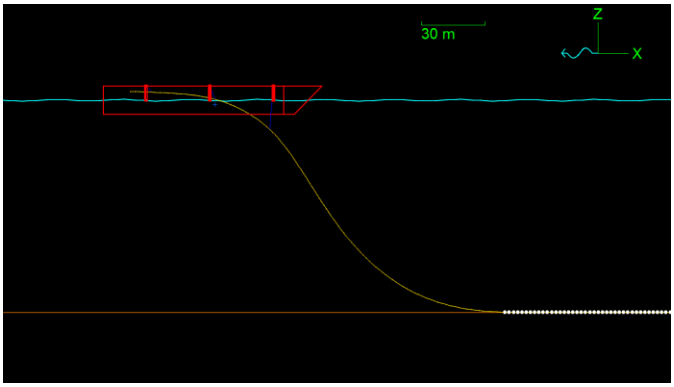
E05 Pipe davit lift



The free end of a steel pipe is lifted from the seabed by davits to bring it alongside a workboat. The lift is modelled dynamically in small waves and no current.

Building the model

The line is initially laid out straight on the seabed. Note that the initial position of the free end (end A) is deliberately chosen to over-stretch the pipe, and the *as laid tension* is set to a low but non-zero value. These both help statics convergence. When statics is converged, end A has moved to its equilibrium position.

Three winches are equally spaced on the vessel side and attached to the pipe near end A. As the winches haul in, lifting the pipe, the pipe free end also moves horizontally towards the anchor. To accommodate this, the workboat has to move forward.

The analysis is carried out in eight stages as follows:

Stage	Description	Time
0	System settles - no haul in	-5s to 0s
1	Winches accelerate from zero payout rate	0s to 5s
2	Winches pull-in at a constant rate, workboat accelerates	5s to 305s
3	Winches pull-in at a constant rate, workboat moves at constant speed	305s to 605s
4	Winches decelerate to a lower constant rate	605s to 610s
5	Winches pull-in at a constant rate, workboat decelerates to zero speed	610s to 810s
6	Winches decelerate to zero payout rate	810s to 815s
7	System settles	815s to 900s

Note that each winch pulls in slightly different amounts to achieve the lift.

The winches are set to a *specified tension* of zero, in statics. This means the pipe is laid out with no load from the winches, and the starting length for each winch wire is set to give zero tension with no slack. In subsequent stages, *specified payout rate* is negative, meaning that the winches haul in. Note that stages 1, 4 and 6 are included to allow the winch payout rate to be changed smoothly (using the *specified payout rate change* option). Allowing the winches to accelerate or decelerate (as they would in real life), rather than applying an instantaneous change in payout rate, results in smoother winch tension results.

Workboat movement is defined on the *prescribed motion* page on the *Workboat* vessel data form. At each stage we define the change in velocity. OrcaFlex arranges that this occurs smoothly by applying a constant acceleration through the stage.

It should be mentioned that the default RAO data in OrcaFlex is in use for this workboat model. The default RAO data are based on a slender tanker hull form, and so are not appropriate for a workboat-shaped vessel. More appropriate data should be applied for real project work.

A brief settling time is provided at the start and a longer one at the end of the simulation.

End B of the line is anchored to the seabed. The model would need to include a very long length of line in order for there to be no tension variation at the seabed anchor due to the lift. In this example, there is a tension rise at end B, because we have included less length of line in the model.

Results

A results workspace is provided: open the file *E05 Pipe davit lift.wrk*.

The tension time history through the simulation for all three winches is shown on the right. Wave action generates variations in winch tension acting at 4.5 s period (the wave period) throughout the simulation. Shock loading is minimised at the points where the winch payout rate changes by the inclusion of acceleration or deceleration phases (as discussed above), allowing the payout rate to change smoothly.

The instantaneous value range graph of pipe curvature is plotted on the lower left. As the simulation replay progresses, you can see the curvature changing. Maximum bending occurs at the attachment of *Winch C*, with a further peak lower down at touchdown.