Bijlage 4

Interview Geoffrey Haine (Geotechnical engineer at DEME Offshore)

What is the first thing that you do when you hear that DEME is in the running for a project?

So first you need to know if you have soil data, because to be able to do leg penetration assessment, you need soil data in order to see what will be the reaction of the soil. That will be the first part. Normally if a client is asking us to go there, he has already some data. Not every time of the exact position but of the area. It depends on the work that you are planning to do. If it is site investigation for example, than for sure you will not have data of the exact site of the jack up, because that's the point (job) of the jack up. But if it's for oil and gas or renewable, then most of the time you have soil data next to the location you want to excavate. So if you are working for an offshore farm for example, the site investigation has been done by the client and then you receive a CPT of a borehole that is close to the where you will go and based on that you do your leg penetration assessment. So from that you will have expected leg penetration and then you will have to do site specific assessment, to see what is the required preload that you have to apply to work safely. So it will depend on the type of operation that you will do. wheatear you expect to have and stuff like that.

So let's say that there are no data from the soil so than DEME itself will go to the place and then they will just sample the ground themselves?

Normally not, depends on the contract. But if you don't have any soil data you will see if it is a well know area. Then you can use the geology, for example if you go to the German bay. You know that you will most probably you will encounter shallow penetration. If it is not a known area then we can ask the client: 'Okay dear client we will not go there unless we have some data.

How is a soil investigation carried out?

Do you know CPT? it's a cone penetration test. It's for soil, so basically you have a cone. where you record the resistance at the tip and the sleeve friction and then it will be used to characterize your soil. From the type of resistance you have you can derive which kind of soil you have, for example this is a layer of sand and this is a layer of clay. This is the expected strength of the clay and then based on that we can do the leg penetration calculation and we will derive the expected leg penetration. With this cone penetration there is correlation and

will we derive if it's sand or clay. A certain value of penetration corresponds to a certain soil type. If you have a high QC (cone resistance) and a low friction ratio then you know it's sand and when you have a lower QC and a higher friction ratio then you know it's clay. Then you can derive the strength of the sand and the strength of the clay. From that you have methods to calculate the leg penetration. You have codes, the latest one is the ISO and it is used to do the leg penetration. We have a software to calculate the leg penetration.

Can you explain the leg penetration curve a bit more?

That is actually the result of a leg penetration. It is not possible to exactly assess the strength of the soil, so we are using lower bound, best estimate and upper bound. And then it will give you a range of the behaviour you can expect. That will be the curve that you will have. For example, this is the smallest penetration so it's the high estimate of the soil properties, so the soil is the strongest that you expect it can be. It's the best estimate. And then that is the lower bound so the soil is weaker then you expect. The red is the required preload that you have to achieve. This is the resistance of the soil and this is the preload that you will apply so it means that if you apply that preload you will, according to our calculation, penetrate around 4-5 meters in this case.

So first you have the data from the soil and then you put it in the software and then the software generates the diagrams that we just saw. Are those send immediately send to the ship?

No, then we do an SSA, a site specific assessment, that we can do internally but most of the time we are using a third party company like DNV, JL or Gusto. They do some checks based on the operation that is planned. If you need to lift a monopole or you don't need to lift a monopole then the worst case scenario will be different. So when you go on side you have to preload and the point of preload is that you will be sure that you will not have a worse condition during the operation then during the preload. The goal of the SSA is to know what type of preload you have to apply, to be sure that you are safe. That depends on where you are, like if you are in the Baltic the wave height will be smaller than if you are in the North over Scotland and also the job that is planned to do, the load and the required radius of the crane.

And as a result you derive the required preload from that. And then when you have the full SSA, which is the leg penetration and then the verification that you are safe to carry out your job, this is send to the ship. And then we see, at that location wheatear there is a risk for punch through or not.

Besides the regular crew is there an engineer or another ground based personnel on board when jacking up?

No, this is not the case. They have a jack-up engineer and the captain can also do the jacking operation. But they are responsible. I am sure they followed a course about jacking. And they also have DP. We are also doing an introduction too all the calculation to the bridge so that they can read the graph and even understand a bot the soil if they have a CPT

What kind of footings are used on board of the jack up vessels at DEME?

Not all jack-ups with DEME have spudcans, on the Neptune for example there is no spud can for the moment. It’s only the tubular leg, but for example on the Innovation, Apollo, sea installer, challenger and Thor you have a spudcan bellow. Actually it depends, with spudcan normally you will have shallower penetration but if you have deep penetration it will be more difficult to extract the leg afterwards. But normally with a very large vessel you will have spudcan otherwise you will go too deep and the leg length that you will need will be too high.

The spudcans can always be changed depending on the project. For example if you have a rocky seabed then you know that the penetration will be low and then you can install a spudcan with a rock tip to have a bigger penetration. In the SSA actually it will also be checked that the jack-up, when having a small penetration (or none), will not move over the seabed because of the expected current. And if this is the case then they will say that it is not safe to go there. And then you either have to change vessel or only working in restricted weather or change the geometry of the spudcan. But with some soil it is not possible to use jack-ups. If you have a soft soil where the leg penetrates like 30 or 40 metres and then also 40 metres of water depth then there is not enough leg length to go there. It could be possible to use a spudcan with a larger surface in this case but we don't change the geometry of the spudcan for every project because it costs a lot of money.

You can also optimize the required preload to minimize the penetration in the soil. So for example a typical case is when you have to install a monopole, normally let’s say you put 3 on deck and you can chose to have only 2 or 1 on board.

Why are there no mat based jack-ups with DEME?

I don't think these jack-ups are so interesting because when you have shallow penetration or if you have a sloth then it will be much more difficult to jack-up so I know that some people are saying that 'yeah if you use a big mat on soft soil it is easier' but I don't know any jack-up like that. Because when you have a sloth or so it is not optimal. You really need a flat seabed to use it. The form of the seabed is also given by the client. They provide a bathymetry because you have to know if there is sloth for the spud cans because then there is a risk of sliding.

On board I saw a program that DEME developed where it gathers all the data that it collected like footprints and soil composition, can you explain this a bit more?

Actually that is survey program. We have a department within DEME that is only doing survey and it's from the bathymetry and also from where we know we have been and then you will try to avoid the previous footprints. I think this program shows all the footprints because when you have the bathymetry and the penetration was deep in most cases you can still see the crater of the previous footprints. So these will also be shown in the program. Before we go to a place we always ask the client if there has been a previous jack-up before, because it is always nice to have the previous record of the penetration to know more about the soil and also to avoid the previous footprint. This is shared by the client.

What are the risk with an existing footprint?

The risk is especially for jack-up with spud can. If there is a footprint, the soil will be remoulded so the properties in the footprint will be different than outside the footprint. So you have a risk that if you are half on the footprint that an inclination occurs because of the different resistance. It doesn't mean that you will fall into the water but a twisted leg with a rack and pinion and the deformation is to big then the rig and pinion system doesn't work anymore.

Do you ever use previous footprints?

Normally if you have to go in the previous footprint either it is the same vessel and then you try to have the same footprint, if it's not then you are trying to put your leg centre in the previous footprint because that is the least risk. Normally they don't have the same dimensions so you cannot always reuse the footprint but if you don't have the same dimensions then it is better to avoid the footprint.