

**PER-ERIK**

OK. Let's get started. Hello, everyone, and welcome. So I hope you are enjoying AU and

**ASTRAND:**

enjoying the keynote. I, for sure, am, except for my throat. You can hear some issues with the air condition here, I think. So well, I will manage. It was worse last night.

OK, so today we are here to discuss BIM innovation and collaboration for success in cross-country rail projects. And we have a great panel here I will introduce you to them shortly. So my name is Per-Erik Astrand. I'm a technical specialist AC in all of Europe. So I will be monitoring this class today. And of course we want this to be an interactive discussion. So please just raise your hand go on with the microphone and get the questions going and get the discussion going.

So OK, I'll give a quick introduction to the panel we have here. So we have Kristin Lysebo for the Norwegian railroad department BIM manager. We have Marit Loland Tveit for Ramboll, BIM manager. We have Marius Sekse from COWI, BIM strategist. We have Gunnar Fjogstad Hansen, also from COWI, BIM coordinator.

We have Philip Hon from Sweco, BIM strategist. We have Atle Hoidalen for Sweco, been coordinator. And then we have some awesome Autodesk people here that have been helping out with this project. We have Lucy Kuhns from Autodesk, a technical support specialist in AC, Civil 3D, and AutoCAD, and whatnot. And we have Nathan Moore, specialists in InfraWorks and [INAUDIBLE] and so forth.

I'll look to start to give you a short introduction to the InterCity projects that we would base this discussion on. So the InterCity project is 230 kilometers rail network in Norway, in eastern Norway, connecting 21 cities. You can see in the middle here we have the capital of Norway, Oslo, and then we have the rail network going up to a city called Lillehammer. I don't know if it's familiar to you, Olympic winter sport in 1994. And then going further down, southwest and east of Oslo.

The whole project is divided into seven subprojects. And InfraWorks 360 is used as a platform for model based workflow for three of these projects. It's to be completed 2030. And the first subprojects in 2024.

If we look a little bit about the main challenges around this project that we're going to discuss

here today is really about communication and collaboration. How do you use the technology to communicate and to collaborate in a large project like this? It's a large project. It covers a lot of different infrastructure. It's many stakeholders, and strong public and local community that have interest in this kind of project. So how do you use the technology to communicate and collaborate? How do you work with your processes to be successful in that?

And then we have digitalization. A big project like this, you have massive amount of data. You have all the way from the early phase, the design phase, to data in the field. How do you achieve that? How do you be successful in that? So this is really the core main challenges of the product that we will discuss today.

To start up, to meet these requirements, the Norwegian railway administration, they have set demands on everyone working in this project. So this is the overhead, the demand that the InterCity project shall be designed, according to the demands in the handbook that's made by the Norwegian railway station-- *Digital Planning*, and *InterCity-- Recommended Methodology for Model Based Engineering*. So we will talk a little bit more about that later on today.

To highlight some of the requirements, the coordination models, as single discipline models are to be delivered in 3D for all disciplines, adapted to the necessary level of detail for each phase of the project. The model shall be updated continuously during the designed phase, and is actively to be used in all communications with stakeholders in the projects.

The models shall be developed in line with the required level of detail during the project they use in all different phases. What I said before, for conceptual design, all the way into the construction phase. And eventually the model shall end up as an "as built model" by end of construction. So these are the highlighted core requirements of the project. And of course the consultants we see that have been working with this project, they have met the demands by setting up their specific BIM strategies to meet these requirements.

OK so I hope that gave you a little understanding about the project. I'm sure maybe you have read the description before. So I would like to kick off the panel and ask Kristin for the railway department, can you give us some more explanation on how you work with these requirements? What made it possible? What's been your thoughts on that?

**KRISTIN LYSEBO:** Well, when the specific project started about two years ago, we had already taken that everything was going to be in 3D. We would build models in 3D. And early on, the developers' overall goal for our BIM strategy for this specific project.

And of course we have a handbook, but we soon found out that the handbook is not detailed enough for a project like this because we needed information to be able to standardize what we were going to do between the seven subprojects that the InterCity project is built on.

So, based on experience from our projects and also what we had known ourselves, we sat down the reference book with the representatives from all the projects. And we have had very open, productive discussions on how we best should adapt the BIM model for the city so it could work for all subprojects.

**PER-ERIK** OK, thank you. I think maybe we can also, before we continue, we can give a little bit of  
**ASTRAND:** background about your role within railway administration. And also let everyone introduce himself, a little bit more detail on what they have done in the project. So maybe if you could pass on the microphone and everyone can give some introduction.

**MARIT LOLAND** OK, my name is Marit Loland Tveit. I am a BIM manager for our project, [INAUDIBLE] project.  
**TVEIT:** [INAUDIBLE] And also I'm responsible for BIM strategy and tying it together with project management in our project. And also [INAUDIBLE].

**PER-ERIK** OK.  
**ASTRAND:**

**KRISTIN LYSEBO:** Well, I'm the BIM manager for the project. So basically my job is to make sure that we standardize as much as possible for all seven subprojects, and keep the reference group alive and so we can have good, open discussions, and together, work to build this BIM to make it even better.

**MARIUS SEKSE:** Yeah, OK, is it working?

**PER-ERIK** Yeah, I think so. Maybe you can speak up a little bit. Do you hear all right, in the back end? It's  
**ASTRAND:** OK?

**MARIUS SEKSE:** That's good.

**PER-ERIK** Perfect.  
**ASTRAND:**

**MARIUS SEKSE:** So, I'm Marius. I used to be the BIM manager for InterCity project, which COWI and Multiconsult has. And I did that, together with Gunnar. So I had the role, which Marit has in her

project, basically putting up IT strategy for the whole project. And this was mainly our first big project together with Multiconsult as another consultant group. So of course we had to break down some walls, not just firewalls, but physical walls in the project office, psychological walls between the consultant group. So the BIM strategy wasn't enough. We had to have a whole IP strategy. So doing that together with group IT in COWI, group IT Multiconsult, and building a BIM manual based on what we can deliver.

**GUNNAR** My is Gunnar. I'm the BIM coordinator for the Haug South or Haug Halden InterCity stretch.

**FJOGSTAD** Mainly, I work with InfraWorks and the Navisworks models. And I coordinate all the models together.

**PHILIP HON:** My name is Philip Hon. I'm working for Sweco and working as the BIM strategist in one of the subprojects. And it's a joint venture with [INAUDIBLE]. And I design the BIM strategy for our project make sure that the BIM management is aligned with the BIM strategy.

**ATLE HOIDALEN:** My name is Atle Hoidalen. I'm a BIM coordinator for the InterCity project for [INAUDIBLE]. My role in the project was to [INAUDIBLE].

**LUCY KUHNS:** Hello, I'm Lucy Kuhns. I'm with Autodesk. And the amazing paradigm shift that we've seen, this collaborative team do, I've been in the infrastructure business a very long time. And to me, this shift of model based design is truly amazing. And they're using our software, particularly InfraWorks, and pushing it beyond the limits, as far as size and the precision of the models that they're able to give. And to us, this is extremely exciting. And Nate and I have been supporting them, sometimes they're leading the way. And it's been an amazing, like I said, paradigm shift to the model based design and seeing this really come to fruition, things that we talked about 10 years ago they're bringing to life today. And it works.

**NATHAN MOORE:** So similar to Lucy, I've worked with all these guys at various times in their teams mostly on the InfraWorks side, just helping them move forward through some of those technical challenges that come up when you're pushing the envelope.

**PER-ERIK** OK, thank you everyone. Any questions so far? OK, so Kristin, going back to you, I know you  
**ASTRAND:** are to the rail station, you are talking about the total use of BIM, about what we said before, how do you digitize from early stage to the field? How do you plan to do that in the railway station? And how is this issue moving forward, the demands you set on the companies that working in these projects?

**KRISTIN LYSEBO:** To say something about the whole railway station first that the handbook was official in 2012. And then in the middle of revising that, for all projects, all railway projects. And part of that work we have found the need to have a BIM strategy for all railway projects. And we hope to have that approved this year, actually. Maybe in the beginning of next year, but first we're hoping for this year.

And we have put forward a few, quite drastic changes, really, for all railway projects. The strategy states that all railway projects are within our organization or that the project that is involved should be done in 3D. We want to be able to create just the necessary drawings but create them from model. And if we have both models and drawings representing the same kind of data, we should try [INAUDIBLE] the model should always have preference.

So if that strategy goes through, we would start working on an innovation plan, how are we going to do this, in reality? We would need to build up a lot of knowledge, in all levels of the railway department. And of course, we would do the same thing we do in InterCity for the build project as well. And of course, the InterCity project is kind of special because normally in the infrastructure project in Norway, you could do one project in one plan level. And then you would stop. And then you would wait for the new funding to start the project again, probably a few years down the line. And in the InterCity project, we start with seven subprojects, all in different kinds of fund levels, but all the way from preliminary plans to construction phase. And we would use the same models, upgraded, enrich it with details as the funding grows. And our total goal is to be able to take all the build data from the BIM models and export them as automatically as possible into our web-based database.

**PER-ERIK  
ASTRAND:**

OK. So the demands and the requirements you have, are they also specific, are the more specific for the model, or do you also set requirements on the processes and how to work in those specific faces, types of meetings, and requirements on the meetings, what information you want to have in the model on those meetings?

**KRISTIN LYSEBO:** So far, we have focused most on the ticket part of the model itself. I think they have solved most of the issues by now. So now the time's come to actually get on with work with it. And some of the consultants have already started, and the railway department is also together with [INAUDIBLE]. In a four year project, you see our implementing in the way of the current engineering methods, based somewhat on me as well, into infrastructure projects. So we're using four of the subprojects in InterCity as a part of-- in this case [INAUDIBLE] process, as well. And of course, our BIM manual will have to be upgraded or updated to include that as

well.

**PER-ERIK** OK, thank you.

**ASTRAND:**

I think Kristin named something integrated with current engineering. Is it familiar to all of you? Some of you don't know what ICE is.

**LUCY KUHNS:** Perhaps you should explain it.

**PHILIP HON:** They design and make decision in the same room that day. One day rush out, and the result. Instead of taking email and design in three weeks and then sending it across the room.

**PER-ERIK** And Philip, you have been working with ICE in part of this project. So, and then you see  
**ASTRAND:** together with the railway administration, your designers, and decision makers, and you decide, you take decisions as you go. OK. So Marit, you have to be working together with Sweco with looking for at the requirements from the Norwegian railway administration. You have made your own strategies on how to meet the demands. Can you tell us a little bit about that, and how you plan to be successful in the project?

**MARIT LOLAND** The first thing we did was to build a BIM team, with the right skills and the right competence. I  
**TVEIT:** think that's the most important part of it, to start, getting the right competence into the project. And I think it's important that we fulfill, in our project, the big infrastructure project, it's important to have the roads BIM coordinator and head coordinator, of course. And also a GIS expert and geomatics expert to deal with all this big data.

And also, like Philip here, our BIM strategist, why should we work with him in our project? We have the requirements from our client. But still we have to think about, think through it ourselves. What is our goals in this project?

And what Philip, and project management, and me work together with, and also the BIM team, was four goals we did set up for this project. And that was an effective communication. That's very important because we have a lot of stakeholders here, both internal and external.

High quality on our models, and everything should be constructed in 3D. Reduction of costs, the total cost of the project, then we have to work efficiently. And also innovation, we wanted to do some innovation in our project as well. And all these goals that we set up to meet the success criteria that will set our client.

So what we did done? We had to choose the right software, the right tool for meeting these goals. And we did have a discussion around that. You remember that? We did discuss it for quite a long time, I think, in our workshop that we had. And we ended up with InfraWorks. And that is because InfraWorks is good at dealing with a huge amount of data in a cloud based service. And that's very important for us, because this is a large scale graphic area. So we need software that can deal with a huge amount of data.

And also because of the communication part of it, you need a good communication tool. InfraWorks also had a high quality visual quality. And that's very important because there are a lot of tools that we could have used, but to our stakeholders, external stakeholders, they need to see, they need to recognize the environments. They need to recognize where they are. And then InfraWorks is a good tool for that.

OK so to meet this requirement of working efficiently, we did also using InfraWorks for design view. Also, that's also for quality control, of course. So we did also use it for design review, we used the design field. So we did a lot of innovation in that part, I think. We have learned a lot. We have been talking with you a lot. And it has been a good tool. We have also learned something to change, that we could change in our process that we are doing in a project, we looking for the future. OK? Maybe that was it?

**PER-ERIK** Thank you.

**ASTRAND:**

**PHILIP HON:** I'd like to add to what-- because one of our challenges in the beginning is when we chose InfraWorks, it was a new technology. And there was a lot of stakeholders that didn't know InfraWorks. And also our clients, they install in their platform, in their PC, it wasn't possible. But Kristin made it possible, because you make some kind of unique solution to that. And the only requirement is the previewer. So InfraWorks, you have previewer, but you have to install that in your PC. And this is one of the challenges that came.

**PER-ERIK** So Marit, you said to Atle that you have been working with this in a really innovative way. And  
**ASTRAND:** Atle, maybe you can tell a little bit more about how you utilize InfraWorks to its full?

**ATLE HOIDALEN:** Yes, Marit told you about it. One of the demands from the railway project was the use of detailed-based models for the existing situation. So they wanted us to take them all the way into data where the existing situation could be modeled. So with this custom map, it's a large

scale replica of the island. So we-- at first we were worried that it would be too large to implement the data in InfraWorks. But actually, that was not the case.

So what we used most time was to actually being able to present the different data in a way that everybody could understand. And match it with attributes with the condition so that it will not only show geometrical objects, but they contained information. So we have a dedicated geomatics team as part of our BIM team. And they did a lot of work with old GIS data, adapting it to our purpose, so we imported the environmental maps.

We imported the recordings for [INAUDIBLE], areas for the significant historical importance. So, yeah. Also, once, we wanted to work with that time-- didn't have much experience implementing advanced practice, this discipline for reliability, availability, maintenance and safety. And the railway board thought that this information also could be available in the model. We actually-- based on an earlier project that tested this, they took that experience and we developed a workflow that enabled us to work quite well within the model. That's some of the ways we used to implement.

**PER-ERIK** So, we have a movie of the existing situation that we have done, so we can take a look at that  
**ASTRAND:** here. Show the audience. Maybe you can tell a little bit about what--

**PRESENTER 1:** Yes, this is a video made in InfraWorks. We chose our base model, or the model for existing runs. Basically what we're seeing here is the model sweep down where we start down at the lowest level with the subsurface rock. These are-- yeah, you see it. The building information. And the geomatics team triangulated a rock surface based on the info and the drillings. So we had the different drilling data as points of interest involved. We have existing rolling through pipes. And then we have the terrain, which is combined with aerial cameras. We also had our geomatics team build up the whole city, and we imported it as GML files. We used coverage areas to visualize the existing railway. So there's a lot of GIS layed down in the model. We imported the property boundaries. All these coverage areas make the data up. So we would use two different colors to show the different data. Environmental data.

Hello, yeah. So, this is the alum slate. And lastly, we also use terrain teams to visualize the 200 year flood. So we had a real detailed base model, and that enabled us to cover a lot of issues in an early stage of the project.

**PER-ERIK** Thank you. Has anyone here used InfraWorks in this way? OK, we have a few. So have you  
**ASTRAND:** worked with this to data aggregations, to build up existing condition, and to have that to show

stakeholders.

**AUDIENCE:** Yes, we used [INAUDIBLE]. It's just like [INAUDIBLE] in InfraWorks. And we use it also to review Autodesk 3D models, and more integrated with that.

**PER-ERIK**  
**ASTRAND:** Thank you. OK, so, Marius and Gunnar, I know you have been working with Inframodel--  
InfraWorks models and use it on the meetings. Can you tell us a little bit more about how you work with InfraWorks? On what meetings to use it, during work meetings and so forth?

**MARIUS SEKSE:** Yeah, it's really the demand from [INAUDIBLE] is that we always use models. So the models we have are InfraWorks models. So, those are the models we use. But there are-- of course there's meetings where something goes wrong, or there is older people that don't really like to use 3D models. And we have to kind of force them to do it, or we have to help them pilot the models. But we try to learn-- or teach them how to use it that way, having as many meetings as possible.

**PRESENTER 1:** Yes, I can follow up on you on that, because we also saw that in our project, that all the senior engineers in the meetings in the start of the project, they had all these drawings in A1 format on the tables. And we had the model up on the screen, but they continuously just looked down at the tables at the 2D drawings. But during the projects we could see a shift, that they would lift their heads and start looking up at the model and eventually they were up at the screen and pointing and telling us to turn off that layer, and you go there. So we definitely saw a change also in the senior engineers focusing more and more on the model instead of looking down at the drawings.

**PRESENTER 2:** Yeah. I would just like to comment that because in this COWI/Multiconsult project, we saw that having high visual quality made our seniors wonder about the actual engineering quality, because it was too good looking. And that's what made our way of working later on more-- using InfraWorks more like a collaboration platform. Doing things there instead of doing very high quality visuals.

We would rather go there and let them explore the terrain, the models, and of course do those 50 different alignments if you like. And it's not that important if you have the right grading in the phase we were. So it was more important that everyone got their hands onto the tools, and that the senior could see that this could go really rapidly. And not go back to their office and say, well, we'll use next week to make those 50 different alternatives and then pick on them. But do it there, directly.

**PER-ERIK** So, the use of InfraWorks, how do you think that that has changed your way of working? If it's  
**ASTRAND:** large project, you use normally-- it's a lot of drawings, a lot of sending information by publishing, making drawings, and so on. So to be able to use this model based environment instead, in terms of efficiency and as a consultant company, how do you feel the biggest wins for you? Is it about understanding the whole project, internal, external communication, or--

**PRESENTER 2:** Yeah, it's actually there we saw the big benefits. Not making it too glossy, making it easy, adaptable for other disciplines that hasn't started doing them, or actually have never touched a CAD tool before. So say, like, environmental scientists and biologists going out in the field. They would need somewhere to place all their data, all their explorations. So giving them the possibility to enter that into one common model was the most important. That was the overhanging goal. Get all the data into the database, and then start developing your alignments, basically.

So we did another big project. It was a highway project, the E16. And we presented it here in 2014. But back then, we were focusing more on the high visual side. So what we saw that was, to get everyone on board using InfraWorks, then we had to step a bit down. It was time consuming updating, of course, on the visual as well.

**PER-ERIK** Philip, I know you have been talking about to digitize these projects and the challenges with  
**ASTRAND:** the amount of data. Can you explain for the audience how you have been tackling this, and the challenges you see with the amount of different services and platforms you are using?

**PHILIP HON:** Yeah. In Norway, we have something called [INAUDIBLE]. Its very specific project design tools we have. And the format is not DWG, and you have to export it. So by using different platform, you certainly have different formats. You have to handle it. And InfraWorks makes it possible, because you can import different formats, and also a huge amount of data. Which means we can actually import everything in InfraWorks, as long as it's not crashing. But, something to add, that our model is far away from perfect. But the way you present it, the way that it's so simple for people to understand, that makes it easier to talk in the same language. This is one of the biggest advantage with InfraWorks.

**PER-ERIK** Are you planning to-- you are using it for the conceptual phase. Are you planning to use it  
**ASTRAND:** more into the detailed design? How do you plan to work with InfraWorks in that sense?

**PHILIP HON:** Our plan is not going forward with InfraWorks because of its precision is not good enough for

building phase. But we can still use it for visualization. We can just build it like a half year, for just presenting it for the public. But, for building phase, it's not enough good precisions.

**PER-ERIK  
ASTRAND:** Oh. OK. Have you changed the way you present to the public? Have you been-- on the meetings, how have you been presenting it with using InfraWorks? Have you making movies and so on? Or are you also changing that process of how you visualize it to the public community so they understand it?

**PHILIP HON:** I think one of the biggest changes-- we don't need to spend a week and do it in the 3D as much, the high rendering visualization. It's that, just use the model to navigate and show the public. You know, that's the biggest changes. I don't know if Kristin and the others agree with me.

**KRISTIN LYSEBO:** We haven't used-- we haven't given the InfraWorks model to the public. We have showed it in public meetings. And we have made movies, some from 3D Studio Max and some from InfraWorks. And pictures that we have, 3D illustrations. So it's a combination.

But we have used-- I think you have used the InfraWorks model in small meetings with municipalities, for example. And internal in the region railway authority. So we have used different combinations of how we have used the visualization tools. But I think that the most benefit we have got from InfraWorks is the collaboration. That we are working together around this model, that the whole team, our client, our project managers, and we can show it also to the stakeholders.

So we use it for design review in meetings. And for quality control, actually as well, because we can do a visual quality control using InfraWorks. And that's very good in this early phase that we are in. And so the best thing that I've got out of it, I think, is the collaboration. The way we can work together now.

**PER-ERIK  
ASTRAND:** So, I would like to ask you guys, when helping out with intercity project, what do you think is so special with this project, and how they have worked in Norway? And kind of the-- what do you think about that?

**LUCY KUHN:** I can say one thing. I remember when this upside down Viking boat came across our desk as a model. And I looked at Nate and said, what is that?

**NATE MOORE:** For me what's been really interesting working with these guys is the level of collaboration. And

you just touched on it with doing the design review through the design feed inside InfraWorks. And that's been really interesting to watch how well that's been working. And I mean you know the details of it better than I.

But to actually be running your collaboration meetings through the collaboration functions within InfraWorks, so that everybody is really very much on the same page, has been really impressive. It's a good use of tools, and it-- I think it also speaks to how well you all collaborate. Anyway, it's a level of collaboration we don't often see with other projects on that scale. I think that's impressive.

**PRESENTER 1:** Yes, I can just follow up on Nate and Lucy's comments there, because as we mentioned earlier, when we started the project and decided to use InfraWorks it was quite a new technology for us. And we were uncertain if we would be able to deliver what the railway department wanted. So me representing the joint venture Ramboll/Sweco, we're both enterprise customers at Autodesk. So actually we were so lucky that we were able to set up weekly meetings with Nate and Lucy during the entire project.

So whenever we stumble upon a problem, we created an agenda and we had a weekly meeting with Nate. And we were able to either create some kind of work around for the problem, or solve the problem within a short time line, which was a key factor because we really didn't have any time to use a lot of resources on solving problems.

**PER-ERIK** No questions so far? OK. Yes.

**ASTRAND:**

**AUDIENCE:** Question. [INAUDIBLE]

**PHILIP HON:** Are you asking-- sorry, the question is, how many people are working on the InfraWorks model?

**AUDIENCE:** On one.

**MARIUS SEKSE:** I think it's a device. But we have a-- we have like one-- we are responsible for one proposal. There's like, 10 proposals, 20 proposals, sometimes. And that make it easier to work with the same proposals. But our BIM team is four or five people is working in the InfraWorks model.

**PER-ERIK** But can you tell how many people are actually? Because that-- is there four or five people

**ASTRAND:** working on the building up the model, then there are a lot of people using it as a

communication too and a--

**AUDIENCE:** That's how I understand it. You brought that information over from [INAUDIBLE]. And I assume that you got the information from those groups of designers.

**KRISTIN LYSEBO:** That's correct. We did get information from the engineers, architects, area planners, stakeholders. That the BIM team coordinated and put into the InfraWorks team-- InfraWorks model.

**PHILIP HON:** And we are some kind of machine. We are transforming the data that is coming in. Like a format that we cannot import directly to InfraWorks, we have to handle it. So, it go through us.

**AUDIENCE:** And why did you model the whole town, the whole city?

**PHILIP HON:** Sorry?

**AUDIENCE:** Why is it important to model in 3D, a model of the whole city? Why not just an area next the the railway?

**KRISTIN LYSEBO:** Why we did have is such a big model, you mean? That's because of the public, the communication with the public. And also we had a big area that we're searching for the railway, where the railway should be, yeah.

**PRESENTER 1:** Also, the railway didn't go just one place. We had three different corridors through the city, so actually the entire city was affected.

**AUDIENCE:** [INAUDIBLE]

**PRESENTER 1:** Yes, yes.

**PER-ERIK  
ASTRAND:** So, you have used it for the data regulation and to communicate and collaborate. But it's also-- InfraWorks is a tool that is going more and more into the detail design. You can do more and more accurate engineering with InfraWorks.

**NATE MOORE:** Yeah, and I think-- well, depending on when you've tried InfraWorks along the way, you've seen it's changing quickly. And I'd say in the next six months or even less, if you wanted more detailed design, I think that's what you'll see. And there's some other sessions with the product management team that go into that in more detail this week.

**PER-ERIK** And also, a lot of analysis, like--

**ASTRAND:**

**NATE MOORE:** Yeah. Yeah, there's a lot more analysis tools coming. I think just a lot more of the general BIM workflow functionality is going to be there in terms of bringing all of that data in and keeping the attributes as you work through the whole process.

**LUCY KUHNS:** And I think it's important to understand that they got their geomatics team involved in their model design at a very early stage. And along with the geodesy and the geomatics the accuracy-- you know, they're continually checking it and working on it. And it was interesting to hear your comments about the precision. And as InfraWorks does become more closer to that design, you know, engineering tool, the precision is going to have to get better. But, you're going to have to start your model base with very, very good and precise data. So, the combination of the both is encouraging. The fact that the model is extremely large and covers-- particularly in rail and long alignment work-- covers very, very large areas, this again becomes more and more important, as some of the work that we've done with them has discovered. We've discovered some of those issues.

**PHILIP HON:** And we do have an intention to use the InfraWorks model with the design tools. But based on two things, is speed and reliability. And we have to-- we have to skip it. We actually order-- we actually arrange an ICE meeting with the InfraWorks model to find the corridors. And everyone knows that you can draw alignment in InfraWorks. But it wasn't reliable enough to do it. So we have to do it in the traditional way, and then use InfraWorks as a collaboration model.

**PRESENTER 3:** We found that to draw directly into the model, we can do it at like station areas, to sketch and get ideas of where we can have parking, roads, et cetera. So, in that way it works pretty well.

**PER-ERIK**  
**ASTRAND:** But how do you see the future with going more to detailed design and doing quantification and moving out to the site? Now we're looking at how you can utilize it also further, you know, for site planning, and reality capture, and bringing the progress so far of a project. That's also one way of using InfraWorks at a later stage. So to have you set a platform, and then if you're working with draws and reality capture, you can bring it in the models. So that's also-- in that sense, you can really continue to use the models throughout the lifecycle.

**PRESENTER 2:** And I guess it's about computer power, and it's about what the visuals should be, how big the models should be. And that's where we did quite an exercise, slicing the models into the right sizes. And discussing whether to have one long stretch or three shorter stretches to be able to

work in the model with a regular laptop. So that was our main goal.

In our project, we had one BIM coordinator. That's Gunnar. We had one BIM manager, that was me. And then we had one specialist with GIS. And that was a very slim organization.

But that was basically because we wanted everything to function on laptops, there and then. That was our main goal. And then getting all the different disciplines to work with this as a collaboration tool, feeding in their data. So, because they have different backgrounds, they have different computers, they have different needs traveling around. So not everyone is having actually a desktop. They have a laptop, and they travel.

So that was quite-- what was discussed very often in the project. How small could the laptop be? Like I bring my Surface Pro. And our assistant project manager, he brought his Surface Pro as well. And he wanted to do InfraWorks.

And they were like, OK. Do we have to narrow the models, narrow the corridors? Or should we tell him not to use the model. So, it's a discussion there. And that's an important discussion further on with development of InfraWorks as well.

**PER-ERIK** I think we had a question. You can repeat it.

**ASTRAND:**

**AUDIENCE:** If there was a massive aha moment, where you said, we will always and forever change our process with this particular part of our projects in InfraWorks? And what was that moment if there was one? This like, we can never live without it again. One major thing.

**MARIUS SEKSE:** I think, we in COWI, we had that in 2012 or 13. Because we started using InfraWorks very early, when it was Infrastructure Modeler. And we had a big road project which I was talking about. And there we went out to the customer, and so it was road authorities in Norway, and started discussing the road corridor. And then doing that in the meeting, drawing up the new corridor together with the clients. That was the big aha. And then we decided to go for that in preliminary stage. Never going back.

**PHILIP HON:** And our clients have the same feeling as Marius said. They are like, what is this kind of software we're using? You're drawing alignment. They never experienced it. So it was like, yeah, wow. There's something for the future. But until we get to the future, Nate has to solve the list of issues we have for InfraWorks. And as we said, precision is one thing, and also a

format that we can take it from face to face to the maintenance that Kristin is-- can accept the format that we deliver from InfraWorks. Right now, you cannot export anything from InfraWorks, but I believe that maybe in the future you can export to the IFC or a GML, like that, then it will be a little bit different. Maybe you have a teaser for us.

**NATE MOORE:** I'll make a list.

**PHILIP HON:** He has a list. Yeah.

**AUDIENCE:** Going from contractor side, is there a lot of talk of collaboration and how you're doing the design, and what these projects are in the pipeline? So when they come to us, then how do you see us collaborating together in the building phase, getting all the great BIM results that you are now experiencing collaborating and helping us work better together then?

**LUCY KUHNS:** That's probably a question for me, I think. What we do say in our handbook is that the delivery format as of now is a DWG file for all disciplines. We may change that as software develops. So we are always looking for the best delivery format for each discipline.

But our handbook and the work process we have also states that the contractor should build everything from the discipline models. And have export formats, or export data, directly from the discipline models to machine control. So that is the work process. That we will demand, where we are working on the text for the contracts templates now. But, that's what we're thinking.

**PER-ERIK** Had another question there.

**ASTRAND:**

**AUDIENCE:** For the design team you, do guys miss the optimization tools that InfraWorks has for highway design that railways don't have? Or maybe, for the Autodesk guys, if this is coming for highways as well?

**PHILIP HON:** Do you mean, if we have a project with the InfraWorks just for highway projects?

**AUDIENCE:** The analysis that you can do in terms of optimizing the amount of earthwork movement you're going to do for the project.

**PHILIP HON:** Actually, we are just using like 10% or 20% of InfraWorks I think. We're still using it as a collaboration model-- yeah, collaboration model. But we did some extreme engineering with

InfraWorks, sitting with our clients on one day and deciding the quantity-- the length of the bridges and the length of the tunnel and then make a budget to the national transport plan. And we made it in one day. So this is something new for our client as well, so in that way there is some innovation. But we are not using InfraWorks as a design tool right now.

**NATE MOORE:** But I think maybe you were asking about some of the functions that are present for roads, like profiles and things, that aren't in rail. And yeah, they've definitely been looking for that. And I know it's in the road map somewhere. But that's-- there's even something this afternoon, I think, that that might shed more light on what that looks like.

**PER-ERIK  
ASTRAND:** Any more questions? I see we are at the top of the hour. If anyone has a last question we can go with that. If not, I'd like to thank the panel for coming today. Thank you for your time. And I wish you a nice time the rest of AU. OK. Thank you very much.