BEFORE THE ARIZONA POWER PLANT AND TRANSMISSION LINE SITING COMMITTEE

LS-358

IN THE MATTER OF THE APPLICATION OF TUCSON ELECTRIC POWER COMPANY, IN CONFORMANCE WITH THE REQUIREMENTS OF A.R.S. § 40-360, ET SEQ., FOR A CERTIFICATE OF ENVIRONMENTAL COMPATIBILITY AUTHORIZING THE MIDTOWN RELIABILITY PROJECT, WHICH INCLUDES THE CONSTRUCTION OF A NEW 138 KV TRANSMISSION LINE ORIGINATING AT THE EXISTING DEMOSS-PETRIE SUBSTATION (SECTION 35, TOWNSHIP 13 SOUTH, RANGE 13 EAST), WITH AN INTERCONNECTION AT THE PLANNED VINE SUBSTATION (SECTION 06, TOWNSHIP 14 SOUTH, RANGE 14 EAST), AND TERMINATING AT THE EXISTING KINO SUBSTATION (SECTION 30, TOWNSHIP 14 SOUTH, RANGE 14 EAST), EACH LOCATED WITHIN THE CITY OF TUCSON, PIMA COUNTY, ARIZONA.	)DOCKET NO.)L-00000C-24-0118-00232))LS CASE NO. 232))))))))))))EVIDENTIARY HEARING)

At: Tucson, Arizona

Date: July 12, 2024

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REPORTER'S TRANSCRIPT OF PROCEEDINGS

VOLUME V
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VOLUME I	July 8, 2024	Pages 1 to 246
VOLUME II	July 9, 2024	Pages 246 to 525
VOLUME III	July 10, 2024	Pages 526 to 789
VOLUME IV	July 11, 2024	Pages 790 to 857
VOLUME V	July 12, 2024	Pages 858 to 1044

INDEX TO PROCEEDINGS

INDEX TO EXAMINATIONS

INDEX TO EXHIBITS

//

INDEX TO EXHIBITS (continued)

NO.	DESCRIPTION	IDENTIFIED	ADMITTED
TEP-6	Testimony Summary of Larry Robinson	386	--
TEP-7	Testimony Summary of Jason Jocham	948	--
TEP-8	Witness Presentation	49	--
TEP-9	TEP Ten-Year Plans	58	--
TEP-9A	Excerpt from TEP Ten-Year Plan for 2024 (Jan. 31, 2024)	58	--
TEP-9B	Excerpt from TEP Ten-Year Plan for 2023 (Jan. 31, 2023)	58	--
TEP-9C	Excerpt from TEP Ten-Year Plan for 2022 (Jan. 31, 2022)	58	--
TEP-9D	Excerpt from TEP Ten-Year Plan for 2021 (Jan. 29, 2021)	58	--
TEP-9E	Excerpt from TEP Ten-Year Plan for 2020 (Jan. 31, 2020)	58	--
TEP-9F	Excerpt from TEP Ten-Year Plan for 2019 (Jan. 31, 2019)	58	--
TEP-9G	Excerpt from TEP Ten-Year Plan for 2018 (Jan. 31, 2018)	58	--
TEP-9H	Excerpt from TEP Ten-Year Plan for 2017 (Jan. 30, 2017)	58	--
TEP-10	Exhibits Regarding Notice Requirements	58	--
TEP-10A	Notice of Hearing	58	--
TEP-10B	Affidavits of Publication and Tear Sheets for Arizona Daily Star	58	--

//

INDEX TO EXHIBITS (continued)

NO.	DESCRIPTION	IDENTIFIED	ADMITTED
TEP-10C	Affidavit of Publication and Tear Sheet for Arizona Bilingual News	58	--
TEP-10D	Letters to Public Facilities re Copies of Application for Public Viewing	58	--
TEP-10E	Map of Notice of Hearing Sign Locations	58	--
TEP-10F	Photographs of Sign Placement	58	--
TEP-10G	Example of Sign Contents	58	--
TEP-10H	Notice of Service to Affected Jurisdictions	58	--
TEP-10I	Notice of Service to Pascua Yaqui Tribe	58	--
TEP-11	Receipt of Filing Fee	58	--
TEP-13	Tour Itinerary/Script/Protocol	254	--
TEP-14	Summary of Public Outreach	929	--
TEP-16	Undergrounding Presentation	950	--
TEP-17	Undergrounding Cost Analysis Study	948	--
TEP-20	Additional Project Comments	929	--
TEP-21	Letter of Support from University of Arizona	368	--
TEP-22	Letter of Support from Tucson Metro Chamber	930	--

//

INDEX TO EXHIBITS (continued)

NO.	DESCRIPTION	IDENTIFIED	ADMITTED
TEP-23	Letter of Support from Southern Arizona Leadership Council	931	--
TEP-24	Email from State Historic Preservation Office re Project Coordination	433	--
TEP-25	Commission Staff Letter re Midtown Reliability Project	171	--
TEP-26	Gateway Corridor Zone Overlay Map	872	--
TEP-27	National Grid Report re Undergrounding high voltage electricity transmission lines	1035	--
TEP-28	City of Tucson Chicanes Examples	936	--
TEP-30	Supplemental Undergrounding Cost Analysis	1012	--
BUMCT-1	Testimony Summary of Mark Barkenbush	37	--
BUMCT-2	Witness Presentation	37	--
UAZ-21	TEP-City of Tucson Franchise Agreement	1011	--

BE IT REMEMBERED that the above-entitled and numbered matter came on regularly to be heard before the Arizona Power Plant and Transmission Line Siting Committee at Tucson Reid Park Doubletree, 445 South Alvernon Way, Tucson, Arizona, commencing at 9:07 a.m. on July 12, 2024.

BEFORE: ADAM STAFFORD, Chairman

GABRIELA S. MERCER, Arizona Corporation Commission
LEONARD DRAGO, Department of Environmental Quality
DAVID FRENCH, Arizona Department of Water Resources (via videoconference)
NICOLE HILL, Governor's Office of Energy Policy
R. DAVID KRYDER, Agricultural Interests
SCOTT SOMERS, Incorporated Cities and Towns (via videoconference)
MARGARET "TOBY" LITTLE, PE, General Public
DAVE RICHINS, General Public
JOHN GOLD, General Public

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CHMN STAFFORD: All right. Let's go back on the record.

Ms. Grabel, I believe we're picking back up with the route comparison summaries.

MS. GRABEL: Yes. That's true, Mr. Chairman.

And before we begin, we did promise the Committee to have today the narrowing of the corridors along the preferred route. I have that in my inbox. I haven't had a chance to study it. So if you'd give us the weekend, we'll give it to you on Monday.

CHMN STAFFORD: That's fine.

MS. GRABEL: Okay. Thank you.

CLARK BRYNER AND LARRY ROBINSON (cont.), called as witnesses as a panel on behalf of Applicant, having been affirmed or sworn and/or previously affirmed or sworn by the Chairman to speak the truth and nothing but the truth, were examined and testified as follows:

REDIRECT EXAMINATION

BY MS. GRABEL:

Q. All right. Mr. Bryner, please take it away with the route summaries. I think this is starting on page 200 of TEP-8.

A. (Mr. Bryner) Yes. All right. Good morning, Chairman, Members of the Committee. Good to see you again.

So just a quick recap of the overview of the routes we went over both together in the hearing as well as out in the field yesterday.

So between DeMoss Petrie and Vine we had the four different route alternatives A, B, C, and D. Let me just orient you to the way the table is set up.

So you have on the left-hand side you have each of the routes. Across the top you have a number of different categories. Each of these categories are basically the categories that distinguish the major factors that -- between -- or some of the major factors that distinguish each of those routes one from another.

So you have total cost. Again, that total cost is inclusive of everything, the engineering, construction, materials, right-of-way acquisition, environmental, as well as if we needed to underground any overhead -- existing overhead lines or communications.

The route length, I think that's pretty self-explanatory.

Residential, what that means is the amount of distance that particular route travels through an area of predominantly residential land use.

The low-income residential, that again is the linear length, but that particular route runs through areas of low income within a predominantly residential land use area.

Historic districts, the linear length of that particular route runs through areas that are designated as historic districts on the National Register of Historic Places.

And then existing overhead utilities, what that is is a percentage of the route that goes where there are existing overhead utilities today.

Overhead distribution to be undergrounded, that's the circuit miles that that route would -- if that route were selected, that would be placed underground.

And the overhead communication to be underground/relocated, that's the miles of communication wires that would be moved underground or relocated if that route were selected.

Would you like me to go through and highlight a comparison of one route to another, or are you okay with that explanation interpreting the table yourselves?

CHMN STAFFORD: I think the members might have some questions.

MR. BRYNER: Okay.

CHMN STAFFORD: Member Hill, did you have

questions on this portion of the route?

MEMBER RICHINS: Chairman.

CHMN STAFFORD: Yes, Member Richins.

MEMBER RICHINS: I just have one question.

Just confirming that route -- oh, excuse me, Grant -- because there's a lot of color on that just confirming that Grant is not a Gateway Corridor Zone?

MR. BRYNER: That's correct. Grant is not a Gateway Corridor Zone.

MEMBER RICHINS: Okay.

MEMBER LITTLE: Mr. Chairman.

CHMN STAFFORD: Yes, Member Little.

MEMBER LITTLE: I'm assuming that the number of miles of overhead communication wires to be undergrounded is way more than the whole route length because there's, like, multiple communication cables on each line or each --

MR. BRYNER: Yes, that's correct. As you saw yesterday, sometimes you had two, three, five.

CHMN STAFFORD: Any other questions, Members?

Are we ready to move to the --

MR. BRYNER: We can go to Slide 201 and --

CHMN STAFFORD: Yeah, the numerical sections now.

MR. BRYNER: So, yeah, so Slide 201 of TEP-8, these are the six different route segments between the Kino Substation and the Vine Substation.

Again, the same explanation of how to interpret this route is true here.

One thing that Mr. Robinson just pointed out to me is just to clarify, if I misstated on the cost, that does not include costs to place the communication wires underground. That's just -- that would be the costs associated with TEP moving our infrastructure underground.

CHMN STAFFORD: Well, wouldn't the owners of those lines pay for the cost of that?

MR. BRYNER: Correct.

CHMN STAFFORD: I think I recall yesterday some might because it depends on the terms of their license or agreement with you guys.

MR. BRYNER: That's correct. But that's more of an exception.

CHMN STAFFORD: Okay. Member Drago.

MEMBER DRAGO: Yeah, good morning, Mr. Bryner.

You'd mentioned the other utilities that would go underground. Is there any reluctance for them to build aboveground poles and say I'm not going

underground?

MR. BRYNER: I don't have any experience with that. Maybe Mr. Robinson does.

MR. ROBINSON: I don't actually. Our joint use agreements are managed by a different area. So I can't answer that question.

MEMBER DRAGO: Okay. No problem. Thank you.

BY MS. GRABEL:

Q. Mr. Bryner, is there anything more in this portion of presentation?

A. (Mr. Bryner) Maybe I can do just one quick reminder looking at the map that we have up on the right-hand screen. Just a quick reminder of what we're seeing right here. These are in the -- these little gray worms, those are the Gateway Corridors.

So that was pertinent to Oracle, Campbell Road -- or, sorry, Campbell Avenue and Kino Parkway and Broadway Boulevard. And the other things that you're seeing right here in the left tilting crosshatch, that's the University Area Plan.

I know there was a question about seeing the completeness of that, so it's Broadway, Country Club, Grant Road, and Stone Avenue. And then also set with inside that you see the crosshatched area, that's the Sam

Hughes Neighborhood Plan. And so those are the specific plans and ordinances that have language specific to the location of utilities.

Q. And, Mr. Bryner, is this Exhibit TEP-26 that you're referring to right now?

A. (Mr. Bryner) Yes, it is.

Q. And was this map prepared by you or under your direction and control?

A. (Mr. Bryner) Yes, it was.

Q. And I think it might be helpful for the Committee Members if the Gateway Corridor requires TEP to construct belowground, which routes would require a finding by this Committee to allow the aboveground construction?

A. (Mr. Bryner) So as we've stated before, we believe that the special exception process provided through the UDC would allow us to build overhead for the perpendicular crossings.

But we would need a finding from the Committee to allow overhead construction for Routes D and 6 on this northern portion of Campbell Avenue and for Route 1 from Campbell Avenue from essentially Ring Road south to just a little bit south of Broadway. And we would need it on Route 2 for the -- about a quarter mile where we would parallel Broadway Boulevard.

Q. Thank you. And if the University Area Plan is found to require TEP to go belowground, which routes would require a finding by this Committee in order to construct them aboveground?

A. (Mr. Bryner) We would need a finding from the Committee for every one of our route alternative segments.

Q. Okay. Thank you very much.

MR. DEMPSEY: I have a question -- go ahead -- if I'm allowed.

CHMN STAFFORD: One second. So say that again. It's the University Area Plan?

MS. GRABEL: Correct.

CHMN STAFFORD: All right.

MEMBER GOLD: Mr. Chairman.

CHMN STAFFORD: Yes, Member Gold.

MEMBER GOLD: I have a question. Your preferred Route B-4 total cost 22.3 million, I just added the two numbers together, the most direct route that requires the least amount of undergrounding is D-1, which is 20.3 million. But that goes almost entirely on a -- the something corridor on Campbell Avenue?

MR. BRYNER: Correct.

MEMBER GOLD: Yesterday I saw power lines on Campbell Avenue; is that correct?

MR. BRYNER: Yes, that's correct.

MEMBER GOLD: Then I have to wait for the City to come in where I can ask them why?

MR. BRYNER: I think that asking the City that question would be more appropriate.

MEMBER GOLD: Thank you.

CHMN STAFFORD: Thank you, Member Gold.

So this is the end of this panel, right, Ms. Grabel?

MS. GRABEL: Yes, it is.

CHMN STAFFORD: Okay. So --

MEMBER LITTLE: Mr. Chairman.

CHMN STAFFORD: Oh, one second. So then I believe they haven't been crossed yet, right?

MS. GRABEL: That's correct.

CHMN STAFFORD: Member Little.

MEMBER LITTLE: Apologies for interrupting you. I was just going to mention that I have a few questions from the second half of the tour yesterday as we were driving around.

CHMN STAFFORD: Okay. Go ahead.

And then after you get done, unless the members have other questions, we'll allow the parties to cross-examine the witnesses.

MR. DEMPSEY: Well, that's what my question

is related to as well, the route, the stuff from yesterday.

CHMN STAFFORD: Okay. Thank you.

Member Little.

MEMBER LITTLE: First of all, I noticed that there are on the routes that have the 46kV overhead, there are some that have transformers on the poles, and then from those transformers the lines go down some direct service, some just someplace else I assume.

I realize that it may be on a case-by-case basis, but in general, where would the pad-mounted transformers be located when those poles are removed?

And then from those pad mounted transformers, I want to confirm that TEP would run underground to a customer's property line?

Maybe just clarify all of that, please, for me.

MR. ROBINSON: Yes. Thanks, Member Little.

So normally what we would do for our underground system our pad-mounted equipment is regularly set within an easement on private property. So the underground would be in road right-of-way and then swing in to a piece of pad-mounted equipment that's set on private property easement just off from the road right-of-way.

MEMBER LITTLE: Okay.

MR. ROBINSON: And so to answer the question about the secondary wire, right, as we talked a little about before depending on the designers' need where the services are going from and to, we'll put that underground service either to a riser pole, and you saw some small, short poles out there with secondary on them, and come up the riser pole to feed the customer, or we'll run that underground service directly to the customer's panel that are along the roadways that had transformers on those poles, right. We would have a transformer pad mounted on the ground near or at that location.

MEMBER LITTLE: Okay. That's what I thought. I just wanted to confirm that.

So the fact that at present there are some services to customers that come directly from the poles that are existing that will be removed, you will not have a need to put another tall pole in place of the one you're removing in order to provide that service entrance?

MR. ROBINSON: That's correct. The service entrance is I want to say a 20-foot pole aboveground and very small in diameter.

MEMBER LITTLE: And for the most part it seemed to me as we were driving around that those poles

if people don't want it underground to their homes go down alleyways, right-of-ways, and backyards, not on the main road that we have concern with at this point.

MR. ROBINSON: Yes. Most of the utility infrastructure runs on the back lot line along an alleyway in these areas.

MEMBER LITTLE: Great. Okay.

I guess my only other question because one of them was answered is for Route 3, down where we drove past the wash -- I can't remember the name of that wash.

MR. BRYNER: Arroyo Chico?

MEMBER LITTLE: Yeah.

Are we proposing or are you proposing that the new line would go in the wash?

MR. BRYNER: Do you want to take it?

MR. ROBINSON: Yes. So that's an area where we need to do floodplain analysis, but the current route would be within the wash parameters designed to withstand floodplain loads.

MEMBER LITTLE: Thank you.

I think that's all I that had, Mr. Chairman. Thank you.

CHMN STAFFORD: Thank you.

MEMBER HILL: Mr. Chair, I had a question about yesterday's tour too.

CHMN STAFFORD: Yes, Member Hill.

MEMBER HILL: In some of the residential areas that we traversed and we looked at sites, because some of these neighborhoods are a little bit older there's also some fairly mature trees. I hesitate to call them stray trees because I don't think they were designed that way, but some of them are along the street.

Can you talk a little bit about -- and I just want to say, you know, with climate change, with cities and towns kind of heating up in future scenarios, those big trees are kind of important to folks for cooling and other things.

Can you talk a little bit about how TEP will approach neighborhood trees and vegetation in these corridors and how you'll manage for that?

Because you're working so hard to make sure that these new lines aren't towering over neighborhoods, but then it might be hard to maintain trees and vegetation underneath there, so can you talk a little bit about your approach to that?

MR. BRYNER: Sure. I'll share really quick, but then I want to have Mr. Robinson speak to that because he's got a lot more experience on that.

But I assume you're speaking -- well, what comes to my mind is along Adams Street there's some large

pine trees, and we talked even in the fly through you could see the wires actually go through the pine trees. So there are clearly places where we would have to remove vegetation. But I'll let Mr. Robinson talk about our practices with respect to that.

MR. ROBINSON: Yeah, that's correct. Overhead power lines, both distribution and transmission line voltages, are not compatible with tree growth, right. And so it is one of the -- actually, one of the major maintenance items and expenses is managing vegetation.

There are some significant trees, those Aleppo pines come to mind along Adams Street, that will either need to be cut back significantly or relocated -- not relocated but removed and replanted.

That's what we'll often do if we have to take out some major trees is work with the customer and give them two or three or four trees for every tree that we remove, planted where they would like them, but that aren't in conflict with our facilities.

MEMBER HILL: Okay. That's helpful. Thank you.

MEMBER FRENCH: Mr. Chairman.

CHMN STAFFORD: Yes, Member French.

MEMBER FRENCH: Yeah. I have one question

with the route tour. For reference, the narration I'm going to speak about is included on the map 10 tour narration.

Mr. Bryner, you spoke about the collocation of 46kV lines and the proposed route along Route 3 on Highland Avenue temporarily collocated. So will this temporary collocation impact the overall height of the structures, and are there any other examples of this temporary collocation?

MR. BRYNER: So, Member French, the -- I'm trying to think of how to answer this. So the temporary collocation would result in a double circuit structure. So you'd have the 46kV on one side of the structure, the 138kV on the other side of the structure. And so an example of that would be it would be very similar to what we saw on 36th Street near the Kino Substation.

Now, we didn't have the insulators for the second circuit, but it would be similar to that. And when we were able to retire the 46kV circuit, once we had transferred all of our electrical connections over and we were able to retire those 46kV substations, then we would be able to remove that wire, and it would look, again, similar to the 138kV structures on the south side of 36th Street that we saw going into the Kino Substation.

Does that answer your question or not?

MEMBER FRENCH: Yes, I believe it does. Thank you.

MR. BRYNER: Mr. Robinson was just telling me that we would have other places where we would do that like along Euclid, but there's various places where we would not be able to retire the 46kV before installing the 138, so we would have some temporary collocations with the 46kV. But the ultimate configuration would be the single circuit.

MEMBER GOLD: Mr. Chairman.

CHMN STAFFORD: Yes, Member Gold.

MEMBER GOLD: It's not on this partial chart, but on the whole chart, the large chart on our placemats, you have a category called constructability.

MR. BRYNER: That is correct.

MEMBER GOLD: Am I to assume that the lower the number on constructability the easier it is and the quicker it is to construct?

MR. BRYNER: That's correct. And that holds true for all of those categories. The No. 1 means that's our best route. No. 6 means it's our worst route for that category. And the others are somewhere in between.

MEMBER GOLD: And the estimated total cost, the same thing, the lower the cost the better?

MR. BRYNER: Correct.

MEMBER GOLD: Thank you.

CHMN STAFFORD: Any other questions from members?

MS. GRABEL: Mr. Chairman, I have one quick question for Mr. Bryner.

CHMN STAFFORD: Please proceed.

MS. GRABEL: Thank you.

BY MS. GRABEL:

Q. Mr. Bryner, just to give Member Little a little bit of visual demonstration for what it would look to build the transmission line over the Arroyo Chico potential floodplain that you were talking about, could those key observation points be found in TEP-1 Exhibit G-3 KOP No. 8?

A. (Mr. Bryner) Just a second.

Q. It's on pages 28 through 31.

A. (Mr. Bryner) I guess you're right, but I wanted --

Q. Okay.

MEMBER KRYDER: Mr. Chairman.

CHMN STAFFORD: Yes, Member Kryder.

MEMBER KRYDER: For Mr. Bryner, this is -- as we were driving west on Speedway at the intersection with Euclid we caught a stoplight, and I looked out the

window, and there was the city stoplight post or whatever structure I guess is the proper name, and I noticed on it a whole lot of what appeared to be remnant double-faced tape.

And I recall having driven the same route quite a number of times that during the term oftentimes there's posters and buy this and vote this and such on these. And that prompted me to think about graffiti on your structures.

And so that's a long lead-in, but I'd like to hear how TEP manages graffiti. And we've been introduced to three different colors of posts -- of structures of the COR-TEN, the stainless or aluminum, and the painted ones.

Could you just kick that around for me a bit.

MR. BRYNER: Sure. So, Member Kryder, to address your question, yes, we have the three different pole finishes. All three pole finishes are subject to graffiti. Our current practice with respect to graffiti remediation is we will identify it either through our inspections that there's a problem or we'll have members of the public report that we have graffiti.

And then we have a team that will go out. Typically what they'll do is they'll go out and paint

over that graffiti regardless of the pole finish. There are a number of instances where you'll go around town and you might see paint over these that has -- does not match the poles at all. That's not typically TEP that's done that. That's citizens that have taken it into their own hands to go and remediate that graffiti. So we try to use paint colors that match the poles better. It's not always perfect but better to try to blend in with whatever that finish is.

And your question has been brought up by many members of the public that our poles are graffiti magnets, and they would like to, you know, know what we can do to address that issue.

We've looked into, so, antigraffiti finishes on some of these poles with our pole manufacturers. For weathering steel, there's not a good solution on that. And we've tried various antigraffiti finishes on some of our other poles with mixed success.

So I'll say we don't have a great solution. We're looking into something that would work long-term for us from a maintenance standpoint. But right now what we do is we go and paint over it.

MEMBER KRYDER: Thank you very much.

Is one finish easier to maintain than the other?

I thought I heard you say that COR-TEN was absolutely difficult. Did I hear that right?

MR. BRYNER: Are we talking about graffiti when graffiti occurs?

MEMBER KRYDER: Yes. A graffiti or posting of signs, double-faced tape, fill in the blank. Some sort of signage that is not yours but it gets posted on your poles.

MR. BRYNER: I think from an overall standpoint they're fairly similar. What we do to remediate graffiti is the same regardless of the finish.

When I mentioned the COR-TEN or the weathering steel, that was with respect to putting an antigraffiti finish on the pole because of the way the pole is finished and -- or the patina -- and I'm terrible with this, but it doesn't lend itself to adding an antirepellant, if you will, on that finish.

MEMBER KRYDER: Yes. By design COR-TEN is not to be painted.

But kind of along the same line, when we came out of I think the Vine tentative substation, I noticed a pole, and I've forgotten the exact street, but it was kind of when we came out and came around the corner, one that was all painted yellow or appeared to be yellow is now that is a resident that got cranky about

this and painted over it, or is that something that the pole weathers to that color, or is that a pole that was painted? Just give me any information that you happen to know about that.

MR. BRYNER: So that pole -- I know exactly the pole you're speaking of. That wasn't a good citizen going out there and trying to paint it. That was a pole that was painted in the Mojave sage color, and over time it has weathered, changed from one color to another, and that's sort of where it lands is that yellowishy color. And then you saw that pole is peeling badly and then starting to rust. That's sort of the life cycle of the painted pole.

MEMBER KRYDER: What's the approximate cost back of the envelope to repaint a pole?

And how often do you in -- this particular example how often would you have to repaint it?

Is that once ten years, once 20 years, or how is that?

MR. BRYNER: I'll let Mr. Robinson take it.

MR. ROBINSON: So, Member Kryder, we normally paint -- we normally paint -- depending on the number of poles we bring in to get painted all at once, there's a little bit of economy of scale depending on the number of poles we get painted.

But it's normally somewhere between 15 to $25,000 per pole depending on the size of the pole and the number of poles that we're getting painted.

And roughly that repaint lasts about 20 to 25 years on a service.

14 years ago you might have noticed when we left north out of DMP and then cut across to get back to Grant as we were going around, those painted poles heading north out of the DMP substation were repainted 15 years ago. You can see they're just now starting to show through and the steel and the little bit of rust underneath. So in the next five to 10 years we'll try to get them scheduled to be painted again.

MEMBER KRYDER: When you say you have a number of them to be painted, does that mean you actually take the pole down, take it into a shop somewhere, and it's repainted there, or -- and you have to set an interim pole?

MR. ROBINSON: No. We have a specialty contractor that we take the lines out of service, and they strip the old paint off the pole, they put primer coat and rust treat any spots that need to be treated on the pole and then put a new coat of paint on top.

MEMBER KRYDER: Okay. So we're looking at a grand a pole a year basically in the scenario you

painted.

MR. ROBINSON: Yeah, that's --

MEMBER KRYDER: Pun intended. Wow. That's a lot of money.

MR. ROBINSON: It is.

MEMBER KRYDER: Cost, original cost, of the three different types that have been under discussion here, are they approximately the same, or is there a serious cost differential between one and the other?

MR. ROBINSON: So there is a differential. The weathering steel pole is the most economical material type to buy originally. I believe painted pole is the second most economical. You'd pay a premium of about 12 to $1,400 on a painted pole. And then a galvanized pole is another 3- to $5,000 on that service preparation.

MEMBER KRYDER: Thank you very much. That's very informative. I value that a lot.

CHMN STAFFORD: Thank you.

Any further questions, Ms. Grabel, or is this panel available for cross-examination?

MS. GRABEL: This panel is available for cross.

MR. BRYNER: If I could just real quick. I just -- I think we didn't -- I didn't fully get to mention the KOP No. 8 to answer Member Little's question.

That is correct, that shows the visual simulation through the Arroyo Chico Wash and us placing those poles down within the flood basin.

MEMBER LITTLE: Thank you.

CHMN STAFFORD: Ms. De Blasi.

MS. DE BLASI: Chair, Banner does not have questions for this panel.

CHMN STAFFORD: Ms. Stash, does the City of Tucson have questions for this panel?

MS. STASH: The City of Tucson has no questions. Thank you.

CHMN STAFFORD: All right. Mr. Dempsey.

MR. DEMPSEY: I just have a couple.

RECROSS-EXAMINATION

BY MR. DEMPSEY:

Q. I guess we'll start from yesterday.

So you mentioned that to underground the distribution you need two six-inch conduits, right? And then potentially more if the communications providers want to add their stuff.

What's the depth and the width of that trench?

A. (Mr. Robinson) So in clarification, it depends on the feeder or in answer yesterday I said one six-inch with a spare is what we normally put in.

Q. Right.

A. (Mr. Robinson) So it's two. But that would be for feeder.

The trench width is usually dug about two feet wide because you have -- because that's kind of the minimum width of the trench because you have to get down and place the conduit and do any trench work on the bottom of the trench to prepare for backfilling.

In addition to that, the depth -- the minimum depth is 42 inches in depth. That's our minimum burial depth.

Q. What are the maximums?

A. (Mr. Robinson) There are some settings depending on topographical features and things like that that can get well over 10 to 12 feet deep depending on what other underground conflicts or other topographical features you're trying to go around.

Q. And how about maximum width?

A. (Mr. Robinson) For distribution, this is average. I wouldn't be able to tell you the maximum we have on our system, but maximum normally would be like a three-foot-wide trench so we could put four conduits in a duct bank. That's generally speaking the maximum width.

Q. So if I hear you correctly, minimum is two feet wide, maximum is four-ish?

A. (Mr. Robinson) At maximum, yeah.
Q. Thanks.
So I actually then have a question about this for you, Clark, I guess.
So the preferred route is 4-B; right? Am I remembering that correctly, 4-B?
A. (Mr. Bryner) That's correct, we call it B-4, but same thing.
Q. B-4. So you have up here -- this is Slide 201. You have up here that Route 4 only adds 0.5 miles of historic. That's just districts? Because to me that seems very small relative to the historic preservation zones and all the -- what is that?
A. (Mr. Bryner) So the historic districts are just the districts that are listed on the National Register of Historic Places, whereas the historic preservation zone is a local ordinance.
Q. And you don't have that listed anywhere on these tables?
A. (Mr. Bryner) Not on these tables.
Q. Well, it's fair to say it's a lot more than a half a mile or more than a half a mile?
A. (Mr. Bryner) I would have to look.
Q. Okay. That's it. Thank you.
CHMN STAFFORD: Any additional questions

from members?

MEMBER LITTLE: Mr. Chairman.

CHMN STAFFORD: Yes, Member Little.

MEMBER LITTLE: I have notes that I took, and now I need to find it, of course, that during when we were reviewing all the routes in depth here in the room, there was a number given for the number of miles of overhead lines that had been installed by TEP after the adoption of the City of Tucson zoning regulations that have to do with overhead, and I have it written down, but I have to find it.

Where are those installations and how was permission obtained?

A. (Mr. Bryner) So, Member Little, I have a map that shows all those installations. It's not an exhibit today. We could make it an exhibit if that was of interest. I could try to point those out based off of my map, but to answer -- I can answer the where.

To answer the how permission was obtained, think would be pretty involved, and maybe that would be a good discussion with the City.

MEMBER LITTLE: Okay. I'm just wondering if there were exceptions granted or --

MR. BRYNER: Okay. No.

MEMBER LITTLE: Okay. I would like more

information about that. Thank you.

MR. ROBINSON: Member Little, can I just add a little bit? From our perspective, we applied for a permit to put the facilities on, and we were granted a permit to build those facilities.

MEMBER LITTLE: Okay. Thank you.

CHMN STAFFORD: All right. Ms. Grabel, are you ready for your next panel?

MS. GRABEL: I actually have two quick redirects for Mr. Robinson. And then I'm ready for my next panel.

CHMN STAFFORD: Please proceed.

MS. GRABEL: Thank you.

REDIRECT EXAMINATION

BY MS. GRABEL:

Q. Mr. Dempsey was asking you about the minimum/maximum average width of undergrounding distribution utilities; do you recall that?

A. (Mr. Robinson) Yes.

Q. Have you done any analysis of the anticipated width and depth of the trench needed to underground the distribution facilities that are at issue with the MRP Project?

A. (Mr. Robinson) For the distribution?

Q. Correct.

A. (Mr. Robinson) We'll just supply our standard application for what that is. I have not.

Q. You have not.

Do you anticipate it's going to be more around the average than a four-foot trench?

A. (Mr. Robinson) Very much so average. The wider trenches are where we have multiple circuits in the same trench. There are occasions where we'll have more than one circuit in one trench.

Q. Would you agree that that's atypical to have more than one circuit in a trench?

A. (Mr. Robinson) Yes.

MS. GRABEL: Thank you. No further questions.

CHMN STAFFORD: Then are you ready to call your next panel?

MS. GRABEL: Sure are am. Sure are, sure am.

So, Mr. Robinson, I think you're excused from this panel. Mr. Bryner, you're forever on that panel. And this is a panel of one to talk about public outreach.

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CLARK BRYNER,

called as a witness on behalf of Applicant, having been previously affirmed or sworn by the Chairman to speak the truth and nothing but the truth, was examined and testified as follows:

DIRECT EXAMINATION

BY MS. GRABEL:

Q. Please proceed.

A. Okay. I think the slides are where I want them. So on the screen on the left, Slide 203 of TEP Exhibit 8. This is the siting process that TEP followed with obviously the outcome of this siting process being the routes that we've looked at -- looked at in extensive detail as part of this proceeding and the identification of route B-4 as our preferred alternative.

So our process includes five different phases, and it was integrated and driven by data that was based on public and stakeholder input.

So the stars on the process indicate where we in particular where we sought that stakeholder and public input. And during phase one of the process, we actually -- we actually held two -- two public outreach efforts during that phase.

And I'm going to walk you through briefly this

process.

So, first of all, so now we're going on to Slide 204 we started off by identifying a study area. So it was based on the end points of the project, which we've discussed already is the DeMoss Petrie Substation, the Vine Substation, and the Kino Substation.

And then we looked at a high level at any opportunities in between those.

As a result we landed on the study area that was bounded on the north by Fort Lowell Road on the east, by Country Club Road on the south, by 16th Street on the west, by 4th Avenue and roughly I-10.

So the study area, it really just placed the limits on where we would consider route alternatives and where we would focus our research and studies. But most importantly, it helped us target who we would reach out to to share information about the project and seek input from.

So based on the study area, we developed a notification area. And so that's shown on the same slide with the sort of blue dashed line. So that was one mile to either side of the study area. And that included an area that had -- over 100,000 homes and businesses were included within this notification area.

So that point we began our outreach process with

the public and stakeholders, and we did so in a variety of ways that are illustrated on the screen. But we had two primary intentions with this. One we wanted to make sure that we educated folks about the project, why we were doing it, how we were doing it, why it was so important, and we also wanted to seek input on community values that would influence our siting study.

So on the screen you'll see these two infographics that have lots of numbers and information about what we did, how we did it, the results of that.

And if you were to add up the various public, neighborhood, stakeholder meeting that we held, you'll see that it adds up to 52. And even after we created these graphics, we've continued to reach out and have meetings with other neighborhoods and members of the public.

So I'm going to talk about a few of the things that you saw on the infographics, but the first thing I want to point out and talk about is our project survey.

So we conducted this between August 31 and October 15 of last year. And we decided to do a survey because despite our best efforts we don't tend to get that much feedback that's helpful in siting a transmission line that is consistent with community values.

So even on a controversial project like this one, we just don't get a lot of specific feedback that gives us that guidance that's needed.

So we wanted to give folks a simple way that they could provide comments in less than a minute that would allow them to participate in a meaningful way in guiding the outcome of the project. And we were also hopeful that by doing this that we would hear from a sample of the population throughout that notification area.

And we believe that the survey was a huge success. We received almost 3,000 responses, and most importantly, we received information that was needed to develop the evaluation criteria that we would use in phase three and four of our analysis.

So the main question that we asked was regarding the criteria and what was most important for us to consider in identifying a transmission line route. So that question is on the screen, which was which criteria are most important in considering the route of the proposed transmission line for the Midtown Reliability Project, and they had the option to select two.

So from this, we learned -- and I know the writing is pretty tiny there, but the most important factor was the impact on low-income or disadvantaged

communities, which we've spoke about already, and the second most important factor was the cost of the line.

Moving over to slide -- or the right screen here, Slide 208. So this map shows where we received the responses from. You'll notice that while we certainly received more responses from the east and north sides of the notification area, we did receive some level of response from throughout the project notification and study areas.

MEMBER LITTLE: Mr. Chairman.

CHMN STAFFORD: Yes, Member Little.

MEMBER LITTLE: This is -- it's extremely impressive to me that you've got that many responses and that they're spread out so much, but that's still only 5 percent of the number of surveys that you sent out.

Is that typical that you get that few -- that low a percentage of responses to a survey?

MR. BRYNER: So I can't say if it's typical or not because this is the first time we've done a survey that we put out to everyone like this.

And I guess I failed to mention too that we e-mailed it directly to 55,000 e-mail addresses for those customers within the area that we had an e-mail for. The rest in our newsletter that we put out we put a link to the survey so that -- well, I guess a link, we put an

address to the survey in a QR code so the folks could participate that way.

I felt like it was a good response, but, yeah, to your point, it's still a fairly low percentage of everybody.

MEMBER LITTLE: I would agree with both your responses, that it is a good response, but when you look at it on a percentage basis, it's a sad statement of how many people care to respond.

MR. BRYNER: I think one other thing that I just want to point out on the map here. You look at this -- so to explain the colors on here, the yellow represents where we received a high rate of response, and then the bluish areas on the map are lower rates of response.

But if you were to overlap that with where the residents are at within this area, you'll see that the bluer areas are primarily industrial and commercial areas, and then the red and yellow areas are within the areas where you have the neighborhoods.

And, again, up in the north and east sections, that's where you have the more dense residential areas. So I think it is fairly representative of the study area.

MEMBER GOLD: Mr. Chairman.

CHMN STAFFORD: Yes, Member Gold.

MEMBER GOLD: This shows density of responses but it doesn't reflect pro or con.

Are the majority of those con?

MR. BRYNER: My next slide -- or my next slide may answer that a little bit.

But we didn't ask do you favor the project or are you against it. We were asking about criteria to evaluate what should we consider as we're looking for transmission line routes.

MEMBER GOLD: I'll wait for your next slide.

MR. BRYNER: Okay.

MEMBER RICHINS: Mr. Chairman, I just -- statistically that is actually a very good return rate to get 5 percent. That's -- when you do most surveys you're in the 2 to 2-and-a-half percent range and response rate, especially e-mail. So this is cool to see how much outreach. And also the disbursement of it I think is really helpful in helping evaluate routing. Nice job.

MR. BRYNER: Thank you.

MEMBER GOLD: Mr. Chairman.

CHMN STAFFORD: Yes, Member Gold.

MEMBER GOLD: To reinforce what he just said, in the newspaper industry if you have an

advertisement saying -- I know I'm going back 20 years, but I'm pretty sure it's constant today, if you put in an ad say giving away free money, you would expect only a 2 percent return. And then after you actually have the prospect and they tell all their friends, then it skyrockets. You did an excellent job.

MR. BRYNER: Thank you.

Okay. So we also gave folks an opportunity to provide an open-ended response to the survey. We asked is there anything else that we should consider.

And to that people took the liberty to provide us feedback on a lot of things, both in other criteria that we considered as well as just how they felt in general about the project. And so on Slide 209 you can see the word cloud with the larger words on there representing some of the words that were repeated the most. So it doesn't take an eye chart to tell which was the most prominent feedback, and that pertained to putting the lines underground.

But as we've spoken already -- sorry, looks like --

MEMBER GOLD: Mr. Chairman.

CHMN STAFFORD: Yes, Member Gold.

MEMBER GOLD: When you asked for those comments and feedback, did you tell them the cost and

time it would take to underground, or are they just saying if it could happen -- thinking in their minds if it could happen instantaneously, we would like it underground.

Did you tell them what undergrounding entails?

MR. BRYNER: So at the point we conducted this survey, this was at the beginning of our second siting study. So we'd gone through this once before and the application that was prepared and then pulled.

We'd gone through -- this came on the heels of our Proposition 412, which was to modify our -- well, renew our franchise agreement with the City of Tucson to raise the funds to place it underground. So there had been I'll say a significant amount of communication with the public on undergrounding, what it entailed, what it cost, but we hadn't directly spoken in this siting effort, this renewed siting effort, about that.

MEMBER GOLD: Thank you.

MR. BRYNER: Yeah.

BY MS. GRABEL:

Q. And, Mr. Bryner, just to clarify, the underground criteria was not a factor listed in the survey sent out?

A. That's correct. And that was actually one of --

one of the questions that we received most often was, Why didn't you ask us about underground? And the reason for that was fairly simply, and this was something that also when we met with the public after this survey that we communicated very clearly to them, and that was that, Hey, Proposition 412 failed.

We've talked in here about all of the different things that we did as a company and in collaboration with the City to try to find a solution to pay for that. All of those came up fruitless, so there was no way to pay for the underground differential cost.

And on top of that, the Corporation Commission came out with their policy statement with respect to underground and its prudency or lack thereof if it wasn't for reliability or safety purposes, and so we communicated very clearly to the public that underground is not an option for this line.

Q. Thank you. Please continue.

A. So nonetheless, though, we did receive some helpful feedback to this question you'll see listed on the left-hand side of this screen on additional criteria from the public that should be considered and that, in fact, was considered in our siting study.

So another thing that you may have noticed as we've talked about these things or these lines over the

past few days is there are a lot of neighborhoods. Within the study area, within the notification area there are 62 neighborhoods.

And we felt it would be good to solicit their active involvement. So we decided to form a neighborhood advisory group. We consulted with the City of Tucson to get ideas on how we might form the group, and with that input and based on past experience, we contacted all of the active neighborhood associations, and we asked them to identify one representative from their neighborhood to participate and represent the views of the neighborhood.

And I know you've heard from several of those representatives. I know Mr. Dempsey was on that group. We've had -- I know we've got Mr. Cummins on the back who was on that group and several others that came to the public comment session on Monday evening.

Let's see. So on the screen Slide 211 right now, this shows 21 neighborhoods chose to participate in the advisory group, and they're represented with the areas that are shaded in blue on the map. So while it was roughly, you know, one-third of the neighborhoods that are formed within the study area, geographically it did represent a fairly large cross section of the study area as a whole. And with some of those larger gaps they're actually in primarily industrial areas.

So the neighborhood advisory group met four times beginning in October of last year, and our last meeting was in February of this year. And at those meetings we -- I'll provide my opinion -- we had some fairly good conversations about the community, about the values of the community, concerns of the community, how we might better communicate and educate the general public on the project and share our messages more effectively. And we workshopped different ideas on opportunities and constraints. We workshopped through our suitability assessment, the evaluation criteria.

And so, again, this group -- I know there were some comments given at the public comment session on Monday about how in the end, you know, we didn't have routes that everybody could agree on, and that was fine.

The purpose of the group wasn't to get consensus on a route, though that would have been ideal. It was to get advice on the community values to shape it and identify, Hey, we're trying to thread a needle here. What's going to be most compatible with the community's values?

And I got to say this group was awesome. They gave a lot of their time, provided a lot of really good feedback, and I know in the end, again, we -- they recognize that not everybody got exactly what they were

after, but it was a better project because of them.

We did also -- we created a group chat, a group forum on this group's IO. That was at the request of the neighborhood advisory group so that when we weren't meeting we could continue to share and exchange ideas.

So while the neighborhood advisory group was representative, meaning there was one member per neighborhood could come and represent the neighborhood as a whole, we still wanted to reach out and gain firsthand knowledge of -- from individual residents of these neighborhoods. So we extended an invitation to all neighborhoods, all of those 62 neighborhoods on multiple occasions to allow TEP to come and attend one of their regularly scheduled neighborhood meetings, or if they wanted to schedule a special meeting for us, so that we could hear their concerns and answer their questions.

So to date, 13 neighborhoods have invited us to attend, and these neighborhoods are illustrated in the map on the right, again, shaded in those blue areas. And we recently met with the leadership of the West University Neighborhood, and it sounds like they're wanting us to come and attend one of their meetings in the coming months. They only meet once a quarter, so next meeting they were going to invite us.

But in total we did meet with 199 different

residents as a result of these neighborhood listening sessions.

MEMBER KRYDER: Mr. Chairman.

CHMN STAFFORD: Yes, Member Kryder.

MEMBER KRYDER: On that previous slide, this is for Clark, are the numbers in parentheses then the numbers of participants?

MR. BRYNER: Yeah, that's correct. Sorry I didn't point that out.

MEMBER KRYDER: Okay. Thank you.

MR. BRYNER: Okay. So, again, so we had the neighborhood advisory group. We had the neighborhood listening sessions, and those were great, but those were sort of by invitation only to attend those.

So we wanted to make sure we had a catchall that anybody in the community could come to and learn about the project, voice their concerns and share their input.

So we did hold four public open houses, and, like I said, everybody was invited to come. And we held those in a hybrid format. Not -- not hybrid as in an online and in person, but hybrid as in we had an open house and we had a presentation.

And the meetings were -- you probably recognize this room. This is where the meetings were at.

So they were very well attended from, you know, over a hundred for a couple of them to just under a hundred for a couple of them. Which is good turnout, really good turnout.

So we did a lot of things to get the word out to people about some of these events that we were hosting and try to give them the opportunity to learn about the project. So I'm just going to go over a few of those.

So, first of all, we did -- we sent out four newsletters throughout the course of this project, plus we sent out a postcard prior to this hearing, so, I guess, five mailings in total.

But within those newsletters we included project updates, maps, links to our project web page where -- I guess I'll talk about that in a minute. I don't want to spoil that one, but these newsletters went out to over 100,000 customers and businesses everyone within our project notification area. And we did so -- they were both in English and in Spanish.

So we also placed advertisements in the newspaper where we invited all of the project open houses as well as to visit the project web page to learn more.

For the first two open houses these were only published in the Arizona Daily Star, but based on

feedback we received from all of you at a previous hearing, the last two open houses were also advertised in the AZ Bilingual so that we could try to make sure we included some of the Spanish-speaking community.

And, of course, we advertised through social media. So we placed targeted advertisements in both English and Spanish. And for the last two open houses we did engage the services of a third party, and as a result we made some changes in our campaign, which did increase the engagement with the advertisements, and you can see that, the results of those changes in the CTR, the click through rate, from the lower numbers to you can see some adjustments we made. And then we really got them up to closer to 2 percent by our last open house meeting. So I think that was well worth it.

And, in addition, to further get the word out, we placed bilingual flyers at 14 different public locations, including the University of Arizona, the City of Tucson council offices and libraries. We did this two weeks prior to our February and March public open house meetings.

And lastly, we placed bilingual signs at all major intersections. You might have seen some of these for -- those were the official hearing notification signs, but we did the same thing for our open houses in,

again, just the February and March open houses based on feedback we received from all of you on the effectiveness of who sees what and pays attention.

And we did advertise on those that refreshments would be provided just as an added incentive.

So at each open house we had a sign-in sheet, and we included an option to be included to a project e-mail list. So those who opted in were added to this list. And we also put anyone who commented on the project via e-mail or via our online comment form and provided their e-mail address on this e-mail distribution list. And then we would send out e-mails to them throughout the project.

So you can see that list grew from the beginning from our first one was 56 recipients up to 478 recipients for our last communication that we sent out regarding this hearing.

And then, of course, we had our project web page. We have a web page in both English. And we have a separate web page in Spanish where everything is translated. And we've continually updated this page. We still update it. We threw some things on there just this week.

And on the web page you can see everything

about the project from needs and benefits. You can grab any of the project newsletters, any of our outreach information. We have a project video that folks can go and watch, an interactive map that you can go and zoom in and see where the project is at in relationship to whatever is important to you. And through the project web page there was also all the ways that you could comment on the project.

So I know we've talked about this a little bit. But I just want to mention here briefly we did have that change with the 46kV lines that we had identified as opportunities, thought we could utilize those and then late in the project found that wasn't going to be a viable option. So those were on between Lester -- well, just north of Lester Street, just north of Adams Street, and just north of 7th Street.

And so as a result of that, we did put in our newsletter once we learned about that our newsletter that went out to 100,000 folks, we identified that clearly in there, that change.

But in the event that people threw away their mail, we wanted to make sure that folks that were going to be directly affected by this knew about it. So on those streets we went and we placed door hangers on every home or business in that area so that they had

every opportunity to be made aware of this sort of eleventh hour change.

Okay. So apart from everything we did to engage with the public, we also wanted to seek input from stakeholders and local agencies who had jurisdiction within the area. And for that, we held four meetings that we call agency briefings where we informed these groups about the project and we provided project updates, but we also sought their feedback so we could understand their concerns, and they could provide us with input on any challenges that we may face as part of the project.

And these meetings were fairly well attended. We had representatives from many departments within both Pima County and the City of Tucson as well as representatives from Banner Health, the University of Arizona, Davis-Monthan Air Force Base, DM50, which DM50 is basically a group that supports the Air Force base, Metropolitan Pima Alliance, Southern Arizona Home Builders, Southwest Gas, Tucson Airport Authority, and the Tucson Metro Chamber.

In addition to those who participated we did invite many others, but they just chose not to participate.

And we continually updated elected officials through the course of the project, and several

did request project briefings from us. So as a result we had the briefings shown on the screen with federal, state, local, and tribal elected officials or their Staff.

And several other stakeholders and groups also requested specific meetings with us. And several of these we did meet with on a number of occasions to provide updates and to hear their concerns or work through any challenges.

MEMBER LITTLE: Mr. Chairman.

CHMN STAFFORD: Yes, Member Little.

MEMBER LITTLE: I'm just curious why was the Public Service Company of New Mexico interested?

MR. BRYNER: Did I have them listed?

MEMBER LITTLE: Well, Public Service New Mexico. I guess I read that as Public Service Company.

MR. BRYNER: No. Okay. Good question.

So it wasn't them interested in us, it was us interested in them. So one -- I think I mentioned this in my testimony, but we received a comment early on about, Hey, your line is going through historic districts, historic areas. Can you look at what other people are doing throughout the country in some of these areas to make their lines fit in?

And so that's -- we reached out to them, so

that's what that was.

MEMBER LITTLE: Thank you.

MR. BRYNER: You had me for a second. I was like I don't know why we included them.

So I know I pointed this out on a few of the slides, but we did have Spanish translation of all of our materials, everything we did. We tried to go bilingual. Our open houses we had five to six team members that were bilingual. We also had a Spanish interpreter with headphones available for our presentations and question and answer sessions at the open houses.

And as a result of that, we received one call to our Spanish phone line. We had one Spanish-speaking attendee at an open house, and we received no requests for Spanish interpretation at the open houses.

And in everything we did, open houses, neighborhood meetings, phone calls, one-on-one conversations, we were always soliciting input from the public. We asked them to submit their comments by paper, by mail, online, by e-mail, calling our phone line, leaving a message.

And as a result of that in addition to the nearly 3,000 responses we received to our project survey,

we received 423 comments or questions. And we responded to every one of these or acknowledged them if there was no response that was needed.

And as you can see from the bar chart on the right-hand screen, the most common comments were with regard to the location of the line or in support of undergrounding the line or about the historic nature of the area and the appearance of the lines.

The last thing I want to point out on the public outreach, which wasn't really our outreach, you know, we did everything we could think of and possibly do to make sure folks were aware of the project, knew what we were doing. But there was quite a bit of news coverage on the project. So that was just another way that people could be become aware of the project or learn about and be pointed to our project web page.

Okay. So now that you've seen what we did to interact with the public and stakeholders I'd just like to go briefly through the rest of the planning and siting process and show you how we took the information that we received through that outreach and public engagement process to influence the development of the routes and ultimately type of routes that were included in our application.

So as I mentioned before, we had three

different public outreach efforts, but there were really three different areas where that influenced the siting study.

So the one was on identifying opportunities and constraints, and the other two were in analysis that we conducted in phase three and phase four. I'll go over those.

So we'll start off first with Irvington opportunities. So when we began thinking about where we could put new transmission facilities, we looked for areas that, you know, appear to be good candidates. This is nothing new or different. This is what we do for all of our projects. And so we looked at linear features such as major roads which can generally accommodate the setback requirements and the space that we need for a major transmission line.

Railroads, which it's kind of subtle in there, but the railroad. You all saw it on the field tour adjacent to Aviation Highway there.

And we looked at existing infrastructure, so such as where we had our existing 46kV sub transmission lines or even places where have higher voltage lines, or if there are transmission pipelines, things like that, again, where there's linear disturbance.

And, boy, I didn't see a change there. There we go.

And then we also looked at where are the industrial land uses at. Again, a lot of folks tend to think of a transmission line as being more industrial, so it's a more similar land use.

And we looked at areas of vacant land or where there were natural linear features such as major drainages or, you know, a river, or things like that.

And these -- whoops, what was that one? Oh. This was a very tiny change. Boom.

And then we took all those and we shared them with the public and with our neighborhood advisory group, and as a result of that we did identify one additional opportunity, and that was actually on Ring Road, which was an opportunity that had been looked at in the previous siting study that didn't come over to this.

And so after that all of those became opportunities for siting the line, which didn't mean that they were the only areas that we could put a transmission line, but it was a starting point for us to begin our analysis.

So simultaneous to that effort, we were also identifying constraints. So that could be natural, manmade, or regulatory barriers that would just make it

more challenging to construct and maintain a transmission line. So that was -- included areas of high density development such as you would have seen around the University of Arizona campus or the City of Tucson's designated Gateway Corridors, which we've talked about extensively.

And then we met with the neighborhood advisory group and as well as just the public at large and identified further opportunities -- or further constraints, which included additional areas of high-density development, some environmentally sensitive areas, and roadways with more constrained rights-of-way.

And so all of those became constraints for siting the line.

CHMN STAFFORD: Mr. Bryner.

MR. BRYNER: Yeah.

CHMN STAFFORD: If you go back to the previous slide, the red oval beneath the word "Vine," what area is that?

Can you refresh my recollection?

MR. BRYNER: That is basically the Banner UMC campus as well as some of the medical facilities associated with the university.

CHMN STAFFORD: And the large oval below that, that's the actual U of A campus, then?

MR. BRYNER: Correct.

CHMN STAFFORD: Okay.

MR. BRYNER: So then we looked at all of the opportunities that we'd identified, and we reviewed them with TEP's engineering group. And just from an engineering standpoint, asked them to identify can a transmission line reasonably be constructed in this area? And if it could, it became a preliminary segment, which was then the starting point for the rest of our analysis.

If it couldn't be reasonably accommodated, it was eliminated. And so the black lines on this map represent what moved forward as our preliminary segments.

So as I mentioned, with all of our outreach one of the primary outputs we were seeking there was we wanted to develop evaluation criteria that reflected the community -- sorry, Member Hill.

MEMBER HILL: Mr. Chair.

CHMN STAFFORD: Yes, Member Hill.

MEMBER HILL: Can we just go back to the previous map?

MR. BRYNER: Yeah.

MEMBER HILL: So at this point in your planning process, you didn't take undergrounding as a constraint for your planning process? I just want to confirm -- or I want to understand how you thought about

undergrounding when you were put your constraints together.

MR. BRYNER: So let me step back one more slide. So undergrounding was never a technology that we were considering as part of a -- as a solution for this project because it was determined to not be viable. But we were considering as the constraint areas where the City had requirements for undergrounding.

MEMBER HILL: Okay. Thank you.

MR. BRYNER: Okay. So the major output, again, of the -- of our efforts to reach out or one of the major our -- or tongue twisted.

One of the major outputs of meeting with the public and our stakeholders was to develop this list of evaluation criteria that we could use throughout our siting process that reflected the values of the community, not just our values or what was required by state statute, but reflected the values of the community that we could use to objectively analyze these different preliminary segments to identify our transmission line routes.

And so this is a list of all that evaluation criteria that was used. And it's reflected on your placemat as well.

So we took that evaluation criteria and it

formed the basis for our suitability assessment, which was phase three of our siting study. So this was a first-level screening of the preliminary segments that were identified. And it didn't utilize all of that criteria at this stage.

So the suitability assessment was conducted using GIS software or geographic information systems where we look at data spatially, and it first involved creating GIS criteria models for biological resources, total environment, which included a lot of various resource data, existing and future residential land uses, historic properties and neighborhoods, noise and communication, native lands, and low-income or disadvantaged communities.

The second step was we created several composite suitability models by combining each of those criteria models and giving each a different weight based on priority.

So this resulted in five different models. We had a balanced suitability model where all of those criteria models were looked at as if they all had the same bearing. We had an environmentally preferred model where those environmental factors were given preferential weights or higher weights.

We had a cultural and historic preferred

model, a residential land use preferred model, and a public preferred model.

So the public preferred model was based on weights of each of the criteria models based on the results of that survey that we did last year. And so the impact on low-income communities was the most important criteria in that model.

We then began our suitability assessment, and we used each of these models. We ran a GIS tool to calculate the highest suitability path. So we overlaid the preliminary segments on top of these models and let the computer do its thing to identify which path had the least impact on any of these criteria.

And so we did that free rein. And then we constrained the model using the constraints that we had and said, All right, you can't go down any of these paths that cross any of those constraints. Now where's the best path? And as a result of that, we identified a number of segments that represented the most suitable paths based on those different priorities.

Lastly, we did visually compare those segments, and we used our best professional judgment to decide if there were routes that represented north, south, east, west paths that were similar to the paths that the computer picked. And if they were similar in

nature to their impacts on those various resources, then we also kept those and moved those to the next step in our analysis.

Then we went and field verified all of these to ensure that they truly were good routes that could move forward and did represent the criteria models that they were intended to, and the output of that became what we call our refined segments.

And those are represented on the slide on 240 with the orange lines, with the dashed black line representing preliminary segments that were eliminated from consideration. So as a result of the suitability assessment, we went from 460 segments we were looking at to just a little over 100 segments.

MEMBER KRYDER: Mr. Chairman.

CHMN STAFFORD: Yes, Member Kryder.

MEMBER KRYDER: One question, Clark. Half an hour ago or so, we saw a slide where you put door hangers on some 50 or 75 or 100 houses because the feasibility of going up an alley proved not to work from an engineering and a practical point of view.

Where within all of this -- by the way, the system that you have looks very well designed and covers all the bases. But where within this could you plow in things like that, oops, we can't go down the alley?

MR. BRYNER: So I would say that that would have been the very first-level screening that we did after identifying the opportunities where we did -- it was a high-level engineering analysis just to decide, hey, can we probably build here? And I think that was probably an oversight that we could have/should have caught at that point.

MEMBER KRYDER: No. I wasn't trying to criticize it. I was just excited about where you could find a flaw in what you'd done and then go back and remediate the flaw.

No plan -- plans by their very definition are always false. We know that because the reason we're doing the planning is we don't know what the outcome is, but we've got an idea of what we'd like it to be.

Am I correct in that?

MR. BRYNER: That's correct, Member Kryder.

And I think we do have a few fail-safes. One of those would also be field verification.

MEMBER KRYDER: Okay. Great. I commend you and your team for putting all of this together. And especially as you're presenting it here it's very graphically obvious. Even though I was sleepy and so on as a result of yesterday's trips, I think I followed it through. Thank you very much. Good job.

MR. BRYNER: Thank you. I thought you were going to as a result of me droning on for the last hour and a half.

MEMBER RICHINS: That too.

CHMN STAFFORD: So it's not just me that Mr. Bryner's dulcet tones are making drowsy.

MEMBER RICHINS: Chairman, I think this is totally unfair. This has been some of the most spectacular outreach I've ever seen at a line siting hearing.

CHMN STAFFORD: It is true and --

MEMBER RICHINS: So kudos to you, Clark.

MR. BRYNER: Thank you. It was a lot of work.

MEMBER RICHINS: Yeah, it was.

MR. BRYNER: All right. So then we move to phase four of our planning and siting process, which was our compatibility analysis.

So at this level we did very detailed analysis. And this is where, again, as part of this we did find that it wasn't going to work to go down the alleyways.

So I think that's something we can -- I know you weren't meaning to be critical, but I think that we should be a little more careful on some of those

earlier phases to ensure we catch some of those things earlier on.

But this -- the planning process did find -- did find it, just not as early as we would have liked.

MEMBER KRYDER: I just wanted to thank you again. Having gone through a couple of these myself in a variety of situations, I truly value what you've done here, Clark. Good job.

MR. BRYNER: Thank you. So as part of the compatibility analysis, this -- at this stage we did take into consideration all of those evaluation criteria that were identified through our public outreach process, and we used experts on each of those criteria to evaluate the compatibility of -- they weren't routes at this point, they were just our refined segments, evaluate the compatibility of those refined segments to each of the evaluation criteria.

And so we had wildlife biologists, archaeologists, transmission line engineers, planners coming in and looking at this and evaluating that.

Some of it was very easy, basically a desktop exercise. Some of it was much more extensive. And as a result of that analysis, we eliminated additional refined segments, and that resulted in really

what became the alternative route segments that were in our application.

And so you can see in the slide on the right, Slide 242, all of the -- and the dark lines are what were the alternative route segments. At this point we didn't have alternative routes identified or we didn't have a preferred route identified.

We did bisect these into the alternative route segments that you have now, the four between DeMoss Petrie and Vine and the six between Vine and Kino. But we wanted to take this and get one more level of feedback from the public before we identified what would become our preferred route.

And so we reached out to the neighborhood advisory group and the public one last time. And so public input was one of the many factors that we considered. It did play a fairly substantial role in the selection of our preferred route.

And so the results of that look like the map that's on the screen, look like the map that's on your placemat where we identified Route B and Route 4 as our preferred routes. Oh, wow, that's it.

MEMBER LITTLE: Mr. Chairman.

CHMN STAFFORD: Yes, Member Little.

MEMBER LITTLE: Just a comment. Amazing.

MR. BRYNER: Thank you.

BY MS. GRABEL:

Q. So. Mr. Bryner, before I turn you over for cross-examination, I would like to enter a couple of exhibits because I think this is probably a good time to do that.

And that is first if you'll look at TEP-14, that's a summary of TEP's strategic outreach plan for the Midtown Reliability; is that correct?

A. Yes, it is.

Q. Was TEP-14 prepared by you or under your direction and control?

A. Yes.

Q. Are the contents of TEP-14 true and correct to the best of your knowledge?

A. Yes.

Q. And then we have late-filed exhibits that should -- the committee members should have in front of them. One is Exhibit TEP-20, which is entitled additional project comments.

Do you have that?

A. Yes.

Q. And what does this exhibit contain?

A. And these are comments that we've received to our -- either through our project e-mail address or

through the online comment form or other means since we filed our application.

Q. Thank you.

And were these comments compiled by you?

A. Yes.

Q. Thank you. And Exhibit TEP-21 which is an exhibit titled, "Letter of Support From University of Arizona." Is that correct?

A. Yes.

Q. Have you seen this document before?

A. Yes.

Q. Can you describe generally what the University of Arizona says about this project?

A. In general, it's a letter of support for the project. They don't provide any specific preference for one route or another.

Q. Thank you.

And if you'll turn to TEP-22, which is entitled, "Letter of Support From Tucson Metro Chamber."

A. Okay.

Q. Have you seen this document before?

A. Yes.

Q. Can you generally describe what the Tucson Metro Chamber says regarding this project?

A. So also a letter of support for the project and

really specifically with respect to the purpose and need for the project and the impact of having a reliable, robust transmission system does on the economic prosperity of the area.

Q. Thank you very much.

And if you'll look at Exhibit TEP-23, which is entitled, "Letter of Support From Southern Arizona Leadership Council."

A. Okay.

Q. Have you seen this document before?

A. Yes.

Q. Can you describe generally what the Southern Arizona Leadership Counsel says about the Midtown Reliability Project?

A. Again, a very similar letter providing support for the project and the need of the project.

Q. Okay. Great. Thank you.

MS. GRABEL: I have no further questions for Mr. Bryner. He's open for cross-examination.

CHMN STAFFORD: All right. We are just at or past our 90-minute mark. So I think now is a good time to take a recess to give our court reporter a break and allow her to stretch her legs. Let's take a 15-minute break. We stand in recess.

(Recess from 10:36 a.m. to 11:04 a.m.)

CHMN STAFFORD: Let's go back on the record.

Ms. Grabel.

MS. GRABEL: Yes, Mr. Chairman.

CHMN STAFFORD: So is this panel -- is the panel of one complete? I see a number of slides left in the presentation. I'm wondering if that's going to be covered by him or you're bringing back the prior panel?

MS. GRABEL: No. Actually, this is going to be covered by Mr. Bryner. He did remind me he has some conclusory remarks.

BY MS. GRABEL:

Q. The next slides -- if you'll advance one, Clark, he's going to talk to that. So let's do that now, and then we'll address the subsequent ones.

A. Yeah, thank you. So I just wanted to make sure before we conclude that I had an opportunity just to put this on record, because, as we met with members of the public throughout the past months, there were a number of commitments that TEP made as far as design considerations, so I want to make sure that they're made official and not just words we spoke in a meeting.

So I've got them listed out on the left-hand side of Slide 245. But we've talked about many of these in some way, shape, or form already. But as part of this

project, TEP has committed to reducing the overall number of substations in this area by seven. As we mentioned, we plan to retire eight 46kV substations, and we'll add the one new substation.

We'll also be able to remove and retire all the 46kV lines that serve those substations today. So the little maps on Slide 245 show the current condition with the blue teardrops that you've seen and the blue lines that you've seen before and then our future condition with all of that being removed and retired.

Further, if the preferred route is the route that's selected, we'll place an additional 4.6 miles of existing overhead distribution lines underground, and as a result of that, 16.8 miles of communication lines would also be moved, either underground or relocated.

So while the preferred route would add eight and a half miles of lines to the area, between the 46kV line retirements moving those lower voltage lines and communication wires underground, there will be a net reduction of overhead utilities of just under 32 miles. So there will be fewer poles, fewer wires in this area.

We've also talked about as a standard TEP would typically build double circuit transmission structures, but in this case unless we have the current need because we're double circuiting one of our routes or we've got to

collocate a 46kV line with it, we will build a single circuit construction as a means of bringing the overall size of those poles down.

One of the other things that we told the public that we would look into and try to find was an antigraffiti finish. We don't have a solution for that yet. We're not done looking. We'll continue to see what we can do. We recognize that's a concern with the public. So we'll continue to look into that. Whether we'll have a solution for this project, I don't know.

And let's see, also in the survey we put out to residents, I didn't share this in my slides, but we also asked them a question do you prefer taller poles and fewer of them or shorter poles more of them? And in response to that we heard back that the folks preferred taller poles and fewer of them.

So as we've talked about, we are looking into the use of an advanced conductor, which if we're able to use that, that would result in us being able to possibly use shorter poles and fewer of them, kind of best of both worlds. So we will look into that as part of this project.

And then with respect to pole finish, we also asked a question on pole finish and the preference in that same survey. The results of that were that the

public preferred our weathering steel poles, which are our standard poles.

Now that's preferential. As we've met with different neighborhoods some neighborhoods have been adamant that, Hey, we love the weathering steel. Others, we love galvanized, we love painted.

So what we have committed to is that whatever route -- if this is approved, whatever route is approved, if it goes through a residential area, that TEP will work with that neighborhood to determine what is the right finish for them. Hopefully it's not painted.

And lastly, we received comments on what TEP could do to enhance the right-of-way. So we talked about the chicanes. There were also other ideas on, you know, could you close down a lane of traffic, put in your line, put in a multiuse path, different things like that.

So obviously these rights-of-ways are not ours. They're the City of Tucson's. But we are committed to working with the City of Tucson on whatever route is selected to see if there's opportunities that we can partner with them to add some enhancements, be it in the form of, you know, some of the things we've mentioned. Possibly art, some vegetation plantings, different things like that, so that we can try to reduce some of the impact.

I think that's the things that I wanted to make sure I shared.

Q. Well, Mr. Bryner, that was actually a good segue in to TEP-28 where I know the Committee was interested in seeing examples of chicanes. And I believe they have them in front of them already -- well, I guess Eli is about to hand them out -- examples from the City of Tucson website about what chicanes are and what they do.

I don't know if you want to briefly explain that to the Committee Members with reference to Exhibit TEP-28.

A. Well, I feel like some of the Committee Members are more well-versed on this than me, but thanks to Mr. Cummins he taught me the meaning of the word chicane, that it was an artificial narrowing.

So we know that it's a pop out, which I learned from Member Hill, that, you know, kind of narrows the lane of traffic a little bit and can -- I know within the City of Tucson they often use it for water harvesting, plantings, as well as traffic calming measures.

So as far as the transmission line is concerned, it would be an opportunity for all of that. But it would also be an opportunity to place our structures a little bit further away from some of the homes and businesses.

Q. Okay. Thank you very much.

MEMBER HILL: Mr. Chair, can I just make a comment about the chicanes?

CHMN STAFFORD: Yes, Member Hill.

MEMBER HILL: The first illustration that the City provides I really want to compliment them on because it isn't just pop out, but they've actually created traffic calming and maintained a bike lane in one of the examples that you see, so I'm really thinking about complete streets and all modes of transportation, so I want to just compliment them on that particular design. That is more innovative than a lot I've seen.

MS. GRABEL: Thank you.

BY MS. GRABEL:

Q. Mr. Bryner, do you have anything further you would like to discuss on this panel?

A. I do not.

Q. Okay. If you'll advance to the next slide. Oh, you didn't want to say anything here?

A. Oh, maybe I do.

It's hard to remember what you want to say on 246 slides.

So I guess just in conclusion, I do want to just remind the Committee of the need for the project. I think we -- on day one we tried to really emphasis why we need this project, why we need this project now, why this

solution is the best solution to meet not only the needs of a growing population using more electricity than it was back in the '50s when it was designed, but also to address that aging equipment that needs to be either replaced or retired, so our proposal is to retire that equipment.

It will also meet the regulatory requirements that we need throughout this area due to other infrastructure improvements that we're making that require an additional transmission path in order to meet the growing needs of the region as a whole.

And it will result in a ton of benefits. As we've looked at the different routes that we have, we do feel that our preferred Route B-4 best balances the impacts to environmental and land use factors that the Committee considers by statute, and it also best balances the concerns and values of the community, albeit there's no perfect solution that eliminates any impacts, but we feel this finds a balance between those.

It will result in that net reduction that we discussed to the overall overhead infrastructure throughout this portion of the City, which will more than mitigate some of the visual impacts of the transmission line and further goals and policies of the City of Tucson's specific plans and ordinances that we've

discussed.

And beyond all that, this project is critical to ensuring that Tucson can continue to thrive into the future.

Q. Thank you, Mr. Bryner.

MS. GRABEL: Does the Committee have any final questions for Mr. Bryner?

CHMN STAFFORD: I have a quick question.

Which panel is going to address the remainder of Slide 247 through 262?

MS. GRABEL: I was just going to add, so we've stipulated to the admission of the compliance, the applicant's compliance with the legal requirements. 247 through 262 just kind of walk through that in mind-numbing detail.

And so unless the Committee would like to hear testimony or has questions regarding our compliance with the statutes and procedural order and regs, I recommend just skipping those 16 or so slides, 15 slides.

CHMN STAFFORD: All right. The only thing that hasn't been stipulated to was the Ten-Year Plans.

MS. GRABEL: Isn't that contained in 9, TEP-9?

CHMN STAFFORD: Oh, it is 9. That's right. I had 10 through 11, so it's 9 through 11.

MS. GRABEL: Correct.

CHMN STAFFORD: Okay. Good.

MEMBER LITTLE: Mr. Chairman.

CHMN STAFFORD: Yes, Member Little.

MEMBER LITTLE: I would just like to commend the applicant on the abiding by the intent as well as the rules of the Ten-Year Plan and the biennial assessment process.

They have kept the Commission Staff apprised of what their plan was from the very get-go, and it has been included in not only local system impact studies, but also regional as well as entire west regional studies, and that's what I like to see.

Thank you.

MS. GRABEL: Thank you.

MR. BRYNER: Thank you.

CHMN STAFFORD: All right. Well, is he ready for cross-examination, then?

MS. GRABEL: Yes, Mr. Chairman.

CHMN STAFFORD: All right. Ms. De Blasi.

MS. DE BLASI: Banner does not have any cross for this panel, Chairman.

CHMN STAFFORD: Ms. Stash.

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CROSS-EXAMINATION

BY MS. STASH:

Q. Hi. This is Ms. Stash for the City of Tucson.

My main question is on the slide from -- that you showed, 245, just the one that we just talked about?

When you were talking to the -- is this the -- were these the slides that you would show when you were at your community meetings, or is this a result of your community meetings?

A. So we did share a slide at least very similar to this in our last public open house that we had with the community.

Q. And so my question is what kind of -- you said that one of the -- of I understood correctly, one of the things that you -- the design elements that you were taking was that you were going to be removing where the blue lines are?

A. That's correct.

Q. Did you give the public any time line or do you have any time line today of what -- when you would suspect that those blue -- if you get your preferred route when you suspect that the blue lines would be taken down?

A. So what we've shared with the public is there's obviously a lot of work that's going to go into

reconfiguring these circuits and everything.

What we've shared with the public is it's going to take us 10 years from the time we get the transmission line and the Vine Substation to make all these improvements. Now, most of these are going to be on the distribution side, which is the below 46kV.

Q. So ten years after the completion of this project?

A. Correct.

So we've been sharing up to -- because we asked May 2027 for an in-service in 2037.

MS. STASH: Okay. Thank you. No further questions.

CHMN STAFFORD: Mr. Dempsey.

MR. DEMPSEY: Yeah, just a second.

CROSS-EXAMINATION

BY MR. DEMPSEY:

Q. I also want to compliment you guys. You've been very professional. You've been easy to talk to and work with. We just have a slight disagreement on a few spots. Other than that, you guys are great.

Can we go back to slide I think it's 246, the whatever the last slide was?

So if you undergrounded a few miles of the

transmission lines where required by law, where we believe you're required to by law, would these benefits also accrue?

A. So we would have the same benefits whether the transmission line was overhead or underground.

Q. Thank you.

Can we go to Slide 237, please?

I think it's one more. It's the constraints slide. Okay. Oh, yeah, 236, sorry.

So some of these questions are obvious answers, but I have to ask them for the record.

On this slide, you on the constraint side you put a big oval over the University of Arizona. And my understanding is you're saying the reason you put an oval over the University of Arizona is because it is high density?

A. That's correct.

Q. And that's the only reason?

A. That's correct.

Q. Thank you.

So high-density development produces constraints?

A. It produces constraints as we saw even on some of the road that we went down --

Q. Right.

A. -- where there was high-density development adjacent to it, it just makes it more challenging. It doesn't mean impossible, more challenging to find a transmission line path.

Q. Thank you.

Okay. So you just mentioned that you're going to explore using advanced conductors.

Do they cost more than nonadvanced conductors?

A. Yes.

Q. Do you know how much more?

A. I've heard numbers, but I'm -- I don't -- I don't have a number in my head, no.

Q. What numbers have you heard?

A. I can't even remember right now. Four times more expensive.

Q. Four times? Okay. Thank you.

This just came into my mind. I was trying to write it out before -- before I got asked to ask questions.

So are you familiar with the Kino Irvington project?

Were you involved in that?

A. I was not involved in that.

Q. Okay. So I guess I can't ask you questions then.

MR. DEMPSEY: Were you involved in that, Larry?

MS. GRABEL: Mr. Robinson is not on this panel, Mr. Dempsey.

MR. DEMPSEY: Sorry.

MS. GRABEL: That's okay.

MR. DEMPSEY: That's all I have. Thanks.

CHMN STAFFORD: Any redirect?

MS. GRABEL: Just one thing.

REDIRECT EXAMINATION

BY MS. GRABEL:

Q. Mr. Bryner, I believe in response to the City of Tucson you said that the distribution lines may not be undergrounded for as long as ten years.

Did you say that?

A. Yes.

Q. So I wasn't here on that day, but my understanding is that Mr. Robinson explained that they would actually be undergrounded prior to then, and it's actually the end of this project that would be completed in ten years; is that correct?

A. So that is correct.

I think in answering Ms. Stash's question, I think she was referring to the -- not just the

undergrounding of the lines that would be undergrounded into, I guess, get out of the way of the transmission line but with respect to when we'd be able to retire the 46kV facilities and remove those.

Q. Okay. So it's to the extent any of your testimony was inconsistent with what Mr. Robinson gave a couple of days ago you would defer to Mr. Robinson?

A. Yes.

Q. Okay. Thank you.

MS. GRABEL: No further questions.

CHMN STAFFORD: Any questions from members?

You can call your next panel, Ms. Grabel.

MS. GRABEL: Thank you very much.

We now call our undergrounding panel, which is panel number four.

And so Mr. Bryner will finally be excused. Yeah, he deserves a round of applause.

Mr. Jason Jocham from Sargent & Lundy will join Mr. Robinson on the undergrounding panel.

Mr. Chairman, I think Mr. -- are you ready? I think Mr. Jocham needs to be sworn in.

CHMN STAFFORD: Yes.

Do you prefer an oath or affirmation?

MR. JOCHAM: Oath.

CHMN STAFFORD: Do you affirm the testimony

you will give in this matter will be the truth, the whole truth, and nothing but the truth so help you god?

MR. JOCHAM: I do.

JASON JOCHAM AND LARRY ROBINSON,

called as witnesses as a panel on behalf of Applicant, having been affirmed or sworn and/or previously affirmed or sworn by the Chairman to speak the truth and nothing but the truth, were examined and testified as follows:

DIRECT EXAMINATION

BY MS. GRABEL:

Q. Mr. Jocham, please state your name and business address for the record.

A. (Mr. Jocham) Jason Jocham, 2 North Central, Phoenix, Arizona 85004. Sorry.

Q. You just moved into that building, didn't you?

By whom are you employed and in what capacity?

A. (Mr. Jocham) Sargent & Lundy. I'm a vice president and project director.

Q. And what is your role in this matter?

A. (Mr. Jocham) In this matter, I oversaw and reviewed the undergrounding report and cost estimate.

Q. That was prepared by your firm?

A. (Mr. Jocham) Correct.

Q. Please turn to Exhibit TEP-7, the witness summary of Jason Jocham.
A. (Mr. Jocham) Okay.
Q. Have you seen TEP-7 before?
A. (Mr. Jocham) I have.
Q. Was TEP-7 prepared by your or under your direction and control?
A. (Mr. Jocham) It was.
Q. Do you have any corrections you would like to make to TEP-7?
A. (Mr. Jocham) I do not.
Q. You were retained to provide expert testimony regarding the cost and operational differences between constructing a transmission line aboveground versus belowground; correct?
A. (Mr. Jocham) Correct.
Q. If you'll please turn to TEP-17.
A. (Mr. Jocham) Okay.
Q. Is this the report that contains your expert analysis regarding the cost of constructing and operating an underground transmission line?
A. (Mr. Jocham) It is.
Q. Was this report prepared by you or under your direction and control?
A. (Mr. Jocham) It was.

Q. Are the contents of this report true and correct to the best of your knowledge?

A. (Mr. Jocham) They are.

Q. Do you have any corrections you would like to make to TEP-17?

A. (Mr. Jocham) Not to TEP-17.

Q. Okay. What analysis did you undertake to reach the conclusions contained in this report?

A. (Mr. Jocham) Sure. Yeah. So in this particular report, we did preliminary engineering which included the use of CYMCAP, which is an industry-recognized program to determine the ampacity of underground cables.

We utilize information locally from Irvington Station and publicly available data around Tucson to help produce that report and those cost estimates. We did go out and receive vendor quoting for a lot of the major materials to support the cost estimate itself.

Q. Thank you.

You used the word "ampacity" just a few moment ago. Can you please define for the Committee what ampacity means?

A. (Mr. Jocham) Absolutely.

Yeah. So ampacity is current that can flow through the cable.

So when we talk about ampacity today, we're going to be talking about the maximum current that can flow through the cable continuously without exceeding its design temperature.

Q. Thank you.

CHMN STAFFORD: Are you saying ampacity or capacity?

MR. JOCHAM: Ampacity. A-m-p --

CHMN STAFFORD: Ampacity. Okay. Yeah, right.

MR. JOCHAM: Yeah.

BY MS. GRABEL:

Q. Okay. Thank you. If you'll please now turn to TEP-16, which is the presentation regarding the engineering and cost of constructing a transmission project belowground.

A. (Mr. Jocham) okay.

Q. Was the presentation prepared by you or under your direction and control?

A. (Mr. Jocham) It was.

Q. Are the contents of this presentation true and correct to the best of your knowledge?

A. (Mr. Jocham) They are.

Q. And do you have any corrections you would like to make to TEP-16?

A. (Mr. Jocham) I do have one correction on a slide with a mislabeled word --

Q. Okay. Do you want --

A. (Mr. Jocham) That we'll touch on when we get there. I'll make sure it's clear for the record.

Q. Thank you.

MS. GRABEL: And, I'm sorry, Jennifer, for talking over Mr. Jocham.

BY MS. GRABEL:

Q. So, Mr. Jocham, because you're retained as an expert I think it makes sense to describe to this Committee the qualifications that make you an expert on the construction of underground transmission line facilities.

A. (Mr. Jocham) Yeah. Sure. So I'll go through my background. Like I had mentioned, I'm a vice president and project director at Sargent & Lundy. S & L is a 133-year-old engineering company. We're currently ranked fourth in the power engineering field according to the engineer news record, which is a national engineering paper basically or website.

My personal experience, I have over 14 years of transmission line design experience, including overhead transmission up to 500kV and then experience in underground up to 345kV. I do have actually experience

above 500kV but not built. So this is what is present in the United States today.

My educational background, I have a civil engineering degree from Arizona State University, and I'm a licensed civil engineer in the State of Arizona.

Q. Thank you very much.

Will you please now summarize for the Committee the conclusions that you reached as described in your report regarding the cost and operational issues associated with building transmission lines belowground.

A. (Mr. Jocham) Yeah, absolutely. So initially let's talk about the differences between underground and overhead conductors.

So with underground, we are going to talk about it as a cable and not a conductor because it is a conductor wrapped in insulation, and therefore it becomes a cable. We'll talk a little bit about the -- let me talk a little bit about the cable itself.

So the cable as you can see -- whoops -- you see a copper conductor in the middle. It is then wrapped around with a semiconductive tape. You can kind of see that black right there.

From that or around that you have a shield that's placed around the cable -- or the conductor itself, excuse me.

And then the white you see here is insulation, which in this particular project is XLPE.

And then on the outside of that you have another black insulation shield, and this is to help protect the insulation against moisture intrusion, which we'll talk about is important with the life expectancy of underground cable.

Around that, you'll have a semiconductive tape. And what you can't see in the picture here very well is normally there are concentric wires wrapped around that. We'll talk a little bit about that that's used in special bonding processes to help ampacity in underground transmission, which underground distribution does have concentric neutrals as well, but they're utilized differently. And do we'll talk about the differences between the two.

Beyond that, you'll have another semiconductive tape shield around the outside of the concentric neutral. And then you'll have an additional shield for water intrusion and then the jacket on top of that.

So a lot of layers with underground conductor, a pretty complicated manufacturing process.

Whereas, your overhead conductor you can see here, there's really two layers. You see a dark and a lighter gray color. The dark color in the middle is your

steel core, which is used to support your overhead conductor. The outside is aluminum, which is used to transfer your energy or power from one point to another.

With the insulation itself, we're going to be limited to a 90-degree C operation temperature, and that's to limit the stress on the insulation, and potential damage of the insulation operating at higher temperatures will affect the insulation integrity itself, and it will start to degrade.

And so as I mentioned a few seconds ago.

Q. Mr. Jocham, can you hold on one second. So if you look at the pictures here, the underground cable versus the overhead conductor, on this slide they look like they're about the same size.

Are they the same size?

A. (Mr. Jocham) Yeah, no. They're very different in size. So for this particular project we did, like I mentioned, go out and quote a cable for this project based off of some preliminary engineering that was performed. That cable size is just shy of five inches in diameter.

Now, the overhead cable that would be utilized for this project SRP -- or, excuse me, TEP's standard ACSS conductor is about 1.16 inches in diameter. So you can see there's a pretty large discrepancy between the

two or a large difference between the two.

And we have some examples here that we can pass around. But your typical overhead conductor as you can see here is pretty thin and narrow in diameter. And this is actually a 138kV XLPE cable. This cable itself is 2500 kcmil, so it's the actual conductor in the middle is much smaller than what would be required for this project, but the insulation thickness gives a representation of kind of what you could expect for a project of this size.

MEMBER GOLD: Mr. Chairman.

CHMN STAFFORD: Yes, Member Gold.

MEMBER GOLD: Is the conduction -- the conductor portion of the underground cable and the conducting portion of the overhead cable the same diameter?

MR. JOCHAM: They are not.

MEMBER GOLD: Is that because one is copper and one is aluminum?

MR. JOCHAM: Actually the copper helps. It helps with the ampacity. If I can use an analogy to kind of describe the differences between cooling effects and how overhead works versus underground, I think it may answer your question.

So the analogy that I like to use when

talking about overhead versus underground is let's say you're ready to go to sleep at night and you're laying in bed under covers and you get really hot, what do you do? You take the covers off and you let the fan blow on you, and that cools you down. Your body is producing heat; right?

And so you can consider that very similar to an overhead conductor where out in the open air it and the wind blowing on it will dissipate the heat away from the conductor itself perfect. Whereas in underground you can assume that you're in your thermal pajamas and in a sleeping bag, and you can't get out, and so that heat is trapped, and it's much harder for it to dissipate.

And so subsequently, you use larger conductors to help reduce the amount of heat produced by the conductor itself.

And so heat is produced on a conductor when you have high levels of resistance, and the more ampacity that you try to push through a line, the more current you try to push through the line, the higher the temperature becomes because you are basically the electrons of the electricity are running into the atoms of the material that the electricity is running on.

And so when you have smaller surface area and you're trying to push a bunch of electricity through,

you get more collisions, collisions produce heat, basically, and line loss. The larger the conductor size, the less collisions, the less line loss, the less heat.

MEMBER GOLD: Okay. That's very good information. It's not what I asked, though.

MR. JOCHAM: Okay. Sorry.

MEMBER GOLD: The underground line appears to be copper colored.

MR. JOCHAM: It is copper.

MEMBER GOLD: And the overhead line is aluminum with steel core.

MR. JOCHAM: Correct.

MEMBER GOLD: For the same voltage, does the copper require less diameter than the steel and aluminum?

MR. JOCHAM: So the underground conductor will require more area because of the insulation around it because it cannot dissipate the heat.

Copper is actually less resistive than aluminum, and that's why we're using copper. It helps benefit. If we were to put aluminum in the underground for this particular situation, we would well exceed the 6,000 kcmil or actually two 6,000 kcmils cables per base.

MEMBER GOLD: Understood. So now you're answering the question I have.

MR. JOCHAM: Sorry.

MEMBER GOLD: So you're using copper underground.

MR. JOCHAM: Correct.

MEMBER GOLD: Aluminum and steel overground.

You can use a thinner -- a lesser amount of copper, but you have to use far more insulation so the thickness of the cable underground by definition of the insulation required your sleeping bag --

MR. JOCHAM: Yes.

MEMBER GOLD: -- analogy requires a much thicker cable.

MR. JOCHAM: Correct.

MEMBER GOLD: Lifespan. Copper survive -- has a better lifespan than aluminum.

MR. JOCHAM: So the lifespan of an underground conductor isn't really driven by the conductor itself. It's driven by the insulation.

And so another analogy for insulation is it depends on how you drive it. If you run it really hard, the insulation is going to break down due to the heat. And electricity wants to find inclusions or defects in the insulation. And once it finds those, it's going to break those down over time, and it's going to break down

the insulation over and over. It's called partial discharge. And the more you have partial discharge the more damage you're producing to that insulation that could potentially fail the cable.

Now, if you run it at a lower temperature, you have less risk of -- or less -- yeah, less risk of finding those inclusions or defects, and the cable could potentially last longer. So you could think about it like an engine. If you run your engine really nice and you never run it over 3,000 RPM, it's going to last a really long time, you change the oil, you take care of it. But if you use it like a drag car, your engine's not going to last very long.

MEMBER GOLD: Okay. So underground cable underground is usually, what, 68 degrees, whereas overhead can be 212, you know, however hot the sun can shine on the cables and your electricity running through can make them.

What I really want to know is lifespan.

MR. JOCHAM: Yeah. So typical lifespan recommended from EPRI, which is the Electric Power Research Institute, which is a well-known institute in the utility industry, it's a nonprofit institute for the advancement of power, they identify a 40-year lifespan on underground cable.

MEMBER GOLD: And what about overhead cable?

MR. JOCHAM: Overhead cable, that's a good question. I'll have to get back to you what EPRI says on the overhead. But typical expectancy on lifespan in an environment in Tucson could be well over 50 years into the 75, potentially 100-year range. I guess maybe --

BY MS. GRABEL:

Q. Mr. Robinson, do you know from TEP's perspective what the lifespan of your typical transmission overhead lines are?

A. (Mr. Robinson) Yeah. Our typical overhead lines last for 75 years per design. We've had some last longer than that, but most of our lines are over 50 years old right now without any conductor issues.

Q. And, Mr. Jocham, before we get to other questions, maybe the members would like to see kind of a show-and-tell with the underground cable versus the overhead distribution line just to see the differences.

A. (Mr. Jocham) Sure. Yeah, we'll pass those around. And then we also have distribution underground cable to pass around as well as an example of what that looks like.

Q. And remember I believe you testified that that example of an underground cable is smaller than what

would be at issue in this case?

A. (Mr. Jocham) Correct.

Q. By about how much?

A. (Mr. Jocham) It looks like to be about an inch smaller in diameter than what would be required for this project.

Q. Okay. Thank you.

MEMBER GOLD: So to review what you said so I understand it correctly, the lifespan of underground cable, about 20 years?

MR. JOCHAM: About 40.

MEMBER GOLD: About 40 years.

The lifespan of overhead cable can be close to 100?

MR. JOCHAM: 75.

MR. ROBINSON: Our design plan is 75 years.

MEMBER GOLD: Okay. So roughly double?

MR. JOCHAM: I think that's a fair statement.

MR. ROBINSON: Close. Yes. Yes.

MEMBER GOLD: Thank you.

MR. ROBINSON: Can I just do a quick explanation of what we have here, right?

MS. GRABEL: Sure.

MR. ROBINSON: So this is an example of our

feeder cable, which is our 600-amp cable that I've talked about in our distribution system. And this is an example of our 200-amp cable, or single-phase cable, on this side.

And then we have, as Mr. Jocham has said, a 138 cable and our overhead. I'll pass them around.

CHMN STAFFORD: Thank you.

BY MS. GRABEL:

Q. Okay. Mr. Jocham, I believe you were about to talk about how many cables you would actually need to meet the ampacity for this project.

A. (Mr. Jocham) Yeah. So, like I had mentioned, we did use a program called CYMCAP to perform an analysis to determine what the actual size of the conductors needed to be to meet the preferred ampacity requirements of this project, which were 2,256 amps.

And so from that we looked at several scenarios, which are all represented in the report TEP-17, which identify a standard duct bank embedded or buried approximately four feet underground, and then multiple scenarios such as jack and bores or trenchless installations where the cable would be deeper and then deeper duct bank installations assuming that we had to avoid existing utilities that were present within the route.

And so from that, it was determined to meet the preferred ampacity we would need two 6,000-kcmil cables per phase to meet that ampacity requirement.

So to put that in perspective, three-phase AC system you're going to have three overhead wires with -- to meet the exact same or similar ampacity requirements underground we would need six of those cables.

Q. So, Mr. Jocham, let me break this down.

First of all, why do you need two 6,000 kcmil? Is that how you pronounce it?

A. (Mr. Jocham) Yeah, kcmil.

Q. Cables?

A. (Mr. Jocham) Yeah. Let me describe what kcmil means.

So kcmil is a -- it's a circular mil, so kc -- or k is the 1,000 circular mils. It's a unit of measurement of the gauge of the wire itself. So a measurement of the gauge of the conductor.

One mil is one one-thousandth of an inch. And so a circular mil is 6,000 kcmil or 6,000 thousand circular mils is approximately 4.7 inches -- or square inches of area of conductor. Whereas a 954 cable, the overhead cable, is about .749 square inches of area.

BY MS. GRABEL:

Q. Okay. So the members are right now looking at

the cable, which is about this size. And you said you need two of those to meet the required ampacity for each project; correct?

A. (Mr. Jocham) Correct.

Q. For each phase? I believe you said that too.

A. (Mr. Jocham) For each phase.

Q. So what is the phase?

A. (Mr. Jocham) So AC systems are three-phase systems. So A, B, and C are 120, 240, and 360 or zero is how AC systems run. We would need basically two instead of one. Two of those underground conductors instead of one of the single overhead.

Q. Okay. And because the Midtown Reliability Project has three phases; correct?

A. (Mr. Jocham) Correct.

Q. So we'll see three different conductors on the overhead line?

A. (Mr. Jocham) Correct.

Q. We would have -- if we were going to have that same three phases, we'd need six of the cables for the underground line; is that correct?

A. (Mr. Jocham) Correct. At minimum.

Q. At minimum?

A. (Mr. Jocham) Yeah.

Q. So explain the "at minimum."

A. (Mr. Jocham) Yeah. So down at the bottom bullet there you'll see optional spare -- or spare, and this is the protection. It's not spare circuit. It's spare phase for reliability.

And so for the record, the statement says, "Optional spare circuit for reliability." We want it to say optional fair -- "Optional spare phase for reliability."

For reliability purposes, utilities will at times install a spare position or a spare phase. And so to install two more conductors, the terminations for those, you could basically give yourself the reliability similar to an overhead line where you didn't have to repair the faulted or damaged phase.

You could go to the spare position by transferring some overhead wire into a different position on the riser structure giving a much shorter return time if there was a problem with the underground section of the line.

Q. So, Mr. Jocham, I'm not sure you answered this question. Why do you need two 6,000 whatever they are kcmils instead of one 12,000? Why can't you just have a larger kcmil cable?

A. (Mr. Jocham) So there are manufacturing limitations. The manufacturers to date will only

manufacture up to 6,000 kcmils. So 6,000 is the largest conductor we can acquire from reputable vendors in the industry.

BY MS. GRABEL:

Q. To today's technology requires you to use a lot more cables than you otherwise might?

A. (Mr. Jocham) Yes.

Q. Okay. And just so I understand it, so you need the optional spare to meet the same reliability benefits you'd have for an overhead line; is that correct?

A. (Mr. Jocham) Similar, yes. I mean, there would still -- there's some availability in there, but, yes, for the most part to be able to transfer and immediately reenergize or reenergize in a similar time frame to what you would do with an overhead repair, yes.

Q. So how many of those larger cables would you have to install in the trench in order to get those reliability benefits?

A. (Mr. Jocham) So two more or a total of eight of them.

Q. It's a big trench?

A. (Mr. Jocham) It's a big trench.

Q. Okay. Please continue.

MEMBER KRYDER: Mr. Chairman.

CHMN STAFFORD: Yes, Member Kryder.

MEMBER KRYDER: One quick question.

In addition to the reliability that Meghan just spoke about are the underground cables encased then individually? Or so we've got eight of these bad boys underground running through a trench of some sort, are they encased then in --

MR. JOCHAM: Yes.

MEMBER KRYDER: Okay. Were you going to talk about the encasement as well?

MR. JOCHAM: I can talk about it now.

MEMBER KRYDER: Okay.

MR. JOCHAM: Yeah. So they're encased in -- each conductor is encased in an individual PVC pipe. So this particular situation with the larger diameter of this conductor, we're going to need an eight-inch diameter schedule 40 PVC pipe and you'll have at minimum.

So if you install the spare, you'll have eight of those. We would still very similar to the distribution install an open position just for, again, further reliability so you would have 10 eight-inch schedule 40 conduits in a duct bank encased in concrete. In addition to that there are other conduits that we would install.

One difference with underground

transmission versus underground distribution, typically underground transmission installs a distributed temperature sensing system. And that is, again, another fail-safe and protection measure to increase the reliability and the longevity of underground. It monitors the temperature of the cable to ensure that it doesn't exceed that 90 C limit. And so all of that is encased in concrete.

BY MS. GRABEL:

Q. Mr. Jocham, I believe you have photographs of that on future slides; correct?

A. (Mr. Jocham) I do have photos of it on future slides.

MEMBER LITTLE: Mr. Chairman.

CHMN STAFFORD: Yes, Member Little.

MEMBER LITTLE: Is there any historic data on the percentage of time that the spare phase is actually used? Needed?

MR. JOCHAM: I particularly don't have any data on that. And as a consulting engineer in the industry, operationally utilities normally don't share that information with us. They kind of keep it in-house. So I probably would have a hard time finding that information.

MEMBER LITTLE: That's fair. Thank you.

BY MS. GRABEL:

Q. But, Mr. Jocham, do you have an anecdote that, you know, discusses an outage where the spare was used?

A. (Mr. Jocham) I have never -- we've installed multiple installed spares on the projects that we've done, but I've never heard of it actually having to be transitioned over in my career.

Ethan may. So I can discuss with my colleague and see if he has experienced that and -- after break and be able to speak on it.

MEMBER LITTLE: As a follow-up, Mr. Robinson, does TEP currently have any 138kV underground?

MR. ROBINSON: No, we do not.

MEMBER LITTLE: Thank you.

MEMBER GOLD: Mr. Chairman.

CHMN STAFFORD: Yes, Member Gold.

MEMBER GOLD: So if I understand what you just said, you said now you're taking these eight-inch PVC pipes with all this stuff inside and you're encasing it in concrete?

MR. JOCHAM: Correct.

MEMBER GOLD: You're burying it more than five feet underground?

MR. JOCHAM: Yes.

MEMBER GOLD: If you have to fix these things, that's -- I mean, you're talking demolishing a street?

MR. JOCHAM: Correct.

MEMBER GOLD: Thank you.

MEMBER KRYDER: Mr. Chairman.

CHMN STAFFORD: Yes, Member Kryder.

MEMBER KRYDER: One more for me at least related question. We're talking now about the 135, the transmission cables.

Is the undergrounding of the distribution cable similar in terms of just the same thing only put on a reduction diet, or is it a whole different game?

MR. JOCHAM: I would say it's a different game. I'm not as familiar with the distribution underground, so Mr. Robinson can speak on that.

But generally all the equipment, as you kind of said, would go on a diet.

But the trenches are significantly smaller. Normally you don't always encase distribution in concrete either. It's just the conduit that's placed into the ground.

MS. GRABEL: Mr. Jocham, let's let Mr. Robinson answer that question. Go ahead.

MR. ROBINSON: Yes. The distribution is

much, much easier to install because of the direct embedment, the narrower trenches, the smaller cable.

We also -- all of the materials for that are not special order items. There are many different manufacturers, and they're off the shelf from a supply chain perspective. And we have almost all of our construction line force can maintain and install underground distribution cables where we don't have any of those resources, tools, or expertise to install 138.

MEMBER KRYDER: Okay. And if I understand a little bit of that, also we've moved from three-phase. When we go into distribution, we're no longer in three-phase; correct?

MR. ROBINSON: That is not correct. We actually have a lot of three-phase distribution underground.

MEMBER KRYDER: Okay. So you would go back to eight cables just as you did overhead or --

MR. ROBINSON: Actually we wouldn't. So yesterday in the tour Mr. Dempsey asked about some of our standards.

In our feeder cable, our standard is a six-inch diameter conduit. And we would have three of those cables pulled into one conduit.

MEMBER KRYDER: Okay.

MR. ROBINSON: On the 200-amp system, which is the smaller cable that we sent around, we would have three cables pulled into a four-inch conduit.

MEMBER KRYDER: Okay. Thank you very much. That helps me with a comparison between the overhead, the transmission lines, and the distribution lines.

And a lot of what I heard the community talking about were concerns about both distribution and transmission, and there seemed always to be kind of an easy interchange between them.

But what you've just told me was that the transmission line is significantly bigger and more difficult than the distribution portion of it.

Is that fair to say?

MR. ROBINSON: So what I'm going to testify to is that we have not ever put 138kV transmission underground, so that difficulty is perceived and estimated. But Mr. Jocham has and that's what his testimony been about.

Distribution is -- distribution underground is a type of facility that we have. On a regular basis I think Mr. Bryner said almost 60 percent of our distribution system's underground. We do it and maintain it on a regular basis.

MEMBER KRYDER: Thank you. Thank you very

much.

CHMN STAFFORD: Member Mercer.

MEMBER MERCER: Yes. Thank you, Mr. Chairman.

So and we're talking about reliability and modernizing the existing grid that you have.

So it seems to me like if we have a blackout or a system failure, it would take a lot longer to fix it if it's underground. Is that -- am I right or wrong or --

MR. JOCHAM: If we did not have the spare installed, then, yes, the answer to that is yes.

MEMBER MERCER: Okay. Thank you.

BY MS. GRABEL:

Q. Even if we did have the spare installed, would you need to, you know, fix the element that went out belowground?

A. (Mr. Jocham) Yes, you would.

So with the installed spare you'd be able to transfer over and reenergize.

But during the repair periods of the failure, whether that was a termination, a splice, or the conductor itself, you would probably have to take outages during the repair process because we won't allow or typically utilities won't allow personnel in vaults with

a transmission line energized for safety purposes.

Q. And in terms of fixing a transmission line that's been undergrounded and that has been, you know, gone out of service, does TEP have the expertise in-house to make those reliability repairs?

A. (Mr. Robinson) No, we don't. We would have to contract that work out.

Q. And, in fact, do the people that install underground transmission facilities require you to use their services for maintaining the line?

A. (Mr. Jocham) I can take that.

So they definitely require initial installation. You can reach out to them for maintenance and repair, but there are other entities out there that can do repairs after the fact. But they are specialty contractors. They have to be scheduled, and it still does take time.

Q. How many special contractors are there that do that kind of work?

A. (Mr. Jocham) There are a handful. I could get an exact quantity, but it isn't significant like overhead transmission where you would have 30-plus contractors across the nation that are capable of doing that type of work. So we'll discuss with my --

Q. Are there any in Arizona that you know of?

A. (Mr. Jocham) That are -- no, not in Arizona to

work on the cable itself.

Q. And so part of bringing that line back in service would require flying somebody in to restore that line; correct?

A. (Mr. Jocham) Correct.

Q. And that adds time?

A. (Mr. Jocham) It does.

Q. Okay. Thank you. Please continue.

A. (Mr. Robinson) Ms. Grabel?

Q. Go ahead.

A. (Mr. Robinson) Can I just add from a cable manufacturing perspective? In order to maintain the warranty from the cable they do have to have certified installers to maintain the warranty of that cable.

Q. Okay. Thank you very much.

CHMN STAFFORD: Member Hill, you had a question?

MEMBER HILL: Yeah. I had a question about an outage.

So with an underground transmission line, when there's an outage it switches to the spare first, and then -- is that correct?

MR. JOCHAM: You would have to manually switch it. It doesn't automatically, but yes.

MEMBER HILL: The utility would switch to

the spare first. And then the utility would have time to assess the portion of the transmission line that caused the outage.

I want to speak to disruptions in the community around that and the neighborhood and things like that.

My understanding, having been around public works as a city council person, is that a lot of these types of facilities have vault areas where we know that we're going -- and you pick those vault areas to reduce disturbance in the neighborhood, so it's not digging up the middle of the street, but it's a vault in a place where we're reducing disturbance to traffic or other things so that we can access that conduit and identify -- because we've got temperature and sensors along the system, identify the section of conduit that's a problem and then where the problem lies.

And then you can essentially kind of pull out the cable and replace the cable and the conduit. And then you can reenergize the system and take the spare out of commission at that point.

I'm not saying that it all happens super fast, and it's a good point that Meghan has identified is the number of contractors available to do this, but I don't want the public to feel like an outage in an

underground system is any more disruptive, you know, from the neighborhood standpoint than an overhead line because you're going to have trucks coming in, and you're -- I don't know.

I'm trying to compare the two overhead under -- I feel like the utility does a really good job of reducing those disturbances in the neighborhood with the design that they select; is that correct?

MR. JOCHAM: Yeah. I would agree with that.

MEMBER HILL: OKAY.

MR. JOCHAM: You would mainly work around the vault locations after installation. The only potential risk there is if let's say you did have a fault on the cable itself and through discharge it fused the jacket to the conduit, then you have a bigger problem.

MEMBER HILL: Okay.

MR. JOCHAM: And so that isn't -- say that there wouldn't be a situation where you're digging up the duct bank and cutting in.

MEMBER HILL: Yeah.

MR. JOCHAM: But most of the time, yeah, your failures would be -- you'd be able to repair them in --

MEMBER HILL: Pull one cable out --

MR. JOCHAM: Yeah.
MEMBER HILL: -- and put the new cable in.
MR. JOCHAM: And we also part of that discussion and represented in the report is spare conduits that are installed that are open. So if let's say you did fuse a cable to the conduit, you could pull a new conductor and just leave that there as a dead cable.
MEMBER HILL: Okay. All right. Thank you.
MR. JOCHAM: So there are ways to help minimize impact, yes.
MEMBER HILL: Okay. Thanks.
MEMBER LITTLE: Mr. Chairman.
CHMN STAFFORD: Yes, Member Little.
MEMBER LITTLE: How far apart are the vaults generally?
MR. JOCHAM: Yeah. That'll depend on the cable size itself, but we assumed for this project about 1600 feet.
MEMBER LITTLE: So a quarter mile?
MR. JOCHAM: Give or take.
BY MS. GRABEL:
Q. Mr. Jocham, it might help if we continue with the presentation so you can see the various photographs so that -- it was useful to me, so I think it will useful to all of you.

A. (Mr. Jocham) Yeah, absolutely.

Q. So one other point I'd like to make. So we talked a lot about the underground conductor only being able to operate at 90 C or 100 -- sorry.

MEMBER HILL: 194 degrees Fahrenheit --

MR. JOCHAM: That's right. Yep.

MEMBER HILL: -- for us American educated -- American education system.

MR. JOCHAM: That's right. 194 degrees Fahrenheit.

The overhead conductor, the ACSS conductor normal operation of that conductor is 392 degrees Fahrenheit. So you can push a lot more power through the line, a lot more amps through the line.

MEMBER GOLD: Mr. Chairman.

CHMN STAFFORD: Yes, Member Gold.

MEMBER GOLD: I've got a conflicted question. This is probably directed to Mr. Robinson.

MEMBER KRYDER: Into your mic.

MEMBER GOLD: Directed to Mr. Robinson. I have friends in the Foothills who inherited a million-dollar house, and there was a cable blocking their view of the mountain. They had the opportunity to spend $25,000, and I may be going back 20 years, to have that section of cable put underground.

Did TEP do that or do you job that out?

MR. ROBINSON: If it was a distribution line, TEP would have done that. We often will sub out the trenching and the setting of the conduit. But the electrical cable and the terminations and all that are always done by our resources.

MEMBER GOLD: So the cable that they used would be a standard overhead cable, or would it be the underground cable?

MR. ROBINSON: It would have been one of the cable samples that we sent around. It probably would have been the 200-amp smaller cable for a regular distribution.

MEMBER GOLD: Was that the underground cable or the everyday cable?

MR. ROBINSON: Yeah, the underground. It would have been -- if it -- all underground cable has to be in that profile.

MS. GRABEL: Mr. Robinson, let's clarify. You're talking about underground distribution; correct?

MR. ROBINSON: That's correct.

MS. GRABEL: So we don't need special contractors for underground distribution, do we?

MR. ROBINSON: That's correct.

MS. GRABEL: Okay.

MR. ROBINSON: So to relocate an overhead cable to an underground cable by a residential, it would have been a distribution system request. And it would have been this smaller cable or this cable. Probably the smaller cable in a neighborhood.

MEMBER GOLD: And that's something TEP can do?

MR. ROBINSON: On a regular basis, yes.

MEMBER GOLD: Thank you.

MS. GRABEL: Thank you.

MR. JOCHAM: Okay. So we'll talk a little bit now about some of the construction differences. And I'll walk you through sort of a concept or a theoretical construction of both types of projects.

So in generality, underground is a linear construction. In this case it will be within the road. There's a significant amount of civil work required for this type of installation, which means a large amount of soil excavation, a large amount of concrete to backfill. And then the positive, though, is minimal structure, and which return -- in return is a minimized visual impact after installation is complete.

I will preface that to say during construction it's probably much more -- the underground is more intrusive. Whereas your overhead construction

you're really only constructing at the structure locations. There's less civil work, less excavation, less concrete, but at the end of the day the permanent installation has more structures, and it provides a visual impact.

And so let's walk through what an underground construction process may look like.

So for this project, we assumed approximately a five-foot-wide trench. That trench could range anywhere from five feet deep to 10 feet dependent on interferences along the road route.

You can visualize an underground installation kind of like an assembly line. So you're going to have -- on the front you're going to have a large excavator. In this particular situation due to the road you're going to have that excavator straddle the excavation or trench. Therefore, that excavator has got to be pretty big for a five-foot trench. You're looking at track widths of about 11 feet wide.

BY MS. GRABEL:

Q. Mr. Jocham, do you have a picture of those?

A. (Mr. Jocham) Yes.

Q. It would be helpful.

A. (Mr. Jocham) Here's a good example of an excavator straddling a trench.

CHMN STAFFORD: What slide is that?

MR. JOCHAM: I did not number my slides, so I apologize.

MEMBER LITTLE: It's the next one.

MR. JOCHAM: It's two after where we currently are.

BY MS. GRABEL:

Q. So, Mr. Jocham, you were on the route tour yesterday; correct?

A. (Mr. Jocham) I was.

Q. I mean, how much would a piece of equipment like that take up of a road -- a residential road such Adams or Vine?

A. (Mr. Jocham) Yeah. So on Adams or Vine it's pretty limited asphalt space, pretty limited road right-of-way up let's say 33 feet or so, 35 feet. You're looking at the excavator itself taking up half of that.

Adjacent to that excavator would come a large dump truck. That large dump truck is going to be nine feet wide and be a couple of feet away from the excavator to allow it to dump the spoils.

So on a street like Adams, you could potentially close the entire section of the road from intersection to intersection while you're doing this installation just purely by the type of equipment that you would need to

bring in.

Q. Thank you.

MEMBER HILL: Mr. Chair, just a --

CHMN STAFFORD: Member Hill.

MEMBER HILL: Just a clarification. I thought the undergrounding only applied to the Gateway Corridors. Like, Adams and Vine isn't the Gateway Corridor.

MS. GRABEL: It's the University Area Plan requires undergrounding all of the roads, and that residential area also will require undergrounding.

MEMBER HILL: Okay. Thank you. Thank you.

MR. JOCHAM: So let's talk about a street like Campbell, which has a raised median. You're looking at an 11-foot excavator that's going to take up at least a lane. You're looking at a dump truck adjacent to that that's going to take up at least a half or another lane and potentially bleed into that third lane.

There is a good chance that you're shutting down the whole side and redirecting traffic to flow in both directions on one side of the road, and probably one lane in each direction having some pretty significant impacts to traffic and to the public.

So after you've excavated, you're going to put in that same excavator that you see here. We'll put

in trench boxes to keep the workers safe. And the intent of trench boxes in this scenario is to limit the amount of excavation.

OSHA has confined space requirements. Those confined space requirements, the only way to minimize those without trench boxes is to pull the excavation back even further and give an escape route for those workers. And so trench boxes are used to keep the side walls protected and the workers safe.

One those trench boxes are installed, you will be able to -- at that point the workers will be able to go down into the excavation and install the conduits and spacers.

At that point, you would come back with cement trucks, and you would pour concrete over top of the conduits.

So to give you an idea of just the amount of heavy construction traffic that you would see in, like, let's say 100-foot stretch because as you can see here, typical installation, you can excavate about 100 feet a day is a good day in transmission line undergrounding.

You're going to see approximately one dump truck -- large dump truck, 20-cubic-yard dump truck, with a 20-foot-long bed every 15 feet of excavation. So you

could during a day see five to six trucks in a day of just dump trucks.

Concrete, those are 10-yard trucks. Do they really carry 10 yards? No. They carry more typically about eight.

So you're expected to see a cement agreement truck about every 20 -- 15 to 20 feet of the trench as well. So, again, another approximately five or so cement trucks.

In addition to that, you have flatbed trucks bringing in trench boxes. You have crew trucks. And all of this in an extremely -- what you're trying to work in is an extremely narrowed right-of-way so that you're reducing the impact to traffic. And so it's a bit of a -- it's a bit of a ballet along a linear stretch.

During -- after the concrete's poured, you're going to place a concrete plate over top of the excavation, which would allow you to move off, keep the public safe, and allow that concrete the cure.

After that dump trucks come back in with select fill. You're going to place select fill on top of the concrete duct bank, and then you would asphalt over that select fill.

Not to, I guess, put words in the City of Tucson's mouth, but based off of -- or you could have

requirements where instead of replacing or asphalting just the trench, some cities I have seen require you to asphalt the entire section of road.

So in our cost estimate, we did only assume that we're replacing the asphalt along or where the trench lies and not the entire road width. That would obviously increase the overall cost of the project. So not entirely sure what the City of Tucson would require, but we have seen cities in the past require us to repave the entire street as part of the project.

So that's a typical undergrounding.

BY MS. GRABEL:

Q. Mr. Jocham, before you continue, can you talk a little bit about the noise impact to the neighboring areas from undergrounding construction?

A. (Mr. Jocham) Yeah. So obviously with heavy equipment and heavy construction you're going to have a large -- a lot of large noises. The excavation of the asphalt itself is very loud.

Beyond that, you'll have multiple heavy pieces of equipment with running diesel engines that rumble and shake, and you have crews yelling. And these projects really don't move very quick linearly.

And so they're going to be there for days at a time. And dependent on time of year and when you would

actually be doing the work, if construction workers were working on a day like yesterday, they're going to do their tail boards at sunrise, and they're going to try to start work immediately. And so as soon as the sun comes up at six a.m. they're full speed ahead because they need to get as much work done before it gets too hot and they need to go home.

So there is going to be a large noise disturbance for an extended period of time, where typical overhead construction you may have noise disturbance for a day or so as they install the structure.

Q. And how long does it take to construct an underground transmission facility?

A. (Mr. Jocham) So an underground transmission facility kind of as identified here, typical installation is about 100 feet a day. So it's a lot longer in duration. I think we did an estimate of about four months to go a mile for underground duct bank installation. That included some cable -- it includes the cable pulling concept, the testing and commissioning and energization of the line itself.

Whereas overhead, you're looking at you can install one to two poles per day, and that's every five to 600 feet, so you could typically go about a quarter mile in a day.

Q. And is that four months calendar days?
A. (Mr. Jocham) Those are four months in calendar days, yes.
Q. Thank you.
MEMBER KRYDER: Mr. Chairman.
CHMN STAFFORD: Yes, Member Kryder.
MEMBER KRYDER: Did I capture then four months a mile underground to four days aboveground? Is that the back of the envelope?
MR. JOCHAM: So four months per mile for underground. Full installation overhead would be one to the two months, but that includes the curing time of the foundations, which crews won't be present during that in the overhead section. So it's still called the construction window, but you're not going to have any disturbance.
BY MS. GRABEL:
Q. Mr. Jocham, before you move on, Tucson's a historically rich area.
Would you agree with that?
A. (Mr. Jocham) Yes.
Q. During excavation are there any other factors that might lead to a delay beyond that four months per mile?
A. (Mr. Jocham) Yeah, absolutely.

So you could experience cultural issues, historic findings, and that could potentially delay the project while you mitigate those findings.

I think one of the public comments was a gentleman from the City of Tucson that worked in the water department for many years, and he said you're going to find a lot in these streets.

We in the cost estimate utilize GIS data that is available from the City of Tucson to identify water lines and sewer lines. But third-party installations we had no idea. And whatever beyond that that's abandoned we also don't know.

And so, yes, that could slow the project. And if something of significance is discovered culturally or historically, it could stop the project in its tracks.

Q. So this project has an in-service date of 2027. If we are required to construct the line belowground, do you think given the time estimates you have there could be a risk that that in-service date could not be met?

A. (Mr. Jocham) I do.

Q. Thank you. Please continue.

A. (Mr. Jocham) Yeah. So, as we discussed, the underground for this is a five-foot-wide trench, five-plus feet deep, but what we haven't talked about yet are the vaults that we have to install as part of this

project.

So those vaults typically need to fit personnel, and so they're really large, 35 feet long by 10 feet wide by potentially 12 feet deep.

Those are buried in the roadway. And so they're made of concrete, and they're quite large. And so they lake large equipment to install. I do have a photo of that right here. You can -- whoops. Right here you can see a large crane installing just a section of the underground vault.

And so all of this is just to show the amount of disturbance that underground can really produce during the construction process.

Overhead your construction impacts are really limited to the structure locations, which are -- 30-by-50-foot pads are a good estimation of what disturbance you would see. And your excavations for the foundations are between four and six feet in diameter at structures, and those every, again, five to 600 feet in locations.

And as Meghan asked down at the bottom there, it's difficult for underground lines to avoid cultural, historical, or environmental obstructions. You either mitigate them or you try to reroute around them, which can prove to be very difficult. Whereas an overhead

line, they're spot locations, and so you can adjust the structures, you know, 10, 15, maybe even 50 feet to avoid those potential risks and obstructions and keep the project rolling.

Q. Thank you.

A. (Mr. Jocham) So as we had talked about, typical underground construction is about 100 feet a day. We see the amount of disruption it can cause, but what we haven't kind of talked about is it could shut down or severely restrict access to businesses, to homes for periods of days.

I think in the prior for SRP the HIP project and the agreement with the City of Chandler, they allowed 48 hours of full closure to businesses and/or residents along the route of the HIP project. And so that has significant impacts to the residents. If this did have to go down Adams or Vine, they wouldn't be able to access their homes with their vehicles.

Additional road closures would occur after the duct bank is installed and the initial traffic control is removed because you're going to have cable pulling operations. Sorry. Before that you're going to proof the conduits with a round, wooden piece of equipment that you pull through the cables to make sure that there are no -- there's no debris in the conduits and the conduits

are round so when you pull the cable through that you are ensuring that you're not going to damage the cable, the very expensive cable that we're installing.

You're going to pull the cable. You're going to have splicing. So at those vault locations you're going to have lane and road closures for the workers to go down into the vaults, perform those splices. The initial splice effort is not a quick process. It's -- at this cable size it's a very time-consuming process.

You're going to test the system after it's installed. And then at that point you'll commission it and energize it.

With overhead, you'll obviously have impacts around the areas where you're installing the structures. And then in addition to that when you're pulling wire you're going to have minor restrictions and temporary traffic restrictions while you pull the overhead wire into place. But those are typically shorter durations. Maybe a day or two.

And as we talked about with overhead, a one- to two-month per mile overall installation process.

And so now with photos. So you can see some steel plating here covering the trenches after the workers were done in that section. So you'll cover up the trenches for worker protection, but those are heavy

steel plates, and you need excavators to move them. So that excavator is really going to remain on-site during the time the trench is open.

You can see here, again, the vault here as we talked about, but one thing that we haven't really talked about yet is the size of the cables and size of the reels. We talked about the cable size itself as an individual cross section.

But this project here is a project in the southwest that S & L has done. This is a 6,000-kcmil cable, and it comes on a nine-foot-wide reel, and that reel is -- let me make sure that I get this right. That reel is 15 feet tall, and it weighs 76,000 pounds.

So to give you an idea of what that is, that's 23 Honda Accords just in that reel. Not the truck. Just the reel itself is 23 Honda Accords. Or if you like animals, it's six African elephants.

All right. To give you a concept of what an overhead reel looks, which I do have a photo of in a later slide, those overhead reels are about five feet wide and about seven and a half feet tall and only weigh about 12,000 pounds or one elephant.

Distribution underground that TEP uses, that reel is about five foot, nine inches wide and about nine feet tall and weighs about 15,000 pounds, so it's about

the same size as the overhead reel to give you a concept of the gross size difference between underground transmission and underground distribution.

You can see in the bottom right-hand corner the concrete cement trucks delivering cement to the site and pouring into the trench. Hard to see but in the shadow here, but you can see this excavator is placing those steel plates on right after the concrete is poured to protect the concrete during the curing process.

And then speaking of that large cable, this is the trailer that is required to hold that cable while it is placed underground. That trailer is an oversized trailer. It's approximately 14 feet wide. So, again, shutting down more than one lane of traffic as you install the cable itself.

And then this is just a small trailer guiding the cable into the vault.

MEMBER HILL: Mr. Chair, I have a question.

CHMN STAFFORD: Yes, Member Hill.

MEMBER HILL: The cable spool for lack of a better term, what's the length on one of those? I'm trying to just imagine.

MR. JOCHAM: Yeah. So it'll vary based off cable size, but we assumed that a typical reel for this project would be about 1800 feet.

MEMBER HILL: Okay.

MR. JOCHAM: And so we conservatively put vaults at 1600 feet based off of that.

MEMBER HILL: Okay. Helpful. Thanks.

MR. ROBINSON: As a comparison to our overhead transmission wire reels, they have 10,000 feet on them.

MEMBER HILL: Okay.

BY MS. GRABEL:

Q. Mr. Jocham, before you continue, I'm trying to imagine all of this equipment on a road such as Vine, especially I don't know if you remember on the tour there was that circular area.

How would a road such as Vine accommodate all of this equipment?

A. (Mr. Jocham) It would -- plain and simple it would be difficult. This is large equipment. And with the cable sizes that you have here, you're going to have heavy equipment. There's a chance -- especially with the roundabout that we passed through on Vine where the buses scraped the tree as we kind of went through that roundabout, it was a pretty tight fit for even a bus, there's a good chance from an engineering perspective and a construction perspective you'd blow through that roundabout and destroy it and have to rebuild it

afterwards.

So it would have impact to the community. And it would -- it's not -- again, with a linear project where you have linear disturbance it sometimes is unavoidable.

Q. Thank you.

A. (Mr. Jocham) So just some additional photos here. As you can see, this is kind of what a cable splice -- the beginning of a cable splice looks like in a vault. They're getting ready to combine those two cable sections together.

Below here, you can see this is that copper foil, your concentric neutral, and then this is actual -- the splice underneath this black is where the splice actually occurs. On top of this, they'll put extra insulation, wrap it up really tight to make sure there's no water intrusion.

Splices on the underground -- underground transmission side are held up aerially on supports on the side of the vault to protect them against standing water or anything like that.

Typical vaults have sump pumps in them to push the water out again to help keep the vault as dry as possible and minimize the potential impact of the cable getting water.

MEMBER KRYDER: Mr. Chairman.

CHMN STAFFORD: Yes, Member Kryder.

MEMBER KRYDER: You spoke earlier about the concrete being brought in after this process.

Is the entire trench filed with concrete or some sort of sand mix and then concrete?

Give me a little insight on that, please.

MR. JOCHAM: Yeah, absolutely.

So the conduits are placed typically on the bottom of the excavation. They're placed in -- they have spacers to make sure that the conduits are spaced appropriately.

From that, that's encased in concrete. Typically we'll stop the concrete a couple inches above the conduits. On top of that we're going to place another foot of concrete. That foot of concrete is red dye concrete. That's help to notify the public as they're excavating there's something very dangerous underneath this.

From that above that foot will be select fill, which will be a determination of engineering during detailed design. The important part of that fill is to make sure that it has the correct thermal characteristics to help dissipate the heat, so it's typically some sort of sand mix.

And on top of that would go the road.

MEMBER KRYDER: Very helpful. Thank you.

MR. JOCHAM: And then on the right here you can see this is just the testing truck. So this will come in after the cable's installed. They'll perform testing on the underground system prior to its energization.

This is just some photos of overhead. Obviously you guys, I think, are much more familiar with that, but excavation of your foundation or direct embedments. The placing of structures, you can see this crane is a 60-ton, all-terrain crane, RT crane.

And then after the structure's installed, you see the wire-pulling operation here. And so you can see that reel size and typical trailer that can be driven on the road. I gave those dimensions earlier, but that's what a typical reel setup looks like for overhead construction.

And so to discuss the cost impacts, we looked at three routes, and I'll -- as part of the cost estimate and study that is provided.

Our first route was 14th Street where basically the start of Kino Parkway or Campbell at that location 14th street and Kino Parkway, and it ran along Campbell all the way to Lester. That section of line is

approximately 1.8 miles.

MEMBER RICHINS: Chairman, just a point of clarification.

Your three routes have nothing to do with the three routes -- the three routes you tested have nothing to do with the three routes as proposed in the placemat; correct?

MR. JOCHAM: Absolutely correct.

MEMBER RICHINS: Okay. And so it would be good if we could understand the length of these tested routes.

MR. JOCHAM: Absolutely.

MEMBER RICHINS: Thank you.

MR. JOCHAM: And I do have one that I've run numbers really quick on on the preferred route just so we can understand.

MEMBER RICHINS: Yeah. It's going to be very difficult to correlate these numbers --

MR. JOCHAM: Yes.

MEMBER RICHINS: -- to anything that makes anything -- that makes any sense to anything we've heard so far.

So, I mean, I'm even reluctant to go through these because it's going to muddy the water more. If I'm going to get a cost estimate, I need to know the

route and how it correlates to what we've been studying for a week.

MR. JOCHAM: Sure.

MEMBER RICHINS: So I don't see how these cost estimates are helpful and could even serve to muddy the waters a bit. So --

MR. JOCHAM: So I can touch on the preferred Route 4. The numbers won't be on the screen here, but I can state them to you.

So preferred Route 4, which is basically starting at Euclid and Broadway and going all the way to the Vine station, that cost estimate quickly done was about 16.4 million a mile, and that is base cost. And I'll touch on that in a second what that means.

And then with the adders was 19.6 million.

And so what I mean by "adders" is the installed spare that we talked about for reliability purposes, but it also includes jack and bores or trenchless installations across major intersections, and this is to help minimize the impact to the public.

One thing about Route 4 that there is one jack and bore that's included in the base estimate of Route 4, and the reason behind that is it crosses the streetcar path.

MEMBER HILL: Mr. Chair.

CHMN STAFFORD: Yes, Member Hill.

MEMBER HILL: It would help me if we could look at Exhibit 26 because it's got the overlay maps.

MEMBER KRYDER: Into your microphone, please, Natalie. Please.

MEMBER HILL: So it would be helpful if we could look at Exhibit TEP-26 because it has the Gateway Corridors and the zone overlays, so when we talk about these numbers, we can actually see the route and see the overlay of those zones.

Meghan -- or, Ms. Grabel, are you okay with us looking at that map when we talk about these numbers?

MS. GRABEL: Yes, Mr. Chairman Stafford and Member Hill, I'm very fine with that.

I also do think, however, it would help to go through -- I understand what you're saying, Member Richins, but they are portions of various of the routes, and I think it will help the Committee to understand why there's a range of factors.

I think that's testimony that won't muddy the waters. I think it will clarify the waters. And maybe the reason we're having difficulty here is because we don't -- he hasn't yet gone through the various factors. He can talk about other things after that, but I would like that testimony to get put into evidence.

CHMN STAFFORD: All right. So the sections he's talking about on the right screen, can you -- I think we need to kind of tie them into where we're talking about --

MS. GRABEL: Certainly.

CHMN STAFFORD: -- for here.

On the other hand, it is after 12:30, and it's getting -- I think I'm starting to get a little hangry, so --

MEMBER RICHINS: Maybe I am too.

CHMN STAFFORD: Yeah. I think maybe we should break for lunch. And then during that time, they can -- the applicant can get the -- kind of narrow their presentation a little bit to kind of focus on what we're talking about looking at, and then we'll come back after lunch and then get into this.

MS. HILL: Mr. Chairman. I'm sorry, Mr. Chair.

CHMN STAFFORD: Oh, yes.

MS. HILL: It's Megan Hill. I'm sorry. In-house for TEP.

I'm sorry to cut in, but I believe we can put together those numbers with Mr. Jocham before the end -- before we conclude today certainly.

What I would like to know, though, is so

that we don't cause any frustration if Member Richins and anyone else that has a specific area that they feel is more important than the ones that are shown up there, if you can explain that to us before we go off the record, I think that would be really helpful so we use the correct parameters.

MEMBER HILL: May I ask Member Richins a question?

CHMN STAFFORD: Sure.

MEMBER HILL: Do you want the preferred route numbers? Is that what you're looking -- I mean, that's what I was looking for is just to understand the preferred route because I think that's the thing that we're taking most consideration of.

But others might want to understand the cost implications for other routes. I don't know.

CHMN STAFFORD: So I think the most relevant would be Section 1, isn't it, because that's the one that clearly the City has asserted undergrounding applies. It's not one of the ones where it may or may not based on how you interpret the University Plan. That's one clearly that's envisioned by what the Gateway ordinance -- Gateway's --

MS. GRABEL: Corridor Zone.

CHMN STAFFORD: Corridor zone, yes.

MEMBER HILL: Good point, Mr. Chair.

CHMN STAFFORD: So I think that -- and that -- because that -- certainly it makes sense to look at that because that's the most direct route. And so that one, if it has to be undergrounded, it's going to be expensive, and it's probably off the table.

If it doesn't have to be undergrounded, what's the cost difference between aboveground, underground? I think that would be one example of something that would be highly relevant of what the cost distinctions would be.

MEMBER RICHINS: Chairman. And to see you halfway, Megan, there are -- I think these are instructive. If we're looking to deviate off a -- say we were to say that going through certain neighborhoods that had to get undergrounded, these are going to be helpful for that.

So let's drop these on a map relevant to that. Is that shown on that? So we can kind of see those segments. I think that would be really helpful to show us what does a short run look like, because this is a good of example of what a short run looks like.

MS. GRABEL: We can do that. I believe Route 1 14th to Lester is Route 1 as identified on this map, but we'll work with that over lunch and come back to

you.

MEMBER LITTLE: Mr. Chairman.

CHMN STAFFORD: Yes, Member Little.

MEMBER LITTLE: Consistent with what we've been talking about, I would also like to see what a section through a neighborhood such as along Vine between Grant and Vine, the substation Vine, what that -- you know, it's more constrained. I realize that there are other issues in that. And if I could have sort of a sense of what undergrounding that section, the difference in cost is.

MS. HILL: So and to do that, I think, one of the -- there are some additional -- which, you will, of course, understand, Member Little, some additional pieces to that. I think we can absolutely do that.

We can maybe give bigger, rounder numbers today of routes and then might be able to segment more on Monday potentially if we can't get the segments quite exactly where you want.

But we'll work with Mr. Jocham. And I think we can definitely get you some numbers for the preferred route and any of those routes that go through neighborhoods which would include Route 3, which is the -- I believe also in -- that runs on the eastern boundary of the Sam Hughes Neighborhood. And so but we

can certainly focus first on the preferred.

MEMBER LITTLE: Thank you.

MR. JOCHAM: So if I may, we do have some of that information, which I think we can share today. It's part of Exhibit 17 or TEP-17.

We do show a map from Vine Substation to Grant along Vine. And we'll be able to look at that on a map. It's at the back of the study.

And then Route 1, as you see it here, 14th to Lester is the -- is Route 1 along Campbell Road -- or Campbell Avenue, excuse me. And so we can go through that as well.

And then any other ones we can update pretty quickly. Our spreadsheet is pretty -- has a lot of equations in it, so we have minimal inputs.

MR. ROBINSON: Can I ask just a clarifying question?

The Route 1 is only along the Gateway Corridor? That estimate is only along the Gateway Corridor?

MR. JOCHAM: Correct. Of Campbell.

CHMN STAFFORD: All right. Well, with that let's take our lunch break for approximately an hour. We stand in recess.

(Recess from 12:38 p.m. to 1:54 p.m.)

CHMN STAFFORD: Okay. Let's go back on the record.

MS. GRABEL: Thank you. Are you ready for me?

CHMN STAFFORD: Yes.

MS. GRABEL: All right. Thank you, Mr. Chairman. Before we continue with the underground slide, I just really quickly wanted to ask Mr. Robinson, in the last panel one of the Committee Members and I'm sorry I can't remember who, asked you a question about what if the joint users of the poles do not want to go underground, can't they just erect their own poles and still stay aboveground.

Have you been able to determine an answer to that question?

A. (Mr. Robinson) Yes, I have. Typically the joint-use applicants can apply to the City or the other jurisdictional governing jurisdictions for overhead permits in those areas if they wanted to. But the challenge of going through that, they'd just join us, and our experience has been in the past, they just join us in the undergrounding of the project and go in our joint-use trench.

MS. GRABEL: Okay. Thank you. All right.

MEMBER RICHINS: Chairman, I want to ask a

question related to that.

CHMN STAFFORD: Yes.

MEMBER RICHINS: So my understanding right then for TEP overhead is by right and for the other utilities it's by permit? The collocated utilities are by permit. But TEP has overhead utilities by right?

MR. LUSK: So this is Roi Lusk for the City of Tucson. Member, this is -- I think that question is decided in somewhat in some fashion by the franchise. And then there are -- the TEP is still subject to certain right-of-way regulations, even though they are a franchised utility. And then you're correct, the communications providers are governed by a lines agreement and a permit.

MEMBER RICHINS: Okay. So if I'm understanding it right, then, the relationship of the disposition of some utilities is regulated by your franchise agreement of some of your --

MR. LUSK: Southwest Gas.

MEMBER RICHINS: So that's the governing document for your guys' relationship.

MR. LUSK: To the extent it doesn't conflict with our regulations, yes.

MEMBER RICHINS: Could you give me an example of a regulation it might conflict with?

MR. LUSK: Well, it doesn't necessarily conflict. It's just the franchise isn't necessarily as specific as the regulation. So, for example, in this case where we're talking about, for example, the Gateway Corridor Zone, what the franchise says is that TEP agrees to comply with local regulation.

MEMBER RICHINS: Do you anticipate that -- so when is -- when do you need to renew your franchise agreement to govern this relationship?

MR. LUSK: I believe it ends in April of '26.

MEMBER RICHINS: And so you'll need to be to the voters when to approve that franchise agreement?

MR. LUSK: Preferably early in '25.

MEMBER RICHINS: Do you have an election that is scheduled at that time?

MR. LUSK: We don't have an election schedule for franchise at this time, no.

MEMBER RICHINS: Okay.

MS. HILL: May I -- Mr. Chair, Member Richins, may I try to clarify something. I'm not sure that -- maybe we are, but I'm not sure that we're talking about apples to apples. May I ask --

CHMN STAFFORD: Yes. Go ahead, Ms. Hill.

MS. HILL: Okay. So the TEP's franchise

agreement with the City governs our relationship with the City. Any of the joint -- what we have joint attachers, and there is a little -- some discussion -- and a franchise agreement is I believe is one of Underground Arizona -- UGAZ's exhibits. I think it's Exhibit 21.

So, but each of the -- and Mr. Lusk, correct me -- but, so anything that we do in the right-of-way, if we're going to construct something we have to pull a right-of-way permit from the City. City knows everything that we do in the right-of-way despite -- even though we have the franchise agreement we can't just drive around and drop poles places.

The same is true for whatever independent relationship our joint attachers may have with the City, communications companies may have with the City, as he said, Southwest Gas, although they're largely underground, that those are different relationships with the City. It is not just the TEP franchise agreement that covers all of this. That would be inappropriate, frankly. We're different entities.

MEMBER RICHINS: Yeah. And I absolutely agree. Thank you for clarifying that. I just wanted to establish that the franchise agreement is the governing document for your relationship subject to local regulations.

MS. HILL: And state law.
MEMBER RICHINS: And state law. Correct.
MS. HILL: Like this one.
MEMBER RICHINS: Nice try.
CHMN STAFFORD: All right. Ms. Grabel?
MS. GRABEL: Okay. Let's proceed.
BY MS. GRABEL:
Q. Mr. Jocham, did you have the opportunity at lunch to slightly revise the slides that we had looked at on TEP-16, I believe, to address the Committee Members' question?
A. (Mr. Jocham) TEP-17, but yes.
Q. TEP-17. Thank you. And Mr. Ancharski is making hard copies for the Committee now. But I think I'd like to ask you to show -- so this new exhibit that we're going to have is going to be TEP-30.
This clarifies the routes that were on the earlier slide. We didn't have to do a lot of number crunching because the routes were still mostly the same. But why don't you walk through and talk about each of the routes you analyzed first and then talk about the cost differential on them.
So let's start with Route 1, and if someone could use the map on the left which is the same map on out your placemats, I believe it's TEP-2, and talk

through which routes we're talking about and where.

A. (Mr. Jocham) Yep. So a lot of the routes that we did in the cost estimate did have portions that were part of the routes that were studied. And so the updated slide on the right will clarify some of that information.

So what we studied as a part of this was Route 1 basically starting at Kino as it enters -- as it becomes part of the Gateway Corridor all way up to Lester. And at that point when it exits the Gateway Corridor, we assumed, or at least from the cost estimate that you see in Route 1 on the right, it terminates.

So approximately 1.8 miles along -- along Campbell Avenue.

And then Route A assumes along Vine Road, which is equivalent to -- yeah, excuse me, Route A, so along Vine Road from Vine Substation to Grant, and then the next one -- table you see here at the bottom --

MEMBER HILL: Mr. Jocham.

MR. JOCHAM: Yes.

MEMBER HILL: Sorry to interrupt. What's the distance of that? Because I'm just writing down the distances.

MR. JOCHAM: Yep, it's in the slide, .46 miles.

MEMBER HILL: I apologize. Thank you.

MR. JOCHAM: Yeah, it was added, so.

And then lastly is Route D, which also shares Route 6 from Lester to Grant.

And so with -- with those you can see the costs.

BY MS. GRABEL:

Q. Well, actually, Mr. Jocham, before we do that, let's go to the next slide just to show the other two routes that we analyzed.

A. (Mr. Jocham) These ones are the new ones that we analyzed over lunch. But we looked at -- these are the preferred routes at least within the University Area Plan. So from Broadway and Euclid Avenue to Vine, which is approximately two miles, and then from Vine along Adams.

CHMN STAFFORD: Wait. Wait. Go back.

MR. JOCHAM: Sorry.

CHMN STAFFORD: So Route 4 --

MR. JOCHAM: Is Euclid and -- starts at Euclid and Broadway where the University Area Plan starts.

CHMN STAFFORD: So it's on Euclid, then?

MR. JOCHAM: Yeah. Underground up Euclid, following the same route to Vine Substation all underground is what that estimate at the top provides.

CHMN STAFFORD: So what's the crossroads where it starts, Euclid and what?

MR. JOCHAM: Broadway.

CHMN STAFFORD: Broadway. Okay. And then all the way up to the Vine Substation?

MR. JOCHAM: Correct. Following the same route.

CHMN STAFFORD: Okay. All right.

MR. JOCHAM: So it's a total of two miles.

And then Route B which, again, starts back at the Vine Substation along Adams and up Park to Grant. And that's 1.18 miles.

BY MS. GRABEL:

Q. And to clarify, those -- the routes that we've analyzed are the portions of each of the routes that are required -- that may be required to be placed underground either by because it's in a Gateway Corridor Zone or because it's in a University Area Plan assuming that the University Area Plan requires undergrounding; is that correct?

A. (Mr. Jocham) Correct.

CHMN STAFFORD: So the last one on here, the Vine Substation to Grant, that would be along Park Avenue and Adams?

MR. JOCHAM: Correct.

CHMN STAFFORD: Okay. Is it Adams Road, Adams Street? What is it?

MR. JOCHAM: Adams Street.

MR. ROBINSON: Street.

CHMN STAFFORD: Okay. Thank you.

MR. JOCHAM: I'm going to go back a slide to talk about the numbers.

So on Route 1, starting along at basically Kino Parkway and 14th Street just south of Broadway is where we propose the underground to start there because of the Gateway Corridor.

We headed north terminating at Lester as it turned -- as the line turned west onto Lester.

And so the cost estimate, and this was in the original report with the detailed breakout supplied, is about $16.8 million per mile for the base case. That totals out to 26.2 or almost 26.3 million for the entire alignment.

And that base case, again, assumes that we would trench -- open trench through Broadway, through Speedway, and through Kino Parkway. And also trenching in front of Banner and the university, open trench.

CHMN STAFFORD: Now, these numbers, are they in addition to the other costs provided for this chunk of the line, or is it in lieu of the other costs?

MR. JOCHAM: So the adders are inclusive of the base cost.

CHMN STAFFORD: No, no, no, no. I'm talking about the costs that the TEP gave for the overgrounding costs, is this a replacement for that or is it in addition to?

MR. JOCHAM: It's a replacement.

CHMN STAFFORD: Okay.

MR. JOCHAM: So the underground costs, to clarify, the underground cost you see here would be the cost to install it as a true underground transmission line. It does not include any of the distribution replacements, relocations.

CHMN STAFFORD: Okay. So if you look at the back of the placemat, you have -- let's look at Route 1. It says length, 4.1 miles, $11,756,509.

Now, we look at this chart, you have Route 1 you have to underground from 14th to Lester on Campbell. You know, are these numbers in addition to the number here?

MR. JOCHAM: No, they'd be replacement of a section of that alignment that you see here on -- because Route 1 that you see here is from Kino all the way to Vine. The underground that we're representing on the table here is only in the Gateway Corridor.

CHMN STAFFORD: Right. And you said it doesn't include undergrounding the distribution stuff; right?

MR. JOCHAM: So this number does on the back of your sheet, includes the relocation of --

CHMN STAFFORD: The placemat.

MR. JOCHAM: On the placemat, yeah.

CHMN STAFFORD: Right. I'm just saying, like, you have these two different numbers and I'm saying it sounds like you don't add them together, but it's not a complete swap out because there's a bunch of costs that are on this underground versus overhead that don't include things that are in these other costs such as undergrounding the distribution stuff.

MR. JOCHAM: Correct. So if you were to go underground with the transmission line --

BY MS. GRABEL:

Q. I think I understand what you're asking.

CHMN STAFFORD: You understand what I'm saying?

MS. GRABEL: I do. So Mr. Chairman, so what we've done here is given for the section of the route an apples-to-apples comparison just to that section we have not yet calculated the entire project cost assuming where you have the aboveground build with the

underground, so we don't have an apples-to-apples with your placemat.

If you'd like us to calculate, we're happy to do that. Probably a Monday project.

CHMN STAFFORD: Yes, definitely a Monday project.

MS. GRABEL: But I think this still has value to walk through, because it does show apples to apples on a certain segment what it would cost to build it underground versus aboveground.

CHMN STAFFORD: Right. And I think what the Committee wants to see, or certainly I want to see is that, for example, like Route 1, that is the most direct route from Kino to Vine.

However, the undergrounding costs would change the equation of whether to select that route or not. And so I want to compare, for example, if the Committee were to say, okay, make a finding of fact that the undergrounding costs are excessive and unreasonable, and issue the CEC notwithstanding that requirement, we need to know what -- because, like, the placemat says what it costs to do it, if you -- if the Committee makes that finding of fact.

These numbers here don't give me a straight apples-to-apples comparison of what it would cost because

the statute requires to say the Committee needs to look at the cost of what the applicant has proposed versus what the Committee recommends.

So I need to have a number that says if it's going to cost X, if we make that finding of fact, it's going to cost X plus Y equals Z, and that Z number is what we want to see to compare it.

MS. GRABEL: Okay. We can certainly get you that number.

CHMN STAFFORD: Okay. Okay.

MEMBER RICHINS: Chairman, it just -- we may be saying the same thing. I was having a hard time following the whole thread you had there.

But, I mean, just using just the placemat math, you're at 2.8 a mile overhead. Is this particular section that much cheaper than everything else overhead? Because you put here 1.2 million a mile. If I take 4.1 miles and divide that into 117 -- 11.7 million, I get about 2.8. Not 1.2.

So is it 2.8 million a mile, or is it 1.2 million a mile?

MS. GRABEL: Thank you, Mr. Chairman. So Member Richins, I think that the placemat includes additional undergrounding distribution facilities that we've agreed to do if we overhead. So the 1.2 per mile

overhead is purely overhead.

But because we have the agreement to construct some facilities belowground, the placemat map is higher. That's what -- that's the difference between the placemat and the 1.2 million.

MEMBER RICHINS: Well, you have to kind of do it anyway, don't you? I mean, shouldn't we be including that?

MS. GRABEL: Yes, that's why we're going to do the math that I talked with Chairman Stafford.

MEMBER RICHINS: Not that -- not that math. Okay. I just -- I wasn't sure I followed everything he was saying.

CHMN STAFFORD: Right. In other words, there's costs included in the placemat such as the -- but that they wouldn't -- that would be different than what's on the screen here. That's not included -- it's like this isn't -- I mean, because this isn't -- I mean another way to do it would be, you know, what's the difference, what's the marginal cost to underground here assuming, because if you're going to underground the high-voltage line, I mean, you wouldn't leave the distribution poles up on the corridor, would you? I mean that seems counterproductive.

MS. HILL: Well, actually, so -- Chairman

Stafford, we actually have technical testimony about that. And if we could proceed just a little bit with some additional questions, it might help refine the numbers that the Committee wants. And what -- because there is actually some -- and it would also help us understand, too, what the Committee would expect if we were -- because it becomes a really different undergrounding project if we're throwing distribution into those trenches as well. Or adding the distribution of the underground into there.

And so that's what we wanted. This is what we wanted to talk to the Committee about and I appreciate all of the Committee's concerns and questions. But I think if we can develop our technical testimony a little more, then we can have a better conversation on Monday.

CHMN STAFFORD: Okay. That makes sense.

MS. HILL: Okay. Thank you.

MEMBER GOLD: Mr. Chairman.

CHMN STAFFORD: Yes, Member Gold.

MEMBER GOLD: Just a simple question, something I'm missing. You have a column here called "Difference."

MR. JOCHAM: It's a multiplier.

MEMBER GOLD: So if I look at total costs for Route 1, 14th to Lester, to underground is 17.8 times

more expensive. Is what I'm looking at?

MR. JOCHAM: With the adders, yes.

MEMBER GOLD: Is that just for this portion or --

MR. JOCHAM: That's just for that portion.

MEMBER GOLD: Okay. Then we'll get the other answer when you do it on Monday and give us the whole thing, the whole route, the cost difference.

MEMBER RICHINS: Chairman, Member Gold, the whole controversy here is that it feels like your technical estimates are being built on flawed math. And if we continue to build on flawed math that we don't agree on, then we can't get to a number, we can't get to something that's a finding that you seek that I'm very reluctant to give you. If the math just on its face doesn't --

CHMN STAFFORD: I'm not seeking -- are you talking to me or to them? Because I'm just throwing out what the --

MEMBER RICHINS: Yes.

CHMN STAFFORD: -- possibilities are. I haven't made any decisions on what's going happen. I'm just trying to figure out what -- kind of chart the course of what decisions we need to make and make sure we don't make conflicting decisions.

MS. GRABEL: Chairman Stafford, Member Richins, if you let us walk through the presentation, you'll see the math that we have done. And we'll explain what it includes and what it doesn't include.

And if you want us to include additional information after that, we can come back on Monday and do that. But I'd to like to walk through and discuss why these numbers are what they are, how they might change, why adders may or may not be necessary, et cetera. If you'll let us put that on the record I think that could help you kind of figure out where we are coming from.

CHMN STAFFORD: All right. That sounds like a reasonable plan.

MS. GRABEL: Okay. Thank you.

BY MS. GRABEL:

Q. Okay. So Mr. Jocham, if you could start with Route 1 and talk through what is included in the underground cost, what is included in the overhead cost, and why certain things were omitted in the calculation.

A. (Mr. Jocham) Absolutely. Yep. So total cost base design for underground includes the underground cables, the underground trench, assuming trenching through all major intersections.

And that totals out at the 1.8 miles to 26.3, approximately 26.3 million.

While the overhead is purely the installation and material for the overhead 138kV line, it does not include any of the distribution. It does not include any land acquisition. Neither of these numbers include land acquisition.

And the reason why, there's a technical reason why we didn't put the distribution underground, because if you put the distribution underground it induces additional heating on the transmission line, which will change the size of the transmission line conductor.

The TV distribution line produces heat. If you add one of those shaker heat hand warmers into your sleeping bag, it increases the heat of your cable and thus requiring a larger cable size potentially.

That has not been studied. So we do not fully understand that impact. So the distribution would stay overhead as to not impact the transmission line that's going underground.

Q. And just to clarify, Mr. Jocham, the distribution would stay overhead only in the areas where transmission is undergrounded; correct?

A. (Mr. Jocham) Correct.

Q. So when we give Chairman Stafford and the rest of the Committee the number they asked for on Monday, we will include undergrounding distribution in the areas

where transmission is aboveground and only undergrounding transmission and not distribution where transmission is undergrounded; is that correct?

A. (Mr. Jocham) Correct.

CHMN STAFFORD: So we'll have a total number for either option for that entire segment of the line.

MS. GRABEL: Correct.

CHMN STAFFORD: Okay. That's -- I understand how you did this, it's kind of a more preliminary just explaining the cost breakdown. We just got a little premature with our questioning, if you saw the numbers and start asking questions before you actually explained what we were looking at here. So sorry I jumped the gun a bit there.

MS. GRABEL: You're all good.

CHMN STAFFORD: I understand, but you understand where I'm coming from, that eventually we need to get to where I am.

MS. GRABEL: Yes.

CHMN STAFFORD: Okay.

MEMBER GOLD: Mr. Chairman.

CHMN STAFFORD: Oh, Member Gold, you have a question.

MEMBER GOLD: Now you added something in

that I didn't hear before. You just said that if we underground the transmission lines you're still going to have power lines, distribution power lines aboveground on Campbell.

MR. JOCHAM: Distribution; correct.

MEMBER GOLD: So you're still going to have lines on Campbell even if you underground.

MEMBER LITTLE: Mr. Chairman.

CHMN STAFFORD: Yes, Member Little.

MEMBER LITTLE: We keep saying distribution. We're including 46kV because that's on those poles also; correct?

MR. JOCHAM: Those would eventually go away, though, because of the installation project.

MEMBER LITTLE: Because it no longer be needed.

MR. JOCHAM: But distribution would remain.

MEMBER GOLD: So that would be --

MEMBER LITTLE: Saw the tops off the poles?

CHMN STAFFORD: One at a time.

MEMBER LITTLE: I'm sorry. So you're going to saw the tops off the poles or --

MR. JOCHAM: Mr. Robinson, would you like to answer that question?

MR. ROBINSON: Occasionally it's that

simple where we would top the pole, but most of the time because of the age of the system those poles would be replaced when it's converted to 14kV.

MEMBER LITTLE: Thank you.

CHMN STAFFORD: And there is another -- like in the neighborhoods there's additional distribution; right? There's not -- it's not just all 46kV because you have the -- all the lines going into the homes, too; right?

MR. ROBINSON: Yeah, the long-term buildout would include updating all of the back alley distribution systems and things like that that are currently at 4kV to be at 14kV ten years from now is what we've talked about under testimony.

CHMN STAFFORD: Okay. And Member Gold, you had a question.

MEMBER GOLD: Yeah, the -- so you're having 48kV pole -- I'm just talking about Campbell, on the Campbell route, Route 1 or A. Whatever that area is on Campbell, the business district.

So you're going to have 14kV lines or 46kV lines or both?

MR. JOCHAM: It would be the 14kV distribution lines.

MEMBER GOLD: And how tall are they?

MR. ROBINSON: Along Campbell those lines are between 40 and 55 feet depending on what we're trying to avoid.

MEMBER GOLD: And how far apart are they going to be spaced?

MR. ROBINSON: They're two to 3000 feet apart.

MEMBER GOLD: So every 200 to 300 feet on Campbell, even if we underground, you're going to have 45-foot-tall power lines every four or 500 feet.

MR. ROBINSON: Yes, that's the way it currently is also today.

MEMBER GOLD: Thank you.

CHMN STAFFORD: All right. Please proceed, Ms. Grabel.

MS. GRABEL: Thank you.

BY MS. GRABEL:

Q. Mr. Jocham, please discuss the adders and talk about what the adders are, what types of facilities are those and how did they increase the costs?

A. (Mr. Jocham) Yeah, so the two key adders are the installed spare conductor for increased reliability purposes, and then the second adder would be a trenchless installation. When it's this short it's a method called jack and bore, where two joint trenches or giant

excavations would be on either side of the road, we'd bring in special machinery and basically push a pipe through underground, and then we'd pull the cable through that. Allowing no disturbance over top of the start and stop point of that procedure.

That obviously specialized equipment, additional cost adders for something like that.

And so we were doing them through all major intersections, again Broadway, Speedway, and across Kino on the Gateway Corridor would those three -- at least for Route 1, three jack and bores were proposed.

Q. So just to underscore, the base cost which is the 14 times on Route 1, for example, does not include the spare cable for reliability purposes?

A. (Mr. Jocham) Correct.

Q. And I think the Committee understands the importance of the spare cable because you'll have extended outages if there isn't any; correct?

A. (Mr. Jocham) Correct.

Q. And the jack and bore is important because on areas such as perpendicular crossings of streets, you'd have to dig up the entire perpendicular crossing if you don't use a jack and bore; is that correct?

A. (Mr. Jocham) Correct.

Q. Okay. Thank you.

Please continue.

MEMBER GOLD: A question before you continue. Mr. Chairman.

CHMN STAFFORD: Yes, Member Gold.

MEMBER GOLD: So for total cost, the only thing we really need to look at is the total cost with the adders because you couldn't -- you wouldn't do this without the adders; is that correct?

MS. GRABEL: I think we should let Mr. Robinson answer that question from a company perspective.

MR. ROBINSON: So from a reliability and operations perspective, we would want to put in the added costs and install and operate that. Partly because this is new to our system. It's the first time we would have 138kV underground. So we would want to make sure to have that flexibility of the spare cable along that route.

MEMBER GOLD: Thank you. So the key number is the total cost with the adders. That's the number we are to consider.

MR. ROBINSON: Yes.

MEMBER GOLD: Thank you.

BY MS. GRABEL:

Q. And Mr. Jocham, just to make one more point of clarification, the numbers on the screen do not include

any additional costs, for example, if there are utilities you weren't expecting that you'd have to relocate, or if there's a sensitive, you know, cultural resource you discover that you'd have to relocate; is that correct?

A. (Mr. Jocham) Correct.

Q. So these are conservative in that regard?

A. (Mr. Jocham) Unconservative in that regard.

Q. Okay. Conservative. Okay. Whatever. Go ahead. Please continue.

A. (Mr. Jocham) Next would be Route A which is basically the length along Vine Road. In the report at the end as part of some of the appendices there are GIS maps that do represent what we are preliminary projecting as the alignment for the underground which includes where vaults are required, where those vaults would be and what they kind of look like.

But along Route A, that distance, you -- you can see the underground cost per mile is much higher. That is mainly due to baseline costs that are required for all undergrounding which includes mobilization of specialty contractors, testing of the cable after installation, and the overall general mobilization cost isn't spread out across the longer linear distances, and so you'll see the cost increase in those sections.

For the Vine Road section, you can see the total

with the cost adders is not much higher than the base design. That's because there are no jack and bores in this section. It's just the additional cable.

And then with Route D, Campbell -- the Campbell route, you can see the cost is a little bit higher, in higher in comparison between the base case and the adders, even though the mileage is generally the same. And that's because this does include a jack and bore across Grant assumed.

For the cost impacts for Route 4 starting, again, on Euclid and Broadway and heading north, the base case on this particular project -- or this particular section of line includes a required jack and bore.

And that is because it does cross the streetcar path and rail typically is a trenchless installation. Otherwise you'd shut down the streetcar for multiple weeks. And so the expectation is that you would utilize trenchless installation to get across that obstruction.

Again, you'd have trenchless installations at Speedway and others as well along that route, and so you can see the cost adder there, or the total cost for two miles is about 40 million.

Again, this does not include any land costs, right-of-way costs. This is purely engineering, material, and construction.

And then finally, Route B, which is the same Route B as the overhead from Vine Substation along Adams and up Park, a 1.18 mile section.

Total would be about 25.4 million, and that's approximately 17.75 times greater than just the engineering procurement and construction of the overhead, not including any land or relocation of distribution and/or third-party attachments.

MEMBER RICHINS: Chairman, a quick question on this. Does that assume you're coming from the north side of Grant, under Grant and then down the route? Or are you starting from the south side of Grant?

MR. JOCHAM: South -- for route -- for Route B we are assuming the south side of Grant where the existing 46kV has just been --

MEMBER RICHINS: Okay. So you have a street go under on that one.

MR. JOCHAM: Yeah, no jack and bore on that one.

MEMBER RICHINS: Thanks.

MR. JOCHAM: And that finishes out the cost aspect. We still have some reliability slides on the other presentation if we could switch back over to that one.

MS. GRABEL: Okay. Do the Committee

Members have further questions on this or would you rather wait until Monday?

CHMN STAFFORD: Let's wait till Monday and you can have a -- more the cost breakdown that I was asking for.

MS. GRABEL: Okay.

CHMN STAFFORD: So --

MR. JOCHAM: Okay. On to the reliability and maintenance portions.

So underground transmission lines are generally reliable. In TEP -- what was the national grid submittal?

BY MS. GRABEL:

Q. Oh, TEP Exhibit 27, I believe.

A. (Mr. Jocham) Correct. In TEP-27, National Grid, a utility both in the United States and the UK who has a significant amount of underground in their system in the UK, identifies and makes a statement to that overhead and underground lines generally have the same reliability and maintenance cost.

Underground lines are protected from weather events providing storm hardening, which is a benefit.

But regular maintenance would require the circuit to be energized in lane closures for personnel to access vaults, so we talked about the safety aspects of

deenergizing the line when you enter a vault.

Those of you who have lived in Arizona know that there was a fatality in a utility vault a few years ago in Phoenix. And so that's just a key indicator of why lines need to be deenergized when you enter those vaults.

This project would use specialty nonstandard materials, which could potentially extend out restoration if a failure and outage were to occur.

It would require specialty contractors to perform that outage work.

Outage durations could be months, and a good example of this is the SRP Price Road Corridor Project. I drive along the South 202 regularly. They had a termination failure, and that circuit and conductor was hanging off that riser pole for about -- for a couple of months before the new termination was placed on it. Probably the public didn't notice but it was very clear to me as an engineer seeing that termination not there and knowing that line was not energized.

MEMBER RICHINS: Chairman. Question.

CHMN STAFFORD: Yes, Member Richins.

MEMBER RICHINS: Mr. Jocham, did I get that right?

MR. JOCHAM: Jocham.

MEMBER RICHINS: Jocham. So when

performing regular maintenance and the circuit becomes deenergized, does that mean customers of TEP lose power during that maintenance interval?

MR. JOCHAM: I think that's a question for Mr. Robinson.

MR. ROBINSON: So in the way that this application is where we would have a looped system, they would not have an outage. We would have a segment that is out of service which would put it more at operational risk. So essentially we would be putting the substation on a radial line to do maintenance.

MEMBER RICHINS: Okay. So no customers typically -- typically customers do not lose power during a maintenance interval?

MR. ROBINSON: Typically, yes, that's true.

MEMBER RICHINS: Okay. Thank you.

MR. JOCHAM: So with speaking of maintenance and outages, again, we can go back to the reduced outage having that installed spare where TEP crews can swap overhead jumpers to energize that spare phase and reduce duration, but, again, that increases the overall cost of the project.

Stored materials and stockyards could reduce material lead times, but you would still need those specialty contractors to do the installation and

that could again cause extended durations for those specialty contractors to be scheduled to come out to Arizona to do that work.

CHMN STAFFORD: Quick question. You may not know the answer. Do these specialty contractors, can you put them on some sort of retainer where you pay them not to work but to be available to work? Does that ever happen? Or it's just that's not something they do.

MR. JOCHAM: I don't know the answer to that.

MR. ROBINSON: Because we haven't pursued anything like that, I don't know the answer to that either.

CHMN STAFFORD: That's right, because TEP has zero underground 138kV transmission lines; correct?

MR. ROBINSON: That's correct.

CHMN STAFFORD: Okay. All right. Member Hill, you had a question?

MEMBER HILL: I do. Mr. Jocham, thank you. I've learned a lot today.

I just want to be really kind of thoughtful about how the public is kind of hearing some of this conversation.

So earlier in the conversation you talked about how SRP had undergrounded something in Chandler,

and there was the potential for 48-hour outages in their contract or in their development agreement, maybe, with the City.

Can you share knowledge that you have about the outages that were there, and maybe Mr. Robinson can talk about how TEP would approach minimizing those outages.

Because I know that's what the contract says. It's kind of worse-case scenario. But for folks who are listening and paying attention to this hearing, I want to make sure that we're clear about what's most likely to happen and kind of not worse-case scenario for these kind of outages during construction.

MR. JOCHAM: Sure. Yeah. Limited access to homes and potentially no access would be the issue.

Now --

MS. GRABEL: Mr. Jocham, let me just clarify. Member Hill, the testimony wasn't that there would be a 48-hour outage, but they wouldn't have access to their homes because of the construction on the street.

MEMBER HILL: Okay.

MS. GRABEL: So it's just by vehicle exactly. It's not exactly what you heard.

MEMBER HILL: Okay. Thank you. That's helpful.

So then I want to kind of understand, like, how many people were affected and weren't able to access their home or business for 48 hours? I feel like those contracts are written kind of worst-case scenario, it might be this kind of time frame.

Can you talk about your company's experience or your knowledge in not having access to a place?

MR. JOCHAM: Sure. I don't know the answer to what happened in Chandler. I wasn't part of the SRP HIP project.

But I can say generally during the process of construction and at the end of the day, you would place those steel plates over top, which at that point you could grant access during those periods of time when construction wasn't on site. But absolutely would be restricted during the day when active construction was going on.

And they would -- I'm sure deals could be struck between the contractor and the public to know when they can and can't access their homes, but I don't truly know what those deals would look like and I haven't been a part of them.

MEMBER HILL: Let me just follow up with you may not know the experiences for folks in Chandler.

Can you talk generally about where your company has done undergrounding and how that access issue has been mitigated to reduce impacts to folks.

You talked a little bit about the steel plates, but --

MR. JOCHAM: Yeah, I mean.

MEMBER HILL: It feels like it's slow going so maybe it's only a few hundred feet at a time. I don't know, can you --

MR. JOCHAM: Right.

MEMBER HILL: I just want folks to have the assurance that TEP and developers are being thoughtful and careful about that and how you mitigate that.

MR. JOCHAM: Sure. Yeah. So S&L is an engineering company, so we don't do the construction of it.

MEMBER HILL: Okay.

MR. JOCHAM: But, I mean, we are around it. And so I think mainly what I've seen and -- is the plates. And so remove the plates in the morning when construction crews are there present and working, and when they leave they place the plates on top. Vehicles can drive over top of those plates. They're rated for vehicles.

MEMBER HILL: Okay.

MR. JOCHAM: So, again, it's -- there may be extended periods of time where you may have to Park and walk or -- or do that. But I'm sure construction contractors to keep the public around them as happy as possible will try to do things. I can't say what those things would be and how effective they might be. But --

MS. GRABEL: And Mr. Chairman, Member Hill, if I may add, TEP's proposal is not to underground and so I just want to make it clear we're not trying to put a parade of horribles and try to anticipate if we were required to underground we wouldn't act appropriately, but our proposal is we don't feel that we should be required to underground.

And I mean, I'll also inform the Committee, obviously this isn't testimony because I'm a lawyer, but we did meet with SRP to talk about the impact of undergrounding, and Mr. Jocham is talking about is not hyperbole. I mean, it's apparently quite impactful. But I'll just leave that as it is.

MEMBER HILL: Okay.

MR. ROBINSON: Member Hill, you asked me to fill in a few things that -- what we might do.

Because we have so much distribution underground and undergrounding, whether it's distribution or transmission, is a linear disruption to access. We

have encountered multiple locations where the access to a commercial property or residential properties are cut off while the trench is open or while there's activity that's going on.

A few things that we try to do are the use of the steel plates.

We also try to work in shoulder hours where we might start early or end late. Sometimes we'll actually do our work at night. But that depends on how we can coordinate that.

And we'll also often work on a weekend when a commercial building or commercial access is closed and so we can mitigate the impact to them that way.

MEMBER HILL: Okay. Thank you, Mr. Robinson.

BY MS. GRABEL:

Q. And, Mr. Robinson, that's undergrounding distribution facilities in your experience; correct?

A. (Mr. Robinson) Yeah, that's correct.

Q. Do you think it would be kind of loud to install an underground transmission facility at night?

A. (Mr. Robinson) The equipment's bigger and so I'm assuming it's noisier. It is -- I know that it's noisier. I just, we haven't done it here.

MS. GRABEL: Thank you. I don't know how

much longer, I just have a couple or questions, but it might exceed the 10 minutes that you suggested we take. So I don't -- this might be a good stopping point?

CHMN STAFFORD: Members, I think we've reached a good stopping point. We'll be here, back Monday and the rest of the week so -- potentially. But -- yes?

MEMBER LITTLE: If I may, I have a couple questions.

MS. GRABEL: Of course.

MEMBER LITTLE: First of all -- I think they can be answered fairly quickly -- do you -- is construction done year-around in Tucson?

MR. ROBINSON: Yes.

MEMBER LITTLE: And my other question is I'm wondering how much of these details have been shared with the neighborhood organizations, with the public.

I'm just wondering if the people that really think they want underground through their neighborhood as opposed to overhead if a route was chosen through their neighborhood, if they really have a good concept of what they would be facing in placing this line underground.

MS. GRABEL: I don't believe, Member Little, that this panel is the appropriate panel to ask

that question. But we can bring Mr. Bryner up at a later time and he can address that.

MEMBER LITTLE: Next week is fine.

MS. GRABEL: Okay. And I might have spoken too soon. Mr. Jocham, do you have another slide? No. Okay. I didn't think so.

CHMN STAFFORD: Anything further? Any further questions from members? Otherwise we'll recess until Monday morning at nine. All right. We stand in recess.

(Proceedings recessed at 2:39 p.m.)

STATE OF ARIZONA)
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COUNTY OF MARICOPA)

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