Hack Zurich Challenge Workshop Transcript
Sep 16 2022
Holcim and Converge

Some people are building a building, right. And they're gonna build the building outta concrete and basically the way this works, that you've got a already big supply, like Holcim and a contractor will be building a building to a certain specification, has to hold up enough. Right. Cause you don't want it collapsing on the people inside the building. Um, and you've also got some other constraints. Like you want it to be able to hit a certain straight during a certain timeframe and you're gonna have a lot of other, um, properties of the material you're gonna want. And so you order your, uh, concrete to something like concrete direct, which is now by wholesome and you make some specifications and they batch it in a batching part. So they put cool. Um, so you've got your batching plant and the face concrete is rocks. Like what's called aggregate.

It's basically rocks water, um, cement, which is basically like blue and then some other chemicals called a mixtures between everything let's talk about, but there's a lot of like complicated chemistry that goes stuff. And you're gonna have all these different waste designed with all these different proper, and they're going to be selected for this construction. Um, and then the annoy bit is that a bit like shipping meats around, uh, cement goes off in the wagon. So you actually have to order it within a specific window and get it to sign within a specific window. Because if it goes off, you have to send it back and you've wasted all that money and all that carbon making something that has to be junked, right. And sometimes you can recycle a bit, otherwise it just gets junked. Um, and so that gets delivered onto the construction site.

And then they make basically like a massive pig tin, uh, called form work. And you pour the concrete inside and put lots of steel and wants other bits and pieces and you build your building and then you're gonna want to know things like, can I take the mold away yet? And the way you know, that is if you know, strength it's reached, right. Cause if you take it away and still liquid, it's just gonna go like total mess. Um, and so the way we solve for that is that we have some sensors. Do you have, we have one. Great. Um, thank you. So these go inside the concrete and they can tell you basically how strong it's, um, and they can tell you lots of other QA things about it as well. So you don't have to, um, guess whether it's strong enough, uh, once you're done.

Cause you can get all sorts of things like thermal cracking, which you really don't want feel a nuclear power station, cause you don't want cracks in the cause. If it goes bang, um, sucks. So, uh, so that's why, so we put these sensors in, so you've got, you've ordered your concrete to a certain specification. It's arrived on the site. You put some sensors in, as you pour and you're building your building, everything so handy. And what I sort of alluded to as part of the

and what we'll be playing with. Um, and then Meg from wholesome joining us from the us. Who's gonna describe the, sort of the wholesome data scenarios. We've got those data from converge and data from wholesome to help, uh, you build something fun that awesome.

Hey, everyone name is Ali, um, expert

<laugh>, I'm not necessarily an expert, but, uh, <laugh> if any of your work on this is, is getting said, um, we don't necessarily expect you to have like a deep understanding of material science angle here. Um, we are certainly all available on the, on the, uh, disco channel. So just feel free to drop those questions if they are technical. I've certainly spoken to a number of you today who have different backgrounds and, uh, you know, some of you are really looking to attack that material side. Again, there's no expectation in that regard. Um, there should be a really wide spread of opportunities that you guys to, to attack this phone. Uh, but I'm gonna give you a quick insight here. And as I said, feel free to drop the slides over the weekend and we can, we can sort of, uh, help steer you if that's what you want.

Uh, if you're lacking materials, knowledge that we can certainly, uh, try and sort of ban for some of that anyway. So it getting alluded to cement is effectively the, the biggest contributor when it comes to, to concrete, um, cement, roughly speaking, historically, it's been around one time of CO2, uh, is emitted for every time of cement that's produced. Uh, so strictly speaking, that's like, partly because we're putting limestone, we're putting raw materials into a kiln that kiln is heated up to about 1500 degrees sea, and we run those all way around. Uh, one thing I do like to say when I'm talking to about concrete is this is an essential material. You know, if we were to fully transition to any other material, we'd really struggle to, to, to build without creating a similar impact with that said, obviously we need to be as efficient as possible.

Uh, I used to just cement each chairs about 4 billion times annual. So that's where that figure comes from. We we're talking on a global picture of about 40 billion, tons of human mate CO2, you're talking 4 billion, tons of that effectively deriving just from cemento. So creating efficiencies within this and be it reducing the volume of concrete use use.

challenge, all, you will talk about more detail, but there's a huge amount of extra cement which gets put into buildings to make it go faster. Should we say, make it perform better? But what contractors don't realize is that often they don't need a lot of the extra performance they're putting in. And so the challenge that that was sort of issuing here is can you build a tool which helps contractors understand how much extra carbon or extra cement they're putting into their S and then reduce it, if you can do that.

And I sort of highlighted this, sorry, I'm gonna steal one or two of your sites. Um, but concrete makes up 8% of global emissions, right? Building in general makes up 11 and the built environment makes up 38. So it's a bit of a problem. But, um, as I said, this sort of overspecification problem accounts about 1% of all cement. And if you could eliminate that that's more than 30 million flights to you. So this industry alone, even if you just touch a tiny piece of it is like massively bigger than aviation, right? And everyone talks about flying as the big, like carbon contributor. This is way bigger. Um, so I'm actually gonna hand over to Holly. Who's gonna tell you a bit more about like what sort of data we have to help with this challenge and,

reducing the volume of concrete that goes to waste, reducing or optimizing the amount of cement we're using in there. So we're talking an industry that, uh, is trying to, to digitize and become as effective as possible. And the concrete direct app is a, is a classic example of a, a major player in concrete industry, uh, looking at digitization and how that can create opportunities. Uh, and also converge is looking at the construction side of that, how those materials are used. Uh, and now we're starting to look into at like what the concrete is composed of and whether we can optimize that, how that's performing in the field and whether that differs from what we designed it to do.

Uh, so over specifications sort of get in, touched on, uh, can come in in all sorts of ways, you know, being the designer, perhaps, uh, adding a huge safety back to the building, it might be harder based on this day, except for you to tap into that. Although we definitely welcome anyone who wants to advocate, or it might be in terms of the ingredients going into that material or whether or not, uh, it achieve the performance they want, or it exceeds the performance they require. So you're gonna find within the data, um, you know, an idea of how

strong it's meant to be as well as how strong it actually gets in the field, as well as what it's composed of and what certifications of that will cement is the big, uh, bad noise in terms of CO2. So generally speaking, the aggregates are about, uh, sort of one, 500 for CO2 impact of cement.

Uh, and water obviously has a pretty limited, uh, body carbon and the chemical ad mixtures we use, you'll hear that time, come up, add mixtures. These are the chemicals that go in sort of modify the properties. Generally we use them in sort of very small ne negotiable quantities. So maybe like a litter goes into to several times of concrete. Um, so for this challenge, you're gonna be given, uh, two fundamental data sets. There's one from the concrete direct app. Um, and that is from a number of sites, uh, in the us, me, me's gonna sort of go into more detail than that, that really relates to the, uh, logistical angle as well as the production angle and then convergence data such as largely on the, the composition of materials and its performance in the field. Um, so generally speaking, I hope for you guys, this this weekend is that you can focus really on that environmental angle, again, as any number of

approaches you can take here.

But, uh, in terms of the opportunity, we think that CO2 is definitely, you know, going to produce, uh, some of the more interesting projects that, that we like to see this weekend. So just a bit more detailed back background converge. Uh, so we have an app effectively. It's a web app that available on mobile phones, IRS and Android contractors are generally using that app. In combination with sensor, you can see here sensors are placed into the concrete itself. So you can see the shape here allows it to be attached to, to the steel that goes into concrete, that is effectively measuring the temperature of the concrete oversight. So you've got a chemical reaction that takes place within that material as then. Chemical reaction is gonna go faster when it's warm and it's gonna go slower when it's cool. So contractors generally building with concrete, you have to understand how that material is gonna perform throughout the year.

And they get that seasonal variation depending where you are in the world. You might find that it gets incredibly cold in the winter. And that slows down the rate of construction. Uh, in summer, there was to get the acceleration that results

from that traditional testing is generally done, uh, by taking samples of material and curing those in like a fixed temperature environment. So they tend to get an insight into seasonal variation. So that's where the sensor tend to come in. I mean, the sensor itself is accessible. We can take other sub measurements with it, but the data being provided today is, is largely just temperature and strength data, um, just getting into the data itself. So for the converge data set here, we've got data from five different construction projects. They're all based in the UK. Uh, add a question some earlier, if there was exact addresses there, uh, there isn't a longitude in latitude or anything.

I think four of the projects we in London or one of is in Manchester. One thing I suspect a lot of the teams who wanna take part in this might find used was to look at, uh, combining this, uh, with some weather data. So for the most part, you'll find in the UK, whether you take London or, uh, Manchester, whatever it is, you're gonna find similar trends, sort of macro trends in, in, uh, weather variation. Let's say, uh, I mean, if any of you're really interested in feel like knowing to the, to the, uh, mile where exactly that site is then message me and I can probably

share some of that. Uh, so of those five, uh, projects, you're gonna see data touching on sort of four different areas. So we've got here, mix the designs, the mix properties schedules, and then sensor data. So mixed designs effectively, what does that concrete, uh, make people, what, what makes up that concrete?

So we've talked about already, some of the aggregates are basically gravel sand or the bulk of the concrete by mass. Uh, and then we've got cement. One thing you're gonna see in the data is different examples of replacement materials for cement. So we've got, uh, Portland, cement is the name that is given sort of the, the core constituent for concrete. There's also materials that is fly Ash and SL. And those two materials are like industrial or byproduct, and they used to reduce the embodied carbon. So we can replace a bit of the cement with, um, with these alternative materials and that serves to, to lower the CO2. So in the mix design data, you're gonna see different examples of things named binders. That's a sort of global term for, uh, cement. Uh, and you may find that there's some examples there with, with Portland cement, and then a little bit of, uh, slack or fly Ash, which is used to, to lower the body carbon on the

aggregate side, just sand gravel.

You might see the limestone different examples of things you'll recognize as rocks coming outta the ground, and then ADM mixtures. These are affect be chemicals. So that fly by big chemicals companies. And I don't think you're gonna find, uh, too much gain really in, in going into that. But again, you're very, obviously you can pull up the data sheets for any of those materials. You see the product name, and Google's gonna be your friend day. You know, if you, if you're confused by the language you see, I think Google's gonna quickly reveal some answers to that. So beyond the mixed designs, you're gonna see some mixed properties stuff in there in a, in a CSV called mixed properties. Um, and that's gonna contain information such as the design strength of that material. Now, the design strength is important because that is what the designer of the building said.

This has to be at least a given strength, uh, to, you know, ensure that the building is gonna stand up now in practice. And you'll see from the sensitive we're gonna get onto to, and second that the material may actually exceed that by some margin. Now we're required to make

their supplier and say, I would like to have a material that not only meets the designers specification for strength, but I want to get there in two days, let's say, and that you'll see is consistent with the, with the sense data they're gonna get there much sooner than it strictly, or they'll get to the design strength, you know, weeks ahead of when they need to and that where the contractor can go as quickly as possible.

And that really speaks to the opportunity to, uh, replace these or, you know, to, uh, based on the sensor data, potentially they could be using a lower carbon mix, um, because they're gonna actually get to the strength they need much sooner. And because they've got that insight, so you may find some, some opportunities there as well. So the mix properties is where you're gonna find the embodied carbon for each of those. There's a schedule CSV in there, and that's effectively just the poor time for every single sensor that you see. So it's a fairly basic data set. That one, it just says, uh, the sensor ID, all of our sensors are given a unique ID. And that'll just tell you exactly when the four time for each sensor started. And then lastly, oh, the sensor itself. So the sensor data is effectively a

time series.

Our sensors take a measurement every 20 minutes. So you're gonna effectively see, uh, a temperature profile. And then that temperature is from the, is it's cast, or it it's placed into that format ready to go. And then they may do that a day ahead. Some something you might notice in the sensor data, there might be like a day or so of leading temperature data, but it's just measuring the temperature. And then as it goes past the start time, you'll see that there's, that strength starts to accumulate. So you you'll certainly if you're gonna wanna make use of this need to combine that schedule data with the sensor data. So you can see, okay, three days have elapsed since the start of this. And one thing is worth noting is you'll see a little bit of that leading temperature data before the strength calculation start. Um, a couple of others I've spoken to today are interested in looking at the underlying sort of functions that are used to determine that, um, there is a data dictionary, like a document that you can see sort of explaining what each of the columns is.

I haven't gone into immense depth on that. Again, I didn't feel that anyone needed to be

materials that exceed that, you know, these there's natural variation within this. So you may find, uh, that the variation from one date, the next is a little bit, you can't really design it to hit the exact design strength on the nose. It'll probably be designed to hit that plus of given margin, but what you'll find percent of data is it'll probably hit that not only at its, uh, normal 28 day strength, which is how we design them to, but also much sooner, often it's sort of three or four days, you'll find those materials are achieving their design strength.

Uh, but in mix properties, I guess one of the key things of interest to you guys will be the embodied carbon. So we measure embodied carbon in kilograms per ton. So it's, uh, or kilograms per cubic meter. So cubic meter of concrete generally will have an embodied carbon of between 150 to 300 kilograms, uh, because cement is the glue. As you said, the more cement you put in generally then the faster and game strength. So some of this over specification language we are using might be a contractor who is, you know, dying to complete their project as quickly as possible. Generally speaking, their biggest cost is time spent waiting for these materials. So they may well call

armed with that degree of material science knowledge, but again, if you want to drop me a message, if you're curious to look into that and perhaps what's possible with manipulating those functions or optimizing them, then, uh, feel free to drop me line. And I can certainly give some more advice on that. Uh, so that's it from my side, hopefully we're gonna be able to hear Meg who's tuning in from the us, she's prepared the, uh, wholesome data. So I'm going to give her a chance now to speak up and we're just gonna see if we can hear her through this microphone set up Meg, is that

Hello? Can you guys hear me?

We can hear just, I think, yeah. Perfect. Go ahead, mate.

Perfect. All right. So, um, to guys, to give you guys a little longstanding of what we are gonna see from the concrete direct side, um, it's going to kind of paint a picture of what happens. Uh, there are two parts of it. So you're gonna see kind of, um, an understanding of what a customer might expect on the day of the delivery. So they give you kind of like a wish list of, you know, this is what I want in my mix. Uh,

these are the intervals. I want my folks to come into the site, um, and all those little details about the day of the pour. And then the second half is the actual data of the core where we kind of follow a truck through its journey from starting from the plant, getting all the detail of getting all the mixes that they need and going into the job site.

So here I, um, for, for this, um, Ary here, we have kind of provided a free, um, data files, uh, from concrete direct. And I've kind of drawn a line through the journey of each data set and where they kind of sit. So the order level data set is what I was talking about the wishlist of the day of the, for the day of the poor. You're gonna see, uh, where the order is going to be going for. So the drop side details, you're gonna see what kind of additives they have asked for, um, and what kind of, uh, structure they're building that day and, and how they're pouring it. So if it's to a pond board, if it's to work, create, uh, and buckets, you're gonna see those specifications, uh, as well as structure as in, you're gonna see, uh, is it a floor?

Is it a column? And that understanding, um, then we move on to the actual day of the floor and

Is it a column? And that understanding, um, then we move on to the actual day of the floor and the batch mixed level data set is going to give you guys an idea of what was actually batched and put into a truck the day of the form for each ticket. So each order is gonna have multiple tickets and each ticket is a delivery that's being made. Um, and so the batch level data has all of those little details about what is in the truck and while it was batched, and also, um, an understanding of what the actual end required design quantity is. So you guys can kind of see, uh, what was, uh, you know, what the machine poured in and, and what that actually, uh, requested. And then we move into the core logistics level data set, and that's going to have all time all different types of time stamps of the truck as it follows the path.

So it's gonna start from when it was at the plant to when it was, uh, getting filled up, uh, to when it got to the job site, when it poured on job site, uh, and then when it washed and it came back to the plant for a different, uh, load, and you are also going to see, um, for each truck and for each payload, what the quantity, uh, of the additive that for, um, that then you can connect to the back level. Um, and then along with that,

we also see truck and plant level, um, details, which kind of tells you which truck started where, uh, and which truck, uh, was, uh, designated to which plant. And, and again, kind of a little bit more depth of who was driving the truck, uh, where the truck was and, and all sorts of things. Uh, and then ending with, again, the poor logistic level where it's kind of looking at the return of the truck after the plant.

Um, so this is how it's set up. And for this, uh, data set, we are looking at 68 different projects. So all of these data points are a sample of all these different projects, but they're all based in, uh, Washington DC in the us. So the way we have tried to kind of, uh, bring convers data and, and concrete direct data in the safe platform is to look at the type of mixes that are used in both, you know, both the data sets. So that there's a, there's a understanding and some, uh, common, common between the two data sets. Um, if you can go to the next time, please,

Thank you. Uh, and with that, we've also provided another data set that you guys are, you know, are welcome to use. Uh, and this is, uh, a lab data set. So this is from Switzer, uh, and where this fits in into this roadmap of the

truck is that when a track is batched on the day of the course, or when a truck is filled up, um, a sample of that mix is collective and brought into lab to do some tests on it before, uh, leaves to go actually deliver. Right? Um, so this data set is going to have, uh, a production level, uh, data set section and a, and a technical level data set. So the production level, again, kind of gives you details of the mix that's in the track and, and, you know, always required versus what the target composition of the mixes were. Uh, and then the technical concrete technical level, uh, section of the data site kind of shows you what the results of the was, was the strength was what the exposure was, was the temperature was, uh, so you guys can kind see and look at the different changes that happened over time to that batch quantity.

That's

Is that your side? Cool. I guess probably worth me going some closing notes, uh, from a challenge, point of view. And then I imagine we've got fair bit of time left, but I'm not sure, uh, if you've got immediate things good to know, but I'm very happy to take any questions you've got as well. Um, so hopefully you can tell from

the two data SETSS there, there's different angles you can look at here. Um, I know last year, uh, <inaudible>, weren't taking apart, but Sen Sen did an event then, and they had some really interesting, um, ideas presented around, uh, the usage of, uh, logistics data. I think they had a kind of two good to go, I think is the name of the app kind of, uh, style thing there. So, uh, companies were effectively taking receipts of concrete, not using it all. And then, uh, the materials, uh, effectively are then free to use for another site.

So, you know, don't hesitate to look at kind of a UX and an app type experience, uh, you know, taking your cues from other, uh, common things. Someone I was joking with earlier, it was like the, uh, the Tinder for concrete, you know, like don't hesitate to, to throw out some ideas like that. You know, you don't need to get too stuck into the weeds in the material science or the CO2 stuff. So that gives you a, a sort of potential route to go down there. Um, I know we, would've loved to have presented today a few data set where, I mean, wholesome and converge, and now start working together on a lot of projects. And certainly if we, if we are dealing with this next year, hopefully we're gonna be able to

provide contestants with a truly combined dead set where we're on the same project.

So they'll definitely give you some bonus points out there. If you guys can find creative ways to potentially use both of the data sets granted, we've got UK based projects for converge and some has projects for the, uh, for the wholesome stuff. So again, there'll be some real bonus points in there if you are able to come up with creative ways to do that. Um, and certainly, you know, if that ends up being a slightly contrived situation, uh, there's no reason moving forward so that can't, uh, you know, potentially be, be rolled out into one unified kind of idea. Um, so I guess that bring to the next thing is we are working with, um, construction companies, right. You know, all over the world, but there's particular one here in Switzerland, uh, where we've talked about the potential to roll out any, any ideas that it delivered here on that site.

So, uh, I mean, there's not only the opportunity to tackle a huge sort of climate angle here, but potentially see your product ideas and solutions rolled out onto a real construction site. Certainly you be able to come and visit any site that we

deploy that onto and, you know, get to see that through. So hopefully that gives you something tangible, do it so you can sort of work towards, um, with that. I'm very happy to take any questions you've got. I'm sure me will still be here for a few more minutes. And, uh, yeah. So any questions, I mean, if someone was speaking you privately afterwards and you don't wanna show your hand, then <laugh> feel free to come to Mely just more

Bit view, or did you see your Solutionary?

Uh, so, uh, the contractors on the whole who are both of us, both, both of our businesses are largely selling to, uh, selling products and solutions to contractors working on construction sites. I mean, these are fairly large businesses. So from that angle, it's B to B. Um, but I guess we all have, we, we still have customers in the, uh, sort of smaller house building end of things, and the, uh, you know, lower end things. So it's, uh, there will be a, there will be a small sort of angle of B2 C potential, but I I'd picture it mostly as kind a B2B thing. Um, equally, like I said, you could take your cues from some more B2, C type product is now. And like, I certainly can, there will be some interesting ideas to sort of draw

from in the wider sort of tech space that perhaps you can, uh, you know, uh, borrow ideas from

The time series data is, uh, com better file or

For, yeah. So you're gonna find one file for each sensor. Um, and the, the naming is you'll find the center ID is within the file name and the contractor also gives each port name. So it might be level, I mean, certainly a lot of the converse for high rise buildings. Most of our customers are using this to accelerate their productivity. So often they're getting up to the level 30. You might say, now that name is just a free form text for the contract, or so you'll see at the beginning of each sensor file of each, uh, time series file, there'll be a description. You know, you'll have to interpret that, um, based on, on what you're seeing, that, that won't necessarily follow strict dimension, but usually you can see quite clearly, you know, it'll be tower one level 25, so it's fairly straightforward to, to pick that up and there. And then within that, you'll see it's all very structured data within that. Uh, but you will just have to sort of, if you wanna interpret where it is within the, within the structure, you will have to sort of infer from the

interesting to look at how much time they perhaps took to hit that certain strength threshold. Um, you know, again, maybe looking at when the design strength, if you look in the mixed properties, it'll say, you know, this has a design strength of 40 mega pascals, let's say, and then you look in a sense of data file and see the hit 40 mega pascals for a given poor within, you know, three days. So there's potentially some interesting stuff you can on the analytics side there, um, you know, lots of interesting ideas you can look at. Um, yeah, the data files are fairly straightforward in a data folder. I think the naming schemes are the only thing you just have to bear in mind that the, the ID, which is really how you're gonna link into the schedule file, um, is at the end of the file then. And there's just a little prefix there, which is whatever the contractor is referred to that call by.

Um, so are you mostly dealing with like onsite, um, pauses or do you also do with like prefab? Um,

We do a lot of prefab as well, but, uh, the five sites you've been given at onsite. Um, but I mean, if your ideas are centered around, you know, if you have ideas around how, um, a pre-

fabrication plant, uh, we can like precast, um, you know, facilities, how they might benefit from it, then that's definitely got applicability. I mean, we work with a lot of precasters here in the re mix industry. Remix concrete is the, the sort of name for when we batch that in the big glory. Um, often they'll supply that to, to a precast factory as well. Some of the smaller precast factories they'll still take delivery of, of concrete there. So, I mean, I don't think in the, in the byproducts mass or the 65 projects in the us, yeah. There's a precast factory there, but there's definitely like numerous examples, our businesses, respectively, where precast factories are using the products. Okay. Thank you. And obviously they have different, you know, they're manufacturing every day, they're manufacturing a fixed number things day, so it definitely does have different, um, you know, aspects to how they might utilize that. Yeah.

Like said any other questions feel free, I'll be floating around until the next workshop. And I'm gonna try my best to stay on the discord. I know you guys are gonna be up really late, so I'm gonna be doing my best to, to, uh, to keep on top of that. If you have any other questions afterwards, we, the prizes, the prizes for the

name they've provided each center.

So how many sensors in the building

Then? So the data you got today, I think range between on the five sites, uh, they range between sort of 60 and 150 sensors going into the, into the project. Some of those are casting to the same pool. You'll see, that has the same poor name at the, the beginning of the sensor filing. Um, and some of those will just have one sensor input. So there's a bit of a variety there.

Just question of interest, the sensors are signal reusable,

So yeah, they transmit data. Yeah. So these are cast into the concrete. You can see the, the profile there so you can strap to rebar. Um, and then they transmit out of the concrete using Bluetooth. Okay. Um, and we can put little companion devices, so it's just automatically push the guard, but a lot of our customers are just, uh, taking their phone onto the port, uh, and then sort of verifying when it hits the strength they need in the data dictionary. You'll see some specific strengths that the contractors be looking to hit. Um, so, you know, it might be

you to do so. So we bring a few people on a zoom call. Again, we have a few people you on site to yeah. Give you some more time to interact and discuss and reflect on your ideas. Awesome.

Including customers that were mentioned, right. Where very you can, the idea can describe what

Help them.

I'm I'm very conscious actually, just now there's people, woman smoke for listening remotely. So just to repeat that, the question was if there's any, any prizes, um, and I mean, beyond the prize for the, the competition of the whole, certainly, and you have had this rolling this out on a, on a real construction site and taking this into real operations, um, is gonna be sort of, uh, a trophy here and you know, that you can be limited to the winners. We'll certainly be open to any, any great ideas that are coming forwards. Uh, and then lastly, yeah, please join us tomorrow for the, uh, the expert panel and bringing questions you have there, I guess on that note, is there any questions from the people tuning in remotely? I'm not sure how many of you there are, is there anyone also, yeah. Any

questions or if you haven't heard anything particularly clearly then, uh, just, just let me know and I can try and go back this

Also to compliment beyond kind of our interest, obviously, to, to continue this, these innovations with you together, your own projects converge, I think has a very full chop role. I think it's also out there

I've done that. I, it would be AMI me not say, uh, we're definitely actively hiring at, at converge. Um, and so, um, we're very interested to see the, the skills everyone has on display and we we're actively hiring on a number of roles. So, uh, um, yeah, if you want to come back with this in London, or we've got a load of remote opportunities as well, you know, we're very keen to chat room. So the data is for anyone tuning in with anyone present here, there's memory sticks, uh, with, with data files on some of those.

project, uh, earlier. Um, I, well, certainly any, any, any solution like said that you, uh, you roll out if you're the winning idea or the idea is considered by us being good would be delighted to try and roll that out into a real construction site. Um, I think the idea I was referring to last year, uh, has been rolled out, is it,

I dunno. Yeah. So one of the, um, products from last year has been tested. Um, and we now look at scaling this in the internally and her, um, and we will, of course try to involve whoever basically contributes to the challenge in testing this some real job site. And there will ought be a price, um, that, um, with what you can build something yourself, that's why we would save, um, for now tos. And yeah, but I think one thing that we really want to do is to involve, uh, the winners is going beyond the school. Cause we really have to bring ideas back into our operations to make impact. And that's, I think a part of the, but there will be a prize for that you can, um, do so. And then maybe for tomorrow around five, I think central European time, we would host an expert panel. So whoever wants to pre-pitch, let's say in the same environment, whatever idea you have to and ask any other questions, um, that would be a good time for