Cool Fixes for Hot Cities Part 2: Los Angeles

Webcast Transcript

September 12, 2018

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Operator: Good afternoon. My name is Francis and I will be your conference operator for today. At this time, I would like to welcome everyone to the Cool Fixes for Hot Cities Part 2 – Los Angeles. All lines have been placed on mute to prevent any background noise.

If you should need assistance during the call, kindly press star, then zero and an operator will come back on the line to assist you. Thank you.

I would like to turn over the call to Victoria Ludwig from U.S. Environmental Protection Agency. Please begin your conference.

Slide 3. Webcast Agenda

Victoria Ludwig: Thank you, Francis. Good afternoon, everyone. I'm Victoria Ludwig. I'm the program manager for EPA's heat island reduction program. Thank you for being here today.

Today, we have a great lineup of speakers focusing on the work – the exciting work that Los Angeles is doing on cool pavements, trees and cool roofs. And first, I'll just let you know we have an overview of cool pavements before Los Angeles speaks.

Kurt Shickman will talk about all you ever wanted to know about cool pavements, but we're afraid to ask. He is with the Global Cool Cities Alliance. Then, Greg Spotts, with the Los Angeles Bureau of Street Services will talk about their very exciting White Streets Project. And then, Craig Tranby from Los Angeles Department of Water and Power will explain what they are doing to promote cool roofs and increase the tree canopy.

We will have a question and answer session at the end and we will explain more about the logistics of that.

Now, I'm going to turn it over my colleague Alexis St. Juliana, who will explain some of the practicalities of today's session.

Slide 4. Webcasts now use Adobe Connect

Alexis St. Juliana: Thank you, Victoria. And thank you, everyone, for joining today. Some of you that have attended past heat island webcasts may know that we have switched to a new platform for our – for our webcast. This is called Adobe Connect and we hope that everyone is able to join easily today.

If you are having trouble connecting, we have a couple of tips that usually resolve those connect issues. The first is to try a different web browser. If you are using Internet Explorer, you might try using a Firefox or a Chrome. You may also need to download the latest version of the Adobe

Flash Player or the Adobe Connect plug-in.

If you continue to have problems, we suggest you reach out to your information technology department. Adobe Connect also has extensive online help pages.

Slide 5. How to Participate

Hopefully everyone can hear me and is connected to the audio. There are two options. The first is to listen via your computer. And in order to do that, you just need to unmute your speakers or headphone. You may also call in to the phone line and, if you're called into the phone line and you're getting some audio feedback, you should go ahead and mute your computer speakers to resolve that issue.

Slide 6. How to Participate

Throughout the webcast all the participants are muted and there are a couple of ways for you to participate. The first is to enter questions into the Q&A box that you see on the right-hand side of your screen. Go ahead and type in questions as soon as they come to you and let us know who you would like to answer your question if possible.

We'll do our best to get through all of the questions during the – you know, during the last portion of today. But if we don't, we really do our best to post responses to those unanswered questions on the Heat Islands web site.

Slide 7. How to Participate

The other way to participate is through a series of poll questions that we'll do during the webcast. It should be pretty apparent how to participate in those although, on mobile devices and tablets, you may need to exit full-screen mode and go to the poll icon which looks like a little slip of paper being entered into a ballot box.

And then, the final way to participate today is through a feedback form and we'll post that link at the very end of today. So that's another great way to give us your feedback on today's webcast.

Slide 8. Introduction

Victoria Ludwig: Thanks, Alexis. So let's begin. I'm just going to give a quick overview of who we are at the heat island program and – there we go.

Slide 9. EPA's Heat Island Reduction Program

The heat island program at EPA provides outreach and technical informational materials to help advance and help local governments implement projects and programs to mitigate their heat islands. We work with both local policymakers and program practitioners, such as the folks that are on the call today. We also work with non-profits that are in this space like the Global Cool Cities Alliance, academic researchers, and some of the industries that are represented in the heat island mitigation space. And we work together to just help them implement heat island reduction programs and give them information that they need to do that.

Slide 10. Newly Sprouted Green Roofs Page!

The first thing – I'm going to explain some of our resources, but I wanted to start off with the most exciting new resource that we have, which has just sprouted. We do have an existing green roofs webpage on our web site, but we have recently refreshed it. What we did is we offer – we have some more – some new photos on the different types of green roofs and some detailed information on those types of green roofs.

We have added new graphics to show you the different construction layers of a – of a green roof. We also have information on some new studies on the costs and benefits, as well as a little explanation of the difference between green roofs and cool roofs.

But the most exciting thing that we've also put on this webpage is a case study developed across office effort within EPA called "Estimating the environmental effects of green roofs in Kansas City, Missouri". What we did here is we analyzed and quantified the energy savings, air quality and health benefits of green roofs in Kansas City projecting into the future. And the idea is that there is a replicable framework that we used in this case study that you can use too in your communities to do the same thing and estimate scenarios of the energy savings and economic savings and health savings from installing green roofs in your city. So we're very excited to announce that. Please do check this out.

Slide 11. Heat Island Program Resources

So then to go – the web site is obviously one of our key program resources. Here are a few of the others that we offer. The compendium is a detailed look at the science of heat islands, what causes it, what are the impacts. And then, we have chapters on the things you can do to reduce the heat island effect.

The key mitigation strategies, each has their own chapter. So there is a chapter on cool roofs and a separate chapter on cool pavement. We included some case study examples of what is going on around the country to cool down cities and some overall explanation for local governance on the different policy mechanisms they can implement that are within their control, laws and incentives and things like that.

The web site has also, in addition to the green roofs page and others, there's a calendar of conferences that are coming up. There's a newsroom with links to our newsletter. And the newsletter – I'm kind of jumping around here, but the newsletter is – comes out quarterly. We invite you to sign up if you haven't already.

You can click on the link there to do that. It'll take you to a registration form. You can also just e-mail me and I can sign you up.

The other resource we have which is found on our web site is a database of activities going on at the local and state level. Right now, across the country, what is going on to reduce heat islands? We know there are way more than 75 things going on, so we really would love to hear what you – what you are doing? So please e-mail me and let me know and we can add you to that database.

We do webcasts. This is part two of a series. In August, we had part one, which was focusing on San Antonio's cool roof activities. And this is part two. We also will do more webcasts in the future covering a variety of issues related to heat islands.

At this time, I'll just mention that the proceedings from that first part webcast are on the web site now, the recording and presentations. And the proceedings from this webcast will be available in just a couple of weeks. If you are registered for this event, we will send you an e-mail to let you know that they have been posted.

Slide 12. What is the Heat Island Effect? [recording begins here]

I know most people on this call I think are familiar with the heat island effects, but I just want to quickly remind everyone that the heat island effect is a – kind of a – it's basically a microclimate at the urban level where the temperatures are higher than the outlying rural and even suburban areas. Suburban areas also can be heat islands.

And studies have shown that often is it – typically urban areas can be up to 7.2 degrees Fahrenheit higher in temperature than the rural areas during the day. And the heat island also occurs at night.

This research shows that it can be up to 4.5 degrees higher in the urban area than the outlying areas. This data comes from just 2017, some analysis that the U.S. Global Climate Change Research Program did.

The heat island effect has many causes. Principally though, it is caused by increase in development which involves increasing in permeable materials that compromise a city and reduced vegetation.

Slide 13. Heat Island Impacts

So the idea with mitigating it is so you can reduce some of those negative effects that come which really encompass everything from environmental effects to increased energy use because of air conditioning.

If the energy is being generated from conventional power sources, you will have lower air quality. There are public health risks, both from the air quality, but also from, obviously, heat-related illnesses and deaths, unfortunately.

Water quality is affected. It has increased in temperatures because of strong water run up, that is hot and just quality of life. It's not fun to live in a very hot city.

Slide 14. Contact Information

So – but there are ways to solve this problem and we're going to talk about that today. And – but here is my information. If you would like to contact me, please feel free and use these links to check out our newsletter in our web site.

Poll Question 1

Slide 15. Poll 1

I want to get in to our experts. So, but real quickly just want to ask a quick question in order to do an accurate count of the number of people that are listening in today. If you could kindly just let us know if there are other people sitting in the same room with you watching the webcast, please just let us know. And we're not going to really publish the results, but it just tells us a lot – it's helpful to us, so thank you very much. We'll give you just a few seconds to do that.

OK. Great. Thanks, everyone. OK.

Overview of Cool Pavements for Heat Island Reduction

Slide 16. Overview of Cool Pavements for Heat Island Reduction

Now, I'd like to introduce our first speaker, Kurt Shickman with the – he is the executive director of the Global Cool Cities Alliance (GCCA), which is a nonprofit focused on helping communities, cities and countries address the challenges of excess urban heat. Kurt co-manages as well the Cool Cities Network which is a group of 25 global cities working to address urban heat challenges in partnership with the C40 organization. The network facilitates peer-to-peer exchanges and serves as a link to the community of experts working in the – in the heat island space.

Prior to joining GCCA, Kurt was the director of research for the Energy Future Coalition and he was the United Nations Foundation's energy and climate – on their climate – energy and climate team.

Kurt is going to give us an overview of all of the various aspects of cool pavements as a set up for the next few speakers. Kurt, welcome and thank you.

Slide 17. Pavement Choices for Cooler Cities

Kurt Shickman: Yes. Thanks very much, Victoria. So, yes, I'm just going to talk a little bit about the options for cooler pavements to help cool our cities today.

Slide 18. Agenda

So I'm going to focus on sort of four main areas.

Just a quick overview GCCA, although I can probably skip that because Victoria did it better than I normally do; then, a quick discussion about the performance and impacts that we've seen both potential and realized for cool pavements; then, some considerations that we see are unique to cool pavements that folks that are looking to implement these types of strategies to consider. And then, finally, I'll do a very brief product roundup of what's out there now.

There's actually a lengthier version of this that's in the slides that were sent around already that go into specific products that are on the market today, their cost, their reflective performance and so on. But I'm going to kind of do a high-level view of that today.

Slide 19. Global Cool Cities Alliance (GCCA)

So here we go. So this is the Global Cool Cities Alliance. I think Victoria did a very nice job summarizing that, so I'll just move on from there.

Slide 20. Pavement makes up 1/3rd of the average city

So why don't we talk about pavement? Why is that important when we're talking about urban heat mitigation? Well, I think the biggest issue is that it's the biggest part of most of our cities.

So if you took an eagle eye view of most cities, about a third of the city would be pavement. And if you break that down even further, it would be about – you know, about half are actually streets; another significant chunk are parking lots; and then, the final sort of 15 or so percent are sidewalks. And so, of the – of the one-third of your city, a good 85 percent to 90 percent of the cities actually, for the most part, asphalt, concrete which tends to be darker in color.

Slide 21. Two options for cooler pavement

So there's two ways that you can cool a pavement and I'll get more into the details of this later. But just, in general, you can either lighten the color of it and, by just so doing, you're reflecting more of the solar energy that contact that pavement rather than having it absorbed as heat. Or you can make the pavement porous or permeable and that essentially makes the pavement act a lot like a vegetative space or a vegetative green infrastructure-type space where it cools through evapotranspiration.

There are pros and cons to each of these so then it's not an either/or necessarily across the whole city. There's going to be benefits to permeable and porous that reflect the pavements can't touch and vice versa. So it is a – kind of a both-ends approach when cities are looking at this.

Slide 22. Reflectivity for common urban surfaces

Here we go. OK. So I'm going to talk a lot about reflectivity and albedo today. I'm going to focus mostly on that and a little less on the permeable side. So rather than just throwing out numbers that are sort of hard to, you know, imagine reality, this is a slide that just kind of gives you a sense of what the sort of common reflectivity values are.

So, for example, if you're – you know, you see a freshly-paved road for the most part, if it's asphalt, it's probably something like 0.05 reflectivity. And what that really means is it's a scale of zero to one. So 0.05 is something like 5 percent of the solar energy that's touching that is being reflected is light and 95 percent is being absorbed and turned into heat. So here you can kind of get a sense of the relative reflectivity values as we go through.

Slide 23. Higher solar reflectance (SR) = lower surface temperatures

And there's a pretty direct linear relationship between the color the surface – of the pavement and the temperature of the surface of the pavement. This is actually taken from a testbed at Lawrence Berkeley National Lab (LBNL) a few – several years ago now. It was 73 degrees in the – and the air temperature was 73 degrees. And you can see as you move from left to right that there is a fairly significant reduction in surface temperature between these three plots that – and these were taken at roughly the same time of the day.

As you look at this in a more – there's a broader study that underlies this and, if you look at that, the relationship is roughly for every 0.1 increase in solar reflectance of the pavement, so in other

words, if you went from a fresh asphalt to a fresh cement concrete, you'd be going up, you know, basically 0.3. So for every 0.1 of those, you're getting about a 7 degree Fahrenheit difference in the surface temperature.

And the other thing I'd just quickly note on this page is, you know, when we're talking about cool roofs, oftentimes we're talking about extremely reflective surfaces and very bright white surfaces to get the benefits. We're not really – that's not the same – it's not the same issue here with pavements.

With pavements, even that – you know, a very high reflective pavement on the far right of the slide is not a super bright color all things considered. So we're not talking about turning our streets blindingly white. We're really talking about a sort of more subtle change in the color.

Slide 24. Cool pavements pilot results (Tokyo)

This is from a study in Tokyo. It was a coded pavement on a busy street in the Ginza district of Tokyo. Just to – just to show this – these results are similar to what we – what I just showed. The only reason I wanted to post this is, you know, they did a fairly non-scientific – I think they were kind of goofing around when they took measurements of the pants – of their – temperature of their pants above the dark color and the light color and actually the light – the light color actually had – their pants were cooler over those.

So was trying to be kind of a funny anecdote from some of these studies that are out there. But the results of these are very similar. You see a very significant drop in surface temperatures during the day and a slight drop between the two over the nighttime and then a real convergence as the night goes on.

Slide 25. Longer pavement life

And that surface temperature reduction actually has some real tangible benefits. So, as you can see, this is a chart looking at a rutting on a pavement that is hot, which is the top one; and a pavement that's warm, which is sort of a cooler pavement. And the x-axis is the number of repetitions over which that was tested. So you could see a fairly significant increase in life when you cool down the temperature of a pavement.

This has some implications for fuel efficiency of vehicles as well, which I won't get into in great detail here. But, in addition to that, just reducing the amount of maintenance that's required on an asphalt pavement is a significant potential savings.

Slide 26. Enhanced visibility and safety

And the surface color also provides some benefits, particularly in a parking context for nighttime illumination. So this is – this is the side by side of the same center before – shopping center before and after a cool coding application. Same amount of lumens and you can see a significant difference in the amount of – in the amount of illumination that you're getting off the same amount of lighting.

So this is a – this could be a huge benefit for safety and for visibility at nighttime or you could go

the other way and say it's opportunity for energy savings.

Slide 27. Energy savings

Because you're brightening the surface, you can get the same amount of illumination with less light fixtures. So you're reducing the energy load and you're also reducing some of the maintenance load that you – which you're talking about, you know, the number of expansions that need to be maintained.

Slide 28. Preserved water quality

And then, sometimes actually this is also a water temperature issue. When you got a hot afternoon rain shower, which is a pretty common occurrence in many high climates or summertime climates, the water that runs off is significantly hotter and running into streams can actually – if they're urban streams, can actually heat the water up by about 8 degrees Fahrenheit.

It's actually hotter than the water that's allowed to leave a power plant, so the cooling water that's being exhausted from a power plant. And that's part of the reason why the Clean Water Act actually looks at heat pollution as a pollutant of concern. So it is also significantly above the temperature where you start to see negative impacts on species and both, you know, animal and plant species in these urban rivers and urban streams.

Slide 29. Improved outdoor comfort

So moving away from surface – the implications of surface temperature and starting to look at more of the ambient air temperature implications, this is a study that was done in a park in Athens. And so, this is pre- and post-view of – this park actually installed a series of cool pavements in and around the park. And what they found was that, (with the) before and after temperatures holding all things equal, that they get about a 2 degrees Centigrade reduction in air temperatures after the application of the cool pavement.

Slide 30. Air temperature reductions – city scale

And this is actually in line with the broader body of research in this area, most of which is modeled. What we find is that, for every 0.1 increase in solar reflectance, on average, we're seeing a cooling rate of about 0.9 degrees Centigrade, which is about 1.6 degrees Fahrenheit.

So going back to that original example, if you are able to lighten your pavement by – to go from, say, a fresh asphalt of 0.5 reflectivity up to, say, a 0.25 reflectivity for an aged, you know, cement; that – you would – you would potentially be getting about 3.2 degrees Fahrenheit reduction in overall ambient air temperatures and about a 14 degree temperature difference on the surface of the – of the pavement itself. So another significant opportunity here to reduce air temperatures and improve the urban heat island response.

Slide 31. Issues to consider (relatively minor)

With all that said, there are a number of considerations to think about as you're looking to roll out cool pavement products or projects in your city. And I kind of group these into three basic

buckets and I'll start with what I would call relatively minor.

The first is just to understand that – I mean, I think anybody that's been around a city or roads know that, you know, dark asphalt lightens over time and lighter concrete will actually darken over time. Now, they don't converge across typically, but they do get closer and closer to each other as time goes on. This is something to think about as you're preparing, you know, impact studies or trying to understand the potential benefit for urban heat island mitigation of some of these technologies.

And the other issue is – and I'll get into a little bit more about why you want to do this – but it's pretty clear from what we've seen that the pairing of shade and structures either from trees or other structures with cool pavements provides the best possible outcome for pedestrian comfort. But it also mitigate – it also reduces the heat island benefit – heat island mitigation benefit you get from cool pavements because that pavement is being shaded rather than reflecting sunlight. So it's – often that is probably a good thing to do, but just something to keep in mind that if you're a heavily-shaded street and it's going cool, you're – the urban heat island mitigation benefit may be impacted negatively by that.

Slide 32. Issues to consider (uncertain)

The second bucket of considerations I'll call uncertain because they can go either way. And the crux of this one is really – just the understanding that the pavement building interaction is extraordinarily complex and unique, you know, block by block. And it's going to be affected by things like how the building is oriented; you know, how much installation it has or how old it is; you know, how many windows it has or how big the windows are; how close it is to the pavements – how close it is from the pavement and what if anything blocks or shades the pavement from the building.

And so, all that together, you can end up with a pavement installation in some context where it actually reduces the energy load on the building because it's improving the natural light that's getting into the building. Or on the other hand, it can actually increase energy because it's increasing the cooling load required to keep the building cool.

So it's a tradeoff. And so, whereas with roofs it's much easier to make – I would – well, at least from my opinion – easier to make a one-size-fits-all or at least say, you know, roofs should at their minimum be cool. It's a little bit harder to do that on pavements because of this unique interaction between pavements and buildings. So that's something to consider as you're looking to see where you might want to put cool pavements.

Slide 33. Issues to consider (potentially major)

And then, finally, the – I would say there's several, what I would say, potentially major issues that are – that are impacted by or that are impacted by cool pavements and some of these will I think mitigate over time, but nonetheless they are issues now.

And the first one I'd mention is – I'd say first cost, but it's not first cost which is, in our estimation about 1.5 to 2.5 times what normal pavements cost. And we've seen cases where that premium is higher. But it's also understanding the ongoing maintenance cost and the differences

between a standard dark roadway or asphalt roadway or a sort of country cement roadway and the cool pavement maintenance cost and so on. So that's an important thing to consider as you're – as you're sort of planning these things.

The other issue we've heard from certain transportation departments is some of these cool pavement products, not all, but some have an impact on recyclability. It makes it harder to recycle asphalt and that's usually a hallmark of any sustainable asphalt program is being able to recycle it. I think New York City recycles something like 70 percent or 75 percent of the asphalt that goes down new is actually recycled. So that can be a potentially big impact that one must understand before they choose a particular product for this.

We talked a little bit about the production and comfort issue of radiated solar energy if it's not paired with shade solutions. Again, when you pair them, we see that this is probably the best outcome for pedestrians. Some studies that I'll show you that really demonstrate just how much cooler and more comfortable it can be when you paired them. But alone, it can be – it has the potential to increase the thermal discomfort on the pedestrian even when it's cool in the air temperature because of that additional radiation.

And then, the final piece I'd note is there is some new research out on the global warming protection when you look at lifecycle, both use and build phase for some of these cool pavement options – not all, but some – the work that's been done thus far quantifies some of these lifecycle global warming potential issues, but not all of them. But what we have so far shows that they may outweigh the urban heat island benefit. But the – you know, that's an ongoing sort of area of research that we're keeping an eye on as, you know, we're, yes, being up on it. This is a – you know, a set of strategy that you want to employ.

Slide 34. Cool Pavement Options

So quickly on the cool pavement option, you see it again breakdown into the sort of two basic buckets. We've talked about a lot of these. One way you can lighten your surface is with just having a lighter aggregate.

So as you're – as your bond – as your sealant or your bonding agent wears off, it wears off to a lighter color rock underneath, and so, you get the benefit overtime. There are certainly coatings, slurries and overlays that sort of lay over top of asphalt to lighten it up. There's various additions that you can add to – especially in cement products that can lighten it and also add some strength. And then, there's permeable and pervious which cool through evapotranspiration, that's also the grass pavers as well.

Slide 35. What's Next for Cool Pavements?

And, you know, I'd just wrap up here with what's next. I think we want to see more pilots of this. I think we're going to hear a lot from L.A. on this. There's also pilots in other cities.

The more we do these, the more we signal to the market that there is an interest in this. We learn more about the durability, long-term performance and we can start to hopefully see the cost come down.

There's also a need for more locally-relevant studies because of some of these considerations I mentioned. I think AB296 in California did a great job of tasking the transportation department to really study this in a local context in California and we need to see more of that.

And then, finally, sort of growing out of those, just more innovation to start to bring down the price point issues related to the global warming potential and just increasing the number of product offerings that are out there.

Slide 36. Thank you!

So, with that, I'll stop. Look forward to your questions when they – when we get to that period and this is my contact information. So thanks very much.

Victoria Ludwig: Thank you, Kurt. That was a great overview. It's obvious that this is a complex issue.

I think what we find at EPA is that the cool pavements are the one heat island strategy that we get the most questions about given its complexity, but also I think given its potential for reducing heat. And also, on behalf of my colleagues at our office of water, it's an important permeable and porous subclasses of the so-called cool – of cool pavements is a great way to reduce storm water runoff, just the amount of runoff and, as you pointed out, in addition, the thermal impact of that.

A lot of cities are turning to permeable pavements as a solution for the storm water runoff issues. So I think it has a lot of potential and it's obviously having success in Los Angeles which we will get to in just a second.

Poll Question 2

Slide 37. Poll 2

But I wanted to ask another poll question for the audience participation part of this event. This is multiple choice and have you or your community tested any cool pavement options? We would love to know. If so, what kind?

Have you done concrete substitution, have you used a lighter-colored asphalt, have you done pavement additives such as slag or titanium dioxide? Have you tried pavement coatings, overlays or a slurry fill? Have you done permeable pavement? Have you done vegetative pavers or none of the above?

We'll give you a few – a few seconds. You can – you can – and if you don't know what all of those are, don't worry because Kurt has some explanation in his – in his presentation that you will have a copy of, so, OK. It looks like everyone has stopped voting. Thanks so much.

The results, looks like it's a tie actually between none of the above and permeable pavement, so that's great at 34 percent of folks trying permeable pavement. Looks like pavement additives – no – vegetative pavers is another popular one, which is a good storm water runoff control measure as well. And all the other ones a few folks have tried, so that's exciting.

If you have a success story in that area, as I said, please let me know. We'd love to learn more about what you're doing.

Los Angeles' Cool Pavements Pilot Project

Slide 38. Los Angeles' Cool Pavements Pilot Project

Great. So let's go on to what Los Angeles is up to. First, we're going to hear from Greg Spotts. He serves Angelenos as the assistant director and chief sustainability officer in the Department of Public Works and, within that, the Bureau of Street Services.

Greg overseas more than 500 staff including the street maintenance, urban forestry investigation and enforcement and methods and standards divisions. In his previous role with the city of Los Angeles, he served as the mayor's lead on an $11 billion portfolio of transit and highway mega projects. So I think we can say Greg is really literally on the ground with these things.

Greg is going to give us an overview of their – of their cool pavements project which you may have heard about on YouTube and various other outlets. We look forward to hearing. Go for it, Greg.

Slide 39. Cool Pavement Pilot Project

Greg Spotts: Thank you so much. Good afternoon or late morning to everyone depending on where you are, very happy to be with you. Thank you, EPA, for organizing. And that was a great kickoff talk as well.

So here at the Bureau of Street Services, we're always interested in, you know, exploring new sustainability options. All of that became much more real for us when our Mayor, Eric Garcetti, published the city's sustainability plan and that plan had more than 100 different initiatives and some of them were grouped up under, you know, climate change adaptation and a subgroup on urban cooling. And so, we saw an opportunity to plug into that with looking at cool pavements.

Slide 40. LA experiences heat-related illnesses and deaths

At the very beginning of this process, we were introduced to this concept by the next presenter, Craig Tranby. Craig and I had worked together in the city and we've both changed roles. He'd moved to Department of Water and Power and I moved to Street Services. And he took me out for lunch and said they were getting ready to do some cool roof work in different neighborhoods and would we be willing to partner up with them, you know, to maybe pair some cool pavement with cool roofs in a given street. And so, we started looking into it. And I'm going to tell you the story of how that came about.

The first slide I have here is about heat-related illnesses and deaths. When I first engaged on this issue, I thought it was about reducing the need for air conditioning and the carbon emissions associated with electricity that's powering that air conditioning.

You know, we live in a desert here in L.A. It's very hot. Permeable won't help us with the heat too much because it doesn't rain in the warmest time of year in L.A. here. It's dry for, like, five, six months.

But later, as I engaged from this topic, I learned that heat-related illnesses and deaths are a very serious problem in Los Angeles. And, in fact, we're one of the only cities in the world that has heat-related deaths in the winter because we can have a 90-degree heatwave in January and people aren't ready.

And it turns out that some of the cities with the most heat-related illnesses and deaths are the ones where people aren't prepared, where it gets hot suddenly; not necessarily Phoenix, Arizona where it's hot all the time. But places where all of a sudden in a matter of a few days you can get certain heat and humidity and static air effects that people who don't have air conditioning aren't prepared for.

Slide 41. And LA is expected to get HOTTER!

And so, there's actually a public health reason in Los Angeles for us to be pursuing urban cooling particularly in a world that's going to get hotter.

And, in fact, L.A. is going to get a lot hotter. This is – you can see this bar graph showing how certain neighborhoods are going to have a much higher number of annual days exceeding 95 degrees. Look at Porter Ranch. Already the hottest neighborhood in the city by this particular metric. That's in the upper left picture of the map.

Porter Ranch has 55 days a year now that are over 95 degrees Fahrenheit. That's going to double as global warning kicks in. So this is already an issue for us, but it's going to be a much bigger issue particularly in the San Fernando Valley, which is kind of the area in that picture above the 101 freeway moving across.

Slide 42. In July 2015, BSS partnered with Rec & Parks and the materials testing department to install a test patch of cool pavement coating at Balboa Sports Complex

So we wanted to get involved and try to help out, you know, the development of ideas on this issue and we found a real mismatch. The environmental community led by Climate Resolve who was our – one of partners and the Lawrence Berkeley Labs felt that cool pavement was sort of a slam dunk, that the science was there and that this is something we should all be doing as a common practice.

However, we couldn't find one instance of a cool pavement treatment being applied in the state of California. We found a report that the city of Chula Vista had commissioned with a very well-known pavement consultant and that reports that all of the activity on cool pavement in California was in off-street parking lots.

So we thought maybe the high-profile city of L.A. could be the bridge to go from this concept that scientists and environmentalists believed in to something practical that cities could feel comfortable with. We went out looking for a product and it wasn't so easy to find one. We also needed to be able to buy it. You know, the city of L.A. has very complex procurement regulations and, when you want to bring in something new, you know, you don't always end up with exactly what you wanted at the end of the procurement process.

We finally discovered that a vendor we already were using for certain kinds of emulsions called

Western Emulsions had a sister company called GuardTop that had a product called CoolSeal that was a thin sealant on top of the pavement. And CoolSeal originally was just a variant of GuardTop. GuardTop, you know, is used all over California and other parts of the west on freshening up, like, the parking lot of a little strip mall. You know, the owner of that mall doesn't want to resurface the parking, so they just put a nice black coating over it.

But the product came in six different colors and it was also marketed to schools for asphalt playgrounds. And it turned out that the grey one was cooler. And so, they started marketing the grey color as a cool pavement coating.

And so, we partnered with GuardTop for them to apply a 7,500 square foot patch at the Balboa Sports Complex, which is one of our parks here in Los Angeles. So, as the chief sustainability officer of Street Services, I reached out to the chief sustainability officer of the Recreation and Parks Department. We found this parking lot that had recently been repaved.

And if you can look at the picture in the lower right, you'll see on the left hedge there's kind of a tree line median. There's another parking area immediately to the left. So we thought we could kind of get a nice control, you know, for an AB temperature test by applying it on the right side of the median and leaving the left side uncoated.

Slide 43. Gray coating is 10 degrees Fahrenheit cooler than black asphalt

So, at the manufacturer's expense, this was installed in July 2015. And we liked what we saw. Here you can see the two sides and in summer afternoons, in 90-degree day, 95-degree day, the coated area was at least 10 degrees cooler than the untreated black asphalt across the median. We thought that we pretty significant.

We also wanted to make sure this coating was safe. And one of the benefits that we have in Los Angeles is a sister department of ours, General Services, has an asphalt lab that's part of the materials testing operation. So we have 40 people who work in materials testing for the city that we can use anytime we want to explore a new product. So materials testing tested this material in their lab and then also here in the field and assured us that it'd met wet traction test for California public streets for both pedestrians and cyclists and cars.

Slide 44. Next Step

So now that we knew that it was safe and it was effective at reducing the temperature, we set out to go put it on the public street. We got funding in the fiscal year '16, '17 budget to do one city block in each of the 15 council districts. And we were applying it where the vendor would bring the material in this little trailered tank and then our city employees would hand squeegee it. And there's multiple ways to apply it which I'll show you in a moment.

But, for the time being we were just hand squeegeeing, we would do a 50-micron thick coat, give it about an hour to dry and then do a second coat. So here are some pictures of that process as it happened.

Slide 45. Results of Pilot Project Phase 1

Well, the results were pretty positive. We were getting 10 degrees temperature differential. One of the things that we were concerned about was staining. Let's compare – let's go back.

When it – when it first goes down, it actually looks like you could eat off it. I mean, you've never seen a street so clean and beautiful in your life. And then, you know, within a month, it looks more like this. Cars are tracking dirt on it, tree leaves are falling on it and getting wet. And then, you can see that sort of – the places where the cars park on the curb lanes can end up being lighter than the parts in the middle that get driven on a lot.

But we were able, in most of the 15 locations, to maintain a 10-degree difference as summer went into fall and fall came to spring. But in some of our locations, we were seeing that difference reduced to 7 degrees or 6 degrees when there was a lot of staining and the staining really varied from location to location.

Our findings on the right, the top five findings. Number two, residents were always excited that we were coming and doing this. To a person, everybody who came out when we told them we were experimenting with a surface that might be cooler, people told us "My neighborhood is getting hotter." It was an interesting contrast to the national political dialogue about global warming because, basically, every Angeleno we talked to has an experiential belief that their neighborhood is getting hotter recently.

We got amazing press coverage, a very funny thing happened. Our first installation was May 20, 2017 and it happened to be the hottest weekend of 2017 thus far. And so, we ended up getting every local news station down because they were all looking for the hot weather story.

I ended up going back to this location with my kids two times over the course of the weekend beyond our actual install because I would get calls from assignment desk that they wanted to send a TV truck out there. So we got a really big kickoff and lots of great video.

It generated press coverage all around the world, the L.A. Times, the New York Times, Washington Post, National Public Radio. We ended up having a story done for the French version of, like, Associated Press, the Agence France-Presse, and that caused us to get articles in nine different languages all over the world.

Increased from other cities started coming in and, you know, at that point.

Slide 46. Summer 2018: Guard Top contractor re-coats the 15 locations with revised Cool Seal formulation

Really the only concern we had was this concern about staining and darkening and sometimes we weren't entirely sure are stains coming on top of this material or is the coating eroding off or is it a little bit of both?

So we worked with the manufacturer and they decided they were going to reformulate the coating and apply it at all 15 locations at no cost to us as a warranty repair. And we thought that was very generous of them. And so, just in the last three months, we have applied the new coating to all 15 locations.

Now, the first time we did this since the manufacturer was doing it at their expense, they decided to do it in a mechanized way and we got to see how that looks like. They have got a slurry buggy in the upper left there which puts down a little – you know, a box that kind of, you know, lays down a thin coating of the material.

And then, the second coating they did by hand spray. And they actually believe that, if you spray on the second coating, you have almost no lines at all from the installation because it isn't being dragged across the previous coating. So they actually came up with a pretty nice finish and I have a feeling this is less labor intensive and a little cheaper than how we were doing it hand applied.

Slide 47. Next Steps: SB1 Climate Adaption Planning Grant

So we have several different next steps we're pursuing. Number one, we received a grant through a recent new transportation funding measure in California to do a ground-up process with the community around one particular metro stop, the Sherman Way Orange Line station, so that the community could help us figure out a multifaceted urban cooling project to make it easier to walk and bike to the rails – to the – to the bus way stop because, actually, one of the problems with urban heat is a warmer city means the last-mile problem for transit is even more significant. If you can't, you know, get to the transit stop without being totally full of sweat that you're not going to want to go to work using transit. So we're going to develop some options for cool roofs, shade structures, cool pavement, tree planting in this neighborhood working with the community.

Slide 48. Next Steps: Multi-Product Demonstration Site

Another next step, we're working with the La Kretz Innovation Campus in downtown L.A., which is the home of the Los Angeles Cleantech Incubator, to put multiple patches of different cool pavement coatings in the parking lot in the front. Those three vertical brown rectangles there, that's sort of an illustration of how we're going to have it. So when you park and walk in the front entrance, you can interact with multiple coatings that will be labeled.

Slide 49. Next Steps: Cool Pavement Phase 2

Furthermore, we'd really like to coat a whole neighborhood. We'd like to see if there's a better cooling effect when all the streets in a subdivision have this coating on it rather than just one discrete block. So we're seeking funding to do a neighborhood-level cooling project in the near future.

Slide 50. Next Steps: Cool pavement on a major off-street bike path?

Another thing we're really interested in is perhaps using a cool pavement coating on a bike and pedestrian path. There's a very large project going on right now. You know these projects where they take an old rail corridor and turn it into a bike and pedestrian way? There is a multi-million dollar project going on through South Los Angeles and we're looking at the possibility of, you know, having that asphalt multi-purpose path be coated with a cool pavement coating to see if it's more pleasant to ride on.

Speaking of things being more pleasant, one of the very funny things we noticed is dogs prefer walking on the cool pavement. Everywhere we went when we saw people with dogs, the dogs would not use the crosswalk which hadn't been coated and was the still the black asphalt. They would bias over a couple of feet to get on to the grey pavement. So the dogs in the neighborhood have figured out what we were doing and endorsed it.

Slide 51. Contact

So this is my contact information here. I'm happy to assist anyone with their inquiries about what we're doing. And we're very excited that, you know, we were able successfully to get a test case out there on the ground and, hopefully, stimulate or catalyze the development of new products and other cities to try their own pilots. Thank you very much.

Victoria Ludwig: Thanks, Greg. That was really great. And congratulations on all of your work. I know that when the YouTube video and other things came out, my coworkers and I have friends contacting us who don't really know much about heat islands or anything, but they kind of know what we do for a living and saying, "My gosh, have you heard about this? This is so exciting." So you guys have done a lot for really advancing the whole idea as far as solutions. So we look forward to hearing about further – your next phases.

I just want to remind the audience, thank you for sending in your questions and comments. Any comments you have for the speakers, we will definitely pass on to them. And everyone's been doing a great job of indicating who the question is for. Several – so please keep those going.

Poll Question 3

Slide 52. Poll 3

Before we get on to Craig, we have one final poll question, so get ready. We would like to know – and this is multiple choice as well – what cool pavement benefits appeal to you the most? Is it the lower temperatures, the energy savings, the pedestrian comfort, the public health benefits, the storm water benefits actually from both permeable and non-permeable now that I think about it, and then any other benefits that you're thinking of? Please choose as many as you like.

OK. Great. Thank you, everyone. We're going to reveal the result. And, not surprisingly – well, it's kind of a close, but – close as far as the top spot, 83 percent for temperature; 73 percent for pedestrian comfort, and then public health benefits are next, energy savings after that, and storm water benefits. They're all pretty equal I would say which goes to show that cool pavements can solve many problems at once which is I think why they're so great and we're glad that people are looking into them as much as they are.

Los Angeles' Cool Roof Ordinance and Free Tree Program

Slide 53. Los Angeles' Cool Roof Ordinance and Free Tree Program

Los Angeles has done some of that, but also they've been doing other great things for several years now on reducing their heat island. And we're going to hear about some of the work they've been doing with trees and cool roofs. They've been innovative in that area too.

The person who's going to tell us about that is Craig Tranby. He is an environmental supervisor in efficiency solutions for the Los Angeles Department of Water and Power. He manages key energy efficiency and water conservation partnerships with other utilities, government agencies, nonprofit organizations and educational institutions.

In his 20 years with the city of Los Angeles, he has developed and implemented programs and policies on various sustainability issues including urban heat island, climate action planning, resilience, community education, green building, materials use, and even brown fields. So he is quite a busy guy. We look forward to hearing about – from you. Go for it, Craig.

Craig Tranby: Thank you so much, Victoria. I'm happy to be here. As Greg said, I think it's good morning for a few folks and maybe good afternoon, or most folks. We're moving on to almost noon here.

Yes. Cool roofs, the free trees combating urban heat island in Los Angeles. On the roofs, Greg, I think we don't have any dog endorsements. But I'm pretty sure for the free trees we have a lot of dog endorsements for that.

Slide 54. Cool Roofs and Free Trees Combating Urban Heat Island In Los Angeles

Slide 55. Los Angeles Department of Water and Power (LADWP)

Let me just provide a little bit of an overview. Department of Water and Power is where I work and where the nation's largest municipal utility. We've been delivering electricity for about 100 years now.

We have a service area that's quite large, 748 square kilometers the city of L.A., which is outlined in dark green on the map. And we serve about four million residents and that equates to about 1.4 million residential and business accounts.

This map more or less shows the power system. We also have a water system with kind of an equivalent map. So this is just to show you some of the reach.

We're undergoing a power transformation in terms of our supply. We are transitioning off of coal and on to – increasingly on to renewables. Some of you may have heard or read about Governor Brown's announcement yesterday signing the legislation to move California to 100 percent renewables by the year 2045, which is very exciting. There's an interim goal, 60 percent

by the year 2030.

We are charting a path towards that at DWP or I think we're a little bit over 30 percent renewables right now. We expect to have a pretty significant jump in about 2025 when we go – get offline from the last coal source we have. So it's very exciting times in California in the utility business.

Slide 56. LADWP Efforts Relating to Urban Heat Island

And what are we doing relating to urban heat islands? The three primary mitigation areas – cool roofs, trees and cool pavements? DWP is involved in pretty much all those areas.

For cool roofs, which is the focus of this talk, we have the rebate that we've offered ever since 2010, an aggressive rebate in terms of the amount of incentive offers. And that later expanded this report, our mandatory coat requirement.

The coat requirement, which I'll go into more on the next slide, came fully into effect in January 2015. At that time, we were able to flip into the code some urban heat island mitigating language addressing non-roof areas of this construction process and we hope to, I think, strengthen that in the next code cycle.

For trees, LADWP has been funding tree planting programs for the purpose of counting energy savings from 2002 to the present. We like to think those have been increasingly, I suppose, rigorous and focusing on the energy savings benefits from shading buildings and reducing air conditioning use as a primary demand for electricity.

And lastly, cool pavements – thank you, Greg, for acknowledging the fantastic lunch we had and that was a fantastic presentation. It's a great story what's been happening with the cool pavement pilot and your vision for scaling that beyond.

We will continue to facilitate. We host that La Kretz Innovation Campus which Greg had the picture and the four – the four or so product demonstrations for cool pavement. We'll definitely be promoting that, as well as cool roof technologies at the La Kretz Innovation Campus.

Slide 57. City of L.A. Cool Roof Ordinance

Looking a little more closely at the cool roof ordinance and the rebate, in the 2015 ordinance, it was in our L.A. municipal code. A roof replacement of any value are subject to cool roof replacement for the purpose of reducing the urban heat island effect, accepting roof repair, replacement at 50 percent or less, and building integrated photovoltaic.

So we made this a mandatory requirement within our code and, thereby, avoided prescriptive exceptions and those would include things such as I'm having a certain amount of ventilation installed or a radiant barrier installed. And we found in other parts of the state where those prescriptive requirements existed, anecdotally, that's what everybody was doing.

They weren't really installing cool roofs. They were using the other exceptions to get around that. So we try to give it a special place in our code and try to acknowledge the urban heat island

benefits and the greater greenhouse gas benefits and made it mandatory.

This – and if you look over to the right side of the page – this was coordinated and supported with the LADWP rebate. At about that time, we strengthened and enhanced the rebate to match the compliance threshold of the ordinance, so we introduced another tier, a lower tier; and that tier helped us get a – this rather pioneering mandatory requirement through the finish line because it's hard to make the case to introduce the new products and the limitations therein as a mandatory requirement without – and some price premiums without offsetting it through a rebate, for instances.

So normally, a utility would pull back on their incentive once a code requirement comes into place. However, we view this more as a codes and standards activity and strategically approached the code cycle as a utility and got the ordinance then in coordination with building and safety and other partners who I will mention in a bit.

Slide 58. City of L.A. Cool Roof Fact Sheet

One of the partners was the Department of Building and Safety. Sort of they enact the code and enforce the code. This is just an example of a co-fact sheet we developed with them. I don't really expect anyone to be able to read this, but this is just to show how we describe the ordinance and the rebate together in one place on the front page. And then, the back page has some FAQ which was a product of some stakeholder outreach that we did leading up to the ordinance.

Slide 59. Cool Roof Collaboration

Cool roof collaboration. Collaboration is key especially with this. We had several city departments involved in this process, building and safety I mentioned.

The Board of Public Works and City Plans and the Bureau of Feed Services have been great to coordinate with on the other mitigation areas for urban heat island trees. And as Greg on a couple of slides showed, we'd love to do neighborhood-scale projects and that's kind of what we discussed from the outset. So we're still trying to get there. We have some ability to do outreach and encourage cool roofs in certain locations and with trees even more so, the free trees. And I'll get into that a little bit later.

And then, I won't – I forget to mention, and kind of in the same context is the city department, the mayor's office, or mayor's office, that is, in this case. This just goes back a ways. We had support from each of the mayor's offices in terms of enacting the ordinance and in terms of the sustainable, the L.A. plan which Greg had mentioned and now in terms of the resilient L.A. plan which also addresses cool roofs and urban heat.

From the nonprofit community, we had Climate Resolve, who was also mentioned. They have been a crucial partner throughout all of this. They were essential in pulling together stakeholders and in influencing stakeholders for the early meetings for the ordinance and have convened researchers and just generally raised awareness and been a good place to respond to media inquiries and any public concerns about the ordinance. Climate Resolve was always there helping to get this through. That was an essential partnership.

Cool Roof Rating Council, who probably most folks on the call might be familiar with, they rate the reflectance and emittance of the cool roofs. They're essential to our rebate process, of course, but they also were kindly offered some space on their web site to help our users and constituents' find – understand information about this new ordinance and the rebate.

And finally, we do have nonprofit outreach grantees that reach out to our – all of our communities in Los Angeles about energy and water conservation. We have – we had further tasked them with – do include information about cool roofs. When you're out there, we want to build awareness, have people understand the benefits of this so there is less, I would say, confusion or concern about the ordinance.

Moving on, the academic partners. LBNL was also mentioned earlier. They've been crucial to everything urban heat island throughout the process entirely. So they – we wouldn't be anywhere without them. And then, locally, we've had great contributions from USC and UCLA.

The business community, I mentioned, we did have a couple of stakeholder meetings – a few stakeholder meetings early on with the roofing industry, which was important. I think we were able to understand the dynamics of the industry with the contractors, the distributors and suppliers and the manufacturers to help us understand the product offerings and somewhat how to set the parameters of both the ordinance and the rebate. So that was very important.

The Los Angeles Better Buildings Challenge serves as a great conduit to reach businesses in the city with messages about these types of measures which is cool roofs. And then, the Los Angeles Cleantech Incubator again is a partner in hosting the cool pavement demonstration pilot, but also is a good sort of thought partner in place to – for innovation and for cool roof ideas and products as well.

Local governance and utilities. Following on our adoption of the cool roof mandatory ordinance, the city of Pasadena here, our neighbor almost immediately adopted their – a similar ordinance as well that really helped. And then, fast forward a few years, now L.A. County is also adopting a similar mandatory ordinance affecting their unincorporated areas which is wonderful. I think that will have a huge impact on the local marketplace.

L.A. County is actually going a little more stringent on the emittance – the reflectance and emittance requirements. So we're happy to see them do that. I think the marketplace has evolved enough to sort of allow for that. And then, we will follow on and align with those – with those levels in our next code cycle which we expect in the next year, year and a half or so. And at SoCal Edison was also a great partner in – during the adoption phase. They provided a cost effectiveness study for this California Energy Commission.

Slide 60. Cool Roof Results

OK. In terms of the results, looking at the rebate, as the – as the smaller pool in the center, the middle sort of concentric circle or pool is the permitted roofs, the slightly larger universe. And then, beyond that is the entire marketplace which is – which is quite a bit bigger probably than depicted.

We have 18,000 permitted roofs to date covering 26 million square feet and saving over 3.6

gigawatt hours per year. Our market transformation is underway. As I had mentioned, manufacturers, to our delight, have been adjusting product offerings pretty much from the outset of the program. And we expect those positive effects to positive effects to impact non-permitted roofs groups and other local jurisdictions by controlling or what is offered on the marketplace.

Slide 61. City Plants

I would like to spend the next few minutes talking about the tree planting side of things. We are – LADWP is the primary funder of the city plans program which provides free trees to customers, through our partnership and various planting – non-profit planting partners. This City Plants is part of the Board of Public Works.

Slide 62. Growing Benefits

We, DWP, are able to fund trees and continue justifying the funding of trees through the energy savings that we can count. So we use tools, the U.S. Forest Service Carbon Tree Calculator initially and then the Eco Smart Layers, a somewhat more advanced tool to provide those calculations through a rather elaborate process. And we try to guide and focus anything that we're funding towards optimal placement in respect – with respect to buildings which is – can be challenging as I'll get to it a little bit later.

Trees or infrastructures that increase in value over time which is wonderful and it saves customers money and energy and provide all those other great benefits that we're familiar with that improve air quality, reduce greenhouse gases. They reduce storm water, runoff, they provide beautification, they increase property values, on and on. So trees are a pretty amazing asset in the city. And so, we focus primarily on planting the new trees to help regenerate the urban forest.

Slide 63. Using Data

Using data, we are now undergoing equity metrics data tracking here at LADWP. We determine where to plant trees and we target communities lacking adequate canopy cover. Just briefly, the larger bubbles on the map show the numbers of trees planted. This is for the year 2017.

Underneath the map is our CalEnviroScreen disadvantaged communities. So the darker census track areas are focused in areas most in need. And as you can see the bubbles pretty much tend to coincide with the areas most in need, which is fantastic. It also coincides with low canopy areas historically, so we love to see that change.

Slide 64. Accomplishments

Some quick numbers on accomplishments. City plans distributed/planted 80,000 trees saving nearly 21,000 gigawatt hours of energy in about 3.5 years. About 25 percent of that is attributable to the urban cooling or urban heat island mitigation as calculated through the eco smart layers tool.

Slide 65. Contact

Slide 66. Barriers, Challenges, and Lessons Learned

Wrapping up here, various challenges and lessons learned for both cool roofs and trees. Barriers and challenges first on cool roofs. This is a rather pioneering program. I think it was the only mandatory residential cool roof requirement that I was aware of, at least, maybe in California, it's not a U.S. code requirement. So we were a little bit out in front and a little bit exposed in terms of push back by either industry or consumers in trying to convey all the benefits and all the product availability to the marketplace. So there were definitely some challenges there.

In general, we can – and understanding the marketplace has been a challenge. We'd like to know – have a better understanding of what products are carried where and what roofers are using what products. And just trying to get a handle on that, we did have those stakeholder meetings which was helpful, but I think it'll be a constant challenge for us to really understand that, but the signs – the signals are pointing positive on that as we get those anecdotal information back.

For trees, we have two kind of primary challenges – matching locations with need and the drought which you all probably have heard about in California. Matching locations with need is a real challenge. L.A. is relatively, I guess, newer major city but it's still built out.

And so, trying to find locations that meet our requirement of energy efficiency, saving energy near – having trees optimally placed around buildings can be very challenging. We – is there a – is there a pavement cut required, is there somebody who can water the tree during its establishment period the next couple of years? How do we find those locations? It's a very individual process and there's a certain amount of cost to that.

And then, the drought. Again, as we've been struggling with the drought over several years – we had a year or a year and half off recently – but it has really damaged, I think, not only the urban forest, but also the perception of should we be planting trees at all during these droughts because trees take water. So we've spent a certain amount of messaging on trying to clarify or help improve the perception on that that trees are actually a low water alternative compared to many landscapes you might have on your yard. And there are certain best practices you can do to reduce the consumption of water. And I think we're making – we made some good progress on that.

Lessons learned, cool roofs, phasing incentives and collaboration. The phasing was kind of that – during that stakeholder phase, getting people familiar with the idea. And then, we actually had a grace period on the ordinance which I think helps get the roofers and the manufacturers ready and the public somewhat ready for this new requirement.

Incentives, as I mentioned before, it – they go hand and hand in offsetting this price premium and really helps kind of sell the whole new requirements in general, kind of helps to alleviate those concerns. And then, collaboration, I've spent some time talking about.

With trees, our – you know, I was orienting the – around the energy savings, ensures future funding which I had discussed. So the more we can kind of tighten that up, the more easily we can continue to fund it and expand our funding in the future.

Slide 67. Contact

So that's it. Thank you so much for having me. I'm happy to answer any questions.

Victoria Ludwig: Thank you, Craig. That was really interesting because you're doing so much and it is innovative at least from what I hear of what other cities are doing, the cool roofs part especially because the fact that that applies to the residential sector, not just the commercial sector, so congratulations to you as well.

Question and Answer Session

Slide 68. Question and Answer Session

We have 15 minutes, so I want to definitely dig in to the Q&A session because we have received a lot of good questions. It's hard to pick them.

So – but don't – never fear, I forgot to mention that what we do is we – any questions we cannot get to on the live webcast, we will provide written answers to them as best we can in the transcript and the proceedings that we will post in the couple weeks. So when those are posted, you can find out the answer to your question.

I might also ask Greg, if some folks could write to him directly, because we're getting a lot of great questions that local government officials are asking – well what about when the warranty runs out and, you know, very practical things that are important – what about the specs? So it might be better if you just talk directly to some of them. But we'll work that out.

Greg Spotts: I'm happy to receive any questions directly.

Victoria Ludwig: OK. Great. Thank you. So let's start with Kurt. I'll give you a two-part one, Kurt, just to save time. And I think you might have addressed one of them.

But could you go into a little bit more detail as far as any issues with glare when you increase the albedo? And another question was, with respect to some of the coatings, there's a – there's a potential issue sometimes related to traction particularly for bikes and motorcycles, has anyone looked into this impact, you know, quantitatively at all or can you address that at all in any way?

Kurt Shickman: Sure. So let me start with the first one which is glare. So I guess there's two things here. The first is in the supplies for both roofs and for roads, but – these are not mirrored surfaces. You're not getting direct reflection which is where you would normally get a glare like you get, you know, on a car window when you're behind the car in the – in the sunny day. This is more diffused reflection. So the issue of glare is not as great for that reason.

And the second issue here is that the changing – the changing color from a dark roof to a light roof is significantly more than a dark road to a cool road. So we're not – you are already experiencing a lot of cool color roads when you look at the difference between most sidewalk colors and the street. So it's not a – the issue of glare has not been one that we have seen come up all that often on most of the installations that we've – that we've been aware of. So – and that's for those two reasons.

And then, the second question was around traction. Well, it's a great question. I think, actually, Greg mentioned in his – in his presentation that the city of L.A. actually did an analysis of the – of the traction and deemed it safe and we've actually seen that. I think, I believe, Chula Vista also did that down in – near San Diego.

So those – from those points, I think we've seen that for the most part these are – these are – these are safe at least from what I've seen. And, in fact, interestingly enough, a lot of the original

cool pavement applications were to highlight bike lanes to either have them standout and the sort of side-by-side lanes or to – or to have those sort of boxes at the front of the – of the – at the front of an intersection. So, in many cases, these technologies came out of – out of that – out of that use conditions. So again, I can look into that further, but my experience has been that that has been a great deal of issue with the safety of the pavements as it relates to traction.

Greg Spotts: Yes. Just to add a little more, the state of California has a minimum coefficient of friction. It is quantifiable and the test we did ensure that it meets that minimum coefficient of friction. And we do those tests every time we do an install.

So we haven't just decided it's safe from the beginning. Every time we do an install, our GST standards lab comes out and I get a written report on that and we haven't had a single installation yet. I guess we've done 30 because we did 15 and then 15 with the revised coating. We haven't had a single one that failed that test.

Victoria Ludwig: For traction?

Greg Spotts: For traction.

Victoria Ludwig: Wow, yes. OK. Great. Thank you. I think that kind of maybe answers or is a good segue to a question for you, Greg, and we're trying to summarize a variety of the questions. It seems to be related to the reapplication that you did.

Has that affected anything – has that affected the cleanliness of the road or the wear and tear, the – how long the pavement lasts and did you include any of that in your specs, like requirements for that? It sounds like maybe you did. Any minimum requirements for the vendor on those issues of, you know, like length – lifespan and cleanliness and wear and tear? Did you think about that at all?

Greg Spotts: Sure. So the reapplication has only gone down in the last 90 days. So it's too soon to tell how clean it's going to stay. In the beginning, when we were looking at the products, one of the tests are – General Services Asphalt Lab did for us was a test on how easily it might abrade off. They had an expectation for how many years it should last. And I guess they have a test where they scrape it over and over and over again and it – and it met that test.

But a very – a different question on whether the material stays on for three years, say, is do you get a cooling benefit at the end of the three years. It's possible the material stays on, but it's so dirty that you don't get a cooling benefit.

So really one of the most important next steps is to figure out how – what is the longevity of the cooling benefit in a very dirty outdoor environment. L.A. is particularly dirty because it doesn't rain for six months. So there's no natural, you know, cleaning of the pavement. And so, we really – you know, one reason why we're taking a – slow on taking this to scale big time is we'd really like to know more about how many years of cooling benefit are we going to get.

Victoria Ludwig: Yes. That's great. And I think we're all going to be waiting very anxiously to follow you along through the years as an example. The – a follow up question, I think, to that is, when you were considering the coating, were you just looking at different things you could do

asphalt related or did you consider a variety of other options like concrete substitutions or maybe doing vegetative pavers? You know, sort of could you explain a little bit about the process for how you narrowed down on an asphalt coating, specifically?

Greg Spotts: Yes. Absolutely. So in Los Angeles we have so many subterranean utilities that get accessed all the time for new service or repairs that concrete streets really don't work for us here. They get trenched to hell, they aren't repaired properly back in concrete. We just don't have the right environment here for a concrete street to get the kind of 50-year to 70-year-service life that you need for how much it costs.

Also, concrete takes a while to cure. L.A. residents are really into driving and they want to be able to drive on the new street day of. You know, the concrete streets we have in L.A., the street was built before the subdivision opened. So no one had to live through the construction of a concrete street in front of their house.

So for all those reasons, adding to the – you know, about 5 percent of our streets are concrete. We do not want to add to that population. We're having a hard time maintaining the concrete that we do have.

We looked at, you know, additives to asphalt. We own two city asphalt plants and we were really concerned about the ability to batch produce cool pavement. You know, the inside of the drum in an asphalt plant is an extremely sticky place. And we thought, you know, how are we going to produce some black asphalt and then produce some grey asphalt and then go back to producing black asphalt? We also felt that the titanium dioxide lightening agent, the pigment, we would be spending a lot more money to lighten 2 inches of asphalt than 100 microns of coating.

So, for all those reasons, for us we thought that the coating was the most cost effective way to begin. We don't feel that vegetative pavers are appropriate in a public street with heavy trucks, trash trucks, delivery trucks that might go on them. You know, we didn't feel we could guarantee we could maintain that. So we went with what we thought was sort of the lowest pain point to enter and explore the space.

Victoria Ludwig: That's a great answer. I think these are exactly the kind of considerations that local officials around the country are wrangling with. So it's really good to hear your very pragmatic and practical solutions.

Moving on to, Craig, I have a question about the tree program. I'm going to combine again a few questions. Is the tree program targeted at businesses or is it just residential citizens? And, either way, how did you engage them or did you have to engage them to want – to have them want a tree? And I guess I'll add on, did you do any education to help them learn how to maintain the tree and some of the stewardship issues that come up with having a tree?

Craig Tranby: Yes. It is both business and residential or – can qualify to get free trees. In terms of the education, I would say, we provide, you know, guidance, handouts and have some things on the web. Those nonprofit outreach grantees have been important in reaching harder-to-reach communities within Los Angeles. We also have our nonprofit planting partners which seek out locations particularly with the street trees.

We have, kind of like, three types of distributions we do or plantings. We have street trees along the parkways that gets planted and permits are pulled and pavements cut. And there's a whole sort of agreement with the business owner or the residents, so they're very much involved in that.

There are also tree adoptions that at a public event where people pledge to take care of a tree and go home and plant it in a certain location. And then, there's delivered trees which are in that similar mode of taking a tree out to a resident or a business and then they would continue on with the planting.

Victoria Ludwig: OK. Thank you.

Craig Tranby: Did I – did I answer …

Victoria Ludwig: So the cool – I think so.

Craig Tranby: OK.

Victoria Ludwig: We might follow up with you to get more details that we can put in the proceedings. But that – I think that's helpful. And a question on the cool roofs would be, now that it's been – it's an ordinance, of course, but how have the residents reacted to it?

Again, have you done – what – a lot of outreach and education? I thought it was great how you said there's been market transformation from the vendors. But the actual homeowners, how have they reacted to the whole thing, either positively or negatively?

Craig Tranby: I think initially there were concerns about reduced choice, the consumer choice of products. Of course – I think maybe many people on the call are familiar with cool colors and there are – there's actually a fairly decent spectrum of roof products. Those – that choice tends to diminish a bit when you get into the asphalt shingle product area. And so – and as you get into the darker colors with asphalt shingles, the cool color is just a little bit more of a price premium. So I think that was the difficult spot where we were hearing some concerns.

That has largely gone away in the last, you know, year or two, a couple of years. And I think a lot of that has to do with the outreach that we did and the rebate that we offer and the – just the acceptance of the products and the increased product diversity coming on to the marketplace.

Victoria Ludwig: Yes. That's good to hear because, again, it's a good experience for others to learn from. Since we don't have that much time, I'm just going to ask what I hope is a straightforward question, maybe to both Greg and Craig and that's about funding.

For the new – the next phases that you're going to do, Greg, is the funding going to again come from your part of the city or are there any other agencies, public health or otherwise, that you might be working with to get funding? And the same question for you going forward, Craig, if you haven't already answered it, is the funding source for the tree program.

Greg Spotts: Great, yes. So there's really kind of three different ways we can get funding here at the Bureau. We can seek funding during the annual budget process for the city of L.A. and the mayor proposes a budget every April 20 and then the council sometimes, you know, edits it or

adds to it. And that's how we funded the cool pavement pilot.

We can also seek external grants and that's how we funded the public study for a multifaceted cool pavement or cool – urban cooling project, the planning grant that we got from the state. And then, the third way is there's a mayoral innovation fund for small-scale activities and we've used that for other things, but we haven't used that for this. But I think we're going to seek money in the regular budget process for the neighborhood cooling project – the neighborhood – the neighborhood-wide cool pavement project.

Victoria Ludwig: Great.

Craig Tranby: And for the cool roofs, I guess that's the incentive funding. So both with the cool roofs and trees these are part of our energy efficiency budget. So we have a – sort of a decoupling in our utility where we're ensured a certain amount of funding for energy efficiency and our – the revenues of the utility would not impact that.

So things are looking good for continued funding or maybe even increased funding for the incentives. Of course, the ordinance is a big, you know, kind of driving factor that the rebates pair with – on the roofs – cool roofs part.

And then, on the tree part, again, this is considered to be one of our energy efficiency programs. It's actually quite cost effective relative to the entire portfolio, in the residential portfolio in particular. So we would – as much as we can find those matches to get new trees out, we would love to spend the money to get those energy savings. So I think the barrier is more penetrating in finding all those locations rather than just not having funding to pay for the trees.

Victoria Ludwig: Well, that's great to hear that money is not an issue for once. Well, folks, we're at 3:30, so I'm going to wrap up. I want to thank Kurt, Greg and Craig for your fabulous presentations.

And again, folks we're going to post the proceedings in a couple of weeks. We will send out an e-mail if you're on our ListServ or if you register for this event so that you can find out when that has been and you could just check our web site on a regular basis.

Please sign up for the newsletter. Check out the new green roofs page and the Kansas City case study.

We have – at the end of the webcast; we're going to have a feedback form. We ask you to please sign – to please fill that out. It really helps us plan future webcasts.

Slide 69. Clean Energy Finance: Green Banking Strategies for Local Governments

Speaking of which, on October 1, my colleagues are going to present a – this is not heat island related, it's more overall local government clean energy – a webcast on green banking strategies for local governments. This is a very – new, emerging exciting field, the green bank idea especially for local governments. So we're going to have a webcast on that.

You can register now by clicking on this link or let me know and I can send you to – give you

more information on that. So, again, thank you very much for joining us. I really hope you found this valuable. I know I did. Thanks again to the speakers. And, Francis, I will turn it over to you.

Slide 70. Connect with the Heat Island Program

Operator: This concludes today's conference call. You may now disconnect. Speakers, please standby.

END