TERJE GLAD: All right, hello everyone. Thank you for attending our class here. And today we're going to talk about a project where we have used integrated concurrent engineering, and we have done some model base bidding. My name is Terje Glad. My first name is quite hard to pronounce in English. I work as a VDC specialist within Sweco. My role in this project that we're going to talk about today has to be as a BiM manager.

And in this class I will focus on the technology part. So I'll show you something from InfraWorks, how we have combined InfraWorks together with integrated concurrent engineering. Together with me today I have Sofia.

SOFIA NYMAN: Yes. My name is Sofia Nyman, and I work as the BiM coordinator in Sweco, Norway. And I also had a role as BiM coordinator in this project. In this presentation, I'm going to talk mostly about the methodology part.

CHRISTIAN MIKKELSEN: And I'm Christian Mikkelsen. I'm working in Veidekke, contractor. I work as an IT manager now, but have mostly background from [INAUDIBLE] production. In this project I was the design manager, and working with tenders mostly, and that types.

TERJE GLAD: And just a few words of where we are from. Me and Sofia are working in Sweco. We are Europe's largest consultancy company. We are 14 and 1/2 thousand employees in Europe. And Christian is from--

CHRISTIAN MIKKELSEN: Working Veidekke, which is the biggest construction company in Norway. So we have about 7,000 employees in Scandinavia, and build mostly everything.

TERJE GLAD: And this is our agenda today. So first of all, we are going to give you some facts about the project that we're working on, or that has been working on. And Sofia is going to talk about how we have used integrated concurrent engineering. And myself, I'm going to talk about our base models in InfraWorks, and how we have optimized the design and construction by using InfraWorks and ICE. And Christian is going to sum it up and talk about how we are calculating using the model.

And first of all, we have a short video that really summarize what we have done in the project, and what we're going to talk about today. So let's start with that.

[VIDEO PLAYBACK]

[MUSIC PLAYING]

[END PLAYBACK]

And maybe Christian can give us some more facts about the project and why we're doing this together.

CHRISTIAN MIKKELSEN: Yeah. So it spelled out a little bit in the film, the market is changing, especially in the infrastructure and civil market in Norway. The public authorities are moving towards more design and build contracts. So therefore, Veidekke needs to partner with a design firm consultancy and work together. And then talking to most of the big firms, where we're looking through, finding someone that shares our mindset.

And then for this project we partnered with Sweco, a lot because they have the same mindset on VDC, virtual design and construction, and ICE, which Sofia will tell you more about. And then Terje it's going to be the pilot now. Show us a little bit in model.

TERJE GLAD: I will try to.

CHRISTIAN MIKKELSEN: Mostly like it was when we were working. So the project is seven kilometers of road. A branch of a main road between Eastern and Western Norway. So this is located in southeast Norway. I think about 10,000 average cars per day. So not a main road, at least in Vegas standards, I think.

But as you can see, it was in a quite rural area with mostly a little farms and a little forest. Going through the project, we can see a great visualization of a tunnel there. So going over the hill, but still. Cuts, so there was a lot of rock blasting. And then mainly expanding or straightening the road along the current or existing corridor. And also then expanding with a walk, or a pedestrian walkway on either side changing sides.

And then the choke in the project, this is the densely populated area. I think we have about 10 houses. So I'm not going to claim it's the 10th biggest city in Norway or something. So just looking through it you get a feel for it for the project. And visualizing like this is very important, or gives us a lot. So we will talk about a little more about that later for the calculation part.

And Terje and Sofia will give a little more info about that, and Sofia will say a little about how

we work.

TERJE GLAD: We will come back to the InfraWorks model very soon. But first of all, let's start with the methodology that we have used.

SOFIA NYMAN: It's a really hard word for us Norwegians. Yeah, as we saw in that short film at the start, and as Christian mentioned, this is quite new collaboration of people that's going to work in one project. We're not really used to working with a contractor in these early stages.

And it shows us mainly because of our joint understanding of working with [? Beman ?] VDC and concurrent engineering methods. So that's why we're using ICE on these products. And we also had a quite short time frame. We're going into this in three weeks. And that's one of the main benefits with ICE is that we can quickly get up the models that we need.

So defining ICE is quite hard. Like many of the words that we use in our daily language, the amount of definitions is almost as many as the users. But the real experts on ICE, they work at [? NOS ?] on Stanford University. So I stole this quote from John [? Kans ?] who works at CIFE, Stanford. So he says that integrated concurrent engineering is a social method helped by technology to create and evaluate multi-stakeholder, multi-discipline VDC models extremely rapidly.

So that's really what it's all about. And for us, that meant co-locating. Both Veidekke and sweco, we sat together in the same room with all focus on the model. So this was all to gain some kind of a joint understanding of the tasks and the problems that we had to solve in order to make this bidding process happen in three weeks.

So [INTERPOSING VOICES] Yeah, thank you. That's the definition. And I'm going to try to explain how we did it. First of all, we talk a little bit about people. It's contractors and consultants put together. So it's not only learning how to work with new people, but working with a completely new organization.

So we put together a team of people from Veidekke with great experience in the actual construction process. Asphalt technologists, geologists, and people from Sweco, road engineers, and road planners, and landscape architects. And of course, a build team so that the model could be in focus.

And the sessions, we did this in three weeks, and we sat together for the whole of those three weeks, of course. We started off with somewhat like 15 people in the initial meeting, and by

then we had already created the base model. It was a tough weekend for them in the meeting, putting that together. But it is because we believe that having that model up on the big screen was important for us with so different backgrounds to really get a grasp of what we were going to do.

And normally when we consultants design a road, we take it to the highest level of detail and then we give it to our clients, which was with Veidekke, in this case. But sitting together like this, Veidekke could really define for us at what level of detail things had to be for them to do the calculations. So some parts of the product need to be highly detailed, and some parts they could do their own estimations based on their knowledge of the bidding process.

So we started by picking apart part the tasks, trying to analyze, what we do in parallel, and what models need to be ready first so that they can go on and do the calculations as they needed. Yeah.

And to try to answer out the benefits, which was the key learning objectives of this thing, when we sit together in normal product meetings, which can be half a day, we normally don't get a result that we can use directly. But sitting together in the ICE session, we do the design right then and there. So the model that we got out from these meetings and the outputs, which Terje is going to talk a bit more about later, it can really be used for a quantity take off and drawings. Just a couple of clicks and we were there.

So that was the main benefits. And we, as the consultant, got a great understanding of what the contractor needed for this bidding process.

TERJE GLAD: Perfect.

CHRISTIAN MIKKELSEN: I think, just want to add, because I think really one of the great benefits when we work together, we can decide what we will build, and not something that can be built by anyone. So we have our input into and work together with the expertise of the consultants to really go to the core of what we want to be able to deliver to the client, what they need, instead of making some generic design that can be built perhaps by someone.

TERJE GLAD: All right, thank you. And let's move over to the base model. This is a really important thing when working with integrated concurrent engineering. We need to have a really good base model to use in the meetings. In this project we got two days to build the base model. So I will try to explain how we have built this model over two days, and I will show you some examples

from InfraWorks on the information that we have put into the model.

I don't think that without InfraWorks, this wouldn't have been possible. So InfraWorks is really a door opener for us to be able to have these ICE meetings, and to be able to work with ICE.

So as I said, we had two days to build this model. So the first thing that we did was to use some open data sources. The first thing we did was to use the InfraWorks model builder. That gave us some rough terrain surfaces, and we had the aerial imagery for our project area. We also got existing buildings and some of the existing roads. Then we have added a lot of data from different open sources that the Norwegian authority provides.

So I will show you some examples later on that we are using a lot of traffic and road data from the Norwegian road authorities. We got information about floodings and weather information. A really big thing here is that we have a lot of protected species, and endangered birds, and a lot of things along the roads, so we need to take care of that. We had a lot of borehole data from water holes, and we had information about avalanches from different ground conditions, and we also tried to connect data from Google Maps into the model so that our project members could use the InfraWorks models as a single source of information.

In Sweco we have a partner who is a geospatial data provider. So together with them we have developed our own geospatial data package. So in this case we could just go into a web interface in a web map. We could select the area that we wanted to work with in, and then we will have the data that you see here.

So we got some lighter data from an airborne laser scan, and we got some detailed high resolution aerial imagery. We had detailed building information so the geometry and information of all the existing buildings. We had some data on the existing roads, and a lot of property information. So we had all the properties and border lines. And we also had pretty good control of all the utilities, electro, and pipings, and existing infrastructure that we put into the model.

We didn't get a lot of data from the tender document, but we got some data. In Norway, the Norwegian road authorities are using a lot of Novapoint, so you've got the Novapoint road model. I don't know if you are familiar with Novapoint, point but it's a European road design software. In order to use that in InfraWorks, we had to move all the data from Novapoint to Civil 3D. We have a script that moves the data from Civil 3D into InfraWorks.

We also had the digital zoning plan. And the soling plan is really important in this project. Really need to stay inside the zoning areas and the zoning plan. So by using a third party application on top of Civil 3D, we were able to move the digital zoning plan with all its informations, or both geometry and information, into the base model in InfraWorks. And we also got some survey data of the existing road and existing pipings. And I will try to show you how we have used all of this information in InfraWorks.

Just to set up in my presentation, I have added some tables here that shows what kind of data we got from which source, and what formats we used, and then resolved it in InfraWorks. I won't go through that now, I will try to show you this in our InfraWorks model.

And just to say that if you have any questions, just ask them, and I will try to answer. Otherwise we can answer questions in the end of the session. And so the first thing, I said, we've used first of all-- oh, sorry. Maybe I have to end my presentation.

CHRISTIAN MIKKELSEN: This is really the great thing that also every party, and the contractors, the calculators, they are not used to doing this. But getting all this information, finding it in one place is really great for us. And we are used to doing PDFs. We are really digital, we are doing PDF. Or that's wrong, I'm really digital, because I have three screens instead of two screens, and PDFs printed. But the future is coming.

TERJE GLAD: All right. So this is our InfraWorks model. As I said, the first thing that we did was to use the model builder to get the first data to have a look on the project. And we also got some laser scans of existing terrain. So if I turn on my wireframe model there, you can see that when we are outside of the project, we are using the model building surface. But we are moving in to the road that we're going to build, the surface will be more detailed. So the level of detail is increasing closer to our project area.

And let's turn off the wire frame again. We also got some survey data and information about existing buildings, and the different utilities and everything. So that is physical objects. But I think the most interesting part here is the nonphysical objects, or the nonphysical information that we brought in.

So I will try to show you some of this. First of all, we have different ground conditions and train erosions. This is area that we need to have an extra eye on. Maybe we need to remove some of the masses. So this is information from the Norwegian authorities. It So here we brought in the polygons for the different areas, and the shape file here has information about what this is.

So just by having my mouse cursor over this area, I can see what it is, and what's this all about.

As I said, in Norway, we have a lot of viking graves and those kind of things. So this is actually a viking grave that we need to stay away from. So we got all of these points and areas within our model. And here again, we can just be there by the point of interest. We imported this as points, and the points had some information about what this point is all about. So here we can see that this is an old viking grave, which is we need to stay, I think it's 25 meters away from this point.

So this is really easy information for all the project participants. They have a great overview of the project and existing situation, and things that we need to consider. We also brought in some nature observations and endangered species. Like this point, here someone has done an observation on some birds, and we might need to consider those birds. And also here, we have connected this point of interest to the nature database observation thing. So here we can just click on this point of interest, and we will get some more information about that observation.

You also have some areas with endangered species within. And also here we have tried to connect this area to some more information that is in the web server. So here, the project team can again just click on a point, and they will have all the information about this area. So that's a great thing about open data.

One very important thing was when we were trying to calculate all the masses and do the county take offs, we need to consider different mass types, and where we had rock, and where we had to blast rock. And we didn't have that much information about the rock surface. So we brought in some information about some water boreholes, as when you're drilling for water in Norway, you are required to report the information from the borehole. So here we have the placement of different boreholes, and we have also connected this to the data sheets that is attached to the boreholes.

So we have all of the information related to that borehole. We can see how deep it is down to the rock bed, and when it's drilled, and who did it. So we have a lot of information there.

In the start of the road, we had an area with quick clay. And that's really, really, really need to consider this. So here as well, we have the polygons from a shape file that created a coverage area. And if we click on the tooltip, we will have the whole report about this area. So it's really

accessible for our project members.

I will try to show you two more examples. As I said, we have some survey data on some existing pipings and existing manholes. These sort of just points and lines that were surveyed out in the field. Each point and each line, they have their unique ID.

So instead of doing some detailed modeling of these manholes, and the pipes, and adding the correct dimensions, and using a lot of time on this, because we have just two days. Instead of doing that, we just connected the ID of this manhole into the data sheets from the Norwegian road database.

So here we can just click on that manhole, and we will have all the information on that manhole. So you know what type it is, and how large it is, and you have all the metadata connected to that manhole. Just to say that this is existing manholes, we will lower the road here. So that's the reason why they are sticking up in the air.

My last example is Google. This is really useful for when we are doing the planning and using the model for construction planning and everything. So for all the buildings and all the properties, we have connected those to Google Maps. So for this house there, I can just click link, and I will access Google Maps.

So I think everything is about bringing information to the project team, and create the information easy accessible. And here within Google Maps, you can, of course, use all of Google's functionality. So Google Street View is a great thing to use when planning the construction and execution of the project.

We also place Google Street View maps around the existing road. We embedded Street View into the tooltip. So here, the project participants can use InfraWorks instead of going into a web browser, and they will have the tooltips here.

So this is Christian's mansion. It's really nice. Yeah, so I think the important thing here is that we are trying to bring a lot of information to the project team, and try to keep the information easily accessible. And now the project team can rely on this as a single source of information.

CHRISTIAN MIKKELSEN: And then making the model available to people that don't usually use all these different sources. Not used to Street View. And then we give them the model, and we put a lot of these tooltips in. So it really helped them access all the information from the open data sources

which they're not all familiar with. So I think it helps us to calculate correctly, which we'll come back to.

TERJE GLAD: As I said, I have added some information both in the presentation and the handouts. So if you want the tooltips and everything, you would find it in the class handout. So let's talk about optimization, and how we try to optimize the design and the execution of the construction.

First of all, rock surface and mass balance. This is really important in order to calculate the project. So this was one of the first tasks that we did. We used the Civil 3D in an ICE meeting with the geology engineer from Veidekke together with Sofia from Sweco, and they used one day. They were combining some boreholes that was done by in the Norwegian road authority in the early stage of the planning of this project, and we also used some information, for example, from the water boreholes that was from the open source.

I think it's quite impressive what they were doing in one day. They found a really nice workflow within Civil 3D to-- OK, you can't see my screen.

CHRISTIAN MIKKELSEN: But then again, jumping the gun on the calculation, this is really important for us because we need the correct quantities. And if you don't know where the rock is, and then we plan the road, is it soil removal or blasting? As a contractor, I'm only interested in money. So we were really happy getting this kind of data so that we can find the right price.

TERJE GLAD: And it was really cool that the workflow that we found in Civil 3D, we were able to create a dynamic surface. To start with we had some information, we had some boreholes. And then during the project we were out in the fields and collecting more information. So the surface that we created within Civil 3D was really dynamic. So it could do change, and it could do reviews underway in the project. And it was all linked up to the corridor models. So when updating the rock surface, we also could update all the quantity take-offs and the volume calculations.

So after having the information about the rock surface, we started to optimize the vertical geometry. What we found at first was that we had a lot of excess rock masses in the project. So we tried to optimize the vertical geometry in order to have a better mass balance.

For this we used first of all InfraWorks just to review the project, and to see all the cut areas, and the areas that we should try to optimize. And then we brought some information back to Civil 3D, and we brought the road model into Novapoint. So the road engineers from Sweco

were sitting together with the construction manager and the maintenance specialist Veidekke.

We also had a landscape architect and a zoning expert available for the meeting. So [INAUDIBLE] we solved by doing this task was that we got an optimized alignment and profile for the new road. We also got an optimized corridor mobile in Novapoint that we used for quantity take-offs. And we were able to move the Novapoint model back to InfraWorks so that we had a updated model in InfraWorks. So there's just a picture from the vertical profile within Nopapoint. It's not really that good as Civil 3D.

The next thing that we did was phase planning. This picture here, the red area, or the red volume shows where we have construction during this phase in the project, and the green line is where the traffic is going in this phase. So in this bidding process, we have to deliver all the phase plans to the Norwegian road authorities in 2D. We did all the planning in InfraWorks Civil 3D. So we did the planning actually in the InfraWorks model. We did that in the ICE meeting with traffic planner from Sweco together, again, with the construction manager and a BiM coordinator or software specialist.

So the result by doing this was that we really optimized the traffic during the construction time. I mean, we are working along existing road here, so the existing traffic, we really need to handle that. We also had some great phase plan visualization in InfraWorks so we could easily communicate the plan of execution of this project. We were able to move all the data from InfraWorks to Civil 3D in order to create the required 2D drawings. So all of the 2D phase plan drawings were based on the InfraWorks model.

This is again just some examples. So for every single phase in the project, we did this modeling. So in InfraWorks we had one proposal for each phase in the project. By having this in the model, I don't think that before we had it in the model, we wasn't able to get this result. So I think the most important thing here was that we did the actual planning in the InfraWorks model.

The next thing we did was to try to do some site and construction planning. So this is actually the planning of the construction execution. We did that in InfraWorks and Civil 3D in an ICE meeting. We had a construction manager, and a construction specialist, and a BiM coordinator. I will show you some examples afterward here, but the result from this was that we really were able to optimize the construction time.

We think that we improved the safety during construction, because we were aware of all the

risks and everything in the project. We had some great site plan visualizations, and visualization of the project execution. So again, communication both to our client, and within our project team. So within Sweco and Veidekke. And we were also able to produce the required site plan drawings that was to be delivered in 2D to the Norwegian road authority.

Again, it's just some images from planning.

CHRISTIAN MIKKELSEN: Yeah. And the thing that's really cool for us is that like you saw with the phase plans with the red and green, everybody's on the same page. We're talking about the same thing. We put it in the model. There's a lot of misunderstanding, I think, when we only work in two dimensions.

And then also explaining all the work that we have done to the client when we submit the tender, and then showing a lot of what we have been thinking. So it gives us an edge, I think, in planning. And the picture we have for you guys, this was lunch. So they were so excited they couldn't even go to lunch. Or they got some fruit, or the lunch of engineers, which is coffee.

So that's really cool. But getting people excited, that's really, I think, one of the main gains.

TERJE GLAD: All right, let's move on to the last part in optimization, the green line.

CHRISTIAN MIKKELSEN: Where it gets really amazing.

TERJE GLAD: OK, so green line, it's all about zoning plan optimization. So we are trying to optimize for design within the zoning plan. I will try to explain what it's all about. We did this in InfraWorks and Civil 3D and Autodesk Subassembly Composer. And we did everything in an ICE meeting. Actually, we did this in one day. Again, with the construction manager and a construction specialist together with a BiM coordinator, and with me.

The results by doing this task was that we reduced the excess masses. So we reduce the need of transport to landfills. We also got up to date the corridor model in Civil 3D and Novapoint, so we were able to add data crammed into take-offs.

So this was the original design. And we have the main road on the left side, and on the right side we have the bike path. In this example the bike path is along the existing road, and we're building a new road on the left hand side. So the original design was that we had a bike path which was four meters wide, and we had a two to one field slope.

And as I said, we had a lot of excess masses, so we needed to get rid of them. So we created a subassembly in Subassembly Composer that widened the bike path into eight meters, and we decreased the field slope into four to one. And that gives us, we are getting rid of a lot of excess masses. Also in having a 2 to 1 slope, we are required to build a guardrail. When decreasing the slopes to 4 to 1, we don't need any guard rail. We get rid of a lot of excess masses.

So we created a subassembly within Subassembly Composer. So it's Civil 3D, and according to our model in Civil 3D, we could really analyze the whole road, the [INAUDIBLE] limiters. And within just a few minutes, Civil 3D had analyzed them, placed the green line thing along the whole corridor model.

CHRISTIAN MIKKELSEN: So we actually went from a situation where we had about 100,000 cubic extra of busted rock to a situation where we almost were missing rock. And one of the main motivations here is all the excess rock had to-- it's not placed just behind the hill, it has to go seven or eight kilometers away. So it's a major, major increase in cost.

TERJE GLAD: And by doing this we also optimized the way we could build this thing, because now in the construction site left hand side, we will have full production. So they won't get bothered by any existing traffic. And we have two way traffic on the widened bike path. And we also take care of the two peoples that live in this area so they can walk safe along the construction site.

CHRISTIAN MIKKELSEN: And then also giving the client or the community more quality, because they get a wider bike path in the end instead of the one that was planned. So we are getting benefits that also benefit the end product.

TERJE GLAD: All right, and let's move over to calculations.

CHRISTIAN MIKKELSEN: So you can just next slide. Clipping from the film again. Because I've been commenting a couple of things when Terje's been speaking. But it's really for us, as the contractor, about finding the lowest, most correct quantity, or my belief. And then combining that with the smartest execution plan.

So using the dream line optimization for widening so that we can work undisturbed. It's a lot easier, it's more effective. And then also finding the solutions and thinking about maintenance, even though it's not our concern, really. But giving the client better solutions, hard quality, and

describing it will give us an advantage in the tender.

So it's all about getting the job but then also trying to be smart, how can we deliver the best product at the lowest possible price? And then we used models, or moving it back and forth through Novapoint and getting the quantity take-off and putting it into our calculation system. And then trying to calculate it, I think we tried to calculate a little traditionally.

But there's something here for us, because we have to change also from going from a normal type contract, where we all get the [INAUDIBLE] quantity, and then calculating, and then starting to think differently. Because thinking about elements. So it's seven kilometers of the same thing. But in this area, there is something special, calculate that extra. But the main body on the road costs the same, at least if we can work the same.

And therefore using the model, and getting all the information and getting the right information to the right people at the right time is to great benefit. So then we get the best solutions, and with the best planned execution, and the highest probability of executing the plan, and also getting the lowest, most correct quantity, Which can get us the job. So I'm not going to show you how we calculate. Everybody knows, I think, or have an idea.

And then for all the guys that came a little late or didn't catch anything on what we said because we have some Norwegian accent or something, they get the movie again.

TERJE GLAD: Play the movie again.

CHRISTIAN MIKKELSEN: And then you can see if we did the same things.

TERJE GLAD: Actually the sound guy came in here and then removed the sound, so let's hope we still have some sound.

CHRISTIAN MIKKELSEN: The music was too cool.

TERJE GLAD: Yeah.

[VIDEO PLAYBACK]

CHRISTIAN   And I think that's one of the times that we've had this much information available just around

MIKKELSEN: primitives.

[END PLAYBACK]

[APPLAUSE]

TERJE GLAD: So we got some time for questions. Is there someone? Yep.

CHRISTIAN MIKKELSEN: Ladies first.

AUDIENCE: Did you feel that you described [INAUDIBLE] more data about the [INAUDIBLE] available during the [INAUDIBLE] phase, maybe at the start of the project, bringing in the project when you start, would you have more information available than a regular situation? How was the amount of time that you spent in [INAUDIBLE] that you don't have to spend to another project? Can you say something about that?

CHRISTIAN MIKKELSEN: I think we definitely have more information when starting the tender, and during the tender, and having it available to everyone. Not only in the guys that are good at Street, or Google. And also in doing this design and build, we have to know a lot more about things. We don't just receive something and put it through our delegation system and push it back.

And then having to consider things in the design and build, then we know the project a lot better and often know why it is the way it is so that we don't try to change something that can't be changed. If that makes sense.

AUDIENCE: And if you speed up the project now faster when you start up? Does that go faster?

CHRISTIAN MIKKELSEN: If we can build it faster.

AUDIENCE: If you start faster then--

CHRISTIAN MIKKELSEN: Yeah, I think we can start a little faster perhaps. But I think we can definitely finish faster. Because we can make it more suitable to our production teams and equipment, and do it in a way that we think is the best. Then there was a question here?

AUDIENCE: Can you not speak to how the contract or your arrangement with the road authority? At some

point after or during this process, did they start requesting rural plan drawings? What did you transition to a more paper drawings documentation type of scenario?

CHRISTIAN MIKKELSEN: I think, if I understand the question correctly, because I think that when we did the design, we did a lot in the model, and then we had to dumb it down in delivering the tender and delivering PDFs. So I think the great gain for us was really for our execution and planning.

But there is movement, I think, also with the clients. They are looking more to models as the preferred way to communicate.

AUDIENCE: Did they make decisions or give you approvals based on the model, or did they ask for paper drawings or PDFs to look at?

CHRISTIAN MIKKELSEN: The tender specified that they needed these, and these, and these paper drawings.

TERJE GLAD: So in the tender documents, we have the drawing list and documents list that we were to deliver.

CHRISTIAN MIKKELSEN: And then there was no evaluation or negotiation process. So it's just deliver the tender as one package, and so. Yeah, [INAUDIBLE]?

AUDIENCE: I think you talked about how this process helped you be competitive. Did it inform many of your risk mitigation slants? Like the fact that you look at all this information together, did that inform you, is there added value in addition to putting the bids at a more competitive price, in maybe figuring out or forecasting what your risk could be just from looking at all this flavors of data?

CHRISTIAN MIKKELSEN: I would like to say yes, but we're not that good at risk. But I think that we get a lot more information. And I strongly believe that the more facts the better the decisions. And the better the decision, the lower the risk. Because taking as much as possible into consideration, then you know more, then there's less risk. I think the biggest risk here is also, again, the quantities. Because now it's our risk. And then we have to handle that in another way than like your bill of quantity contract, when we just say, oh, it went up, we need more money.

AUDIENCE: Did the project allow for different options of the alignment, or were you fixed on a [INAUDIBLE] in this instance?

CHRISTIAN The zoning plan is quite strict. So you can't move the outer edges, or you can't move or

MIKKELSEN:	change any of the elements. So the only thing that we really can is that the zoning plan doesn't have heights. So in one of the big cuts we raised the level of the road so that we didn't have to blast as much. But that was as much as the zoning plan allows.
AUDIENCE:	So if you do a [INAUDIBLE] did that allow to do [INAUDIBLE] additional guides to do the possible option [INAUDIBLE]?
CHRISTIAN MIKKELSEN:	I think so. But the tender documents clearly stated that alternative-- or it's funny, because they have one paragraph, then they find an alternative, and the next paragraph says this is not allowed. So it was quite clear, but then it's up to us, and we can do the risk in our project and say, there is a possibility of changing the zoning. And if we believe that this is a minor change and we can try to get it, then we can do the risk of saying because it adds value and is better for us, then we can try.
	But it's a risk. Because then if you can't do the zoning change, then we have to build what's in the plan. But at this level of zoning, it's really set. So we can't do a lot of changes. But there are coming big projects where they are definitely rethinking. And just to add scale, I think this is about a little in excess of $20 million.
AUDIENCE:	It was based off of [INAUDIBLE] survey or something, or did you actually go out and do some ground survey before you started the ICE session?
TERJE GLAD:	We got the LIDAR scan from our geospatial data provider. So that was not included in the tender documents, but it was existing data. so we didn't do the scan for this project.
AUDIENCE:	So you didn't need to do a [INAUDIBLE] survey to--
TERJE GLAD:	No, they had actually done that. So we had access to the ladder data from the Norwegian authorities, because they have laser scanned the entire Norway, or they are doing it now. And they had did some survey of the existing road. So we were able to use that data in Civil 3D. So we had a quite good model of the existing road.
AUDIENCE:	How was the legal situation [INAUDIBLE]
CHRISTIAN MIKKELSEN:	No, we handle it as a contractor. We have the contract with the contact, and they are our supplier. So we ended up they getting paid and not us.

TERJE GLAD: All right.

CHRISTIAN MIKKELSEN: Any more questions, or everyone happy? Thank you.

TERJE GLAD: Thank you.