Works

Washington, D.C.

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EXAMINING THE EFFECTS OF EXTREME HEAT AND WEATHER ON TRANSPORTATION

Wednesday, September 13, 2023

United States Senate

Committee on Environment and Public Works

Washington, D.C.

The subcommittee met, pursuant to notice, at 10:03 a.m. in room 406, Dirksen Senate Office Building, the Honorable Thomas R. Carper [chairman of the committee] presiding.

Present: Senators Carper, Capito, Fetterman, Mullin.

STATEMENT OF THE HONORABLE THOMAS R. CARPER, A UNITED STATES SENATOR FROM THE STATE OF DELAWARE

Senator Carper. Good morning, everybody. I welcome our witnesses. I was just joking with the Ranking Member, she starts her morning with a distinguished panel, and I understand she has dinner tonight, maybe, with Lady Gaga. So you are the opening act, how is that? We will see how that goes.

[Laughter.]

Senator Carper. One of my all-time favorite pictures is the picture of Tony Bennett, who died not long ago, there was a great shot of him a couple of years with Lady Gaga. And I thought, I want to grow up and be just like Tony Bennett. You have that chance.

All right. Good morning, everybody. I call this hearing to order.

Today's hearing comes at a time when the topic of extreme heat is top of mind for literally millions of Americans. Just last week, Washington, D.C., our Nation's capital, where we gather today, experienced its hottest day on record. Temperatures reached 99 degrees with a heat index between 100 and 105 degrees.

That record followed a summer of sweltering heat waves across large parts of our Country. For example, Phoenix, Arizona, home to one of our witnesses today, saw temperatures of

110 degrees or hotter every day from June 30th to July 30th. I am going to say that again. When I read it, I didn't believe it. But Phoenix, Arizona, home to one of our witnesses today, saw temperatures of 110 degrees or hotter every day from June 30th to July 30th, and even hotter days in August.

In fact, this summer was our planet's hottest on record, according to data from the European Union Climate Change Service.

Extreme heat contributes to dry conditions that make areas more susceptible to wildfires that burn out of control. Just last month, our Nation witnessed the heartbreaking loss of lives, homes, and businesses due to the unprecedented wildfires in Hawaii. For years we have seen the same thing happen across Western States including California and Oregon and others.

Wildfires can have wide-ranging impacts on transportation, from road closures and travel disruptions due to excessive smoke, to the weakening of highways and bridge structures from the heat generated by those fires.

These are not unrelated or isolated events. Extreme heat also means warmer oceans, which lead to stronger and more destructive hurricanes. Currently, we are in the middle of an active hurricane season that has already resulted in damaging storms that have unleashed wind, rain, and storm surges in Florida, in the Southeast, and on the West Coast.

In my own State of Delaware, coastal storms and flooding have resulted in the closure of parts of State Route 1, the major north-south highway which links communities along our east coast.

The frequency, intensity, and duration of more intense heat waves, wildfires, and extreme weather across the United States have only gotten worse in recent years due in large part to human-caused climate change. In turn, this has put our Nation's transportation infrastructure, our workforce, and our travelers at a greater risk of harm.

Extreme heat can impact our transportation infrastructure in many ways. For example, when temperatures reach triple digits, roadways can buckle, resulting in costly damage that disrupts travel and leads to unsafe road conditions. In fact, it is estimated that the additional road maintenance and replacement costs caused by extreme heat could reach a total cost of $26 billion nationwide by 2040.

And it is not just roads and highway infrastructure that experience the effects of extreme heat. High temperatures can cause rail tracks to shift, delaying or slowing rail service, something that as a frequent rider on Amtrak between D.C. and Delaware I have experienced just in the last week. Last summer, a commuter train in the San Francisco Bay Area derailed when the temperature of the tracks exceeded 140 degrees.

When talking about extreme heat, we can't forget that heat's effect on transportation infrastructure directly impacts the people who use it as well as those who build and maintain it. We know that rising temperatures have serious implications for our health. Thousands of people in the United States are hospitalized each year due to heat. Many of these hospitalizations are workers who are exposed to dangerously high temperatures on the job.

Today, we will hear about the impacts that urban heat islands have on the people who live in cities, including many of whom live in low-income and disadvantaged communities. We will also hear about the hazards faced by our transportation construction workforce, whose jobs require them to be outside, building and repairing our roads, highways, and bridges even when temperatures soar to record highs.

In the years ahead, extreme heat will continue to threaten our infrastructure and public health, even as we work to transition toward a clean energy future. Fortunately, solutions are available to help transportation agencies better address the effects of extreme heat. Cities like Phoenix, Arizona and Los Angeles, California are turning to innovative materials, including cooler pavement, which gives off less heat than traditional pavement.

Communities are also deploying strategies to reduce the

urban heat island effect by planting more tree cover to help cool sidewalks and transit stops and reduce the overall heat intensity in dense, highly paved places. In Delaware, we have already planted 80,000 trees since the launching of a program initiative called the Tree for Every Delawarean Initiative. We launched that, I think, in 2020.

I am proud that our committee has taken a leadership role in implementing policies to address extreme heat and weather at the Federal level. In the Bipartisan Infrastructure Law and the Inflation Reduction Act, we created new programs including the Healthy Streets Program, the PROTECT program, and the Neighborhood Access and Equity Program to help States and local governments better address this challenge.

With that, my hope is that today's hearing will help to further our committee's understanding of the nexus between extreme heat and transportation. I also hope that our hearing today will bring greater awareness to the work that is being done across our Country to address this increasingly urgent problem.

Today, we are privileged to be joined by a panel of three witnesses who will testify about the many ways in which cities, the labor force, and the private sector are working, and in many ways working together, to make our communities more resilient to extreme heat and weather events.

I would say, just before introducing our Ranking Member, Senator Capito, when we talk about issues like these, extreme weather and extreme weather events, I am a guy who always looks for opportunity in adversity. That opportunity would include the creation of jobs, good-paying jobs. That would be part of, as we address these issues today, I am always looking for that: how do we create a more nurturing environment for job creation and then in all this adversity, and there is a lot of it now around the planet, how do we somehow grasp and create some economic opportunity for people to work.

With that, I am delighted to be sitting next to Senator Capito, as I do often, and to turn this over to her.

Senator Capito?

[The prepared statement of Senator Carper follows:]

STATEMENT OF THE HONORABLE SHELLEY MOORE CAPITO, A UNITED STATES SENATOR FROM THE STATE OF WEST VIRGINIA

Senator Capito. Thank you, Mr. Chairman. Thank you for calling today's hearing and for your ongoing commitment to bipartisanship in the committee's business.

I also want to give a warm welcome to our committee witnesses, and I understand one of my fellow native West Virginians, Mr. Parsons, who is from Fort Ashby, West Virginia. Thank you for taking the time to share your expertise with us today.

If we look back at the first eight months of 2023 our Country has confronted several types of disasters. We have seen catastrophic floods in California and Vermont, tornadoes in Arkansas and Mississippi, violent hailstorms in Texas, a hurricane that made landfall in Florida, flash floods in my home State of West Virginia, and those horrible, massive fires in Hawaii.

The consequences of extreme weather are felt in both urban and rural communities year-round. With the many challenges that our States face in improving their transportation infrastructure, I am very proud of this committee's bipartisan work to provide them with the funding they need to address these challenges in the IIJA. And as with varied extreme weather events show, there is not a one-size-fits-all approach to

addressing infrastructure and resiliency.

As my colleagues have heard me say many times, maintaining flexibility within the Federal-Aid Highway Program is absolutely crucial to ensuring that States can tackle their unique transportation needs head on. I am pleased that the programs and policies we established in the IIJA have adhered to this principle. So, as we continue with the oversight of the implementation of the IIJA, I will work to ensure that States retain that flexibility provided to them within the law.

One of the IIJA's new programs that is especially relevant to today's hearing is the Promoting Resilient Operations for Transformative, Efficient, and Cost-Saving Transportation, or the PROTECT program. As the acronym suggests, this program provides a renewed focus on improving the resiliency of our transportation infrastructure to withstand extreme weather.

Specifically, it gives formula funding to all States and directs the Secretary of Transportation to also award competitive grants to eligible entities. The funding can be used to carry out planning activities, build evacuation routes, and reinforce existing highways and bridges, among other eligible uses.

The program is important because it is a new tool we have to ensure we are preparing for the future, and not just responding to the aftermath of extreme weather. To do otherwise

would be a failure in our stewardship of Federal taxpayer dollars, and could delay timely disaster response and recovery efforts.

I noted earlier that the PROTECT program places a renewed focus on resiliency. That is because resiliency is not a new consideration for States and other non-Federal partners as they design and construct highways and bridges to best serve our citizens. Infrastructure owners were already incorporating resiliency into asset management strategies, planning documents, and project development. I am glad to see that the work that we did in the IIJA is furthering these efforts.

As we were developing the IIJA, one of my other policy priorities was improving the environmental review and permitting process. I am pleased that we were successful in this area. The IIJA included a robust set of provisions to make this process more efficient, without sacrificing environmental protections, and included codifying the One Federal Decision policy for surface transportation projects.

Our ability to prepare for, respond to, and recover from extreme weather is directly related to whether States can get their projects through the morass of the Federal environmental review process, and secure the necessary permitting approvals. Faced with challenges like extreme weather, we cannot afford to have a process that adds years to project timelines, and drives

up costs, especially given the current inflationary environment. This issue continues to be an area of focus for me.

I was pleased to see that further improvements to the project delivery process were included in the Fiscal Responsibility Act. However, I am troubled that the Administration is not faithfully implementing that law, and instead seems intent on adding more hurdles to infrastructure permitting.

Recently, the CEQ proposed phase two of its NEPA implementing regulations, which they advertise as implementing the Fiscal Responsibility Act provisions. But additional changes in that proposal, which have no textual basis in the Fiscal Responsibility Act, seek to transform environmental reviews from information-gathering processes into tools that slow projects that the Administration does not support, and many times they don't support because of political reasons.

The Administration is proposing to layer on political bias and favor certain types of projects at the expense of others. I hope that the Administration corrects course on these issues based on stakeholder feedback, and adheres to the FRA's plain text.

I look forward to hearing from our witnesses today about the on-the-ground efforts to address the effects of extreme weather on our transportation infrastructure. I thank the

Chairman again, and I yield back my time.

[The prepared statement of Senator Capito follows:]

Senator Carper. Thank you, Senator Capito.

I think next I am going to take a minute to introduce each of our witnesses, then we will lead off with David Hondula. Has anybody ever mispronounced your name, Mr. Hondula? Never?

[Laughter.]

Senator Carper. All right, we will try not to do that today.

Our lead-off witness today is Dr. David Hondula, who is the Director of the Office of Heat Response and Mitigation for the City of Phoenix, Arizona. Have you always lived in Arizona?

Mr. Hondula. Ten years, Senator.

Senator Carper. Okay. In his current role, Dr. Hondula helps coordinate and implement programs to protect people from dangerous summer heat and improve their quality of life. He is a member of the American Meteorological Society of Board of Environment and Health, a faculty member at ASU. My wife is a graduate of ASU, Appalachian State University.

[Laughter.]

Senator Carper. The other ASU. But anyway, Dr. Hondula is a member of the American Meteorological Society's Board of Environment and Health, and faculty member of ASU School of Geographical Sciences and Urban Planning. Dr. Hondula also has authored more than 90 peer-reviewed articles, book chapters and technical reports related to extreme heat and public health and

urban climatology. He earned a Ph.D. in environmental sciences from the University of Virginia in 2013. Where did you grow up?

Mr. Hondula. In New Jersey, Senator.

Senator Carper. All right. Next, we are going to hear from Travis Parsons, who is the Director of Occupational Safety and Health for the Laborers' Health and Safety Fund of North America. Mr. Parsons has over 25 years of experience working in safety, and has worked at the Laborers' Health and Safety Fund of North American since 2002, is that right?

Mr. Parsons. Yes, sir.

Senator Carper. All right. In addition to his work for the Laborers, he is Vice President for the Labor Division of the National Safety Council, where he sits on the board of directors among other leadership positions. Mr. Parsons is a native of West Virginia. Tell us where you were born.

Mr. Parsons. A little small town called Fort Ashby, West Virginia, over in the eastern Panhandle.

Senator Carper. All right. I know you have heard of that, more than a few times, probably been there more than a few times.

Senator Capito. Yes.

Senator Carper. A native of West Virginia, graduate of West Virginia University, who played Penn State in football a

week or two ago, right?

Mr. Parsons. Ouch.

[Laughter.]

Senator Carper. And the next week, Penn State played the University of Delaware. Really big ouch.

Mr. Parson. Yes, and we actually played three Pennsylvania teams in a row. We played Duquesne last week, and we play Pitt this coming weekend.

Senator Carper. We have Duquesne coming to Delaware in a week or so. As I told the President of the University of Delaware, don't schedule Penn State. Once is enough.

[Laughter.]

Senator Carper. Mr. Parsons, football aside, we are delighted that you are here today.

Last but not least, we will hear from Dr. Aimee Flannery, who is Global Principal for Transportation Risk and Resilience, at Jacobs, Solutions and Technologies. Dr. Flannery has an extensive background in researching, developing, and implementing projects and policies to improve the resilience of our Nation's transportation infrastructure. Previously, she has held positions at the U.S. Department of Transportation, the Applied Engineering Management Corporation, and for a time was an associate professor at George Mason University, not too far from here.

Dr. Flannery earned her Ph.D. in civil engineering from Penn State.

[Laughter.]

Ms. Flannery. Apparently, the infamous Penn State.

[Laughter.]

Senator Carper. We are glad to see her. I understand she is the mother of at least one daughter, who is sitting over her left shoulder. We are watching your daughter to see if her lips move when you speak.

We welcome all of you. We thank each of you for your willingness to testify before our committee today. We are now pleased to hear your testimony, starting with Dr. Hondula. Dr. Hondula, you are recognized for five minutes. Take it away.

STATEMENT OF DAVID HONDULA, PH.D., DIRECTOR OF THE OFFICE OF HEAT RESPONSE AND MITIGATION, CITY OF PHOENIX

Mr. Hondula. Thank you, Mr. Chairman, and good morning, Senators. Thank you, Mr. Chairman and Ranking Member Capito and Senator Kelly for the invitation to join you today. It is an honor to be here with my fellow witnesses to share what we are learning about how to manage and mitigate heat in the hottest large city in the Country, Phoenix, Arizona.

As the Chairman noted, this summer has been an especially challenging one for us. We set a new record with 55 days total of those temperatures of 110 degrees or higher.

All across the Country, local governments like ours have begun to recognize that there are serious deficiencies in planning for, mitigating, and managing extreme heat. In an effort to address this gap, the City of Phoenix launched the Nation's first publicly funded local government office focused on heat, the Office of Heat Response and Mitigation that I am proud to lead.

Our new office works with many local partners to coordinate and improve programs that help protect people from the dangers of heat and ensure that our cities and communities are cooler, safer, and more comfortable. Improving our cities' resilience to extreme heat requires that we engage across all levels of government and across all sectors of society, and it requires us

to significantly invest in communities that have been historically underserved. These are communities that have older transportation assets that are more likely to be strained by the heat, communities where people have fewer transportation options, and often must walk in the heat. These are communities that simply have fewer trees and less shade, places we might call shade deserts.

I would like to share some examples from Phoenix that highlight how we are working to address heat challenges in the transportation sector. You might be aware, Senators, that the transportation sector contributes to making our cities hotter for several reasons. One of those reasons is that the transportation sector uses a lot of land. Pavement accounts for more than 30 percent of the land area of Phoenix, and pavement is a significant contributor to urban heat, due to its low reflectivity of solar energy.

The City of Phoenix is a national leader in the testing and implement of technologies that alter that reflectivity, the reflectivity of the road surfaces, through our Cool Pavement Program. This program has now reached more than 100 miles of city streets that have received a light gray solar reflective coating.

The City and Arizona State University have been collaborating to produce an independent, rigorous and open

evaluation of the Cool Pavement Program. We have found that the coating is highly effective at reducing the road surface temperature, the temperature you would feel if you put your hand directly on it. That temperature has been reduced by up to 12 degrees Fahrenheit.

With this reduction, the underlying asphalt itself experiences less thermal strain. So the coating may reduce long-term asphalt maintenance needs and costs.

We also need to think critically about how heat impacts the experience of our transportation users. Residents tell us all the time that heat impacts decisions they make about where they will go and how they will get there. These decisions of course in turn impact commerce, labor, education, health care access, and so much more.

Phoenix is accelerating its investments to make more shade available for transportation users. One investment is called our Cool Corridors Initiative, through which we are striving to achieve 200 miles in the city with at least 60 percent shade coverage for pedestrians.

Phoenix is continuing to closely monitor all Federal funding opportunities to scale up and accelerate our ability to address heat through the transportation sector. We are so appreciative of Federal resources included in the IRA and Bipartisan Infrastructure Law to help us do so.

The City worked with Senator Kelly to help create the Health Streets Program in the BIL, which could fund, for example, Cool Pavement projects. Phoenix has also applied to the EPA's Government-to-Government Environmental Justice grant program that was created in the IRA. Our proposal there is to create a model cool corridor in a shade desert in south Phoenix. This cool corridor would integrate a wide range of cooling features, including shade and freely accessible chilled drinking water that would more fully support neighborhood mobility and connectivity.

Shade and heat mitigation elements are also included in Phoenix's 2022 RAISE award, and our recent proposal to the PROTECT grant program.

We respectfully ask that the Federal agencies and Congress continue to work to ensure that formula and discretionary programs include heat response and heat mitigation initiatives as project eligibilities. What is especially important to us is that the notices of funding opportunities and project evaluation criteria clearly and appropriately acknowledge how heat-related initiatives can be competitive for funding.

Moving forward, continued work to integrate heat planning and thinking across all scales of government sectors and agencies will be critical to help pursue community health and prosperity. Our experience in Phoenix is that our

transportation infrastructure and systems are very important focal points as we work to build a more weather-ready and heat-ready Nation.

Thank you.

[The prepared statement of Mr. Hondula follows:]

Senator Carper. Dr. Hondula, thank you so much for leading us off.

Mr. Parsons, you are recognized for five minutes. Go right ahead.

STATEMENT OF TRAVIS PARSONS, DIRECTOR OF OCCUPATIONAL SAFETY AND HEALTH, LABORERS' HEALTH AND SAFETY FUND OF NORTH AMERICA

Mr. Parsons. Thank you very much, and thank you for having me here this morning. Good morning, everybody, good morning, Chairman Carper and Ranking Member Capito, and esteemed members of the Committee.

As pointed out, I proudly serve as the Director of Occupational Safety and Health for the Laborers' Health & Safety Fund of North America. From here on I will just say Laborers, because that is a mouthful. We serve LIUNA and its memberships, which is the Laborers' International Union of North America, their signatory employers, and affiliates.

I am also a proud member of LIUNA Local 11, which is D.C., Maryland and Virginia, or some people refer to it as the DMV, having nothing to do with motor vehicles.

My primary areas of expertise and focus are industrial hygiene, hazard awareness and correction, ergonomics, infection control, and overall jobsite safety. As was pointed out by Senator Capito, I am from a small town in West Virginia originally, in the eastern Panhandle, although I have lived here for 21 years in D.C. and I am raising my family here.

Being from that small town in West Virginia, that instills in me a deep concern for the well-being of blue-collar workers, especially for their safety and health on the job, at the

workplace. I am very grateful for the opportunity to address this vital issue of heat that affects our Country's workforce and the health and safety of its laborers.

I will start with a little description around the problem, as Senator Carper did a very good job of framing this, so I will try to be brief. Nationwide, we face a sobering reality that far too many workers lose their lives every year due to extreme heat, and many more are suffering from heat-related illnesses and injuries, some chronic. The urgency of this issue cannot be overstated. Extreme heat is on the rise, with record-breaking heat waves affecting millions of Americans every year.

It is an alarming trend: every 1 degree Celsius increase in temperature leads to a 1 percent rise in workplace injuries. One percent doesn't sound like much, but that is a very significant concern when we have over 160 million workers in this Country. That is a lot of people affected by heat.

Just last month, as the Chairman pointed out, we witnessed Hawaii grappling with heat, devastating wildfires, Louisiana declaring a heat emergency and tropical storms reaching unprecedented locations such as California, Texas, and Puerto Rico. It is evident that extreme weather and heat are becoming an unfortunate and enduring reality.

Despite the alarming images of hurricanes, tornadoes and floods, it is essential to note that extreme heat claims more

lives than any other weather-related phenomenon. The symptoms of heat stress can strike suddenly, often unnoticed, and it is too late to intervene. Prevention is the strongest defense.

Prolonged exposure to elevated temperatures strains the heart, the lungs, the kidneys, and may lead to chronic health conditions. I just read recently in my research it is also being tied to respiratory problems, that go along with the environmental problems that the wildfire causes, with the heat.

Survivors of severe heat-related illnesses bear long-term health burdens including muscle and organ damage, chronic kidney disease, and exacerbation of preexisting conditions, such as diabetes and cardiac disease.

Now let's talk a little bit about the cost. The economic impact of extreme heat is profound. Employers failing to implement basic heat safety measures cost our economy hundreds of billions of dollars every year. That is both in direct and indirect costs. These cost encompass absenteeism, reduce productivity, worker turnover, overtime costs, and creates workers' compensation premiums, liability expenses, and equipment damage due to a rise in workplace incidents.

Some may argue that providing additional rest breaks increases payroll expenses for employers. However, safer working conditions means fewer injuries and illnesses, resulting in lower health care costs, reduced workers' compensation

claims, and less lost time from work. The old adage of "an ounce of prevention is worth a pound of cure" rings true to me when I think of these numbers. Investing in heat-related illness prevention outweighs the cost of neglecting it. Increased breaks not only protect workers from heat stress but also enhances productivity, saving employers money in the long run.

The notion of a conflict between worker safety and business profitability is a false dichotomy. Ensuring that heat hazard safety measures are in place in the workplace is in everyone's best interest.

Who faces the burden when you think about heat and a lot of these weather-related incidents? I think of the workers out there, especially blue-collar workers. Some of the most affected workers include those in construction, landscaping, and roadwork, members of LIUNA. It is imperative that we improve the tracking of injuries of heat-related illness and the impact on our workforce.

Tragically, low-income workers and workers of color bear the brunt of these consequences in construction alone. African American workers experience heat-related deaths at a rate 51 percent higher than average and a death rate for Mexican born workers is a staggering 91 percent higher.

Workers' physical and mental capacities decline

significantly as heat and humidity rise. Research reveals that worker productivity drops 3 percent for every degree Celsius when it is above 75 degrees Fahrenheit. In the end, it is not about the temperature scales, it is about protecting workers.

Now I want to talk about some solutions. We possess the knowledge, the science and background to mitigate heat-related illness in this Country. While many employers adopt these strategies, regrettably, not all do. Embracing the mantra of water, rest, shade is a strong place to start.

These measures, which are well-documented and easy to implement, reduce the risk of heat-related incidents. Workers require access to cool drinking water and adequate cool-down breaks in shaded, air-conditioned areas. If you want to ask what temperature, 80 degrees and below in these areas of breaks.

Moreover, the implementation of work acclimatization protocols such as a comprehensive written program, training for supervisors and front-line workers, emergency response procedures, and diligent recordkeeping are all vital components of a comprehensive heat-related illness prevention program.

The right to a safe workplace is a fundamental human right. Exposure to excessive heat is one of the most pressing hazards facing workers today. Tens of thousands of workers suffer from heat illness, injuries and fatalities yearly in the United States. Employers bear the responsibility to protect those

workers. The people who build this Nation, provide our food, and delver essential goods deserve every safeguard available.

In conclusion, it is past time to protect workers from heat-related illness, injury and death. We must act decisively. The burden of occupational health-related illness on our economy is substantial and growing. Neglecting these hazards of excessive heat for workers carries significant financial consequences for employers.

Thank you for your attention and commitment to addressing this pressing issue. I am open to any questions and discussion you may have on this critical matter.

[The prepared statement of Mr. Parsons follows:]

Senator Carper. Mr. Parsons, thanks very much for that testimony.

Before we introduce Dr. Flannery, my maternal grandma and her husband, my grandfather, lived right outside of Beckley, in a little town called Beaver, also known as Daniels, right by Shady Springs High School. I remember when we were little kids, we would go back and visit in the summer. One of my grandmother's favorite sayings was, an ounce of prevention is worth a pound of cure. As little kids, we were just wondering what she was talking about. But it has finally become clear to me, the wisdom of my grandmother and her husband as well.

I just had to give her a shout-out for introducing me to that phrase a long, long time ago. A lot of wisdom there.

All right, Dr. Flannery, you are on. Your daughter is here watching over your shoulder. So do your best.

STATEMENT OF AIMEE FLANNERY, PH.D., PE, GLOBAL PRINCIPAL, TRANSPORTATION RISK AND RESILIENCE, JACOBS

Ms. Flannery. Good morning, Chair Carper, and Ranking Member Capito, and members of the Senate Committee on Environment and Public Works. My name is Aimee Flannery, I am the Global Principal of Transportation Risk and Resilience for Jacobs Solutions.

I want to thank you for the opportunity to testify today as you examine the effects of extreme heat and weather on transportation systems, and how the private industry are helping our community partners. I would also like to thank the American Council of Engineering Companies for their leadership in making my testimony possible.

As mentioned, my career to date has provided me the opportunity to serve as an educator of tomorrow's civil engineers at George Mason University where I was a tenured member of the faculty. I have also worked for a small woman-owned business, have been a business owner myself, and have had the privilege of working at U.S. Department of Transportation Office of Research in the Office of the Secretary prior to joining Jacobs.

As America's largest engineering firm, Jacobs is investing in people and technology to address resilience challenges alongside communities across the Nation. My experience

incorporate climate resilience began a decade ago this week while working for the Colorado Department of Transportation. In September of 2013, a stalled cold front clashed with a warm, monsoonal air mass from the south and dropped 20 inches of rain on northern Colorado. The extensive rainfall and duration resulted in flow surges, damaging and destroying major sections of roadway, along with access bridges and retaining walls. Many residents were cut off with no access out of the Big Thompson River Canyon.

The operational response involved over 19,000 evacuations and 2,000 air rescues. The event resulted in nine deaths and caused nearly $4 billion in damages to public and private infrastructure, including damages to 50 major bridges and 485 miles of roadway.

Changes to the FHWA Emergency Relief Program in May of 2013, just prior to the September floods, allowed the Colorado Department of Transportation to pursue more resilient designs to address major damage to some of their facilities. One specific area known as Horseshoe Curve on the U.S. 34 corridor was destroyed by flooding in 2013, and had been previously destroyed by flash flooding in 1976. These changes to the emergency relief program allowed for a final design that provides for a more resilient corridor, with access for first responders during emergency events. It is anticipated to minimize damage from

similar future events.

In 2013, addressing extreme weather events and climate stressors were just emerging as a new area of concern within the highway industry. Today, nearly two years since the passage of IIJA, the transportation industry has for the first time dedicated funding to address resilience from natural hazards.

The PROTECT program alone provides over $8 billion in formula and grant funding opportunities for proactive management of system vulnerabilities. State agencies and their partners have been working diligently to develop resilience improvement plans and prioritize lists of projects for their highway systems.

We at Jacobs are pleased to be working with several States represented here on the committee, including Delaware, West Virginia, and Maryland, on their resilience improvement plans.

A few challenges that I have heard from professionals that I work with include the need to increase training for their staff to understand awareness of resilience strategies, to better understand economic assessment methodologies for resilient design alternatives, to better understand best practices for incorporating resilience into design, and to better understand Federal aid requirements of new programs.

Incorporating climate resilience into our standard practice has yet to be fully integrated, but change is happening. To

that end, the future transportation reauthorization efforts from this committee to spur the incorporation of resilience into practice could include supporting the industry to better understand risk tolerance and what is an acceptable level of resilience for the range of facilities that our industry maintains. These criteria may support potential changes to design standards and material specifications to address climate resilience in the future.

As a former educator, the need to integrate infrastructure resilience into our undergraduate and graduate degree programs is also necessary to ensure that the next generation of transportation engineers and planners are well-versed in these concepts.

I thank you for your time, and I look forward to your questions.

[The prepared statement of Ms. Flannery follows:]

Senator Carper. Thank you for your testimony.

I will start off, then yield to Senator Capito. I think it was a 2021 study that found that taking a proactive approach to adapting U.S. roads and roadways to climate change could save the economy up to $470 billion annually by the year 2100. As I have said more than a few times in this room, climate change is an issue we can no longer afford to ignore. I think most people have bought into that.

That means investing in our transportation infrastructure and making upgrades to protect against extreme heat and weather before infrastructure is damaged, rather than just continuing to make the same repairs over and over again.

I will start off with a question for Dr. Hondula. Would you please describe for us how Phoenix is taking a proactive rather than a reactive approach to extreme heat?

Mr. Hondula. Thank you for the question, Chairman Carper. I think it is critical to be proactive in our efforts to prepare and that preparation really shows up at the minutiae of operating local government in the procurement processes, in our negotiations, in our engagement with industry, thinking about how products work, what the product design specifications are.

Just to give you one example from Phoenix, in our city we are concerned about the impact of heat on the electronic systems in the field that operate our traffic systems and streetlights.

That might include diminished lifetimes from LED bulbs. Our traffic signal controller cabinets have fans in them that provide some cooling. When we are shopping for products on the market, building procurement processes, we need to be sure that heat is a factor in that process.

Senator Carper. As a follow-up, are there any key lessons learned for other cities about the benefits and challenges to proactive adaptation?

Mr. Hondula. Chairman Carper, thank you, it is an excellent question. Unfortunately, I think we are still very much in the early stages of learning what it means to build heat-resilient communities. Phoenix, as I noted, is at the forefront of deploying Cool Pavement technology. We are learning as we go, as we deployed 100 miles where it is most --

Senator Carper. A hundred miles out of how many miles?

Mr. Hondula. Many thousands. So just a small fraction.

Senator Carper. So it is a start.

Mr. Hondula. It absolutely is a start.

Learning which products bond correctly to the road material, what any tradeoffs might be in terms of pedestrian thermal comfort or safety. I think all of our communities across the Country are still learning how to become more heat resilient.

I think an important role the Federal Government is

beginning to play and can continue to play is convening cities together to share what we are learning and ensure we are applying best practices as quickly as possible. As you noted, there is a strong sense of urgency to ensure we are ahead of the game here.

Senator Carper. All right. Good, thank you.

Mr. Parsons, as you described in your own testimony just a few minutes ago, transportation worker productivity decreases significantly as heat levels increase. Transportation agencies, transportation contractors and labor organizations all have a stake in finding solutions to ensure the construction workforce can continue to safely and efficiently do their jobs building and maintaining our Nation's roads, our highways, and our bridges.

Would you please elaborate on what your union is doing to work collaboratively with the private sector, with government agencies and other stakeholders, to respond to the effects of extreme heat on construction workers?

Mr. Parsons. Yes, thank you for that question, Mr. Chairman. Yes, we work collectively, we are a labor management cooperation fund, so we work with our signatory contractors for worker training, we visit job sites, help contractors write programs, especially small and medium size contractors. That is one way we help, is by assisting our signatory employers.

We also work on a Federal level nationwide on worker advocacies for better protections for workers with every agency that plays in the worker safety and health space. Whatever agency affects workers, whether it is Federal Highway, Federal OSHA, EPA, we work hand in hand with them to increase protection for workers on our jobs.

Senator Carper. Thank you. A question now for, it could be for Dr. Hondula or Dr. Flannery. Dr. Flannery, why don't you take the first shot at it.

I am proud that our committee has played a leading role in the enactment of the Bipartisan Infrastructure Law and the Inflation Reduction Act, both of which include new authorities to help make our transportation system more resilient to extreme heat and extreme weather.

Would you, Dr. Flannery, please take a moment to discuss how programs like the Bipartisan Infrastructure Law and the Healthy Streets Program and so forth, the RAISE grant program, describe how these programs and others will help States, will help transportation agencies and local government take more proactive action to make their transportation infrastructure more resilient to hazards like extreme heat and flooding?

Ms. Flannery. The one thing that the PROTECT program does provide is for the first time dedicated funding to address things like extreme heat and extreme weather events. For years

we have known as an industry that we have needed to address these things. But we have a very vague system that is aging, so there is lots of need and potentially not a lot of dedicated funding.

So the PROTECT program does provide for the first time dedicated funding, and has spurred within the agencies a need to begin to address resilience, understanding where the vulnerabilities are, and beginning to address those with prioritized lists of projects.

Senator Carper. I am going to yield now to Senator Capito and Senator Mullin as well. I think we have one of our Senators from the Commonwealth of Pennsylvania who is on his way here. We look forward to his arrival and others as well.

When we come back, Dr. Hondula, I am going to ask the same question Dr. Flannery has answered, I am going to turn to you and ask that question. For now, Senator Capito.

Senator Capito. Thank you, Mr. Chairman.

Dr. Flannery, I mentioned in my opening statement how important I think to not have a one-size-fits-all regulatory environment coming down from Federal Highways. You mentioned in your opening statement that a variety of States, one of which is my home State, that you have seen action on. How important is it to reject that one-size-fits-all and give the flexibility that each State -- obviously, West Virginia's needs are not the

same as Arizona, as he tells the story. How important is that?

Ms. Flannery. Sure, happy to answer. One of the challenges with a one-size-fits-all is it limits our understanding of the range of threats that do affect highway assets. For example, we talked about things that happened in Colorado with extreme rainfall and monsoonal air masses. Those aren't quite the same threats that would affect the State of Florida, for example, where you have a lot of hurricanes and sea level rise.

So understanding the range of threats that affect assets is really important, and they vary greatly across the Country. But also understanding the maturity of data systems within agencies. Some agencies are a little bit further ahead of the curve, some are a little bit behind. So having sort of a very rigid program might be challenging for those who aren't quite ready to jump into the boat fully to embrace the programs. Flexibility is very important.

Senator Capito. As you are seeing now, the PROTECT program is rolling out. Are you finding that the flexibility is in that program?

Ms. Flannery. Yes, I think so.

Senator Capito. Good. Let me ask this question. You just mentioned this, that State DOTs are tackling this in different ways and at different rates of speed. How could they focus on

to get their efforts to move forward more quickly, and how can the Federal Highways Administration help them with that?

Ms. Flannery. The one thing we do benefit from as an industry is Federal Highways and the Transportation Research Board and AASHTO have been aware of this challenge that we have to our system and have been developing guidance and research over the past several years on the topic. Now we are into the dedicated funding sources to actual implementation. We are seeing the hiring of new staff, we are seeing the expanded duties of staff to begin to address resilience. I think that is helping tremendously for States to begin to accelerate implementation.

So they are looking for opportunities, in particular, in West Virginia for example we are looking at opportunities throughout the life cycle of projects and throughout the agency to actually engage staff with these resilience concepts. So whether it be maintenance and operations all the way through to design, there is an opportunity to engage and to include resilience in the decision making.

Senator Capito. Thank you. Dr. Hondula, let me ask you, I was interested to hear about the Cool Pavement. You described that in your opening statement. Just curious, how do you think they are going to be reapplied? It is a new concept, I guess, are you just it experimentally, or are you planning to expand

that?

Mr. Hondula. Thanks, Senator Capito. As I noted, we have been very proud of our work to evaluate the Cool Pavement program with university researchers. But as you note, we still are in the early stages. Our street transportation department would say that we have moved beyond the pilot stage, we have seen sufficient success in terms of how the material is bonding to the road surface, how residents are perceiving, how it is performing in real world conditions, which we can't learn from a laboratory.

So we have upgraded it into a full-scale program. But we are continuing to learn about how well it will perform over time. One concern, for example, is that the reflectivity will degrade as cars drive on the surface, as it weathers.

Senator Capito. You mean it wears down?

Mr. Hondula. It will become less reflective as it become dirty. The same as if we put a piece of paper on the road it would become dirty as well.

So we need to understand how the long-term performance evolves, what the right scale of investment is, at what pace, and see if we are achieving those cost savings that are possible with the reduced thermal wear and tear of the asphalt.

Senator Capito. Keep us up on that. That is very interesting.

Mr. Parsons, you did a good job describing the challenges of the heat on our workers. I think we want to make sure we have as many laborers working as possible in safe and healthy conditions. One of the ways we can do that, I think, is to get permitting reform, which I mentioned in my opening statement. I know you all as an organization have been supportive of permitting reform. I didn't know if you wanted to make a statement on that in terms of how it impacts the number of workers and how many workers are actually engaged since we have these permit delays. Is this an area of concern for you?

Mr. Parsons. Yes, thank you for the question, Senator Capito.

Absolutely, permitting, while important, should never get in the way of progress. We are all about workers going to work safely, and also workers going to work as soon as they can, shovels on the ground, ##@@## on the road. So we never want to see permitting get in the way of progress or active work.

As a matter of fact, I have actually seen permitting get in the way of some safety interventions on roadways. I will give you a prime example. Everybody knows what a Jersey barrier is, a concrete barrier on the road that protects workers from the traveling public. That will be specced in, it will be paid for, even in a low-bid environment in the Federal highway system. Then permitting will come through and take it out, and there are

workers out there exposed to hazards because of that permitting.

Senator Capito. Wow.

Mr. Parsons. So absolutely, anything we can do to streamline permitting, although sometimes important, especially for safety, as long as it is safe out there and we can streamline it and not hold things up, absolutely, I agree with you.

Senator Capito. Thank you.

Senator Carper. Thanks, Senator.

We have been joined by Senator Fetterman, our neighbor to the north of Delaware. Delaware and Pennsylvania used to be the same State, and we gave them their independence about 200 years ago. They seem to have done pretty well since then, too well when it comes to playing football.

Senator Fetterman, you are recognized. Welcome aboard.

Senator Fetterman. Mr. Chairman, thank you.

I am deeply concerned for the welfare of our transportation workforce in Pennsylvania, of course. Mr. Parsons, these workers are forced to work in an extreme heat without Federal safety standards. What lessons can we take from the States that have set heat standards, or those that have eliminated worker protections?

Mr. Parsons. Thank you for that question, Senator. What I will say to that is, we need codified heat protections across

the Country. There is only, in this whole Country, I think there are 44 States that do not have a Federal OSHA rule. There are six States that have somewhat of a version of it, and there are three that have a permanent rule.

So without mentioning all those States and messing that up, California kind of set the way a long time ago, and Oregon and Washington State jumped aboard last year after the extreme weather and heat-related conditions.

We like those rules in place. We like them codified, best practices. In the construction world, unfortunately, there is a lot of good actors out there that do the right thing, fortunately, but unfortunately sometimes smaller contractors either don't have the means or the way to implement programs unless they absolutely have to.

So we have to set the standard straight across the board, have codified rules for everyone, and have minimum criteria to base our worker protections on.

Senator Fetterman. Thank you. Of course, extreme weather events, particularly flooding for our transportation infrastructure in Pennsylvania is really wreaking havoc. Dr. Flannery, can you walk us through why it is so important that States and agencies have a consistent source of Federal emergency relief funding that they know will be there into the future?

Ms. Flannery. Thank you, Senator. One of the things that agencies need in terms of the emergency relief program and some of the changes I mentioned earlier in my opening have allowed for the use of resilient designs post-disaster. We have seen changes within the ER program that have been very beneficial. I think States are doing the best that they can with the limited dollars they have to address the needs of their systems, of their asset management programs. Sometimes they just don't have the ability to get to those needs before these major events occur.

So continual funding of the FHWA Emergency Relief Program is essential to maintain system operations.

Senator Fetterman. Thank you very much.

Mr. Chairman, I cede my remaining time. Thank you.

Senator Capito. [Presiding.] Thank you.

Senator Mullin?

Senator Mullin. Thank you, and thank you everybody for being here.

Dr. Flannery, first of all, thank you for being here. I sure appreciate your expertise on this. In your testimony, you mentioned the importance of State DOTs maintaining flexibility to accomplish greater returns on infrastructure investments that cater to unique transportation needs. As we know, one size doesn't fit all, right? What is good for New York maybe isn't

actually the best idea for States like Oklahoma.

Can you give us a few examples of projects that you have worked on to improve resiliency, and as a result have withstood the extreme weather for specific designs?

Ms. Flannery. Sure. I will tell you a little bit about a project that we did in Colorado. We had a major rockfall, rockslide event that occurred on the I-70 corridor that shut down the corridor for nearly two weeks. One of the things we did, working with Federal Highway Administration and the Colorado Department of Transportation was to look for resilient alternatives, how could we avoid this type of shutdown of a major interstate, east-west corridor in the State of Colorado in the future.

We researched and investigated. There was some new technology in terms of rockfall netting that was available. There were some other things we could do in terms of monitoring and making the public aware if these events occurred in the future, in terms of warning devices.

Working with FHWA and the division office in Colorado, as well as the Colorado Department of Transportation, we worked to ensure that in the future events are hopefully avoided, and if they do occur, that we can clear them quickly and reopen the facility.

Senator Mullin. What year was that rockslide on I-70?

Ms. Flannery. The I-70 in Glenwood Springs area?

Senator Mullin. Yes, what year was that?

Ms. Flannery. That would have been 2016, if I remember correctly.

Senator Mullin. I think you are correct, because I got stuck in that. We got rerouted and had to go way around through the canyon. Then we had to go through a game refuge or a national park. It was an absolute mess. I was pulling a trailer, too, so that even made it worse.

Ms. Flannery. Not fun.

Senator Mullin. I appreciate you getting that fixed for us.

[Laughter.]

Senator Mullin. Streamlining infrastructure projects is obviously, it is a must, it is not a need, it is a must. If we want to integrate infrastructure resiliency into our Nation's transportation sector, to do this there is obviously some imperative for the State DOTs to provide information that is required for them. If I understand it correctly from our State DOT, that information isn't always easy to access. Would you agree with that?

Ms. Flannery. As I mentioned in my opening, I was a professor at George Mason University. One of the things I think our industry desperately needs is the continual training of

staff. For example, I went to school nearly 30 years ago. I was not taught about climate resilience. I did not teach climate resilience when I taught at George Mason University. We have a whole bunch of practitioners that are 10, 20, 30 years out of school who never heard these concepts.

Working with organizations like ASCE, for example, the American Society of Civil Engineers, the Transportation Research Board, FHWA and training outlets is really important. They hear the term; they recognize the need for it. But what does that mean when you put it into practice, I think is still a little bit of a gap. We are working on that, and there is lots of training available. But it is going to take a bit for it to kind of make its way down through the layers of staff and those that can actually impact resilience.

Senator Mullin. Well, this is me being a politician, you don't look like you were in school that long ago. Your daughter is way too young for that. That is me being a good politician.

[Laughter.]

Senator Mullin. Going back to that, is there something that Congress needs to do to maybe enact, is there legislation, is there an understanding we need to put into a bill, is there something we can do to help with that?

Ms. Flannery. I fall back on this term that I use, models, metrics, and methods. I often say to people, if I say to you,

make something more safe, what does that mean? In our world, that means fewer crashes. If I say to you, make something more resilient, you kind of know what I mean, like don't fail and recovery quickly. But what does that mean in terms of design or in terms of operations or in terms of maintenance practices?

So we don't yet have standard methods to sort of address resilience or fold it into design. We don't quite fully understand what resilience investments do in terms of return on investment. So things like fundamental research to understand how assets perform under a range of threats would be really ideal. The development of understanding of risk tolerance and what is the acceptable level of resilience on the range of systems that we operate is also something that I think could be helpful for the industry.

Senator Mullin. Great. Thank you so much.

Senator Carper. [Presiding.] Dr. Flannery, in my last question, I directed a question to Dr. Hondula. I said when it was my turn again, I was going to ask the same question of you.

Both of you mentioned the PROTECT Program that we created in Congress in the Bipartisan Infrastructure Law. I think Dr. Hondula, you also mentioned the Healthy Street Program and the RAISE grant program as well. My question, Dr. Flannery, would you take a moment as well to discuss how these programs and others will help States, transportation agencies, and local

governments take more proactive action to make the transportation infrastructure more resilient to hazards like extreme heat and flooding?

Ms. Flannery. For the past several years, State departments of transportation have been implementing asset management programs and performance management programs. They have begun to look at climate resilience along those lines of how long can assets last, are they deteriorating more quickly, do we need to repair them after extreme events and things like that.

The PROTECT Program, the thing that it does is provide a dedicated stream of funding, so States are now a little bit more comfortable thinking about how I might address resilience from soup to nuts, from planning all the way through design. They see that there is an opening in terms of continual funding, there is an opportunity to make the investments that they have known about, but maybe didn't necessarily have the funding to actually dedicate at the time.

So they are very excited about it. I actually just left a conference of 25 State DOT representatives on the topic of resilience in Wilmington, Delaware.

Senator Carper. When was that? When were you in Wilmington?

Ms. Flannery. Last night, and I am heading back tonight.

Senator Carper. Me too.

[Laughter.]

Ms. Flannery. They are very excited, and the enthusiasm within the industry is very palpable, and very fun to actually be a part of the industry right now.

Senator Carper. That is great, thank you.

Let me turn to Mr. Parsons again. In your testimony you talked about the burden of extreme heat on transportation workers, and the fact that many of the folks that you and others represent come from low-income and in some cases disadvantaged communities. These construction workers are on the front lines of adapting our transportation system to extreme heat events, yet in doing so they are also bearing the burden of extreme heat on their own health and well-being.

What type of health impacts from extreme heat are you seeing on our transportation construction workforce? What are some of the effective strategies for addressing these negative impacts?

Mr. Parsons. Some I mentioned lead to chronic diseases. But the more immediate effect is what is called heat stroke, we have all heard of it, and we have all experienced dehydration. But if a worker gets heat stroke, it is usually too late. Oftentimes, the symptoms aren't there.

So we need to put in place requirements to have something

as simple as water, rest in the shade. What I mean by that is so much water per hour, a place to take a break, mandatory breaks, at least 15 minutes every two hours. That break area should be shaded, and it should also have some kind of cooling mechanism, whether inside or outside. It doesn't do any good if it is not cold air.

So the types of injuries you experience are exacerbation of people who already have existing conditions, like diabetes, it affects your heart, it affects your kidneys because of dehydration. That answers the first part of your question.

You would think it is human rights on the job, but in today's world, we just don't have that for our workers. When it comes to the low-income workers or other workers of color, oftentimes they are placed in the most dangerous jobs, and they don't speak up for themselves. They may or not be documented workers, they may be lower paid.

So they are worried about losing their jobs more than anybody, so they don't speak up for safety on the jobs, another reason why they are more vulnerable.

Senator Carper. Thank you for that.

Dr. Hondula, I want to come back to you for my next question. Based on your experience and your running the first municipal office in the Country, I believe, dedicated to addressing heat, what advice would you have for other cities

that are struggling with extreme heat and are looking for solutions?

Mr. Hondula. Thank you for the question, Chairman Carper.

I think our experience is that it is critical within the structure of local government and arguably other scales to clearly articulate where the leadership is in the organization for heat, which department and which people there are responsible for ensuring heat is a consideration in every relevant policy or program.

There are tens of thousands of large and small cities, large and small towns across the United States, not everyone is going to be positioned or have the right model to have an entire office in local government. I still think it is possible in every city to designate a heat leader in the organization, so when people have questions, whether it is residents or people from within the organization, they know where to go. That has been very helpful for our experience in the City of Phoenix.

Senator Carper. Good. Anybody else, any other panelist want to comment on that? What advice would you have for other cities that are struggling with heat and looking for solutions? Any thoughts? If you don't that is fine, but if you do, you are welcome to respond. No? Okay.

Follow-up question for Dr. Hondula. How can the Federal Government better assist States in their efforts to stand up

these offices? As a recovering governor, I used to be governor of Delaware for eight years. I loved being governor. There are 14 of us here in the Senate who are former governors. We were all part of the National Governors Association in those years, and part of the National Governors Association is a center for best practices that Tommy Thompson and I were active in standing up when he was governor of Wisconsin.

The idea is for States to have a forum, a vehicle, to share ideas that work. So I always hold that out there as a way for States to help one another, including transportation issues.

Dr. Hondula, how can the Federal Government better assist States in their efforts to stand up these offices? Any more thoughts you have, please proceed.

Mr. Hondula. Thank you, Chairman Carper. I would like to echo a sentiment we hear from Dr. Flannery that education is a really important role that the Federal Governmetn can play in supporting resilience efforts at the local scale for heat or other hazards. We have been really proud to work with the National Oceanic and Atmospheric Administration as part of their efforts to coordinate cross-Federal agency engagement on heat through the National Integrated Heat Health Information System.

Phoenix has been proud to be one of four cities participating in a heat and equity pilot program. We are in dialogue on a regular basis with Las Vegas, Charleston, and

Miami, learning about our experiences. We all have a different approach to heat, heat manifests differently in our four different cities, and we have a different governance model as well.

I think agencies like NOAA, like the CDC and others can be very helpful in building heat literacy at the local level, understanding the design vocabulary, the specifications. What is the difference between air temperature and surface temperature, for example? These are critical concepts that our local leaders need to have to ensure that our hazard mitigation plans are thoughtful and comprehensive in addressing heat, and that heat shows up in other planning processes and in the budget processes in a meaningful way to help our residents.

Senator Carper. Good, thank you.

Another question, I don't mean to be picking on you, Mr. Hondula, but we will give Mr. Parsons and Dr. Flannery a few more shots as well. This summer's widespread extreme heat has been really staggering, including a month, as we talked to earlier, of temperatures over 110 degrees in your City of Phoenix. Academic scientists affiliated with world weather attribution found that the maximum heat experienced in July in the western United States would have been virtually impossible, virtually impossible, without human-caused climate change.

A question of you, Dr. Hondula, would you talk with us a

bit about how climate change is affecting the work that you do in Phoenix to address extreme heat?

Mr. Hondula. Thank you, Chairman Carper, for the question. In part, I think it created this job. I think one of the motivating factors for our mayor and city council to create the Country's first local office focused on heat was our observation that temperatures have been rising in the southwest and indeed all across the Country, and that they are expected to continue to rise.

Other motivating factors were the recognition that heat does have serious public health consequences, as my fellow witnesses have provided testimony regarding, and that there is this governance gap for heat. There has been too much ambiguity regarding where in the organization responsibility falls for managing heat.

In the City of Phoenix, we see climate change and extreme heat as closely coupled topics. We hear from our residents all the time that they are concerned about how it has been getting warmer and what that means for the future. We hear stories about going outside, playing in the evenings in bare feet from residents who have been in Phoenix for multiple generations. But they say they don't see the same happening with their children today, and they are concerned about what the future looks like.

So I think the projections of a warmer future are motivating our work very strongly every day. I would argue that the work is already important. Even if projections were for a cooler future, we still are not doing a good enough job meeting the heat challenge today. But the fact that the projections are for a warmer future adds more motivation and a sense of urgency to our work.

Senator Carper. Thank you.

Dr. Flannery, another question of you. What more should the Federal Government do to help States prioritize the resiliency of our transportation infrastructure?

Ms. Flannery. As I mentioned earlier, we still have a need for some fundamental research. What I mean by that is understanding asset performance under a range of threats and a range of magnitude. For example, how might a culvert perform under a rainfall event of some particular magnitude versus another.

Also taking into consideration the age of the asset. As we know, our infrastructure can be upwards of decades years old. Understanding how they may deteriorate or fail under different conditions is something that we still have a lot of need to better understand.

Also listening to some of the testimony about heat, some of the emerging research, understanding the deterioration of

pavements under these increases in temperature is something that we still have yet to incorporate into our pavement management programs. It could be something, again, fundamental research that places like Turner Fairbank and some of our university transportation centers would be very valuable.

Senator Carper. All right, good. I am going to be talking about football here. I don't want to mention baseball, but they have a term in baseball that is called, when a pitcher is holding a ball, releases the ball, there is a certain way of throwing a pitch. The pitcher can telegraph the pitch. I am going to telegraph a pitch. I have a couple of questions to ask of you. I am going to give you the chance of, maybe a question you were not asked, which you would like to have been asked. Just tell us what that question would be, and answer it. That is how we will wrap up right at the end.

We have a lot of competition going on with hearings in the Senate today. There is a large forum going on in the building next door, right here in the Capitol, on AI, a major forum on AI. So we were maybe hoping that a couple other colleagues could join us, but there is a lot going on. That does not diminish at all the importance of this hearing, so we are deeply grateful for your participation.

Dr. Hondula, your written testimony mentions the effect of electric vehicles on reducing heat intensity. I am told that

something like 30 percent of the greenhouse gas emissions that we are creating in this Country comes from the cars, trucks, and vans that we drive. Maybe another 25 percent comes from power plants that produce the electricity that we use, and maybe another 20 percent comes from the manufacturing operations of asphalt, steel mills and stuff like that.

Would you talk with us a little bit about the effect of electric vehicles on reducing heat intensity, please?

Mr. Hondula. Thank you, Chairman Carper. Phoenix is very proud to be leading national efforts toward vehicle electrification. In fact, the term Electric Valley circulates in our local conversation in Phoenix because of the progress we have made.

Separate from the greenhouse gas emissions that you noted, Chairman Carper, vehicles are also a very important part of the urban heat story, because they directly emit waste heat into the environment. We have all had that experience of standing next to a car and feeling the heat radiating off of it. It is estimated that vehicles add up to 40 percent of all heat added to the urban environment from energy consumption. Other sources might include air conditioners, for example.

So vehicles are a really important part of the story of why our cities are hotter than their surrounding areas. If we can have vehicles that emit less waste heat, which electric vehicles

would, we could potentially be achieving cooler cities in the future.

We are certainly trying to make an effort to lead by examples as a local government, converting our city's vehicle fleet to alternative fuel sources. We are making good progress doing so with our light duty vehicles, and we are in the early stages of transitioning heavy duty vehicles, including the bus fleet. When we talk about resilience to extreme heat, having electric and other alternative fuel sourced heavy duty vehicles that work well in the heat is still an area where we are looking for more market innovation.

Our bus fleet transition plan includes plug-in battery electric buses and hydrogen fuel cell electric buses. We are pursuing a complete transition to 100 percent zero emission buses by 2040. We have been using Federal funding to help with this transition, including more than $16 million in FTA low- and no-emission grant funding as part of the BIL. We are also appreciative of the new Charging and Fueling Infrastructure Grant program created in the BIL that will continue to expand the deployment of EV charging and other types of alternative fuel stations.

The transition to alternative fuels can be a transition toward vehicles emitting less heat into our already hot cities. Thank you, Chairman.

Senator Carper. Thank you. Maybe one more for you, then we will get each of you to ask your own questions.

Dr. Hondula, what has been the biggest challenge you face in trying to reduce shade deserts across the City of Phoenix?

Mr. Hondula. Thank you, Chairman Carper. Eliminating and reducing these shade deserts is certainly a priority for our office. Of course, one of the challenges is simply the availability of resources to do so. Eliminating a shade desert requires more than just handing a tree to a person and hope that it will survive. We need to be very comprehensive in thinking about the complete basket of strategies and solutions that can allow for more shade.

We are certainly appreciative of additional resources. The new Urban and Community Forestry Program we hope will help us get there. We have a couple of large proposals in there.

But I think the biggest challenge that we experience, and other cities would experience, is that there are locked-in legacy effects of previous infrastructure design that constrain how and where we can move forward. There are only so many places in the city that are easy to modify right now to add more shade. But the places where we really need shade require more significant overhaul of the streetscape, of our infrastructure systems. And of course, that becomes more expensive.

We need to break those patterns that we have been locked

into and be strategic and thoughtful how we do so. We know that we will be needing the Federal Government's assistance to get there in all of our underserved communities.

Senator Carper. All right. Either of the other witnesses want to comment on that question? All right.

Before we close, this is a chance for you to ask maybe a question you wish you had been asked but were not, then respond to that question. Dr. Flannery, would you lead this off?

Ms. Flannery. Sure. One of the things I think that as an industry we are still struggling to understand is the rightsizing of assets. What I mean by that is, does it make sense to build your way out of some areas. In some ways, there may be areas in your system that might not make sense to re-invest in. It may make more sense to move the facility or abandon the facility.

I think there is still a lot of research to be done in that area, and a lot of support to State agencies as they struggle to some of these areas that are challenging within their system that experience repeat damage. Understanding risk tolerance is also something that we as an industry could use help with.

Those are things that I think FHWA and AASHTO, the Transportation Research Board, could help with.

Senator Carper. Thanks very much.

Mr. Parsons, please. A question, if we were sitting in

different seats, I was out there and you were asking a question, what question would you have asked?

Mr. Parsons. Maybe two quick ones. I would address something that has already been mentioned but maybe expand on it. One of them is from my esteemed fellow witnesses here. I wrote a couple notes down for myself.

We really need to work on interagency cooperation between all of our Federal programs, Federal Highway, EPA, OSHA. A lot of times there is a punting back and forth on whose jurisdiction is what. We really need to work on better cooperation between those agencies for worker protection. So I think you brought up interagency cooperation.

Along those same lines, another thing I wrote down was understanding of Federal aid programs, especially in the era of IIJA, BIL, whatever you want to call it nowadays. We have an opportunity right now as a Country to improve our roads, to improve our resiliency and to improve our worker protections like no other. There is a lot of money out there. We need to educate people on how to use that money, how to access that money, and how to level the playing field for employers alike.

Then the one last thing I would like to say, this whole one-size-fits-all, I agree, one sizes does not fit all across the Country especially when it pertains to heat. When it comes to heat, you are talking about relative humidities that are

different, different temperatures, wind, personal protective equipment, type of work you do. But you need to have a fundamental ground that you start with when it comes to worker protection, such as water, rest, shade.

So while it is not one-size-fits all, we have to do exposure assessments on our jobs, it is actually a requirement for the employer to do that across the Country. They have to do exposure assessments for every hazard, including heat. So it is not one-size-fits-all, it is an exposure assessment with fundamental core values and protocols to start with.

Senator Carper. All right, thank you for that.

Dr. Hondula?

Mr. Hondula. Thank you, Chairman Carper. Perhaps two questions that might have been asked, or that I would be interested to ask somebody sitting in this seat. In the Phoenix area there has been some mixed messaging in the media coverage of the Cool Pavement Program, including a headline that Cool Pavement makes people hotter.

So a question might be, why are these conflicting messages in the media about the Cool Pavement Program? If I may take a moment just to explain the state of our understanding thus far about Cool Pavement.

Senator Carper. Yes, please do.

Mr. Hondula. The reason that cities are pursuing or might

consider pursuing Cool Pavement is that pavement is hot, and if we can make a hot surface less hot, that should produce a benefit in terms of cooling the city.

But like every heat mitigation strategy, there is the potential for unintended consequences. If we plant a tree, for example, in the wrong place, it could disrupt above or below ground utilities, which could have unintended disruption or service.

With respect to Cool Pavement, what our experience in Phoenix has been is that because we are reflecting more solar energy away from the surface, a person who is standing directly above it, on the road surface when the sun is out, might experience more heat stress than over traditional coating. The sunlight has to go somewhere, and if it is reflected into the human body, that could be adverse for the person standing on that street.

This does not mean we shouldn't deploy Cool Pavement, but it means we need to be very strategic in where we are putting Cool Pavement, avoiding places like playgrounds or plazas where pedestrians tend to congregate. In our cities, there are thousands and thousands of miles of pavement where people are not congregating. Those are the places that make the most sense for more reflective surface, rather than these settings of congregation.

That is how we have had this mixed messaging emerge in our media coverage of Cool Pavement in Phoenix. That was one question.

And if I may entertain a second, Chairman Carper.

Senator Carper. Yes, you may.

Mr. Hondula. I think it could be argued that our cities and Federal Government are behind where we would like to be in managing heat. The question might be, why is that the case. I don't think we have adequately framed heat as a hazard like others. As you and my fellow colleagues here have noted, heat is a very consequential hazard for Americans in terms of the public health impacts, accounting by most metrics for more deaths every year than most other hazards combined.

Yet when we look at lists in notices of funding opportunities, here are the hazards and disasters you can apply for money for, heat does not always appear on that list. In fact, heat is not yet included in the Stafford Act that shapes how FEMA can issue its response and hazard mitigation money to communities.

I don't think it is just a matter of getting the word heat in the acts. We need to think about the mechanisms, the evaluation, the processes that will provide the right resources to communities. But it would be a terrific first start if we could see extreme heat start to appear on lists along with all

the other hazards that are so consequential for Americans. We know that heat is consequential as well.

Senator Carper. Good. I saw a couple of our witnesses nodding their head as you spoke. Do any of you want to add anything to what Dr. Hondula just said?

Ms. Flannery. I was just going to say, this is something that we definitely need to study further in highway infrastructure, understanding material performance, understanding asset performance under those stressors of extreme heat. It is an area that we haven't researched very extensively to date, and certainly something that we need to invest in.

Senator Carper. Thank you. Mr. Parsons?

Mr. Parsons. I will just say I concur with that last statement, that we need more funding, available funding for heat as a hazard, for all of the above, for occupational and public health resiliency. And I forgot to mention that I loved your "heat leader." In the construction world, we call that a competent person on a job site. But it is a heat leader, I wrote that down from your statements. Thank you.

Senator Carper. Good. Thank you all.

Before I do a little bit of housekeeping, let me just say, I have had the privilege of representing Delaware, which is about 90 minutes away by train from Wilmington to Washington. It is not all that hard, the trains start early in the morning

and run into the night. I have been able to represent Delaware and serve Delaware and live in Delaware and work here and go back and forth.

Usually when I am driving to the train station in the morning, I have an electric vehicle, it is really great, a lot of fun to drive. It also has a great music system. It is one of those deals where you can play radio stations or whatever, you can also make requests. I asked my music system to play an appropriate song for today's hearing, we kicked off the hearing this morning that Senator Capito may well be in a forum later today with Lady Gaga, who is quite a star in her own right.

I asked the music system on my car to play a song called "The Heat is On," by Glenn Frye, who was one of the original Eagles. The heat is on, it has been on for a while, and it is likely to be on for a long while. The question is, what do we do about it? What do we do about it?

As it turns out, here in the Congress, with the support of the Administration, we have done a lot about it. I announced a couple of months ago that I am not going to run for re-election next year. But I remind my colleagues and the constituents at home that I will continue to serve in the Senate until high noon on January 3rd, 2025. So I am going to be running through the tape on a lot of things that I still want to get done. One of those is to fully implement the appropriations in the Bipartisan

Infrastructure Law, not just those that deal with roads, highways, bridges, ports, and rail and so forth, but also climate provisions. I want to make sure that we have fully implemented provisions in the Inflation Reduction Act that pertain to climate change.

I mentioned earlier that if we can address climate change, including heat, in our State and all the States across the Country, including Arizona, we can do it in a way that can create a lot of jobs, a lot of economic opportunity. If we are smart, we will do both.

I am not that smart, but I have really smart people around me, and a lot of smart people who serve on this committee. Our staffs, both on the majority and minority side, have looked across the Country to find witnesses that are well suited to address this issue of heat, and they have come up with all of you, each of you. We are grateful that you have joined us. Thank you for the work that you do, thank you for imparting your wisdom and your thoughts to us today.

Before we adjourn, a little bit of housekeeping. Senator Kelly has been trying to get here, he is in another hearing, and I think Senator Markey is in another hearing, and there is this big forum that is going on in AI, artificial intelligence, that a lot of people are participating in this morning. But that does not mean there is not strong interest in continuing to

address the heat and the things that are causing the heat.

Before we adjourn, a little bit of housekeeping. Senators may submit questions for the record until the close of business on Wednesday, September 27th. We will compile those questions, send them to each of you, our witnesses, and we will ask you to reply to us by Wednesday, October the 11th.

I am going to look over my shoulder and see from majority staff, minority staff, if there is anything else we are forgetting.

All right. In our business, at this point in time, we say it is a wrap. We are grateful for the work you do, and for your sharing your wisdom with all of us today.

With that, this hearing is adjourned. Thanks so much.

[Whereupon, at 11:29 a.m., the hearing was adjourned.]