

---

## 99/107

# Effective Tension and Wall Tension

Buoyancy and contents pressure and weight loads on a line affect the wall tension and effective tension. This is modelled in OrcaFlex using the standard effective tension approach.

In this document we show that the OrcaFlex modelling of line buoyancy and contents weight and pressure loads is correct, by validating OrcaFlex results against results given in the well-known and respected book "Floating Structures: a guide for design and analysis: Volume 2" (editor Nigel Barltrop).

## 1 Validation against Barltrop Examples

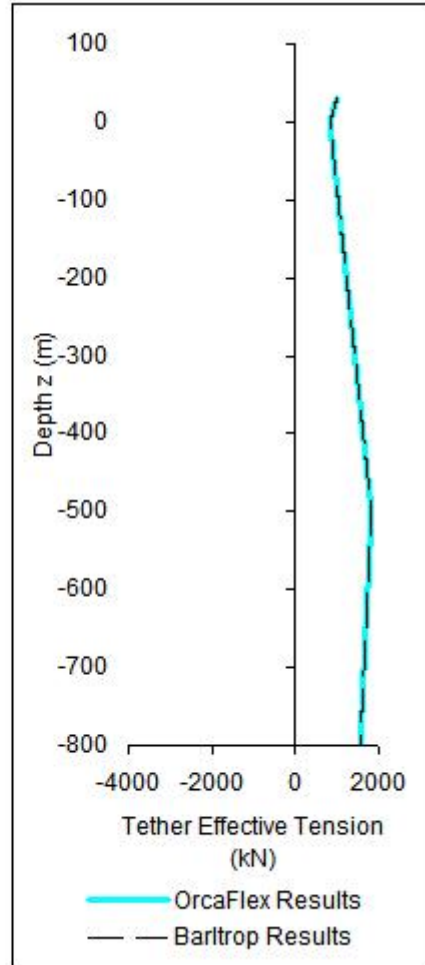
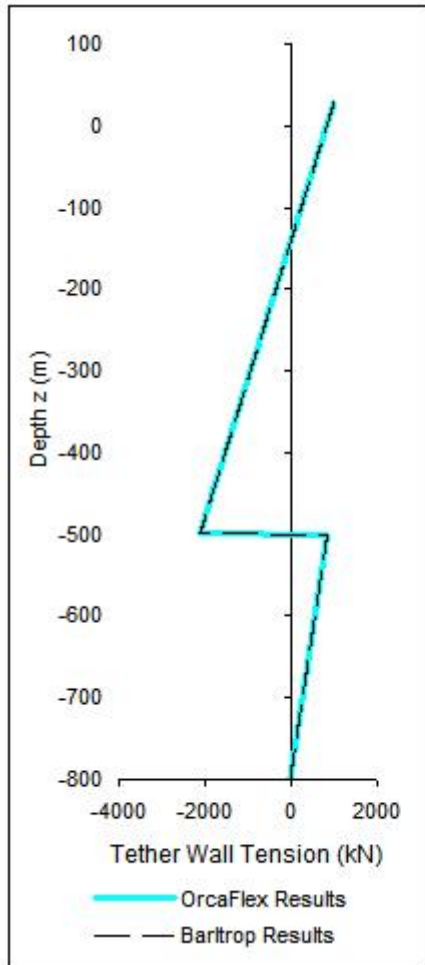
Section 11B of Barltrop's book gives a good explanation of the effective tension approach to modelling buoyancy and contents weight.

Section 11B.5 of the book gives two useful and illuminating examples of tension distributions in vertical lines, one being a tether and the other being a riser containing oil at pressure. For both cases the book gives graphs showing how wall tension and effective tension vary along the length of the line. The OrcaFlex file "Tether and Riser Examples (Barltrop, Floating Structures Vol 2, section 11B.5).dat" models these two cases.

The graphs and summary tables below show that the OrcaFlex results match very well with those given by Barltrop. The graphs show OrcaFlex results as a light blue solid line, on which the Barltrop results are overlaid as a dotted black line.

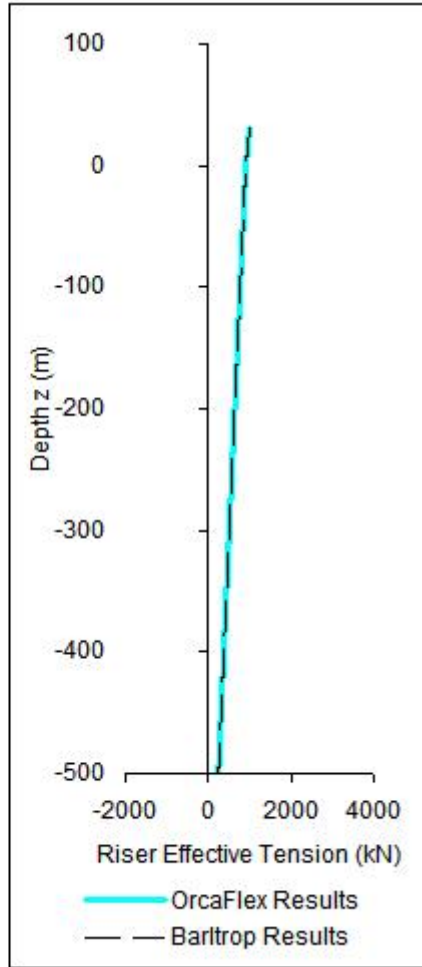
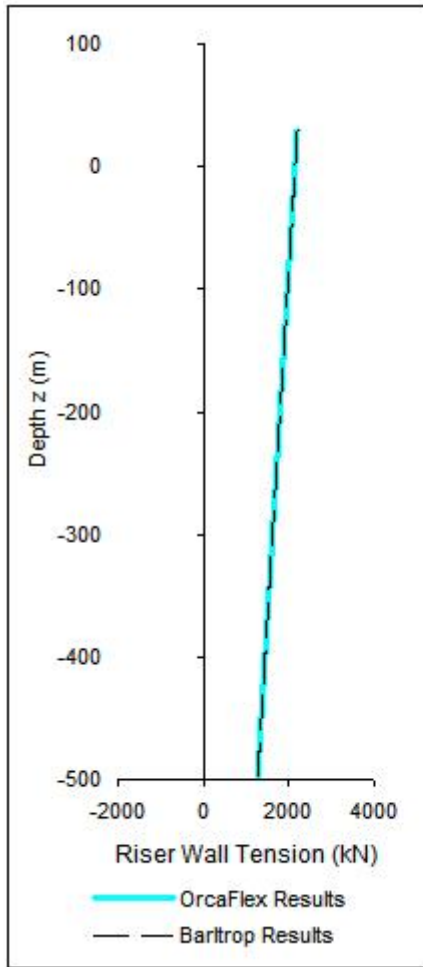
The summary tables show the numerical values at the key points along the lines. The OrcaFlex results match those given by Barltrop well (to the accuracy of the figures given in the book).

## 2 Tether Example



z		Wall Tension	$P_{ext}A_{ext}$	Effective Tension
30.000	OrcaFlex	1000.000	0.000	1000.000
	Barltrop	1000.000	0.000	1000.000
0.000	OrcaFlex	823.147	0.000	825.128
	Barltrop	823.150	0.000	823.150
Just above -500	OrcaFlex	-2124.382	3947.329	1822.948
	Barltrop	-2124.357	3947.339	1822.982
Change at -500	OrcaFlex	2960.497	2960.497	0.000
	Barltrop	2960.504	2960.504	0.000
Just below -500	OrcaFlex	836.115	986.832	1822.948
	Barltrop	836.147	986.835	1822.982
-800.000	OrcaFlex	-25.480	1578.936	1553.456
	Barltrop	-25.432	1578.936	1553.504

### 3 Riser Example



z		Wall Tension	$P_{ext}A_{ext}$	Effective Tension
30.000	OrcaFlex	2196.230	0.000	1000.000
	Barltrop	2196.202	0.000	1000.000
0.000	OrcaFlex	2143.431	0.000	901.747
	Barltrop	2143.419	0.000	901.279
-500.000	OrcaFlex	1263.428	986.835	242.451
	Barltrop	1263.702	986.835	242.767