APPENDIX

A

ANCHOR CALIBRATION - DEEPSTAR DATA

DET NORSKE VERITAS

TECHNICAL REPORT

Date of first issue: 13 January 1999	Project No.: 76010051
Approved by: Arne Løken, Head of Section	Organisational unit: Risers, Mooring and Foundations
Client: Joint Industry Project (see participant list inside)	Client ref.:

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Summary:

See Conclusive Summary.

Report No.: 98-3585	Subject Group: P5
Report title: Back-fitting analyses of drag-in plate anchors in clays (Technical Report no TR 2-2)	
Work carried out by: Pål Strøm, Rune Dahlberg	
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Date of this revision:	Rev. No.:	Number of pages:
13 January 1999	01	48

Indexing terms

Technology Development
Anchor
Capacity
Penetration

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Table of Revisions

Rev. No	Description		Date
01	Issued for comments	Technical Report TR 2-2	13 January 1999

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1 CONCLUSIVE SUMMARY

Table 1 shows the range of the calibration factor for the anchor line that gives a best fit solution to anchor shackle pitch and horizontal distance considering the 'as measured' values from the Bruce anchor tracker. Table 2 shows the same with a correction made to depth and horizontal distance based on the manual measurements taken. The average values in Table 2 are believed to be the most representative.

The range given represent the values from the analysis from a shackle depth of about 2 metres down to the final depth. The calibration factor approach constant values when depth corrections are included. The average corrected value from Table 2, with all three tests considered, is 0.9.

Table 1 Summary of anchor line interaction parameters – no depth correction

Test	anchor line	f_{NC} (fit to shackle pitch)	f_{NC} (fit to horizontal distance)	f_{NC} (average value)
1. Test 4-DL-1 at Onsøy	32mm wire	0.8 – 1.1	0.9 – 1.2	0.8 – 1.15
2. Test 5-DL-2 at Onsøy	32mm wire	0.5 – 0.9	0.85 – 1.1	0.6 – 0.9
3. Test 9-DL-3 at Onsøy	32mm wire	1.1 – 1.25	0.75 – 0.9	0.9 – 1.15

Table 2 Summary of anchor line interaction parameters – with depth correction

Test	anchor line	f_{NC} (fit to shackle pitch)	f_{NC} (fit to horizontal distance)	f_{NC} (average value)
1. Test 4-DL-1 at Onsøy	32mm wire	0.7 – 0.85	1.05 – 1.15	0.9 - 1.05
2. Test 5-DL-2 at Onsøy	32mm wire	0.4 – 0.6	0.95 – 1.05	0.7 – 0.8
3. Test 9-DL-3 at Onsøy	32mm wire	0.75 – 0.9	0.55 – 0.65	0.75 – 0.85

f_{NC} - Calibration factor for normal resistance (bearing capacity) on the anchor line

Loading rate was concluded to play an important role in the analysis. Reducing the pull-in speed in the tests was found to decrease the line tension with about 18% pr. log cycle. The actual drop in normal resistance for the anchor line in test 9-DL-3 was found to be about 25%. It can thus be concluded that the normal resistance presently included in DIGIN for wires, overestimates the anchor line resistance by approximately 30% at Onsøy. A tentative formulation for the normal resistance, taking the sensitivity of the clay into account, has been suggested as a modification to DIGIN.

Only the normal resistance was used as basis for the anchor line calibration as no measurements of load at the shackle, and thereof the contribution from adhesion resistance, could be assessed. The latter plays, however, a minor role with respect to the embedded anchor line catenary.

Table 3 shows a summary of the anchor calibration factor for penetration, from the DIGIN backfitting analyses of the drag-in plate anchor tests. In general the range is too large, but appears to be anchor specific. Separate analyses for the Onsøy tests indicate that both anchors show a better trend when using minimum energy instead of minimum force as a criteria for accepting a possible equilibrium solution in the DIGIN analysis. In general an equilibrium solution from DIGIN for drag-in plate anchors gives a larger range of acceptable anchor orientations in the soil than for fluke anchors. The minimum force and the minimum energy was found to represent the outermost boundaries with respect to possible anchor orientations.

Table 3 Key data for summary of drag-in plate anchor calibration - penetration

Test	Anchor	s_u	St	*FANC*	Comments
Onsøy tests	0.7 m^2 Denla	10 - 15	6 – 10	3.5 – 5.0	Best fit to tension in the lower range and to the travel path in the upper range
Onsøy tests	1.4 m^2 Denla			3.0 – 4.5	
Onsøy tests	0.7 m^2 Stevmanta			1.0	
Onsøy tests	1.4 m^2 Stevmanta			1.0	Good match to path, but overestimate force by 15%
DeepStar tests	4.6 m^2 Denla	2 – 40	about 2	2.0	Reasonable match *
DeepStar tests	5.2 m^2 Stevmanta			1.0	Depth not known. Pull-out resistance used to find depth *
Petrobras tests	10 m^2 Denla (march 97)	5 – 30	2	1.3 – 1.5	High strength seabed intercept with low gradient used in analysis
Petrobras tests	10 m^2 Denla (dec. 97)	5 – 30	2	1.5 – 2	
Petrobras tests	11 m^2 Stevmanta (dec. 97)	5 – 30	2	0.5 – 0.7	

FANC - Calibration factor for sliding resistance at the anchor

Table 4 shows a summary of the comparison between drag-in plate anchor tests and DIGIN back-fitting calculations.

Table 4 Key data for summary of drag-in plate anchor calibration – pullout

Test	Anchor	s_u	η	Comments
Onsøy tests	0.7 m^2 Denla	10 – 15	0.55 – 0.75	
Onsøy tests	1.4 m^2 Denla			
Onsøy tests	0.7 m^2 Stevmanta			
Onsøy tests	1.4 m^2 Stevmanta			
DeepStar tests	4.6 m^2 Denla	15 – 40	(1.25) 0.8	Number in bracket is for the as reported intact shear strength, indicating that the strength of the soil was underestimated *
DeepStar tests	5.2 m^2 Stevmanta		0.8	see comment in Table 3
Petrobras tests	10 m^2 Denla (march 97)	15 – 30	0.65 – 0.8	High strength intercept with low gradient used in analysis
Petrobras tests	10 m^2 Denla (dec. 97)	25 – 30	0.7 – 0.8	
Petrobras tests	11 m^2 Stevmanta (dec. 97)	15 – 30	0.8	

η - Empirical coefficient accounting for soil remoulding and eccentric/ inclined loading to be applied to the theoretical bearing capacity factor for normal loading.

* Shear strength is based on miniature vane on disturbed samples and may have underestimated the shear strength at the site. A 37% increase in the intact shear strength was found to give a reasonable match to the test data with the presented calibration factors for both pullout and embedment.

For the pullout test it appears to be necessary to include an empirical coefficient of about 0.6-0.7. Factors as loading rate during pull-out and a somewhat uncertain depth in some of the tests may have played an important role in the offshore tests.

The calibrations performed are further elaborated for the DeepStar tests and the Onsøy tests within this report. The Petrobras tests data are, however, confidential and cannot be distributed to the participants.

2 INTRODUCTION

2.1 Participants

The project is organised as a joint industry project (JIP) with financial funding from the following twelve participants, which is gratefully acknowledged:

BP Exploration Operating Company Limited, UK.
Bruce Anchors Limited, UK
Det Norske Veritas, Norway
Health & Safety Executive, UK
Minerals Management Service, USA
Norsk Hydro ASA, Norway
Norske Conoco AS, Norway
Petrobras UK
Saga Petroleum a.s, Norway
STATOIL, Norway
SOFEC, Inc., USA (only Part 1)
Shell Internationale Petroleum Maatschappij B.V., The Netherlands (only Part 1)

2.2 Brief Description of Project

The project is divided in three parts, and the objectives of the respective part-project are briefly summarised in the following.

Part 1, which was executed between August 1995 and February 1997 had the following main objectives:

- Development of a design procedure for fluke anchors in clay, utilising the results from fluke anchor tests compiled from different accessible sources and the offshore industry's general knowledge about fluke anchor performance in clay.
- Follow-up and compilation of data from drag-in plate anchor tests and identification of important design considerations and necessary further work to improve such anchors for deep water application.
- Writing a DNV Recommended Practice (RP601) for design of fluke anchors based on the work on such anchors in Part 1 (after formal completion of Part 1).

Deliverables from Part 1 comprised a total of nine Interim Reports and seven Technical Reports, plus an executable version of the computer programme DIGIN. RP601 will be published in 1999 and replaces the originally planned Classification Note.

Part 2, duration March 1997 – January 1998, focuses further on deep water anchors in clay with the following main objectives:

- Further improvements to the DIGIN programme, e.g. better equilibrium solutions, and update of the fluke anchor back-fitting analyses from Part 1.
- Compilation of more drag-in plate anchor test data, e.g. from the DeepStar Project and Petrobras (through confidentiality agreements).
- Back-fitting analysis of drag-in plate anchor tests to improve our understanding of this type of anchors both during installation and pullout.
- Development of a design procedure for drag-in plate anchors.
- Specification and execution of a pilot reliability analysis of fluke anchors using the PROBAN system, with DIGIN providing the anchor-soil behaviour input and the DEEPMOOR project providing the extreme distribution of the line tension during storm.

Part 3 will comprise a full scope reliability analysis of a fluke anchor in clay with the objectives

- to develop a reliability-based design procedure for fluke anchor foundations and
- to perform a formal code calibration.

In the revised scope for Part 3 presented to the Steering Committee, it has been proposed to extend the reliability analysis to include also drag-in plate anchors in clay.

2.3 Project Organisation

In DNV the project team has consisted of Rune Dahlberg (*Project Manager*), Pål J. Strøm, Trond Eklund (until 30.06.97), Jan Mathisen, Espen Cramer, Torfinn Hørte and Knut Olav Ronold with Knut Arnesen as *Verifier*. Arne E. Løken is *Project Responsible*.

The *Steering Committee*, composed of one representative from each participant with Tom Guttormsen from Saga Petroleum (Part 1) and Asle Eide from Statoil (Part 2) as *Chairman*, contributes to a validation of the final products from the project by approving plans and reviewing and commenting on the Draft Final Reports.

2.4 This Report

This report presents the results from the back-fitting analyses for the drag-in plate anchor tests available within this project.

Selected test data are processed and presented.

For the anchor line backfitting, field measurements of both horizontal distance and shackle pitch at the anchor are used as target values in DIGIN analyses, giving a range of the calibration factor of concern. The backfitting is performed for a wire forerunner.

For the anchor tests, the results from the backfitting analyses with the DIGIN programme are presented in the same format as for the tests. A best fit solution is sought by varying certain factors until a best possible comparison between the calculated and measured anchor performance is achieved. In the anchor calibration the conclusions from the anchor line is not included, but the effect is discussed. A comparison and summary for each test set is presented.

For the anchor analyses and their comparison with tests a short sensitivity study for the factors considered variable is performed.

The Petrobras test data are, however, confidential and cannot be distributed to the participants

3 DEEPSTAR TESTS - 1996

3.1 General

Drag-in plate anchors, also called Vertically Loaded Anchors (VLAs), were tested by Aker Marine Contractors, Inc. (AMC) on behalf of the DeepStar Project. The tests were conducted in 1996 with the prime purpose to evaluate the instability and performance of new models of both the Bruce Denla anchor and Vryhof Stevmanta anchors. The tests were performed in about 91 m water depth.

3.2 Test programme

A total of 7 tests were conducted at the South Timbalier Block 295 (ST-295) in approximately 91 m of water using the AHTS Ross Chouest. 4 tests were performed with the Bruce Denla anchor and 3 tests with the Vryhof Stevmanta anchor. The tests were conducted from October 20 to October 22, 1996.

The DENLA anchor tested was the Mark 2, had a fluke area of 4.58 m^2 and weighed about 1300 kg. A 73mm x 853 m multi strand, torque balanced pull wire (forerunner) was used. To ensure that correct anchor orientation was achieved during first set down, a short section of small diameter drogue tail was attached to the back of the flukes. The anchor incorporates two shear pins positioned in the lower end of the anchor shank. The anchor was deployed with both shear pins installed with a low initial fluke angle (angle between the fluke and shank) to ease initial fluke penetration into the seabed. After failure of the small shear pin the fluke angle increased to allow full embedment. To fail the second, larger shear pin, the reaction force, must exceed the break load of that pin. The procedure for this was to steam back while keeping the deployment line in tension, and then to apply a load from a heading approximately 180° opposite from the installation heading.

The STEVMANTA anchor tested was the Mark 5 design, with a fluke area of 5.22 m^2 and a weight of about 1800 kg. A 73mm x 853 m multi strand, torque balanced pull wire (forerunner) was used. To ensure that correct anchor orientation was achieved during first set down, a tailing line composed of 19mm x 30 m wire + 51mm x 4.5 m chain was attached to the back of the fluke. The anchor incorporates a fluke angle adjusting device that terminates the four wire slings attached to the anchor flukes and allows different fluke angle settings (for shallow and full embedment). The fluke angle adjuster included two shear pins. The smaller shear pin had a nominal break load of 63 kN, which ensured initial penetration by use of 35° fluke angle. When line tension exceeded the break load of the small shear pin the fluke angle opened to the intended 48 degrees which was maintained until this shear pin broke at 920 kN. Then the fluke angle opened such that the line tension became normal to the fluke.

3.3 Soil conditions

The soil at the test site consists of homogeneous, normally consolidated clay. In situ strength is measured by miniature shear vane tests and are copied in Figure 1, also presenting remoulded shear strength measurements. The gradient of the intact shear strength is 1.6 kPa/m. The sensitivity of the clay can be seen to be about 2.5 down to 15 m depth, and then a marked decrease to about 1.6 below this depth. The unit weight of the soil in question is about 16.5 kN/m^3.

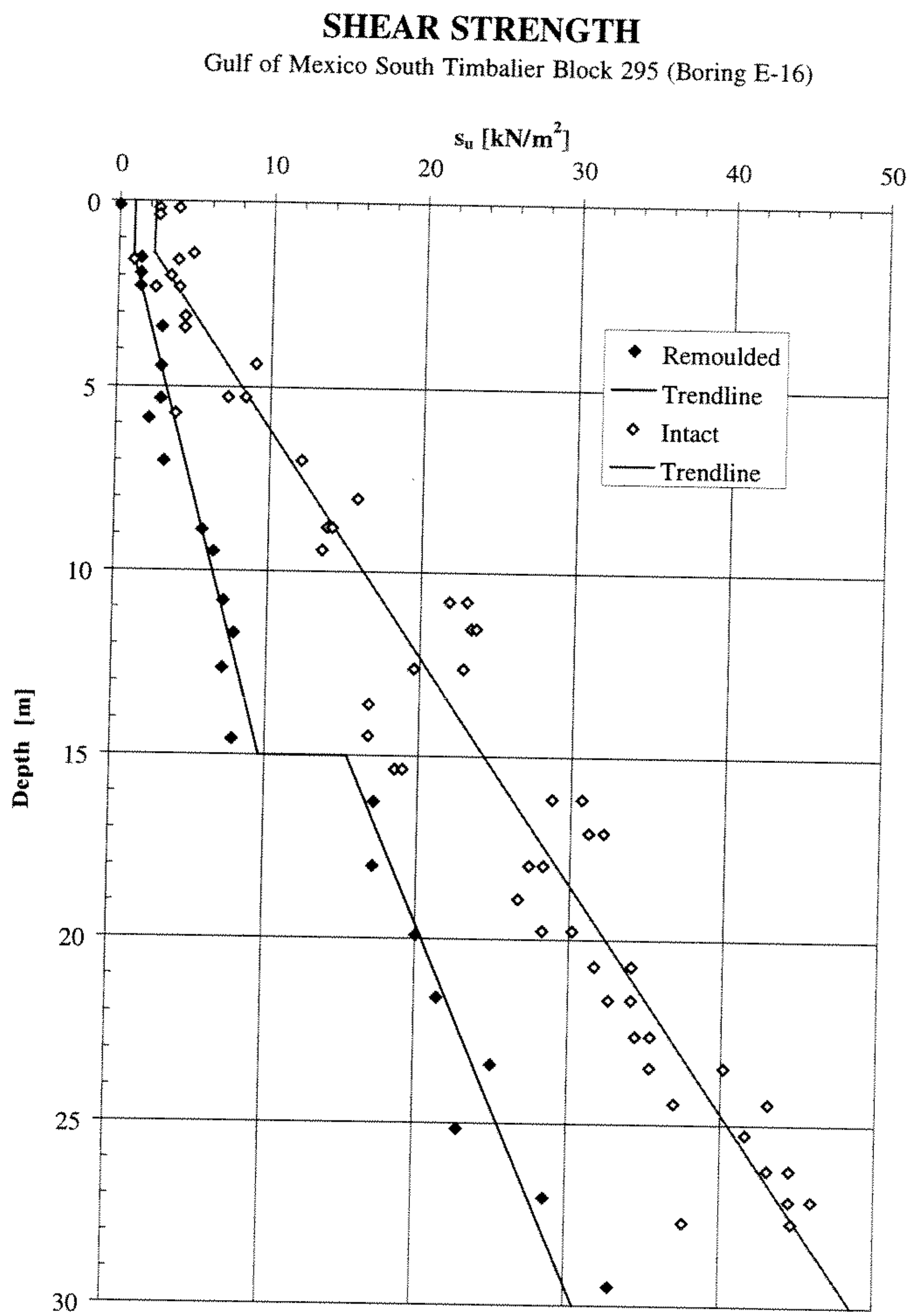


Figure 1 Shear strength profiles – miniature vane

3.4 Test results

Table 5 Summary of test results for the two anchor types

Test no. - Anchor	Installation load [kN]	Pull-out load [kN]	Performance ratio (shear pin ratio)	Depth of embedment [m]
1A – Stevmanta	1091	1848	1.69 (2.08)	N.A.[2)]
2A – Stevmanta	1113	N.A.[1)]	N.A.[1)]	N.A.[2)]
3A – Stevmanta	1247	1670	1.34 (1.70)	N.A.[2)]
1B – Denla	490	913	1.86	9
2B – Denla	890	1490	1.67	N.A.[3)]
3B – Denla	957	1670	1.74	N.A.[3)]
4B – Denla	1514	N.A.[4)]	N.A.[4)]	21

1) - Shear pin did not work
2) - Depth not measured
3) - Tracking device did not work
4) - Deep dive test. Unable to test pullout capacity

Tests 1A and 3A give rather low performance ratios, but this may be due to the method of trigging the anchor for vertical loading, which makes it difficult to determine from the measurements at which load the shear pin actually fails. As described in section 3.2 trigging takes place during anchor installation at a predetermined load, which is set by the break load of the shear pin (theoretical value is 920 kN at the anchor shackle). The number in brackets are derived from the assumption that the actual embedment load is equal to the break load of the shear pin.

From figures included in Appendix A it can be seen for test 1A an increase in the line tension gradient with time around a deck tension of about 900 kN. For test 3A there are no apparent change in gradient at this tension, but a distinct increase in the gradient at about 1100 kN. For test 2A no distinct increase in gradient can be seen. This may be taken as an evidence that for both tests the shear pin is broken, but for test 3A maybe at an higher level than reported. However, from the distinct change in soil sensitivity it may also be that such an increase can be explained by initial anchor penetration into the less sensitive clay layer.

Tests 1B and 4B show a large range in achieved penetration depths. This is of particular interest as this can be used to determine the penetration resistance versus depth.

In tests 2B and 3B the anchor tracker did not function, which means that the depth of penetration will have to be estimated, and one way to do it might be to fit them within the range determined by the two other tests for that anchor (tests 1B and 4B).

3.5 DIGIN back-fitting analysis

Figure 2 presents the test results compared with DIGIN calculations for the Denla anchor with two different assumptions on intact shear strength and a range in the anchor calibration factor. The pullout tests can be seen to give higher values at the achieved depth than what can be calculated from theoretical pullout resistance with a bearing capacity coefficient of about 13.8 (shape factor included). This may be an indication of that the intact shear strength is underestimated which is not unlikely since the shear strength profile is derived from miniature vane tests on samples subjected to sampling disturbance. The embedment resistance was also found to be below the resistance experienced at the end of installation, which gives further justification for assuming that the undrained shear strength has been underestimated.

Based on the experience from other tests, it may not be correct to match the measured pullout resistance with the theoretical value, but instead to look at a say 20% reduction ($\eta = 0.8$), being an empirical correction as a result of a possible inclined loading and some soil remoulding during pullout. A best fit to the pullout tests was than achieved with an increase in the intact shear strength of 37%. With this correction, the DIGIN gave a good fit to the embedment load with an anchor calibration factor of 2.0, which is more or less the same as the new ratio between intact and remoulded shear strength.

Figure 3 presents the test results compared with DIGIN calculations for the Stevmanta anchor with the same assumptions on intact shear strength as for the Denla anchor. It can be seen that the depths fit reasonable when the 'as reported' shear strength is applied and the embedment load is taken as the break load of the shear pin. It may also be concluded that the depths fit reasonable with the actual measured embedment load and the corrected shear strength.

From the backfitting analysis it can be seen that the anchor may have been installed at a depth of about 13 m to 15 m (plate depth), meaning that the tip of the anchor penetrates somewhat into the less sensitive clay below. The fact that this takes place at an installation load in the same range as the break load of the shear pin adds to the uncertainty with respect to the actual embedment load for the tests.

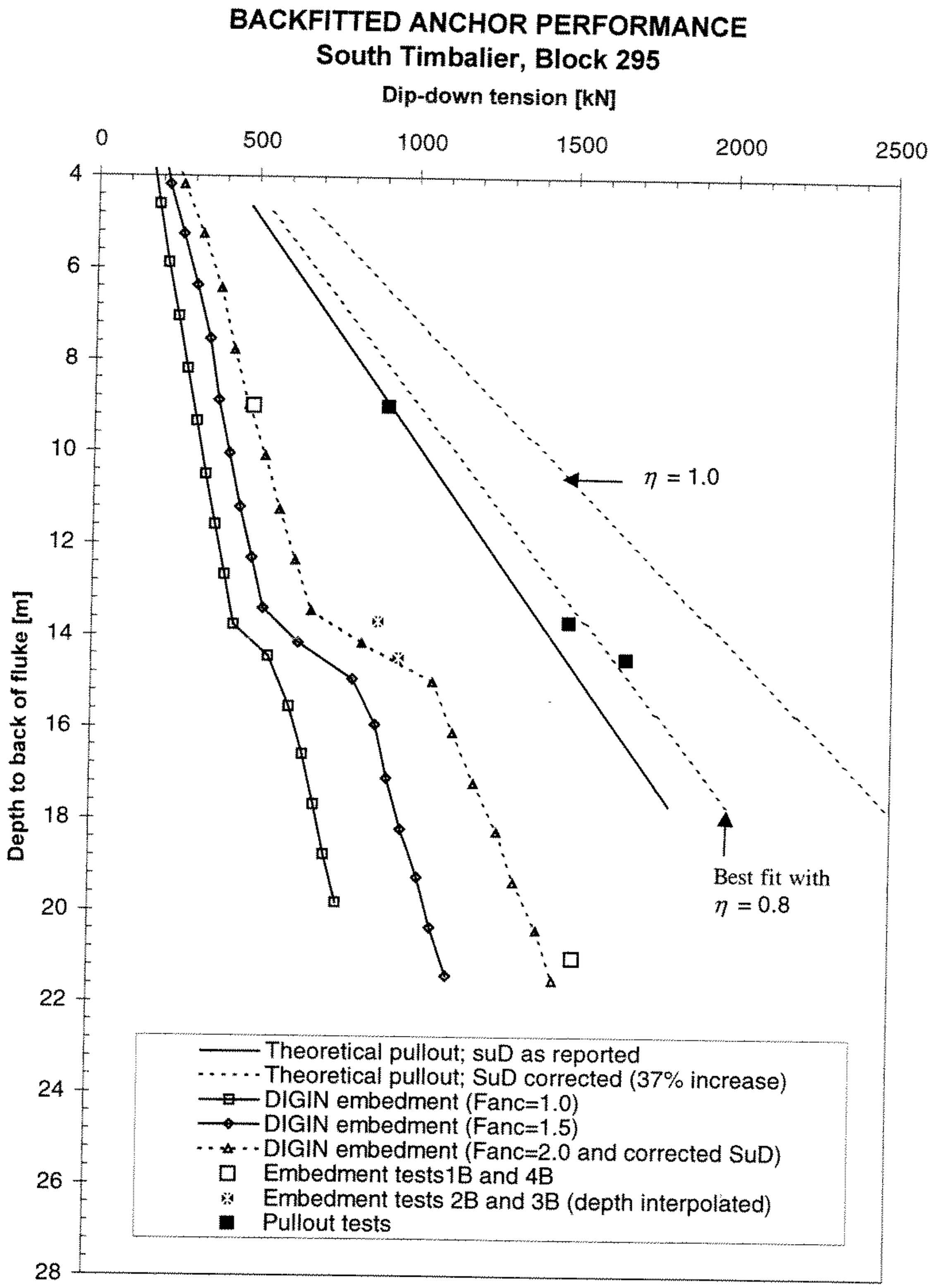


Figure 2 DIGIN calculations with Denla anchor

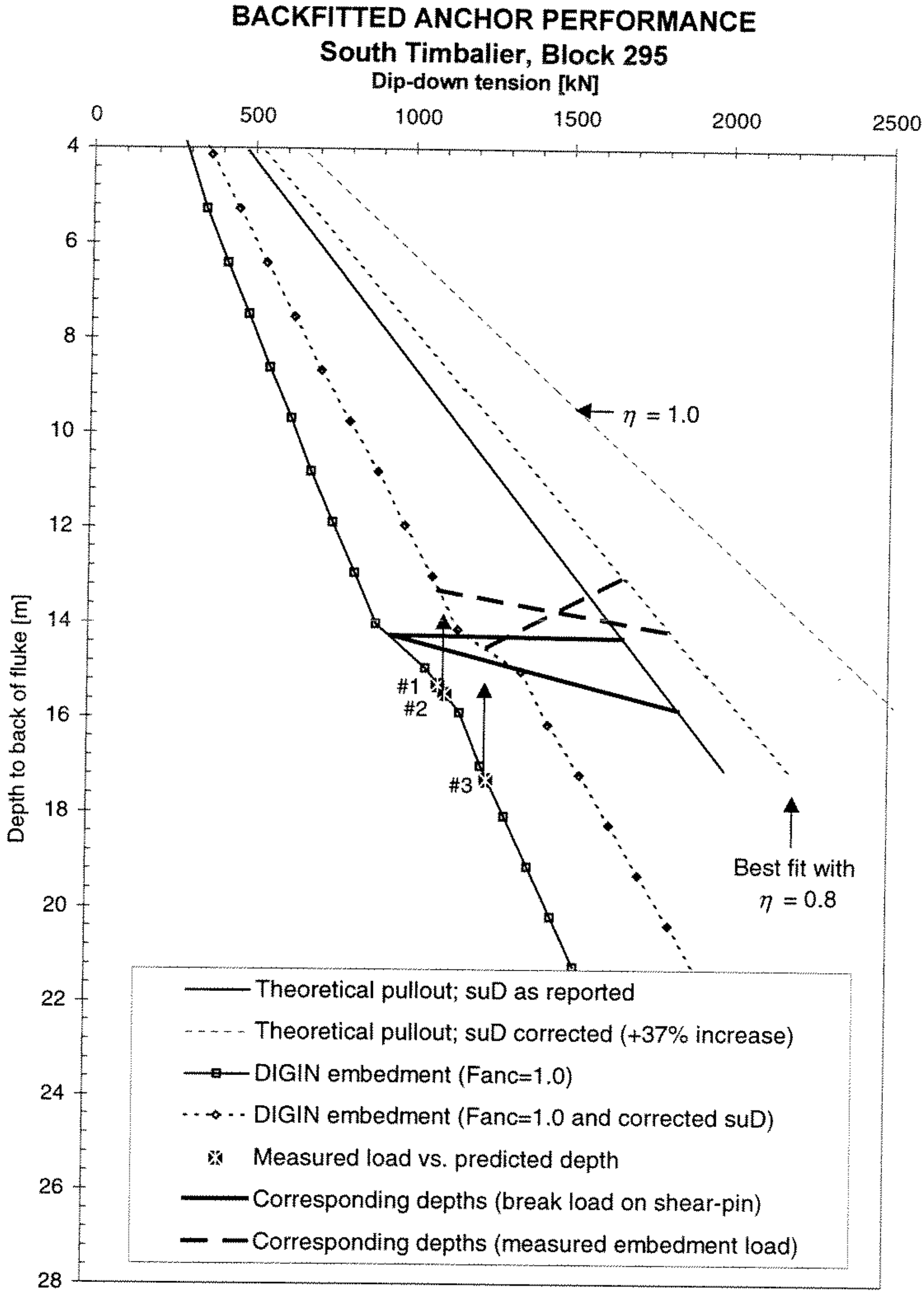


Figure 3 DIGIN calculations for Stevmanta anchor

4 ONSØY ONSHORE TESTS – 1998

4.1 Test programme

A total of 13 planned tests and one additional test were performed during the period 8th to 15th June 1998.

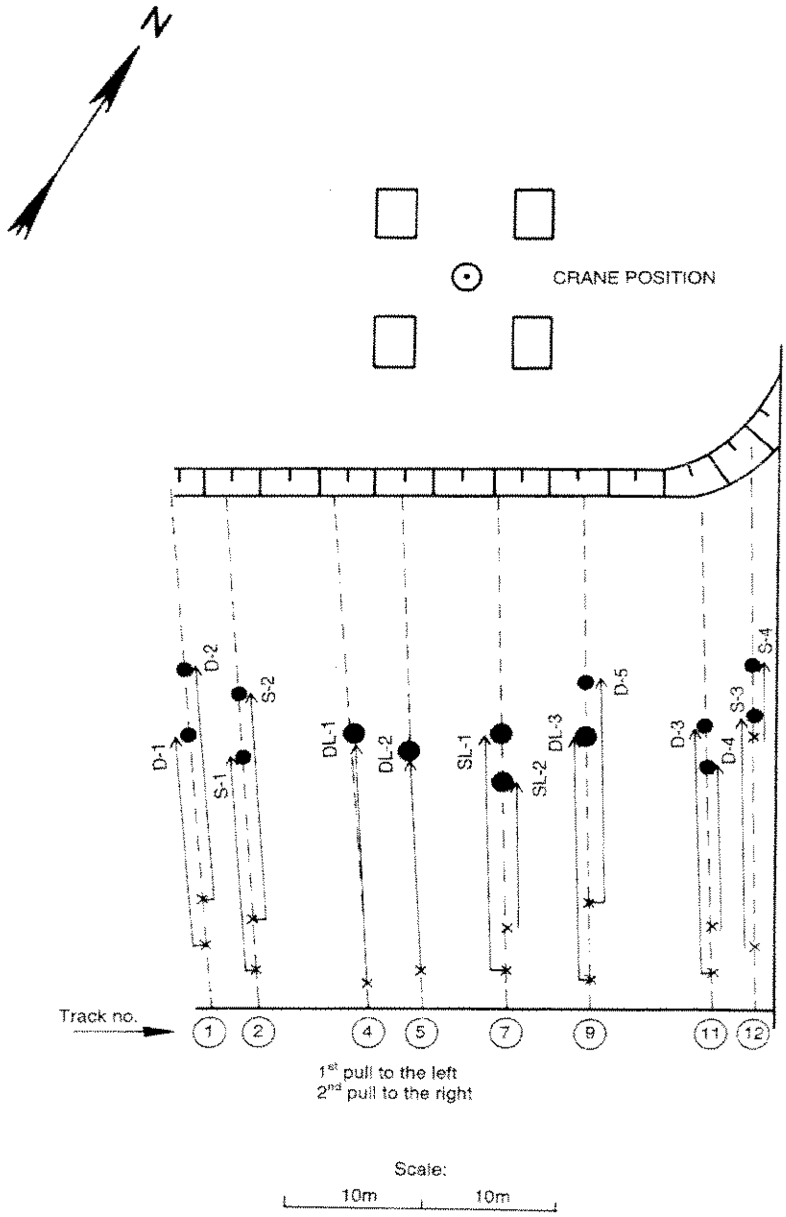


Figure 4 Test area Onsøy

Figure 4 gives an impression of the arrangement of the anchor tests relative to each other within the test area. The height of the fill, from which the crane and the winch operated, is about 1 m above the level of the actual test area. The trench depth was initially set to 0.7 m, however, the smaller anchors had some problems to penetrate mainly because the dry crust was too hard for the light anchors. The trenches were therefore made approximately 1 m deep.

In addition to recording all the basic parameters during the tests, the effect of varying certain parameters was studied in a few tests.

Interesting effects of reduced speed during penetration and pullout, and of consolidation both on the restart penetration resistance of the anchor and on the pullout resistance were recorded.

4.2 Instrumentation

Figure 5 gives an overview of the parameters, which were measured during the anchor tests. The on-surface system automatically logged the sensors at an interval of about 4 seconds whereas the on-anchor system were logged by a frequency set by the soil turbine at the probe on the anchor, see Chapter 4.2.1. Forces in the pull wire were measured during penetration, triggering, pullout (normal loading) and retrieval of the anchor, and the (uplift) angle of the installation wire at the "roller" was measured during anchor penetration.

In addition, *manual* (time stamped) measurements were taken of the pulled-in length and the moving dip-down point of the installation wire, and of the embedded length of the signal cable. These manual measurements were loaded into the main data base after completion of the tests, each measurement with its corresponding time.

The anchor tests were also video recorded by a professional video photographer, which serves as a general, although not technical, documentation of the tests. An edited video film has been produced for future use and reference.

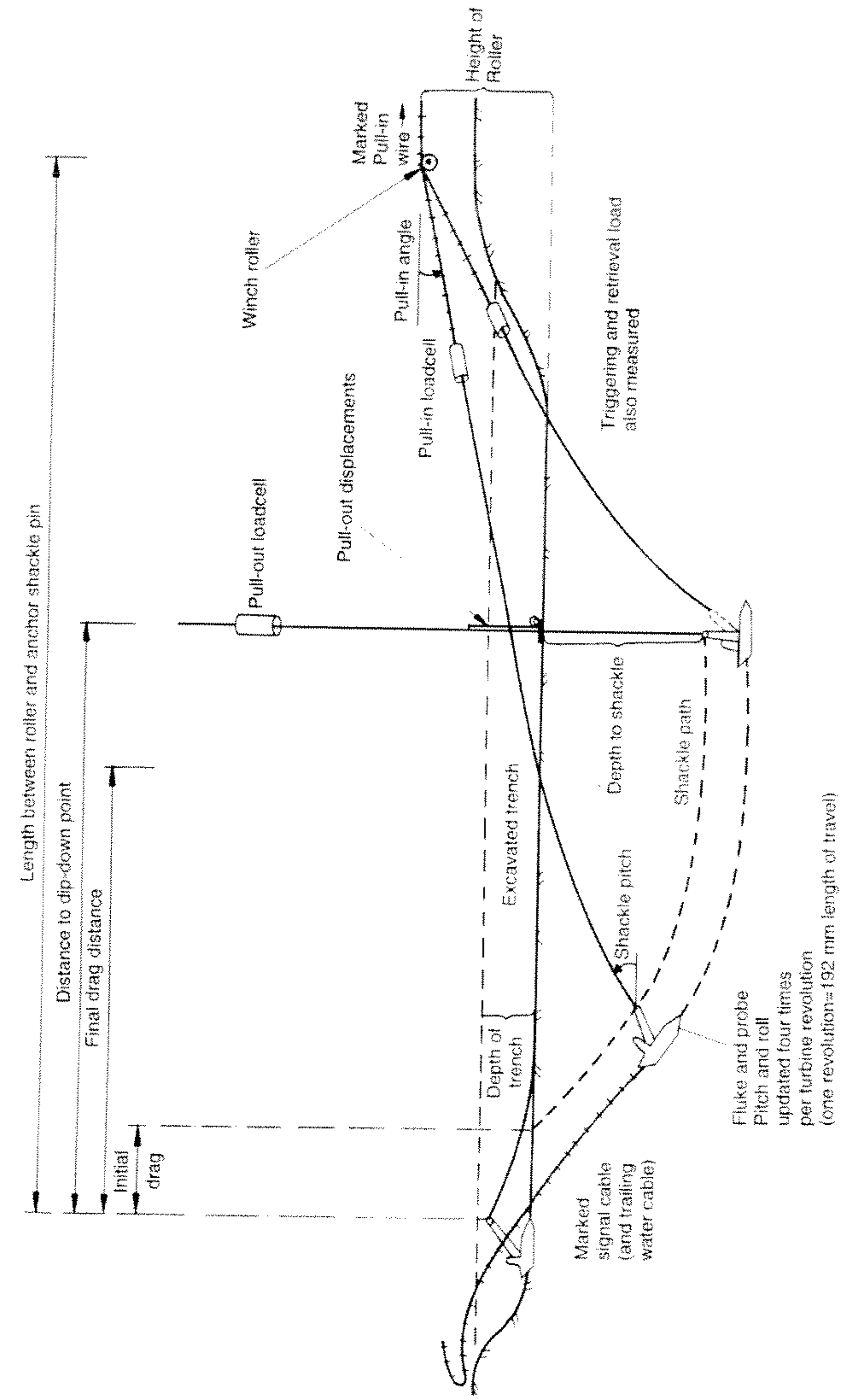


Figure 5 Anchor instrumentation – overview of parameters

4.2.1 On-anchor system

The Bruce Anchor Tracker was used on all the anchor tests carried out at Onsøy (with the exception of the initial embedment tests). The tracker system is based around a laptop PC which reads the angular measurements from four accelerometers at fixed distances along the anchor trajectory. Three accelerometers are positioned in mutually orthogonal axes relative to the anchor fluke and are used to measure fluke pitch, roll and yaw. The fourth accelerometer is housed in a pivot probe mounted underneath the front of the fluke which aligns with the direction of relative soil movements. A soil turbine is rotated by the incident of soil flow as the anchor moves forward. Rotation of the turbine is used to clock the laptop PC which reads the accelerometer outputs two times pr. revolution /2/.

Data was transmitted in real time via the signal cable (umbilical) and displayed on the controlling laptop PC for all tests, and was successfully captured for post-processing on all but the first test (1-D-1). The cause of this failure was a software communication bug, which was corrected for the remaining tests. All other software routines and features performed without problem. The hinge support for the soil turbine (probe) enabled the automatic logging system to produce data also during rotation and pullout of the anchors, with the exception for the distance required for probe reorientation towards a direction perpendicular to the penetration trajectory.

The additional measurements required by DNV from the on-anchor system were load and angle at the shackle, and pressure from the trailed water hose. No load or angle data from the small shackle were recorded due to cable damage in transit. A replacement shackle pin was prepared and sent by courier to the site but it too suffered an electrical fault. Angle data was recorded from the large shackle when it was used and this correlated well with calculated values for the buried cable. Load data was not recorded due to an electrical failure in the strain gauge amplifier circuit built into the load pin.

Water pressure readings were taken on several of the small anchor tests and were good down to about 3.6m depth, beyond which the amplifier saturated and caused some distortion in the other recorded parameters.

The distance increment between readings was designed to be 92mm, however a specific test at the actual site established the value to be 86mm in the prevailing soil conditions. This value was used in all subsequent processing of data. The depth below trench bottom predicted by the tracker system was checked by the water pressure readings mentioned above and by measuring the length of pullout wire between the anchor shackle and the trench bottom before the pullout test. The general conclusion is that the anchor tracker is a reliable instrumentation package, which can be used with confidence in clay.

The recorded embedment trajectories correlated well with the values measured at the surface and provide an excellent back-fitting analysis database.

4.2.2 On-surface system

The actual load cells used were accurate to within 0.1%, but considering the whole instrumentation chain this figure increases to about 1%. For the 10 tonnes, 20 tonnes and 40 tonnes load cells this gives an inaccuracy in the measurements of about 100 kg, 200 kg and 400 kg, respectively. A problem with the data transmission from the 40 tonnes load cell was discovered during two of the pullout tests with the large anchors, which required a correction relying on the measured crane hook load. The correction amounted to about 2 tonnes, which gave results comparable with other tests. In the other large anchor tests the 20 tonnes load cell was used during the pullout test.

The low band width angle transducer used to measure the uplift angle of the pull-in wire was calibrated in the DNV laboratory before the tests and it was found to be accurate to within 0.05°. Due to possible vibrations in the wire during the measurements the overall inaccuracy will be somewhat higher, and a value of 0.1° is considered applicable. The transducer can measure angles within ±45°, which means that the accuracy of the measurements will be ±0.2%.

4.3 Soil conditions

A soil investigation carried out during 1997 at the actual site confirmed the soil data known from previous investigations. The clay undrained direct simple shear (DSS) strength $s_{u,D}$ is constant 10.5 kN/m^2 to about 4 m depth, and increases from thereon with depth at a constant gradient of 1.3, see Figure 6. The clay is thus somewhat overconsolidated to 4 metres depth, from where it is normally consolidated. The thickness of the dry crust was estimated to be 0.7 to 1.0 m in thickness based on the information available. As mentioned in Section 4.1 the ground surface tests at the first day of testing showed that the trench had to be about 1 m deep to reach beyond the dry crust. The sensitivity S_t of the clay varies between 6 and 10 (decreasing with depth), which is slightly more than normally found at the deepwater offshore sites.

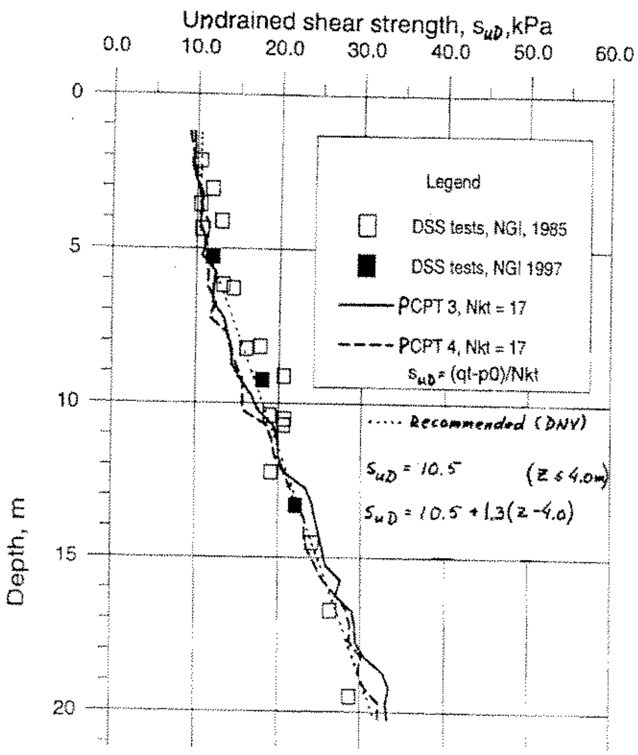


Figure 6 Soil strength profile for Osnøy

4.4 Test results – Installation

4.4.1 Key results

Table 6 shows the key results of the measurement taken during penetration.

Table 6 Key results from anchor penetration at Onsøy

Track & Test	Penetration - DNV measurements					
	Dragged distance	Travelled length [1]	End pull-in speed	Anchor resistance	Depth of trench	Uplift angle [3]
	[m]	[m]	[m/min]	[kN]	[m]	[deg]
1 - D-1	16.2	17.8	2.61	52	0.95	10.7
1 - D-2	18.2	18.8	0.97	50	0.90	14.4
11 - D-3	20.5	24.4	2.86	50	1.10	17.4
11 - D-4	14.0	15.0	2.51	44	1.10	13.6
9 - D-5	17.0	20.0	2.73	53	1.00	18.0
2 - S-1	15.8	16.5	2.73	56	1.20	12.1
2 - S-2	17.1	20.5	1.67	55	0.95	15.2
12 - S-3	19.0	19.8	0.64	52	1.10	12.9
12 - S-4	4.4	N.A.[2]	2.89	51	1.00	12.5
4 - DL-1	19.1	18.5	2.61	97	1.20	14.5
5 - DL-2	17.5	21.0	2.20	98	1.00	14.5
9 - DL-3	17.5	19.0	0.14	78	1.25	13.9
7 - SL-1	17.6	18.8	1.72	82	1.10	6.8
7 - SL-2	10.5	11.7	1.84	80	1.10	12.0

1) Travelled length according to marked signal cable.
2) Signal cable not pulled out prior to testing (continued immediately after pull-out)
3) Uplift angle measured close to the pulling device at end of penetration (≈ uplift at dip-down point)

LEGEND:

Track &Test (Track No.) - (Type/size of test anchor) - (Test No. of that anchor type/size)

D DENLA (small)
DL DENLA (large)

S STEVMANTA (small)
SL STEVMANTA (large)

4.4.2 Line tension vs. depth

Figure 7 through Figure 10 show the increase in line tension versus depth during penetration for all tests where the Bruce Anchor Tracker provided real time information.

Figure 7 shows the results for the large Denla with an excellent repeatability. The effect of a reduced pull-in speed is also very visible in test 9-DL-3, where a drop in pull-in speed from 2.5 m/min to 0.14 m/min gave a decrease in line tension of 22% (corresponding to 18% pr. log cycle)

Figure 8 shows that results for the small Denla. The repeatability is fairly good, except for test 1-D-2 which may have hit some wooden material. The decreasing line tension with depth in all tests except 11-D-3 is due to interference with the pullout zone from the previous anchor test in the same trench. For test 1-D-2 it appears that the anchor shackle is raised (moved upwards) within this zone. When entering new undisturbed soil the tension gradually increases. At the end of penetration a line tension gradient with depth which corresponds to the trend from the first test in the trench can be found.

Figure 9 shows that results for the large Stevmanta. Test 7-SL-1 were penetrated only to a small depth and stopped for consolidation over the weekend. The fluke had a pitch angle of about 24° when the anchor was stopped, i.e. a rather steep penetration that gave room for further penetration after the weekend of consolidation. Both the tests with the large Stevmanta hit wooden material and came up with a piece of wood. For test 7-SL-1 the wood impact took place some fluke lengths of drag distance after restart of the anchor. No information from the tracker was available after the weekend of consolidation as the power supply only lasted for about 24 hours.

Figure 10 shows the results for the small Stevmanta. The water hose was fitted on all the tests. The results are somewhat scattered, but the depth measurement can only be said to be reliable down to about 3.6 m because of problems with the water pressure cell which affected the other results from the tracker, see brief discussion in Section 4.6.3. The trend down to about this depth is extrapolated down to a fit with the line tension from on-surface measurements.

Figure 11 shows the anchor probe trajectories in trench no. 9 as a reference for the drop in line tension that can be seen for the second test in a trench, see also Figure 4.

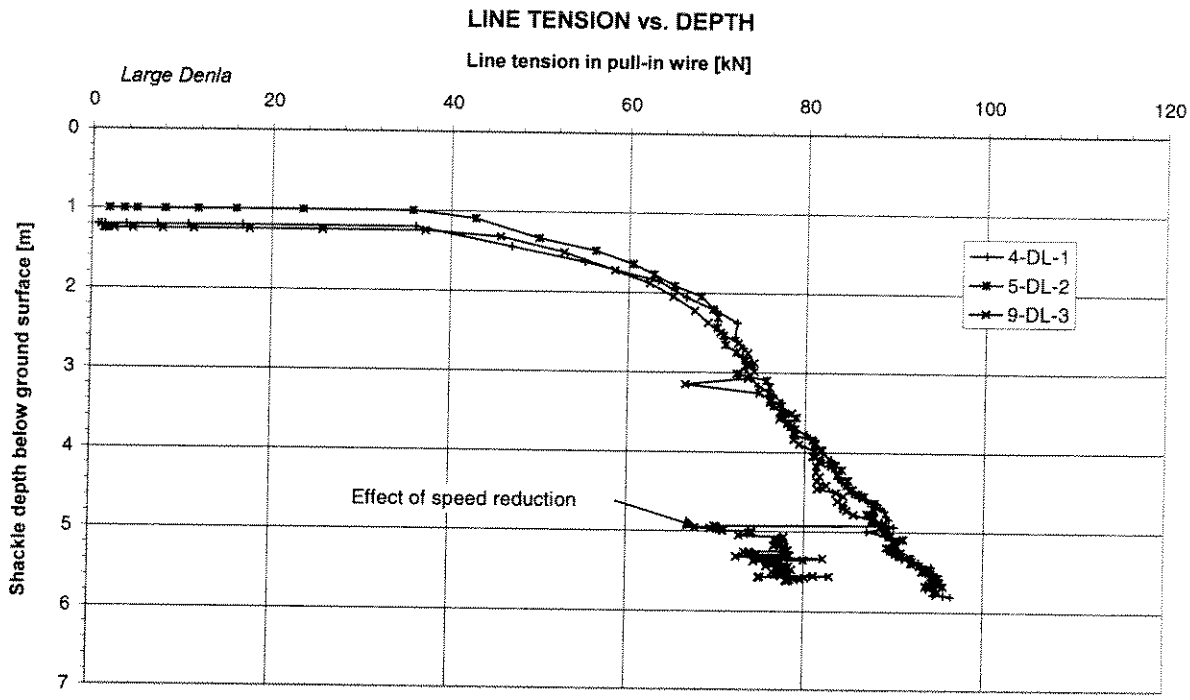


Figure 7 Large Denla – Line tension vs. depth

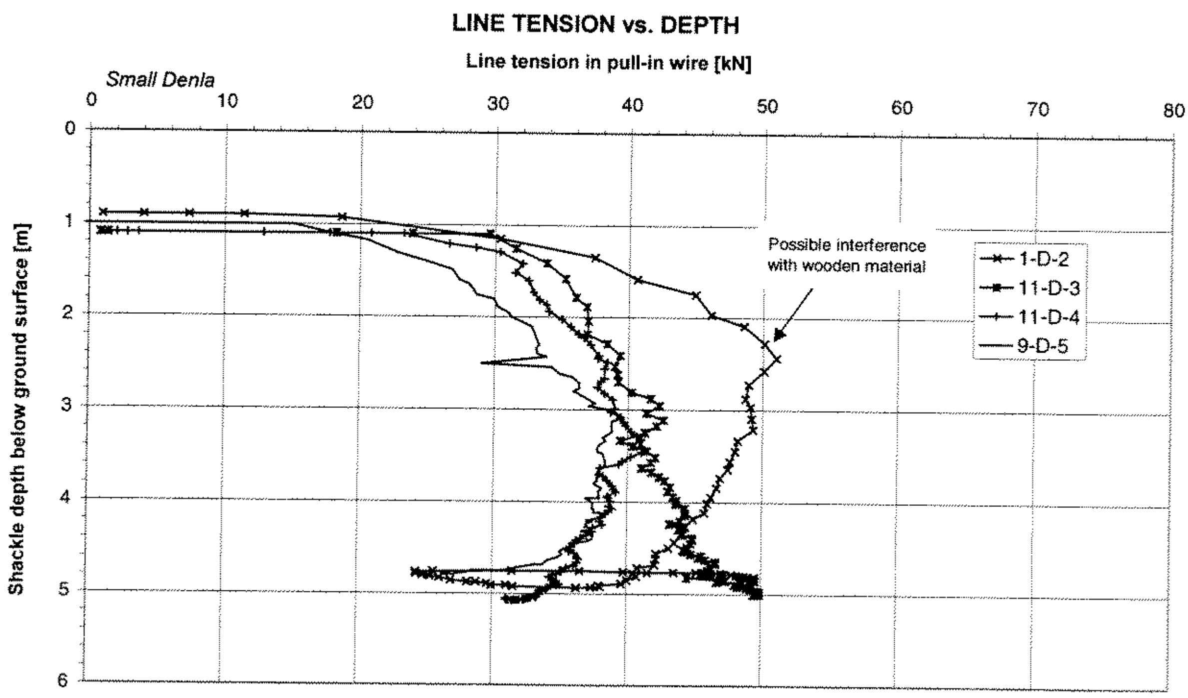


Figure 8 Small Denla – Line tension vs. depth

No.	Length [m]	Type	Diam. [m]	Width [m]	Circum. [m]	Weight_air [kN/m]	Weight_sub [kN/m]	EA [kN]	dL(water) [m]	dL(soil) [m]
1	853.00	1	.073	.073	.229	.282	.226	.293E+06	.50	.200

Depths

Range : .00 -20.00 m
Step : NA

Anchor

Anchor type: Drag embedment
Anchor name: Vryhof Stevmanta
Fluke/Shank angle before scaling: 43.79 (Connection/Back/Tip)

Moment equilibrium : Must be found

Fluke mode allowed : Restraint

Line connection:

X = 2.98
Z = 2.86
Grp : 2

Anchor tip:

X = 1.93
Z = .00
Grp : 1

Anchor back:

X = .00
Z = .00
Grp : 1

Weight data:

W = 36.30 kN

COG X = .34
Z = -.20

Anchor groups: 2

No.	Definition
1	Fluke
2	Shanck

Anchor members: 20

No.	Group	Nodes	Cross section shape Side	Front	F.Area	X	Y	Z
1	1	9	2	1	.514	.00	-.84	.00
						.00	.84	.00
						1.16	1.12	.00
						1.93	.84	.00
						1.93	.75	.00
						1.16	.00	.00
						1.93	-.75	.00
						1.93	-.84	.00
						1.16	-1.12	:00

Note: Coordinate direction changed compared to input

No.	Group	Nodes	Side	Front	F.Area	X	Y	Z
2	1	3	1	1	.170	.00	-.84	.00
						1.16	-1.12	.00

						.00	-1.69	-.42

Note: Coordinate direction changed compared to input

3	1	3	1	1	.170	.00	1.69	-.42
						1.16	1.12	.00
						.00	.84	.00
4	1	3	1	1	.000	.00	-.84	-.42
						.00	-1.69	-.42
						-.64	-1.08	-.67

Note: Coordinate direction changed compared to input

5	1	3	1	1	.000	.00	.84	-.42
						.00	1.69	-.42
						-.64	1.08	-.67

Note: Coordinate direction changed compared to input

6	1	4	1	1	.000	.00	-.84	-.37
						-.23	-.89	-.37
						-.13	.00	-.23
						.00	.00	-.23
7	1	4	1	1	.000	.00	.84	-.37
						.00	.00	-.23
						-.13	.00	-.23
						-.23	.89	-.37

Note: Coordinate direction changed compared to input

8	1	5	1	1	.000	.00	-.84	-.37
						.00	-.84	-.54
						-.69	-1.07	-.87
						-.77	-1.11	-.74
						-.64	-1.06	-.60

Note: Coordinate direction changed compared to input

9	1	5	1	1	.000	.00	.84	-.54
						-.69	1.07	-.87
						-.77	1.11	-.74
						-.64	1.06	-.60
						.00	.84	-.37
10	1	5	1	1	.029	.00	-.84	-.54
						.60	-.84	-.30
						2.11	-.84	-.08
						1.93	-.84	.00
						.00	-.84	-.36

Note: Coordinate direction changed compared to input

11	1	5	1	1	.029	.60	.84	-.30
						2.11	.84	-.08
						1.93	.84	.00
						.00	.84	-.36
						.00	.84	-.54
12	1	5	1	1	.044	.44	.84	.00
						.30	.79	.23
						.00	.78	.30
						-.05	.79	.23
						.00	.84	.00
13	1	5	1	1	.044	.00	-.84	.00
						.44	-.84	.00
						.30	-.79	.23
						.00	-.78	.30
						-.05	-.79	.23

Note: Coordinate direction changed compared to input

14	1	5	1	1	.023	1.34	.84	.00
						1.75	.84	.00
						1.64	.79	.23
						1.54	.78	.30

						1.44	.79	.23
Note:	Coordinate direction changed compared to input							
15	1	5	1	1	.023	1.75	-.84	.00
						1.34	-.84	.00
						1.44	-.79	.23
						1.54	-.78	.30
						1.64	-.79	.23
Note:	Coordinate direction changed compared to input							
16	2	7	1	1	.047	1.84	.00	2.39
						2.04	.00	2.61
						3.00	.00	3.04
						3.06	.00	2.92
						2.61	.00	2.25
						2.33	.00	2.33
						2.04	.00	2.12
17	2	4	1	1	.170	.22	.81	.15
						.27	.81	.15
						2.64	.00	2.43
						2.59	.00	2.43
Note:	Coordinate direction changed compared to input							
18	2	4	1	1	.093	1.54	.81	.15
						1.57	.81	.15
						3.01	.00	2.68
						2.98	.00	2.68
Note:	Coordinate direction changed compared to input							
19	2	4	1	1	.170	.22	-.81	.15
						2.59	.00	2.43
						2.64	.00	2.43
						.27	-.81	.15
20	2	4	1	1	.093	1.54	-.81	.15
						2.98	.00	2.68
						3.01	.00	2.68
						1.57	-.81	.15

Interaction parameters:

Line	Nc	=	Default
	Fmud	=	0.7/0.2
	Femb	=	.30
Anchor	Nc	=	Default
	F	=	1.00

No scaling.

SUMMARY OF CALCULATIONS :

Dep	Tension								Penetr.		Lengths				Distances			
	Fairlead		Seabed				Anchor		Dir.	Orien.	Susp	Seab	Embd	Pull	Susp	Seab	Embd	Pen.
	TF	AngF	TTD	AngTD	TDD	AngDD	TA	AngA	AngD	AngO	LS	LM	LE	LP	DS	DM	DE	DP
.1	120	34.2	99	.0	74	.0	74	4.0	133.0	133.0	299	550	3	0	280	550	3	.1
1.0	179	27.8	158	.0	137	.0	134	11.1	125.0	125.0	371	470	12	0	355	470	12	1.3
2.0	265	22.8	244	.0	227	.0	222	12.5	125.0	125.0	456	376	21	0	443	376	21	2.8
3.0	361	19.5	340	.0	327	.0	320	14.1	118.0	118.0	533	289	30	0	523	289	30	4.4
4.0	451	17.4	430	.0	420	.0	411	16.1	116.0	116.0	599	216	38	0	590	216	38	6.4
5.0	539	16.0	518	.0	511	.0	500	18.0	114.0	114.0	657	150	46	0	648	150	45	8.5
6.0	627	14.8	606	.0	602	.0	589	19.8	112.0	112.0	709	92	53	0	701	92	52	10.9
7.0	712	13.8	691	.0	690	.0	675	21.3	110.0	110.0	754	40	59	0	747	40	59	13.5
8.0	802	13.0	781	.2	781	.2	765	23.0	109.0	109.0	790	0	64	0	783	0	63	16.3
9.0	893	12.4	873	.8	873	.8	856	24.3	108.0	108.0	790	0	64	0	784	0	63	19.3
10.0	979	11.9	958	1.4	958	1.4	941	25.9	106.0	106.0	789	0	66	0	783	0	65	22.6

11.0	1069	11.5	1048	1.9	1048	1.9	1031	27.1	105.0	105.0	787	0	68	0	781	0	66	26.2
12.0	1149	11.1	1129	2.3	1129	2.3	1111	28.5	103.0	103.0	786	0	70	0	779	0	68	30.2
13.0	1351	10.5	1331	3.0	1331	3.0	1312	28.6	105.0	105.0	784	0	72	0	778	0	70	34.2
14.0	1439	10.3	1418	3.2	1418	3.2	1398	29.8	103.0	103.0	782	0	74	0	776	0	72	38.2
15.0	1539	10.1	1518	3.5	1518	3.5	1498	30.9	102.0	102.0	780	0	77	0	774	0	75	42.7
16.0	1633	9.9	1612	3.7	1612	3.7	1591	31.9	101.0	101.0	778	0	79	0	772	0	77	47.6
17.0	1725	9.7	1704	3.9	1704	3.9	1682	33.0	100.0	100.0	776	0	81	0	770	0	79	53.0
18.0	1821	9.6	1800	4.1	1800	4.1	1778	34.1	99.0	99.0	774	0	84	0	768	0	81	59.0
19.0	1913	9.4	1892	4.2	1892	4.2	1869	35.1	98.0	98.0	771	0	86	0	766	0	83	65.7
20.0	2002	9.3	1982	4.3	1982	4.3	1958	36.1	97.0	97.0	769	0	88	0	764	0	85	73.3

SUMMARY OF ANCHOR PERFORMANCE :

Depth	Anchor tension		Resistance contributions decomposed in pull direction					Restraint	
	TA	AngA	%tip	%slide	%weight	%Nfluke	%bearing	%Nf	%|N|f
.1	74	4.0	54.5	10.7	3.4	34.4	-2.9	0	0
1.0	134	11.1	40.5	9.4	5.2	50.5	-5.6	43	44
2.0	222	12.5	35.8	8.2	3.5	58.3	-5.8	56	57
3.0	320	14.1	40.1	9.2	2.8	51.9	-4.0	47	85
4.0	411	16.1	39.4	9.0	2.4	52.9	-3.9	47	85
5.0	500	18.0	39.1	8.9	2.2	53.5	-3.8	47	87
6.0	589	19.8	39.0	8.9	2.1	53.6	-3.7	48	88
7.0	675	21.3	39.3	8.9	2.0	53.3	-3.5	48	88
8.0	765	23.0	38.5	8.7	1.8	54.7	-3.7	49	84
9.0	856	24.3	38.0	8.6	1.7	55.5	-3.8	49	84
10.0	941	25.9	38.3	8.7	1.7	55.0	-3.6	49	84
11.0	1031	27.1	38.0	8.6	1.6	55.5	-3.7	49	84
12.0	1111	28.5	38.6	8.7	1.6	54.5	-3.5	49	84
13.0	1312	28.6	33.7	11.5	1.3	57.4	-3.9	54	83
14.0	1398	29.8	34.4	11.8	1.3	56.0	-3.6	52	82
15.0	1498	30.9	34.1	12.0	1.2	56.4	-3.6	53	82
16.0	1591	31.9	34.1	11.9	1.2	56.5	-3.6	53	82
17.0	1682	33.0	34.1	11.8	1.2	56.6	-3.6	53	82
18.0	1778	34.1	33.9	11.7	1.1	56.9	-3.7	53	82
19.0	1869	35.1	33.9	11.6	1.1	57.0	-3.7	54	83
20.0	1958	36.1	34.0	11.6	1.1	57.0	-3.7	54	83

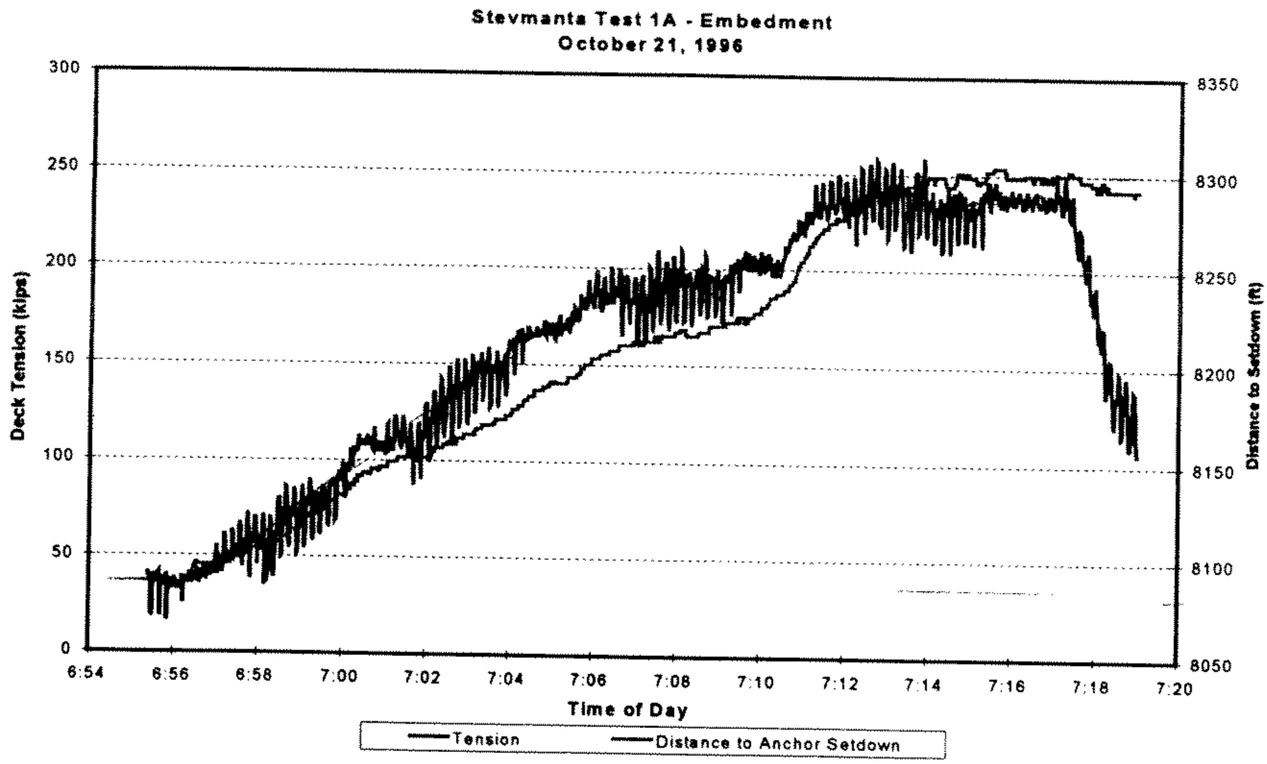
DEFINITION OF LISTED PARAMETERS:

- Depth : Depth of anchor attachment point (shackle pin) [m]
- TF : Tension at fairlead (upper end of mooring line) [kN]
- TTD : Tension at touch down point [kN]
- TDD : Tension at dip down point [kN]
- TA : Tension at anchor attachment point [kN]
- AngF : Line angle at fairlead (from horizontal) [deg]
- AngTD : Line angle at touch down point (from hor.) [deg]
- AngDD : Line angle at dip down point (from hor.) [deg]
- AngA : Line angle at anchor attachment point (from hor.) [deg]
- AngD : Penetration direction of anchor (from vertical) [deg]
- AngO : Fluke orientation (from ver.) [deg]
- LS : Length of suspended anchor line [m]
- LM : Length of anchor line on seabed [m]
- LE : Length of anchor line embedded in soil [m]
- LP : Length of anchor line pulled in on pulling device [m]
- DS : Distance of suspended anchor line [m]
- DM : Distance of anchor line on seabed = LM [m]
- DE : Distance of anchor line embedded in soil [m]
- DP : Dragging distance of anchor from seabed intercept [m]

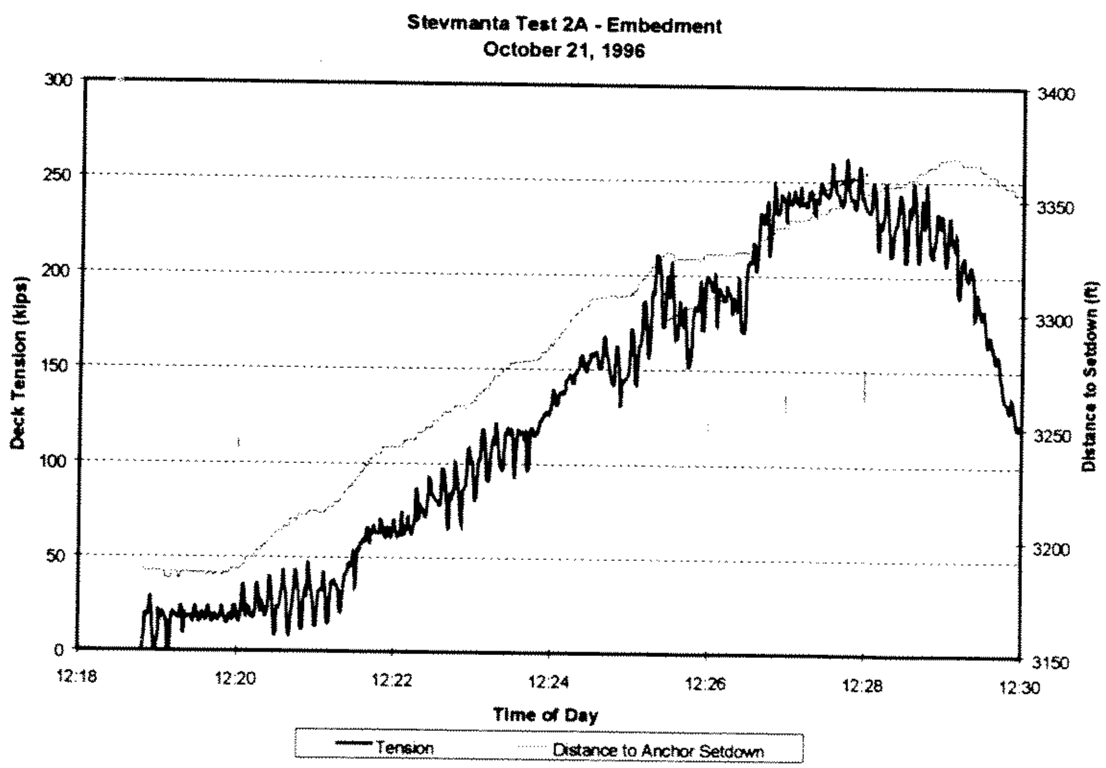
- %tip : Tip resistance in percent of TA [%]
- %slide : Sliding resistance in percent of TA [%]
- %weight : Anchor weight in percent of TA [%]

```
%normal    : Normal resistance in percent of TA                   [%]
%intern    : Normal resistance on members not defined as fluke
             (e.g. internal forces) in percent of TA              [%]
%Nfluke    : Restraint (normal resistance) on fluke members       [%]
%Nf        : Mobilized normal stresses on fluke in percent of
             maximum normal stresses on fluke                     [%]
%|N|f      : Mobilized normal stresses (absolute value) on fluke
             in percent of maximum normal stresses on fluke       [%]
```

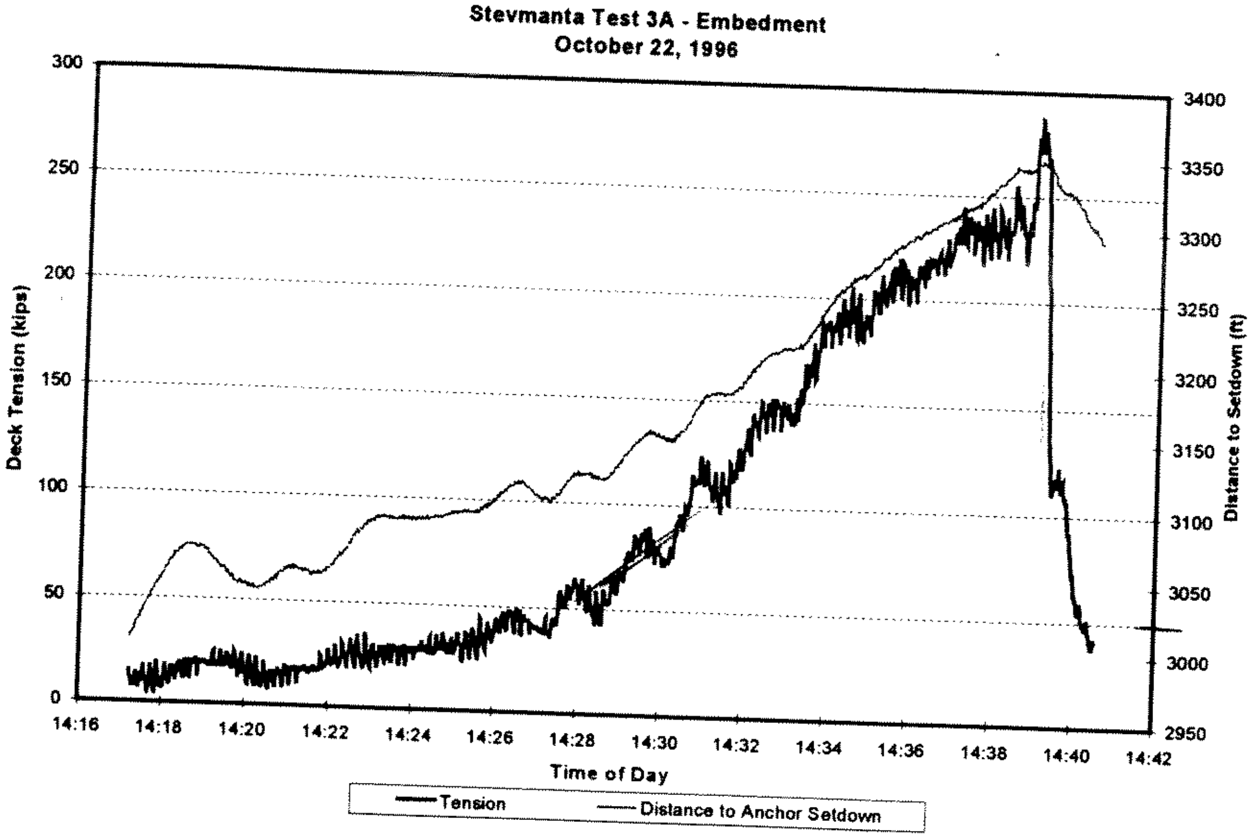
Program completed at Time   :19:23:01



Stevmanta Test 1A - Embedment
October 21, 1996
Deck Tension (kips)
Distance to Setdown (ft)
0
50
100
150
200
250
300
8050
8100
8150
8200
8250
8300
8350
6:54
6:56
6:58
7:00
7:02
7:04
7:06
7:08
7:10
7:12
7:14
7:16
7:18
7:20
Time of Day
Tension
Distance to Anchor Setdown



Stevmanta Test 2A - Embedment
October 21, 1996
Deck Tension (kips)
Distance to Setdown (ft)
0
50
100
150
200
250
300
3150
3200
3250
3300
3350
3400
12:18
12:20
12:22
12:24
12:26
12:28
12:30
Time of Day
Tension
Distance to Anchor Setdown



Stevmanta Test 3A - Embedment
October 22, 1996
Deck Tension (kips)
Distance to Setdown (ft)
Time of Day
Tension
Distance to Anchor Setdown
300
250
200
150
100
50
0
3400
3350
3300
3250
3200
3150
3100
3050
3000
2950
14:16
14:18
14:20
14:22
14:24
14:26
14:28
14:30
14:32
14:34
14:36
14:38
14:40
14:42

APPENDIX
B
ANCHOR CALIBRATION - PETROBRAS DATA

NOT INCLUDED

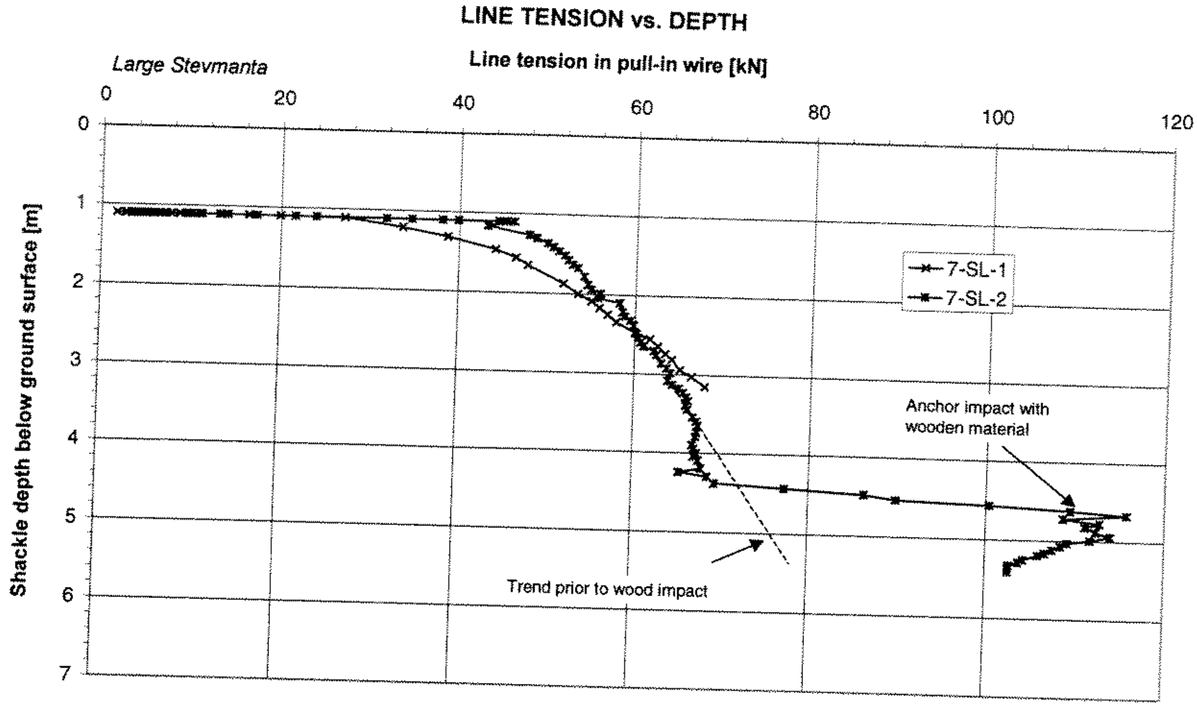


Figure 9 Large Stevmanta – Line tension vs. depth

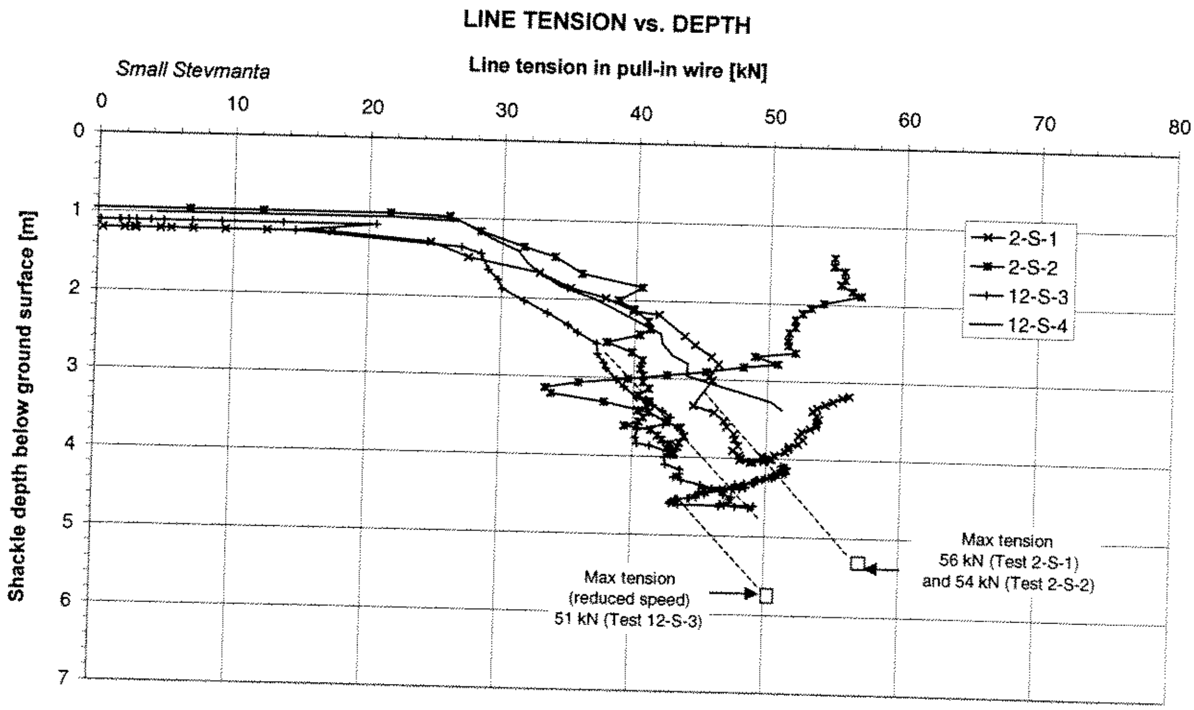


Figure 10 Small Stevmanta - Line tension vs. depth

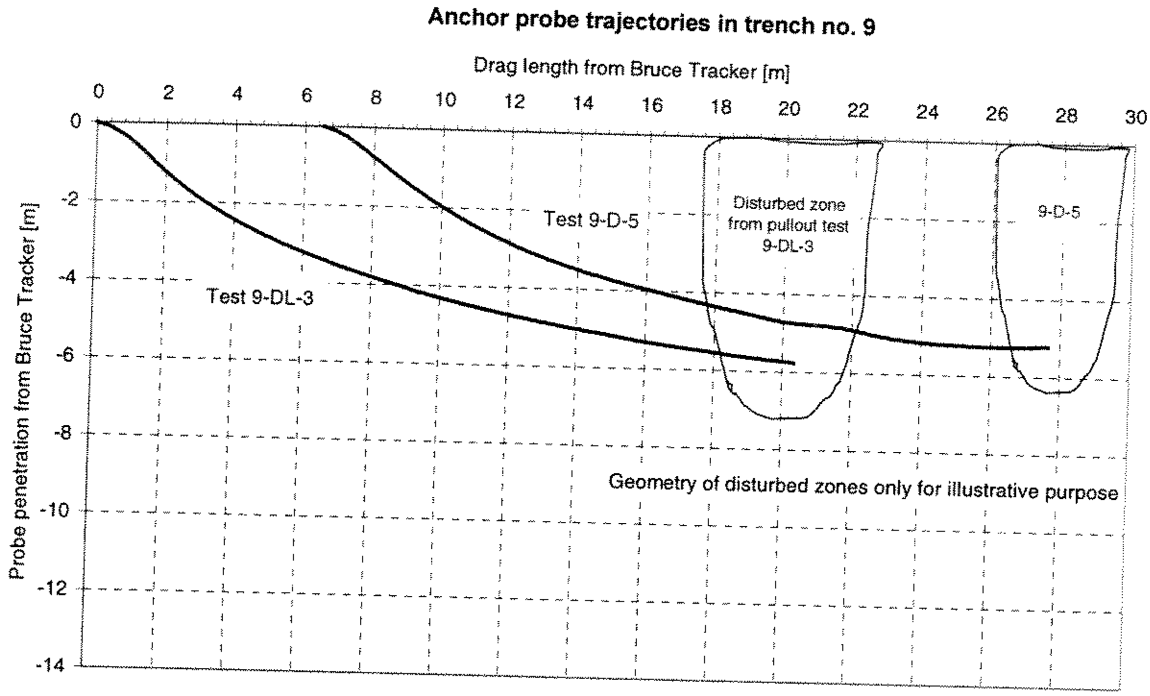


Figure 11 Anchor probe trajectories in trench no. 9

4.4.3 Restart of anchor (consolidation)

Figure 12 shows the measured line tension during embedment for anchor 7-SL-1, with a final tension of 8.4 mT (82 kN). There are no indications of the anchor being in contact with wooden material at this point.

Figure 13 shows the measured line tension after restart of the anchor. It can be seen that the restart level is about 11.5 mT (113 kN). This represent an increase of about 38 %. As the anchor starts to move a gradual drop can be seen, but the anchor hit some wooden material and the line tension continued to increase. 2 minutes after the tests the anchor passed the problems and continued to pick up resistance with a slight decreasing gradient with time. The pull-in speed was constant during this test.

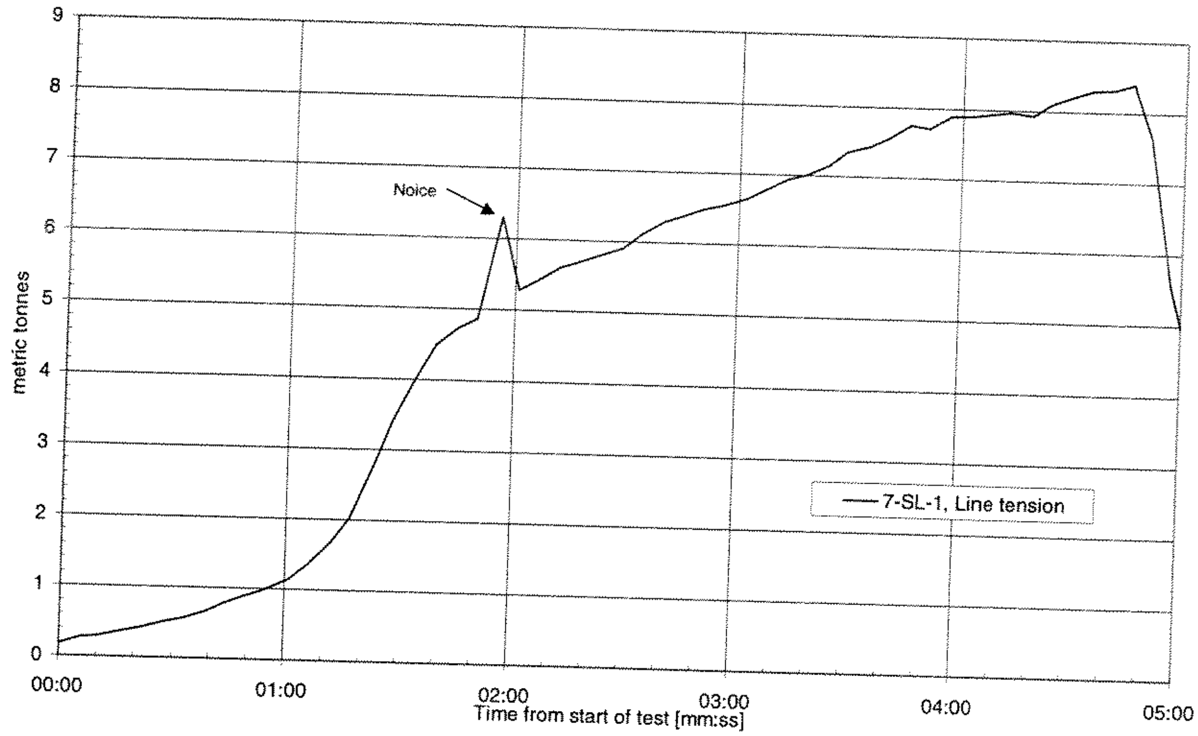


Figure 12 Measured line tension during embedment for anchor 7-SL-1

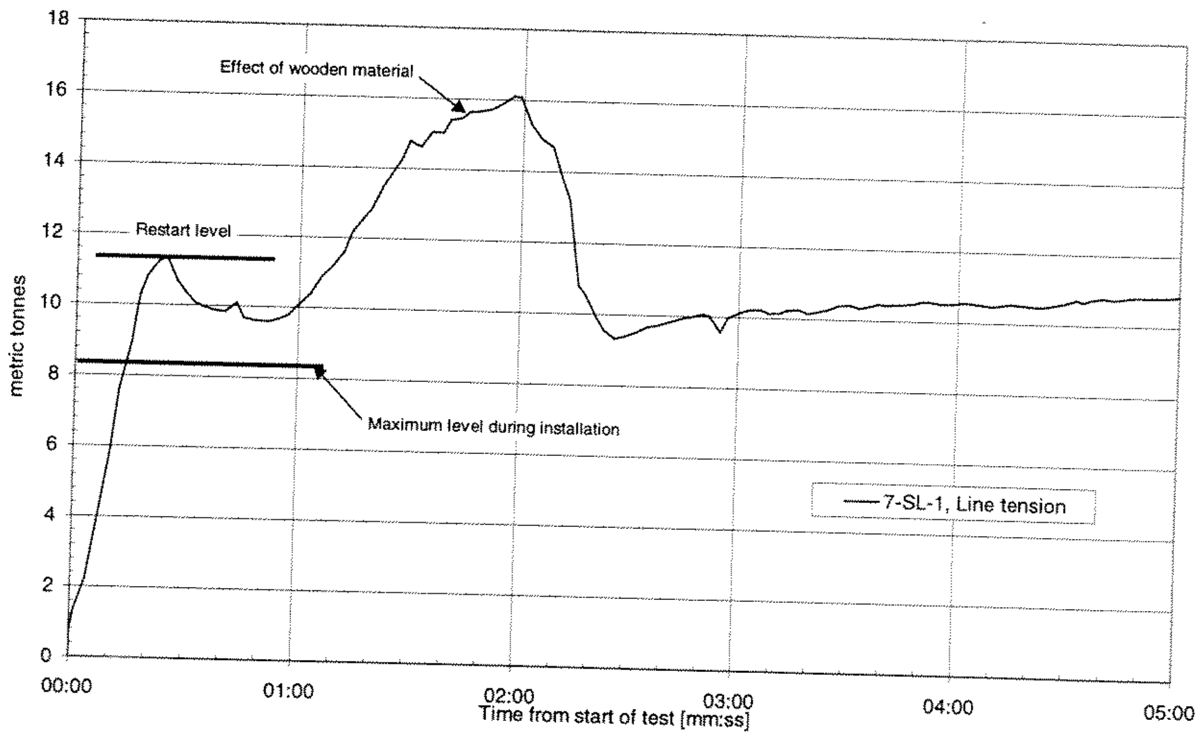


Figure 13 Line tension needed for restart of anchor after 60 hours of consolidation

4.5 Test results – Pull-out

4.5.1 Key results

Table 7 shows the key results from the pullout tests at Onsøy.

Table 7 Pull-out performance at Onsøy

Track & Test	Pullout - DNV measurements						
	Penetration of shackle	Pullout speed	Failure displacement	Time to failure	Failure resistance	Residual resistance	Performance ratio
	[m]	[m/min]	[m]	[min]	[kN]	[kN]	[-]
1 - D-1	4.05	N.A. 1)	N.A. 1)	N.A. 1)	100	N.A. 1)	1.96
1 - D-2	4.58	0.38	0.42	1.1	119	111	2.46
11 - D-3	4.60	0.22	0.43	1.9	83	85	1.75
11 - D-4	4.30	0.14	0.15	1.0	82	81	1.91
9 - D-5	5.00	0.39	0.37	1.0	89	98	1.76
2 - S-1	5.00	0.10	0.17	1.7	102	103	1.85
2 - S-2	5.45	0.49	0.63	1.3	103	92	1.95
12 - S-3	5.80	0.33	0.52	1.6	90	98	1.80
12 - S-4	2.45	0.05	0.36	6.7	76	75	1.52
4 - DL-1	5.30	0.24	0.32	1.3	211	148	2.26
5 - DL-2	5.80	0.34	0.33	1.0	213	194	2.24
9 - DL-3	5.20	0.37	0.37	1.0	192	171	2.53
7 - SL-1	4.80	0.13	0.16	1.2	203	209	2.49
7 - SL-2	3.30	0.31	0.23	0.7	159	182	2.03

1) Failure displacement not recorded.

LEGEND:

Track &Test (Track No.) - (Type/size of test anchor) - (Test No. of that anchor type/size)

D DENLA (small)
DL DENLA (large)

S STEVMANTA (small)
SL STEVMANTA (large)

4.5.2 Bearing capacity coefficient vs. depth

Figure 14 shows the 'as tested' bearing capacity factor (N_c*) from all tests at Onsøy. The bearing capacity factor was found to have a quite large range (from about 9 to 13) with an average value of 10.1.

The bearing capacity factor is given the following definition:

$$N_c * = \frac{R_{pi}}{s_u \cdot A}$$

where

R_{pi} - the as tested pullout resistance at failure (clear increase in pullout speed)

s_u - intact direct simple shear strength at depth of plate

A - projected area of fluke (1.4 m^2 for large anchors and 0.7 m^2 for small anchors)

The majority of the tests are performed at the same speed, being somewhat lower than offshore loading, but certainly above the reference time for a static test in the laboratory. Since loading speed was found to have a noticeable impact on the penetration resistance, an effect of this could also be expected for the pullout test. The test equipment did not allow for running the tests at a set speed, but in one of the tests the speed was reduced quite much (ref. test 12-S-4). Comparing this test with the previous one in the same trench and with the same anchor (12-S-3), one might expect that the deviation in bearing capacity factor is due to speed alone since both tests were performed beyond the depth for maximum bearing capacity factor. The calculated bearing capacity factors in the two tests are 9.06 and 9.91, for the 12-S-4 and 12-S-3, respectively. The deviation in loading speed (or strain speed) for the two tests is a factor of 6.05, giving an increase of 9.4%. Compared to increase pr. log-cycle this represent 12%.

Quite interesting this effect of loading rate has also been found for the Troll clay offshore Norway, and by comparing the strain rate for the anchor tests at Onsøy with those derived from static and cyclic triaxial tests on the Troll clay it has been possible to relate, at least approximately, the pullout resistance at Onsøy to a static resistance. It appears that the pullout resistance for the anchors at Onsøy include a loading rate effect of about 25%.

The static resistance is given the following definition:

$$R_s = \beta \cdot R_{pi} = \eta \cdot (N_c \cdot s_u \cdot A)$$

where

β - factor accounting for the difference in rate of loading compared to a static test = 0.8.

η - empirical coefficient accounting for the combined effect of soil remoulding and eccentric/ inclined loading

N_c - theoretical bearing capacity coefficient $N_c = N_{c\,Plane\,strain} \cdot (1 + B/L \cdot 0.19) = 13.8$

s_u - intact direct simple shear strength at depth of plate

A - projected area of fluke (1.4 m^2 for large anchors and 0.7 m^2 for small anchors)

Figure 15 shows the combined effect of soil remoulding and eccentric/inclined loading as can be found when scaling the measured pullout resistance down to a static resistance using the above equation.

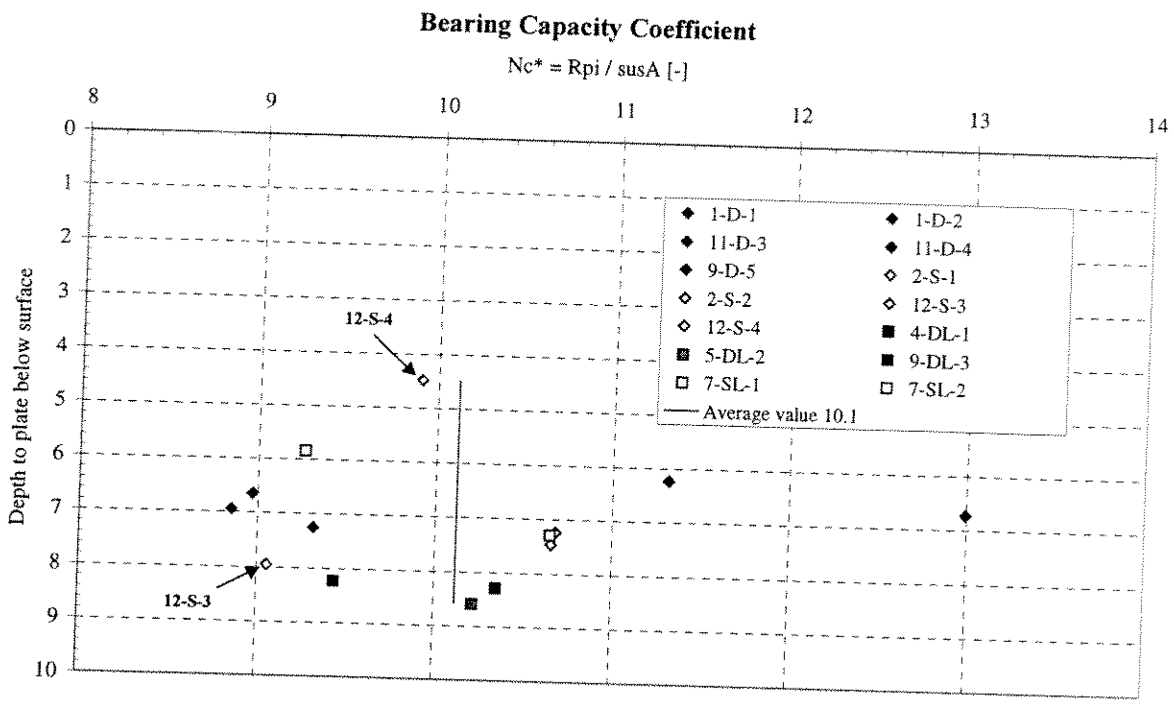


Figure 14 Bearing capacity factor as function of plate depth below ground surface

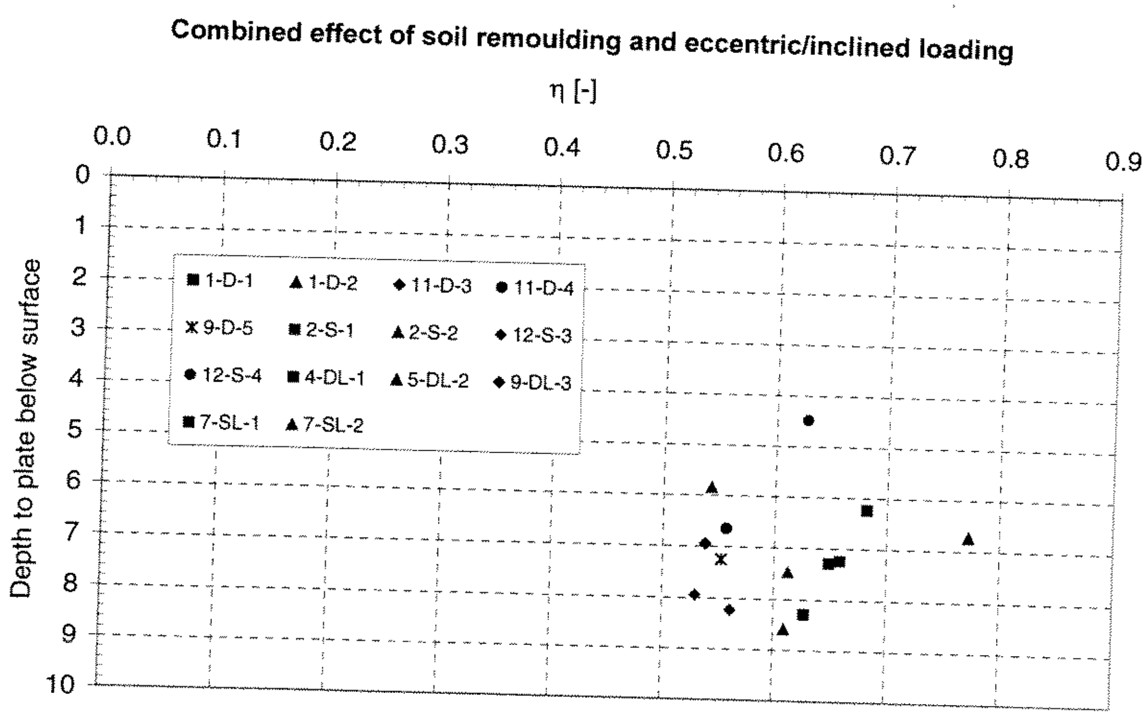


Figure 15 Range of the empirical factor accounting for soil remoulding and inclined load

Figure 16 shows a typical orientation of the anchor when starting the pullout test. The testing procedure adopted at Onsøy, which aimed to position the crane straight above the anchor, and then pulling vertically, will in many cases give an eccentric reaction. For the large Denla the fluke orientation was about 12.5 degrees from the horizontal, and the eccentricity introduced by applying a pull normal to the trench, may have given rise to an eccentricity of about 0.3 metres in front of the centre of area. This may have reduced the theoretical bearing capacity factor somewhat.

Another reason for this rather large correction could be due to the strain softening effect on undrained shear strength. The various ways of shearing the soil to failure in a pullout test may lead to a progressive collapse if the peak anisotrophic shear strength is achieved at different strain levels. It is thus likely that the maximum resistance can be found at a strain where some of the soil is partly remoulded and some is not fully mobilised since strain compatibility needs to be achieved in the failure surface.

Both areas need to be further evaluated to get a full grip on the mechanisms governing for the pullout resistance.

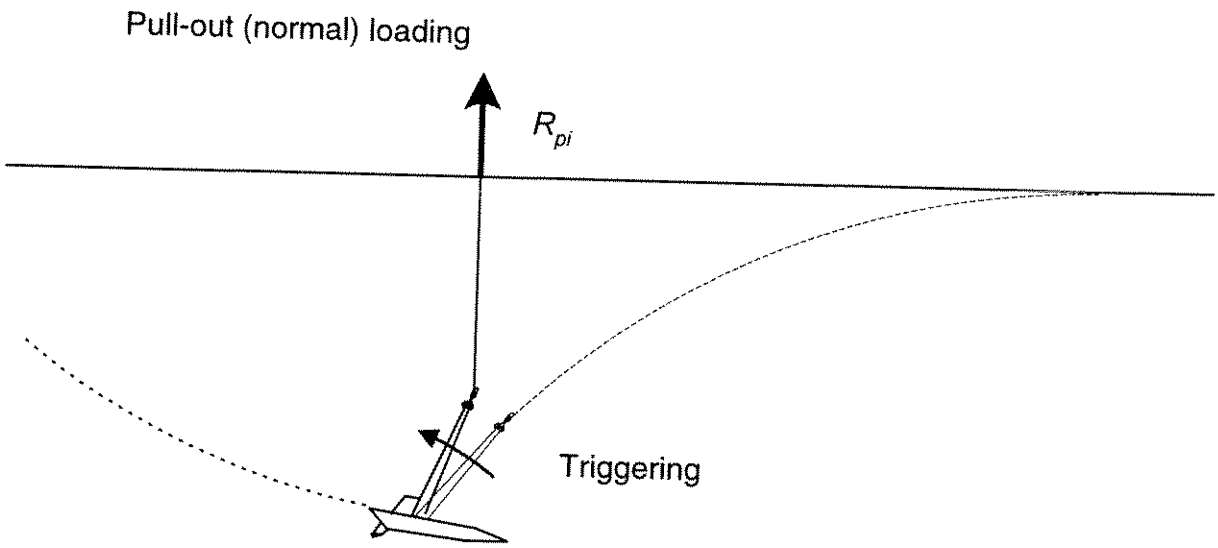


Figure 16 Typical orientation of large Denla during pull-out test.

4.6 Verification of Bruce Anchor Tracker

4.6.1 Introduction

The Bruce Anchor Tracker was checked in two separate ways. Firstly by surface measurements and secondly by a water pressure readings down at the anchor.

4.6.2 Verification based on surface measurements

Figure 17 shows the deviation in travelled length measured by the tracker as a percentage deviation from the length of the trailing signal cable. It can be seen that the travelled length measured by the tracker is fairly accurate, meaning that the probe is making the number of revolutions it is supposed to.

The range in measurements is within ±15% deviation, with an average of +3.8% (overpredicts the distance). It is the authors' view that the travelled length measurements are probably the most accurate with respect to a direct comparison between manual readings and the Bruce tracker. The flexible signal cable follows the same trajectory as the fluke, and the difference between the cable attachment point and the probe remains constant during penetration. Some initial error may, however, be present as the anchor slides somewhat before it enters the soil. This initial error should result in a slightly longer travelled length for the probe, being in line with the trend recorded.

Figure 18 shows the deviation between the shackle depth (through fluke pitch and probe depth) measured by the tracker and the shackle depth measured before the pullout test, as a percentage deviation of the travelled length.

It can be seen that the penetration depth from the small Denla anchors was overestimated by 0.4 m to 0.9 m (from 2 to 5% of the travelled length). The large Denla showed the opposite trend, underestimating the depth by 0.6 m to 1.3 m (from 3 to 7% of the travelled length). For the Stevmantas the depth to the large anchors are overestimated and the depth to the small anchors underestimated. In both cases with an even larger deviation than found for the Denlas. Knowing that the travelled length is fairly accurate, the uncertainties may be related to either one or a combination of the reasons below:

1) Local soil disturbance at the tracker position effects the pitch of the probe
2) Exact reference level of the probe at beginning of test is uncertain.
3) Pullout wire may not have been entirely straight when the shackle depth measurement was taken, or anchor itself may have moved upwards when preparing for pullout
4) Error in zero readings for fluke pitch

Local soil disturbances around the fluke tip, which may affect the pitch of the probe are believed to give a general trend which either over- or under-estimates the penetration depth. Although this is not found to be the case, one cannot exclude this as an uncertainty.

The depth variations within the trench were accurately measured at three characteristic positions in the trench, showing a general trend of the trench bottom being at the same level (starting position slightly below in some tests).

With respect to the straightness of the pullout wire any significant deviation here would appear on the measured pullout displacements. The overall trend from those measurements is a failure displacement of 0.35 ±0.20 meters. The measurements do not show a clear relation in direction of the larger anchors having the largest displacements, so there are reasons to believe that the straightness of the pullout wire has not been entirely the same for all the anchors. The deviation in failure displacement may also be partly explained by the pullout test not being started just above the anchor in which case the failure displacement will not be pure vertical displacements.

Deviation in the shackle depth appears to be anchor dependent, and it is thus reasonable to believe that the major uncertainty has to do with the placement of the tracker on each anchor and possibly also the zero-readings of the fluke pitch being an input to the software used for processing the measured values (from accelerometer).

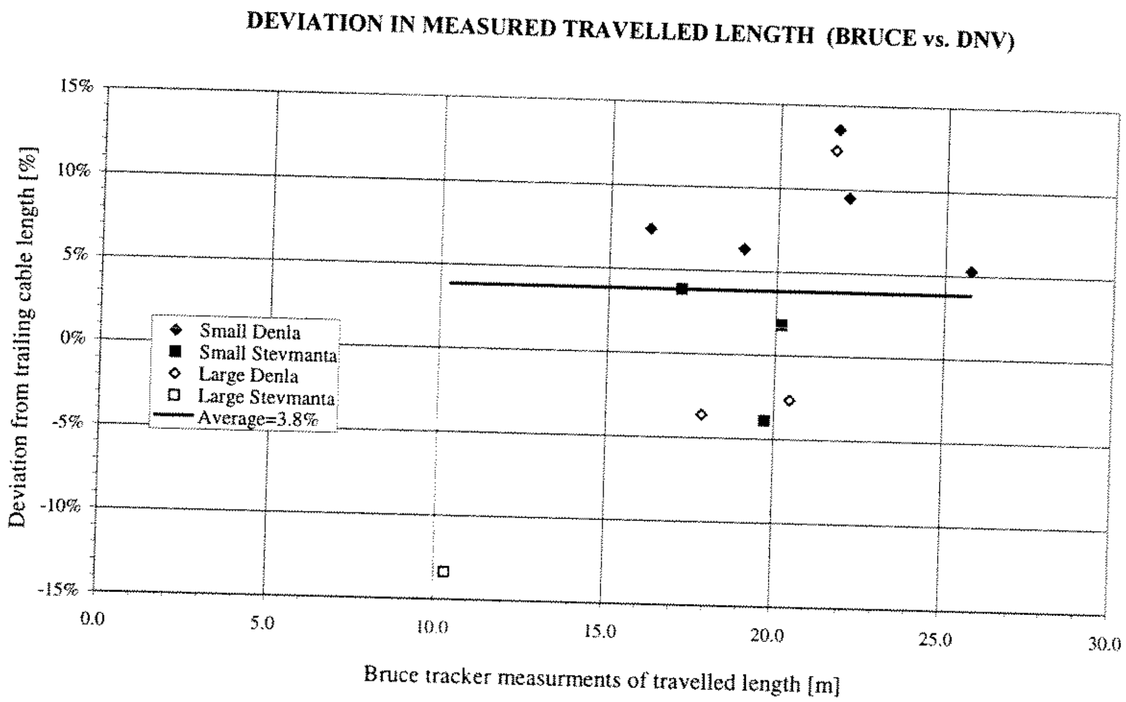


Figure 17 Trend of tracker measurements – Travelled length

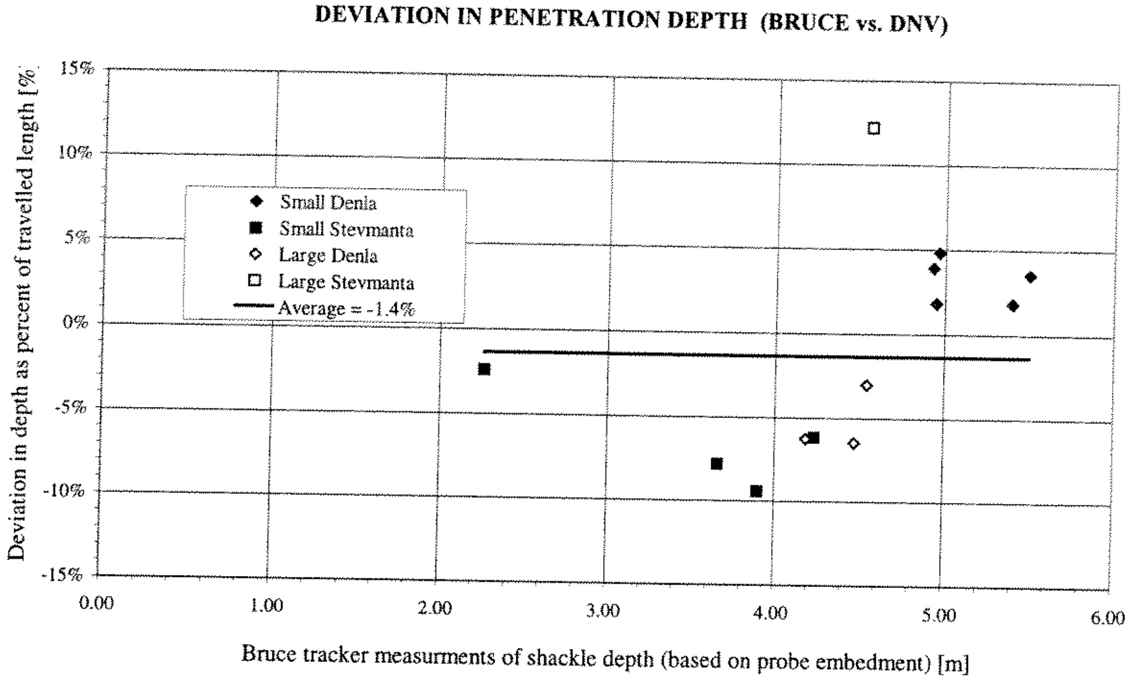


Figure 18 Deviation in measured shackle depth

4.6.3 Verification based on water pressure readings

Figure 20 through Figure 23 show the depth with water pressure readings compared to the depth given by the Bruce Anchor Tracker (through fluke pitch and probe depth). The depth of the probe appears to be accurate for all tests with the small Stevmanta down to the depth recorded, except for tests 12-S-3, where the depth is somewhat underestimated by the Bruce anchor tracker. For test 12-S-4 the whole penetration is covered. Measurement on the pullout wire after preparing for pullout shows very close agreement (depth of 3.49 m compared to 3.30 m from the probe). For the small Denla, only one test was performed with water pressure readings (1-D-2). Although noise is present along with the readings, it seems as if the depth from the small Denla is also accurate down to the depth recorded.

Detailed analysis of the problem in laboratory conditions after the tests were completed identified that the gain setting for the pressure transducer was too high, causing it to saturate at a certain pressure. The effect on the other data is non-linear but useful information may be extracted, knowing the relationships between the artificially increased supply voltage and measured values.

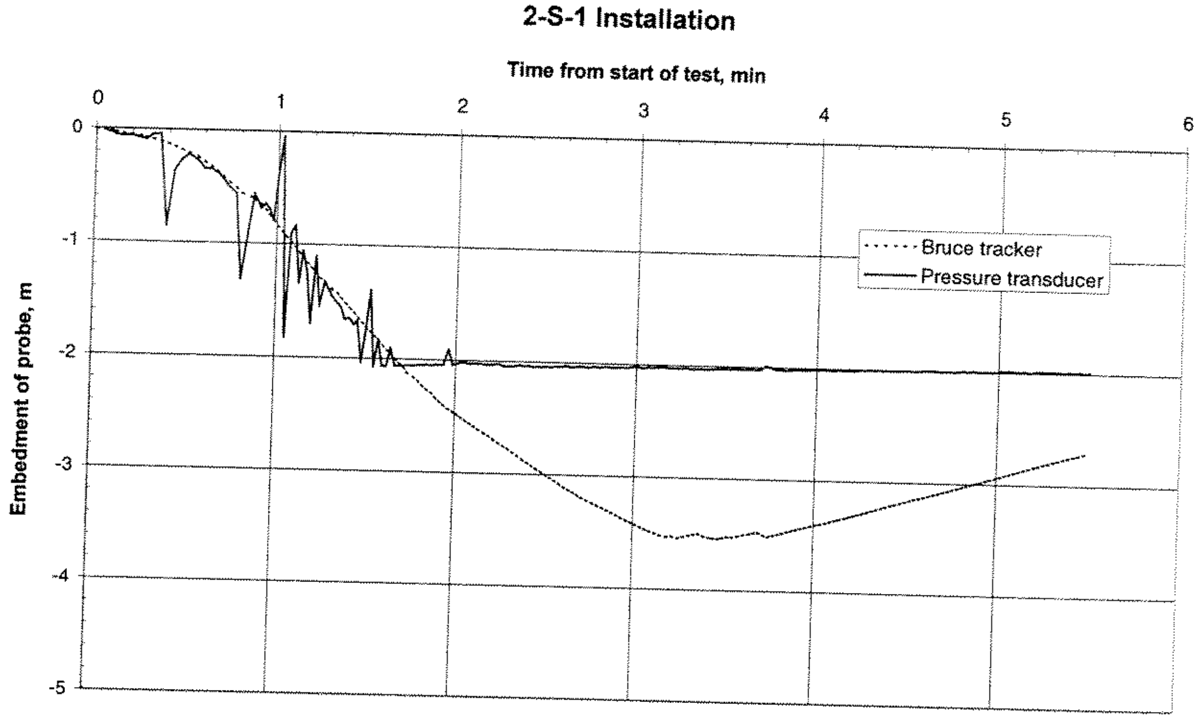


Figure 19 Water pressure readings compared to depth from Bruce tracker (2-S-1)

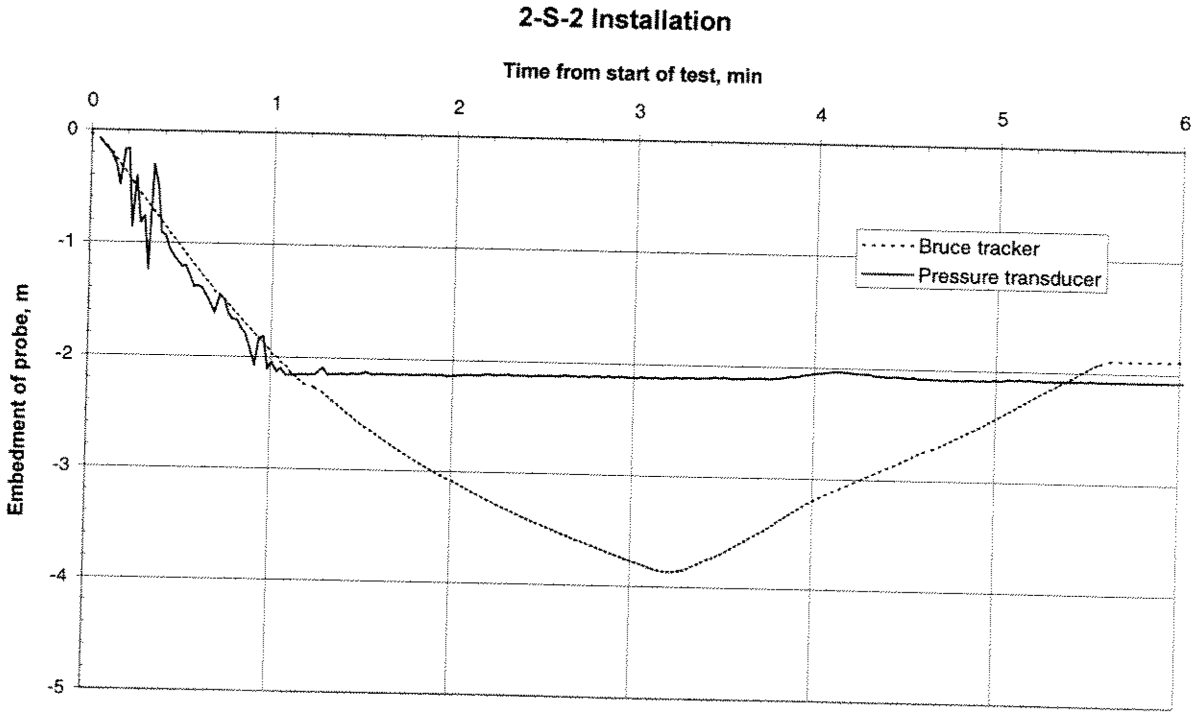


Figure 20 Water pressure readings compared to depth from Bruce tracker (2-S-2)

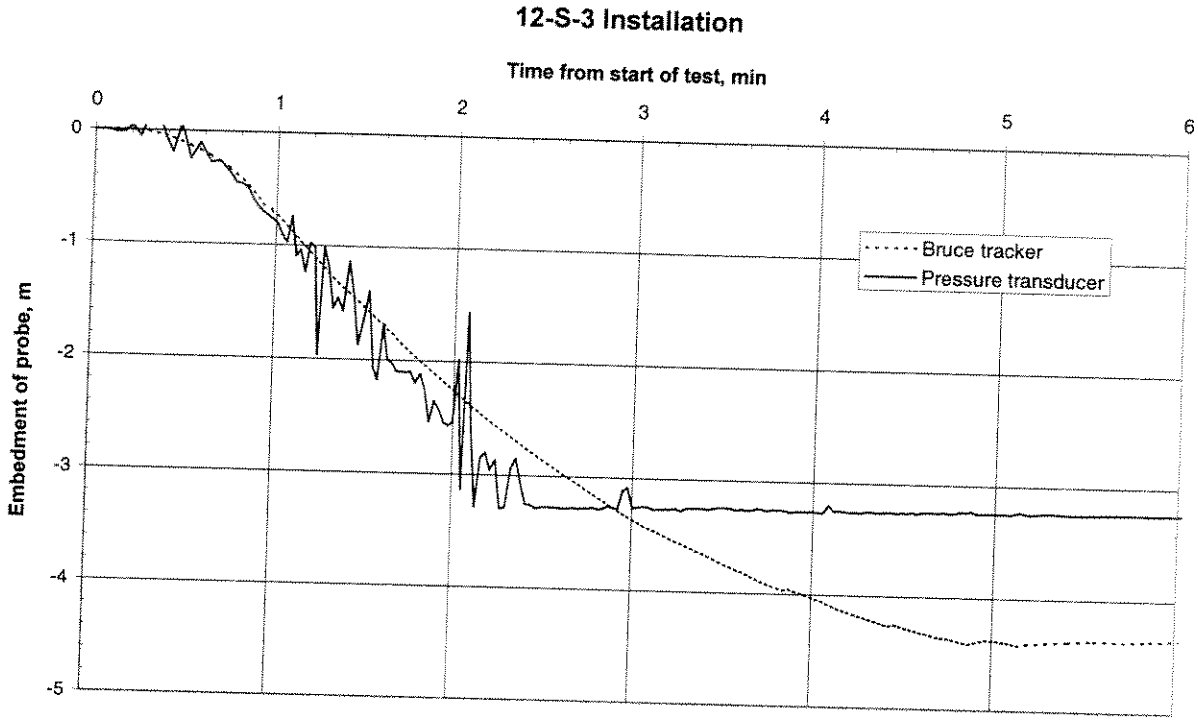


Figure 21 Water pressure readings compared to depth from Bruce tracker (12-S-3)

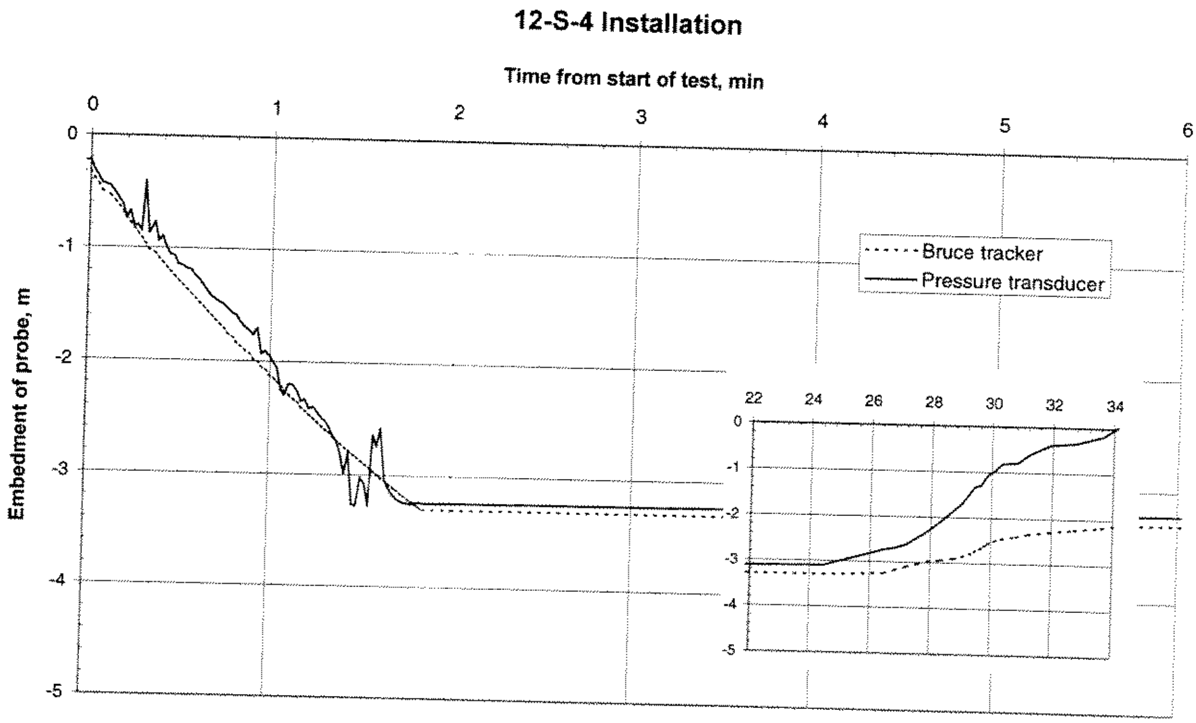


Figure 22 Water pressure readings compared to depth from Bruce tracker (12-S-4)

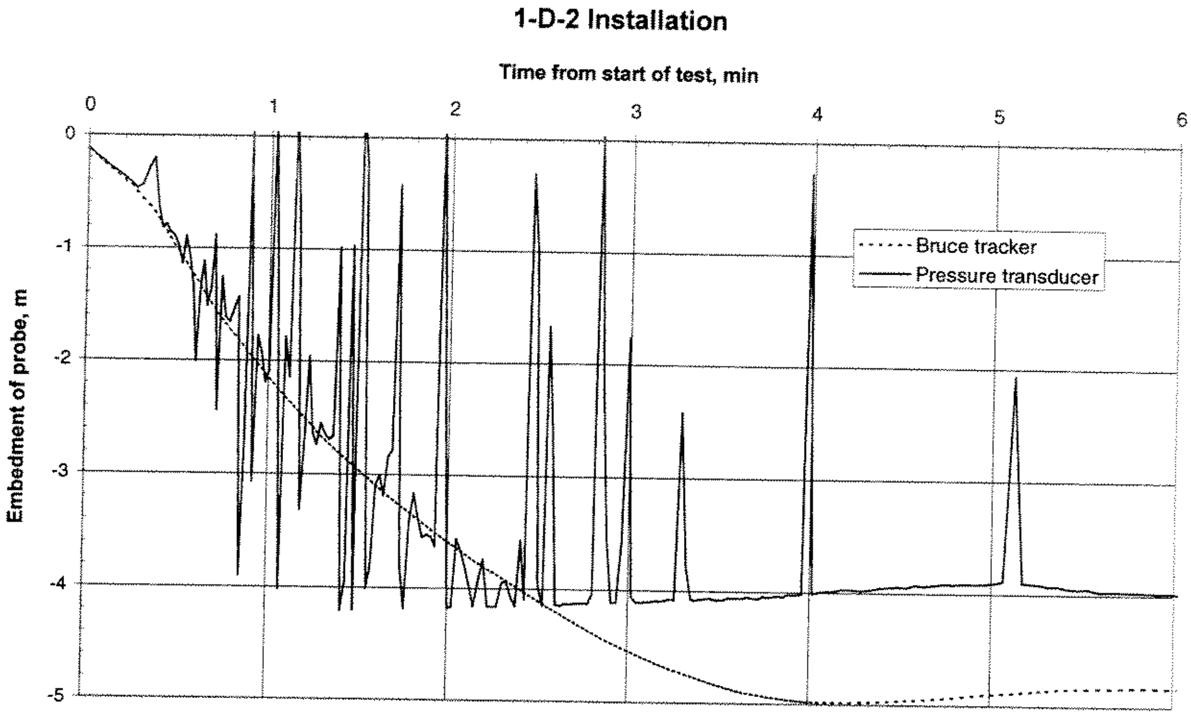


Figure 23 Water pressure readings compared to depth from Bruce tracker (1-D-2)

4.6.4 Conclusion

The Bruce Anchor Tracker has proven to be a useful tool with great potentials for monitoring the anchors during penetration.

The high expectations were however not fully met for the Onsøy tests, and though this to some degree may be related to uncertainties in the manually measurements, some areas that need to be further considered are presented below:

- The probe trajectory is constructed from segments, and any deviation in a starting values (e.g. zero readings for fluke or probe relative to fluke) will add up during penetration.
- The uncertainties with the depth from the tracker also appears to increase as the probe pitch becomes more and more horizontal, i.e. with increasing length of drag.
- The placement of the probe underneath the fluke should be further investigated to see if not the best position will depend on both the anchor size and type.

4.7 DIGIN back-fitting analysis

4.7.1 Anchor line calibrations

For all the tests with the large anchors an instrumented anchor shackle was used. The two tests with the large Stevmanta suffered however from a poor definition of horizontal shackle pitch, leaving only the three large Denla tests as suitable for backfitting purpose. By comparing tension measurements, anchor line intersection point with the trench (dip-down point) and the probe position at same time, it is possible to determine the boundary conditions for the reverse catenary of the installation wire in soil (tension, pull-angle, horizontal distance and depth of anchor shackle). The sliding resistance remains unknown in the analysis, but this has little effect on the reverse catenary geometry

The three tests with the large Denla all showed very similar increase in line tension vs. depth, and were expected to give a clear indications of the normal resistance on the anchor line included in DIGIN. multiple DIGIN analyses were performed searching for the calibration factor giving the measured shackle pitch and the horizontal distance between the dip-down point and the anchor shackle.

The calibration factor, C, is applied directly on the normal resistance, q, on the anchor line through the following equation.

$$q = C \cdot N_c \cdot s_u \cdot d$$

where

N_c - bearing capacity coefficient for plane strain conditions

s_u - intact direct simple shear strength

d - wire diameter

Two separate analysis were performed. One without any corrections to the depth and drag as given by the Bruce anchor tracker, and a second where the deviation in drag lengths and penetration depth as discussed in Chapter 4.6.2 were included as a correction to the depth and position of the anchor shackle expressed as a linear function of travelled length.

Figure 24 shows the calibration factor needed to fit the shackle pitch at the uncorrected depth from the Bruce Anchor Tracker. A clear increase with depth can be seen. The range is rather large within the depths considered, but one may choose to put less weight on the calibration factor for the initial part of the penetration curve, simply because they will be more affected by local undulations in the trench and the starting position of the probe. For test 9-DL-3, where the speed was reduced with a corresponding drop in line tension, a sudden decrease in the calibration factor can be seen suggesting that about 25% of the normal resistance is due to the loading rate effect

Figure 25 shows the calibration factor needed to fit the uncorrected measured horizontal distance. Again a rather distinct increase with depth, but now test 4-DL-1 and 9-DL-3 has changed with respect to giving the lower values.

Since both horizontal distance and shackle pitch should be fitted for one set of calibration factor, it is reasonable to use an average value of the calibration factor computed from the two already presented. Figure 26 shows the average value and again a clear increase with depth but now with a smaller range.

The conclusion from the verification of the Bruce Anchor Tracker for the large Denlas has been used in the following to correct for both depth and horizontal distance.

Figure 27 shows the calibration factor needed to fit the shackle pitch at the corrected depth. The increase with depth is less evident than without depth corrections.

Figure 28 shows the calibration factor needed to fit the corrected horizontal distance and depth. Again the increase may be see to be less evident than without any corrections.

Figure 29 shows the average calibration factor as a mean value from fit to shackle pitch and horizontal distance. The calibration factor approach a range from 0.8 to 1.05, with 0.9 as an average.

Loading rate can be concluded to play an important role in the analysis. Reducing the pull-in speed in the tests was found to decrease the line tension with about 18% pr. log cycle. The actual drop in normal resistance for the anchor line in test 9-DL-3 was found to be about 25%. It can thus be concluded that the normal resistance presently included in DIGIN for wires, overestimates the anchor line resistance by approximately 30% at Onsøy (i.e. 25% / 0.9). One possibility could be to replace the present formulation by one taking the soil sensitivity into account /1/:

$$N_c = 9 + 3 \cdot \alpha$$

where

α - is equal to the inverse sensitivity of the clay.

This will represent about 20% reduction in the normal resistance compared to the present formulation and will give close agreement to the results where depth corrections are made.

Only the normal resistance was used as basis for the anchor line calibration as no measurements of load at the shackle, and thereof the contribution from adhesion resistance could be assessed. The latter plays, however, a minor role with respect to the embedded anchor line catenary.

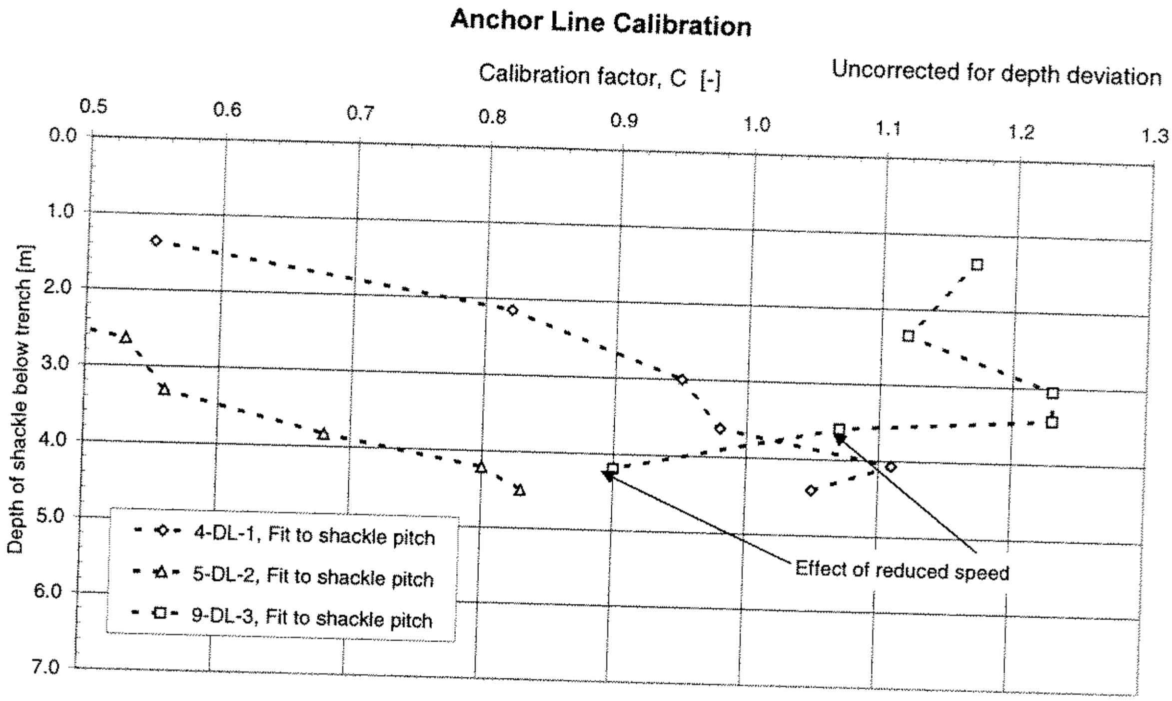


Figure 24 Normal resistance calibration factor vs. depth – Fit to shackle pitch

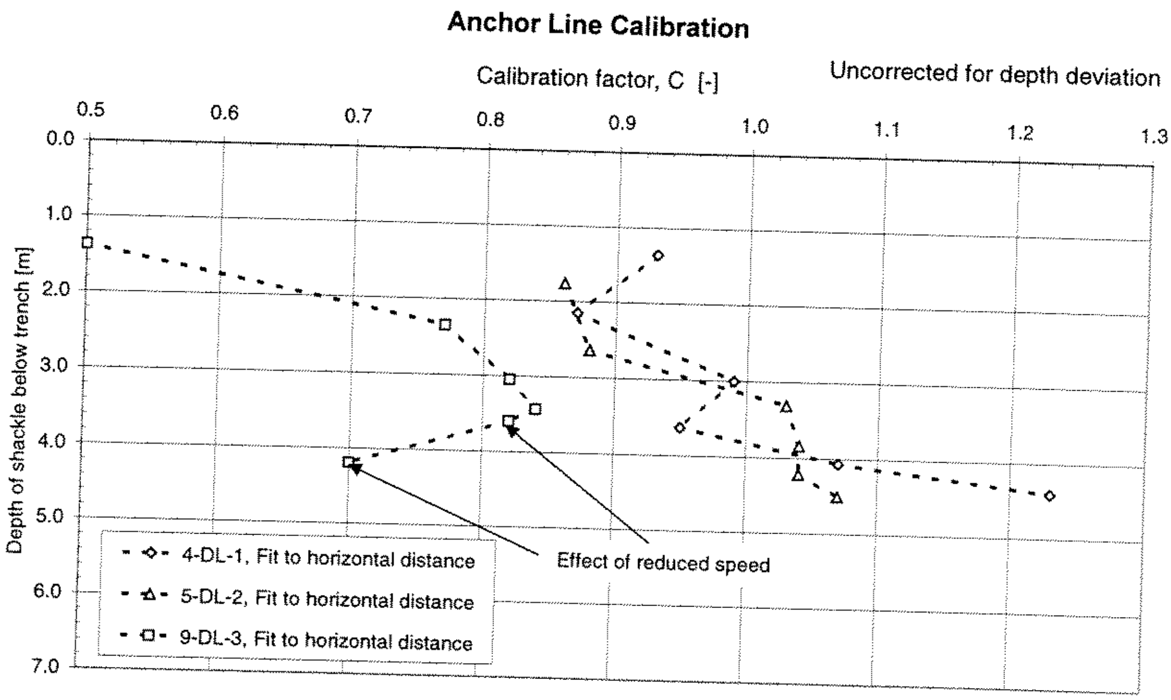


Figure 25 Normal resistance calibration factor vs. depth – Fit to horizontal distance

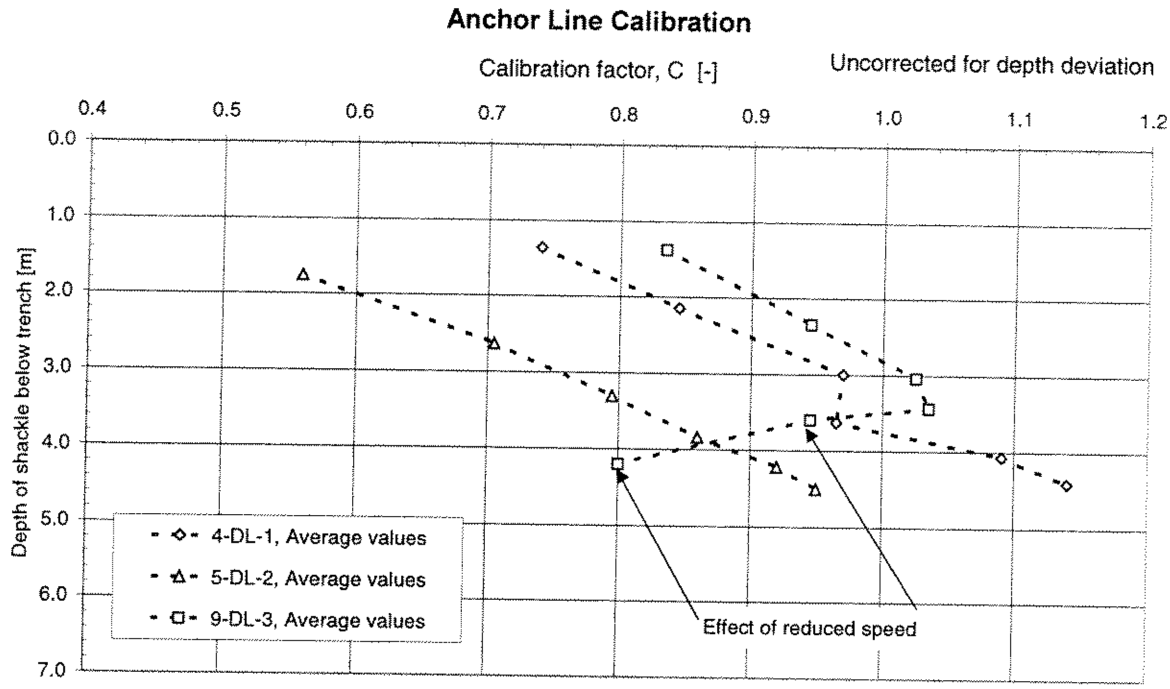


Figure 26 Average calibration factor with uncorrected depth [-]

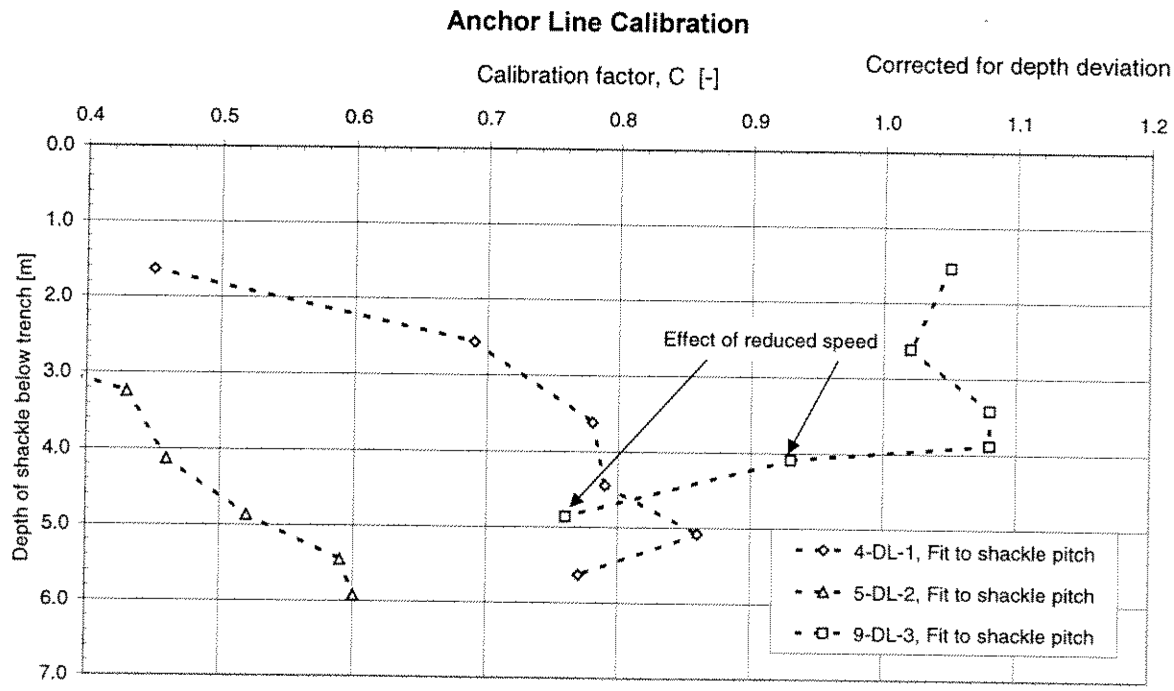


Figure 27 Normal resistance calibration factor vs. corrected depth – Fit to shackle pitch

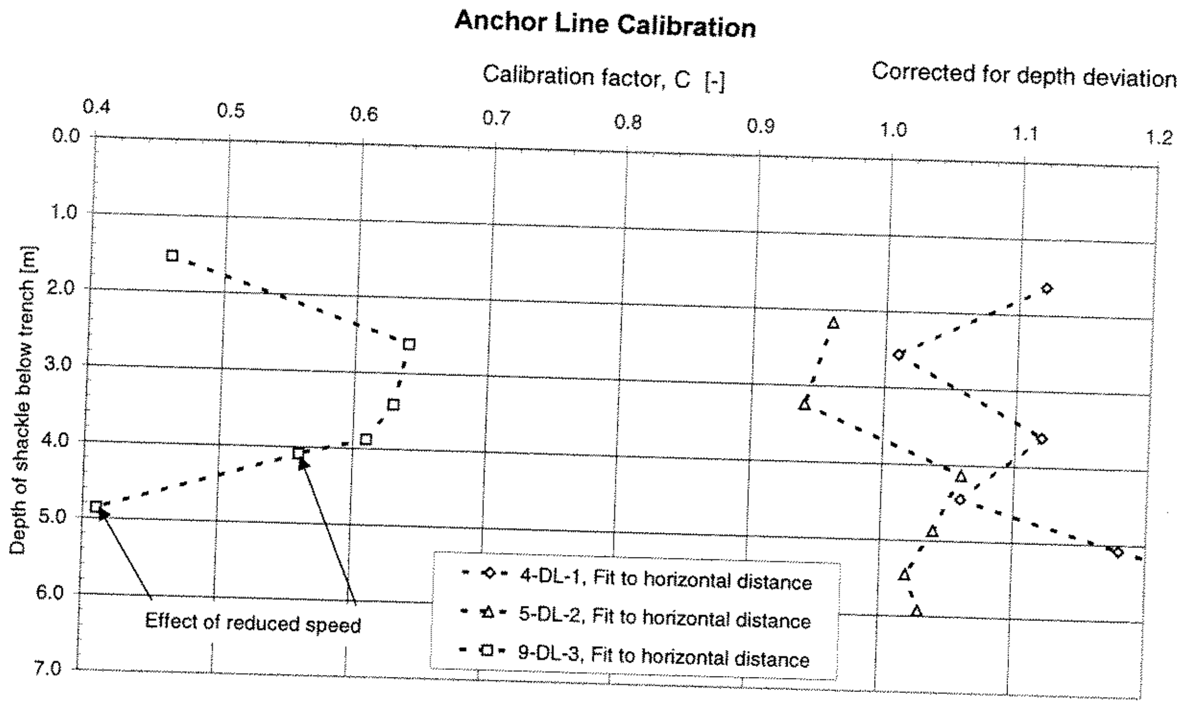


Figure 28 Normal resistance calibration factor vs. corrected depth – Fit to horizontal distance

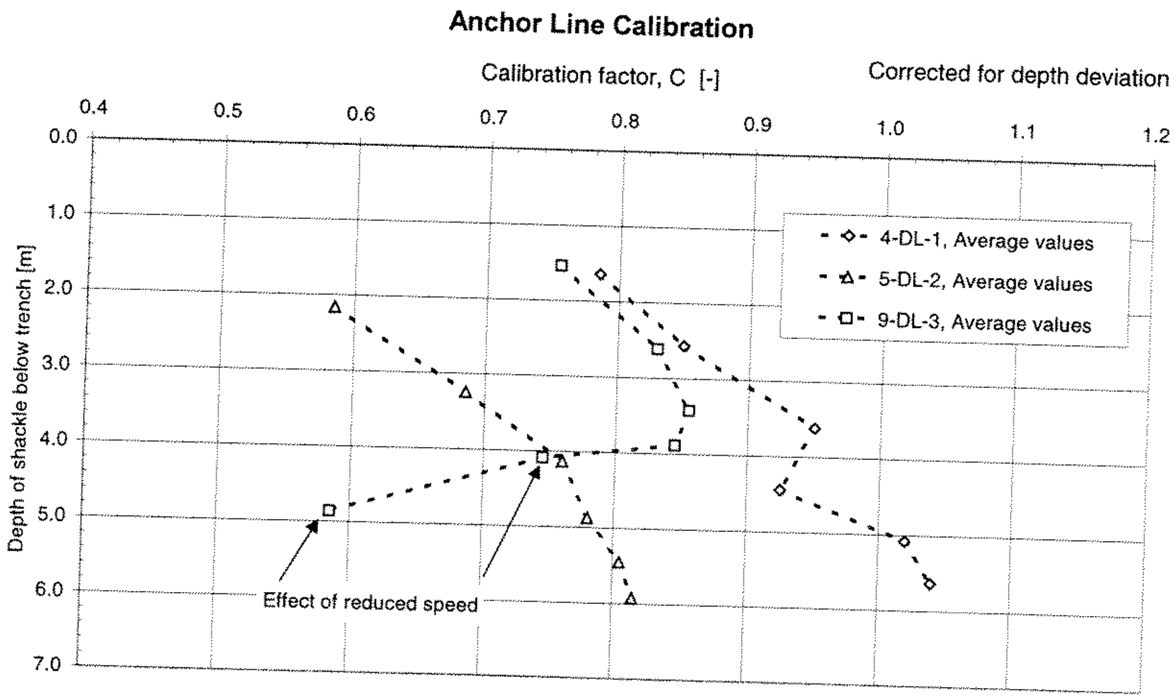


Figure 29 Average calibration factor with corrected depth

4.7.2 Anchor calibration

The anchor calibration is performed with DIGIN without modifications to the anchor line resistance. The combined effect of loading rate and reduced normal resistance was however found to give an average of 10% decrease in the normal resistance. The consequence of this is that the DIGIN analysis will give a slightly higher vertical load at the anchor, and reduce the penetration depth. The effect of this is believed to be minor.

In order to match the penetration resistance measured during the tests, a loading rate factor must be included. However, instead of increasing the resistance in the DIGIN calculations, the best fit is sought for a tension without loading rate effect included. This is simply done by multiplying the measured resistance by the inverse loading rate factor, i.e. a factor of 0.8.

The analysis with the large Denla anchor reveals that there is quite a difference between the observed behaviour and that predicted by DIGIN. In order to come near the observed penetration path a quite large adhesion resistance must be used (*Fanc* times the remoulded shear strength) and still the development of line tension versus depth does not show a satisfactory trend.

Figure 30 shows the line tension with depth from three DIGIN analyses with the large Denla compared to the measured line tension and the line tension tentatively corrected for loading rate. It can be seen that a best fit to the corrected tension may be obtained with a calibration factor of about 3.0.

Figure 31 shows three penetration paths from DIGIN analyses with the large Denla, compared to the measured penetration path with the Bruce Anchor Tracker. A best fit is obtained for a calibration factor of about 4.5.

Figure 32 shows the line tension with depth from three DIGIN analyses with the small Denla compared to the measured line tension and the line tension tentatively corrected for loading rate. It can be seen that a best fit to the corrected tension may be obtained for a calibrations factor of about 3.5.

Figure 33 shows three penetration paths from DIGIN analyses with the small Denla, compared to the measured penetration path with the Bruce Anchor Tracker. A reasonable fit is obtained for a calibration factor of about 5.0

Figure 34 shows the line tension with depth from one DIGIN analysis with the large Stevmanta being party consolidated at final installation, compared to the measured line tension and the line tension tentatively corrected for loading rate. A best fit to the corrected tension cannot be found since the adhesion resistance contributes with a minor part to the line tension. For a calibration factor of about 1.0 the corrected line tension is about 15% overestimated. Recalling the results from Section 4.4.3, it can be seen that the measured increase in line tension after 60 hours of consolidation represent a degree of consolidation of 50%. At 100% consolidation would have given about 80% increase in the line tension in these soil conditions.

Figure 35 shows the penetration path from one DIGIN analysis with the large Stevmanta, compared to the measured penetration path with the Bruce Anchor Tracker. A reasonable fit is obtained for a calibration factor of about 1.0

Figure 36 shows the line tension with depth from three DIGIN analyses with the small Stevmanta, compared to the measured line tension and the line tension tentatively corrected for loading rate. A best fit to the corrected tension can be found for a calibration factor of about 1.0.

Figure 37 shows three penetration paths from DIGIN analyses with the small Stevmanta, compared to the measured penetration path with the Bruce Anchor Tracker. A best fit is obtained for a calibration factor of about 1.0.

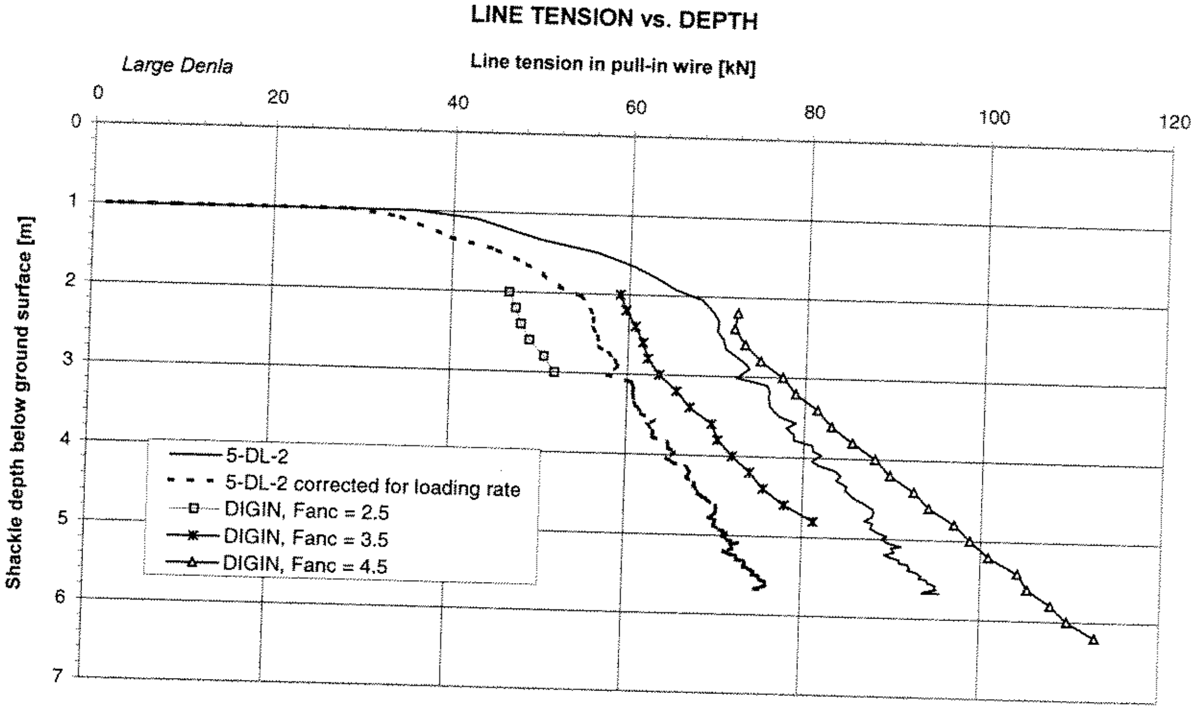


Figure 30 Large Denla – DIGIN Backfitting with various adhesion resistance (Fanc)

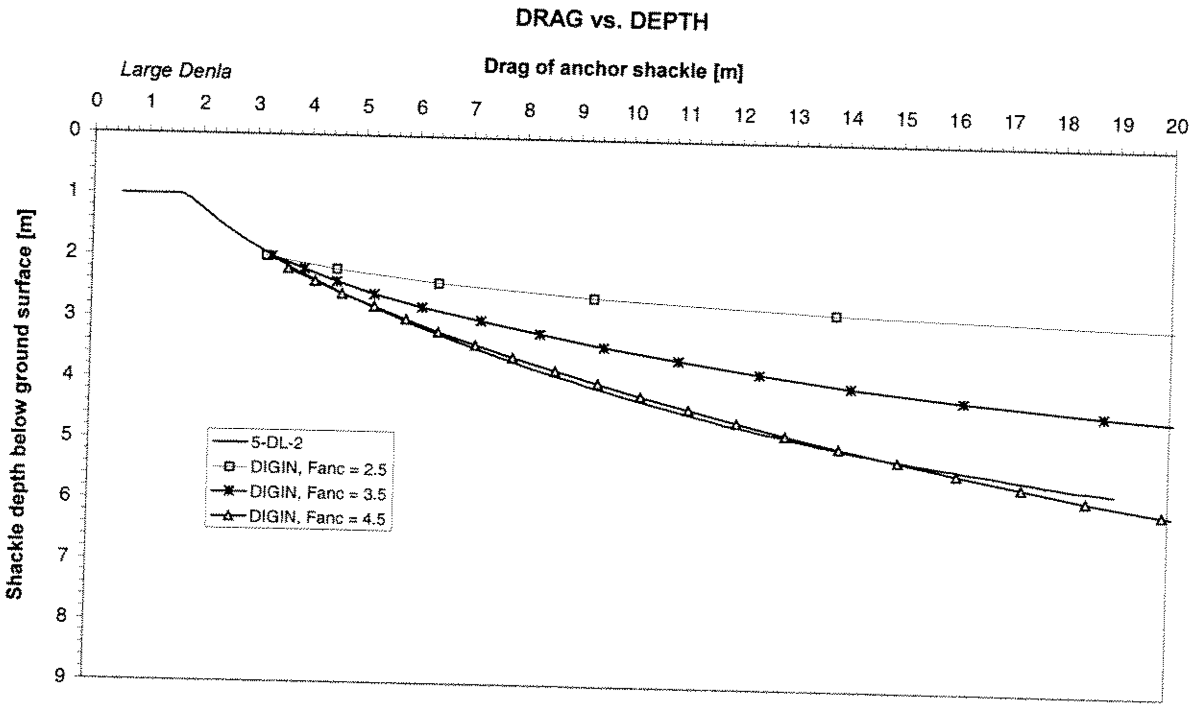


Figure 31 Drag of large Denla anchor (shackle point) for various adhesion resistance

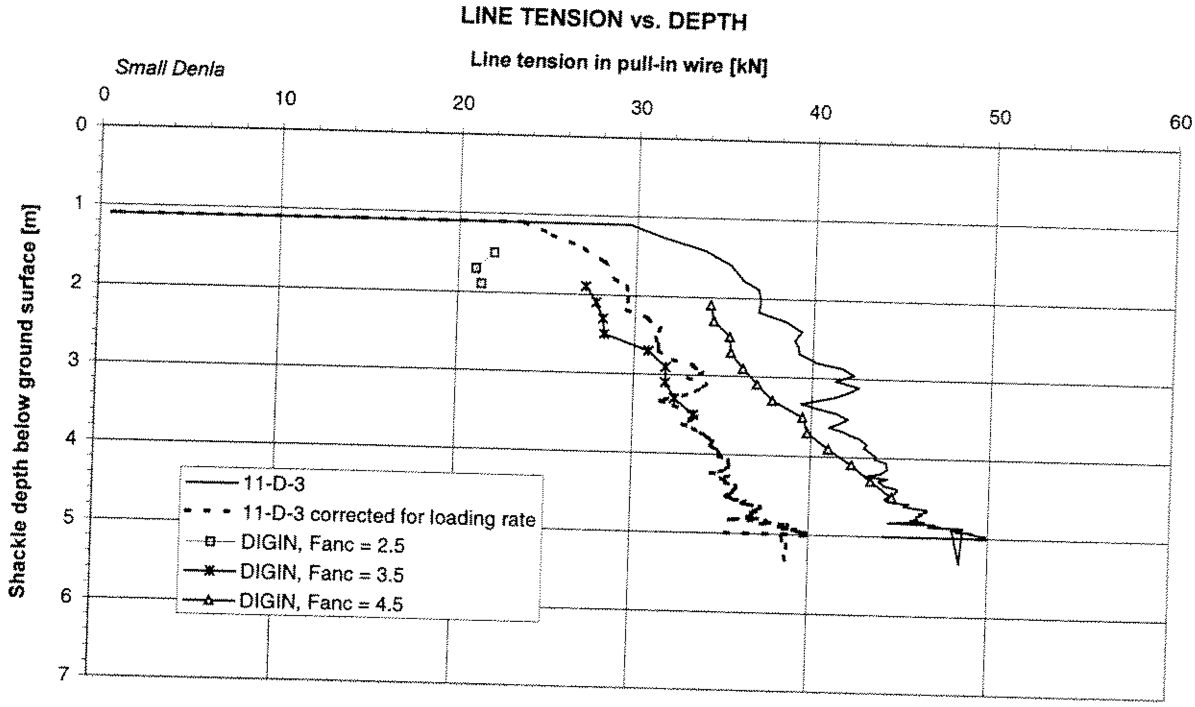


Figure 32 Small Denla – DIGIN Backfitting with various adhesion resistance (Fanc)

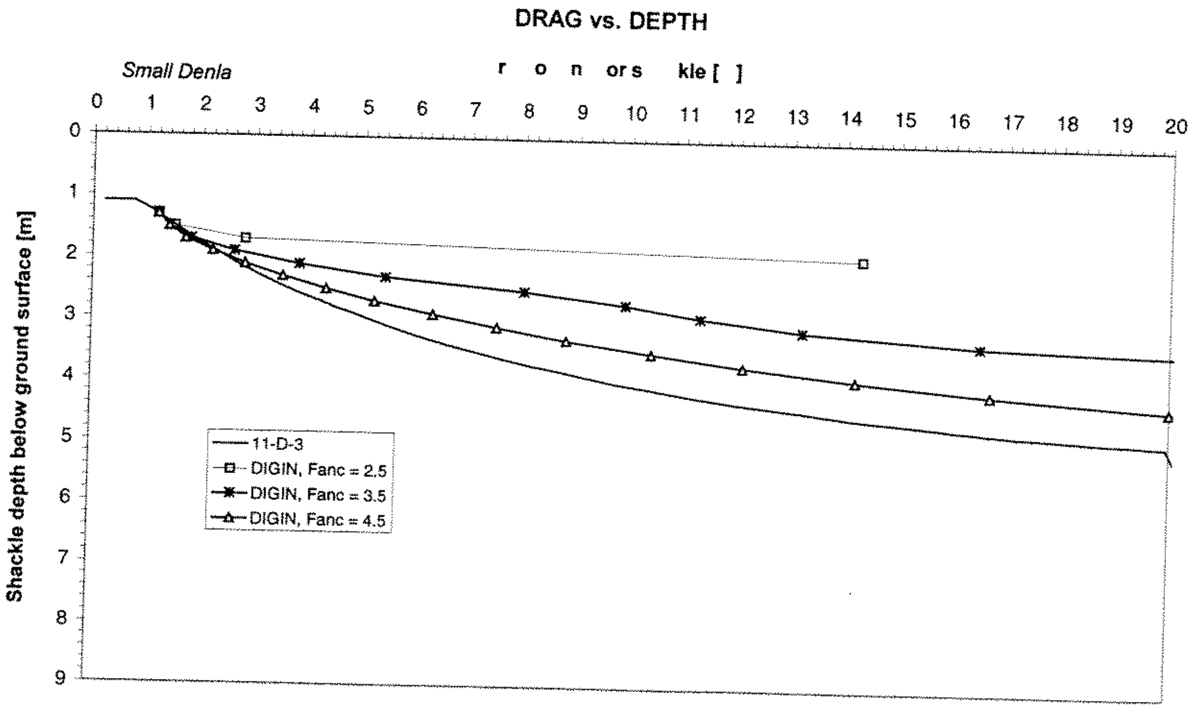


Figure 33 Drag of small Denla anchor (shackle point) for various adhesion resistance

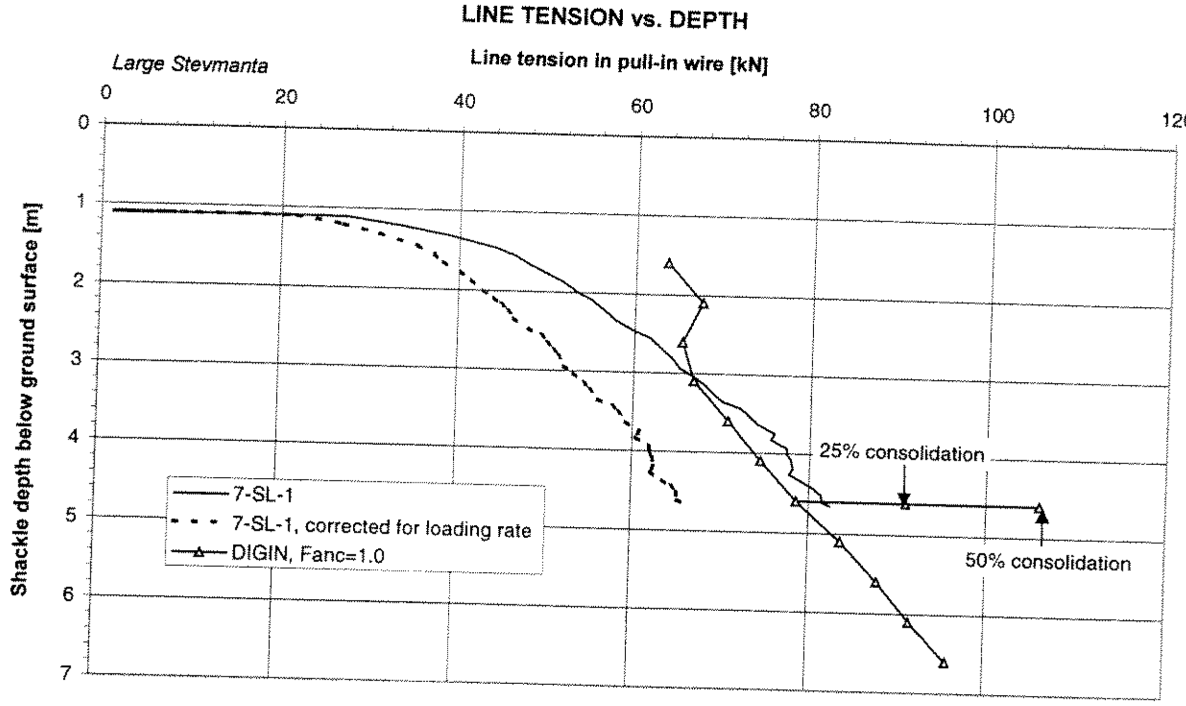


Figure 34 Large Stevmanta – DIGIN Backfitting with basecase adhesion resistance

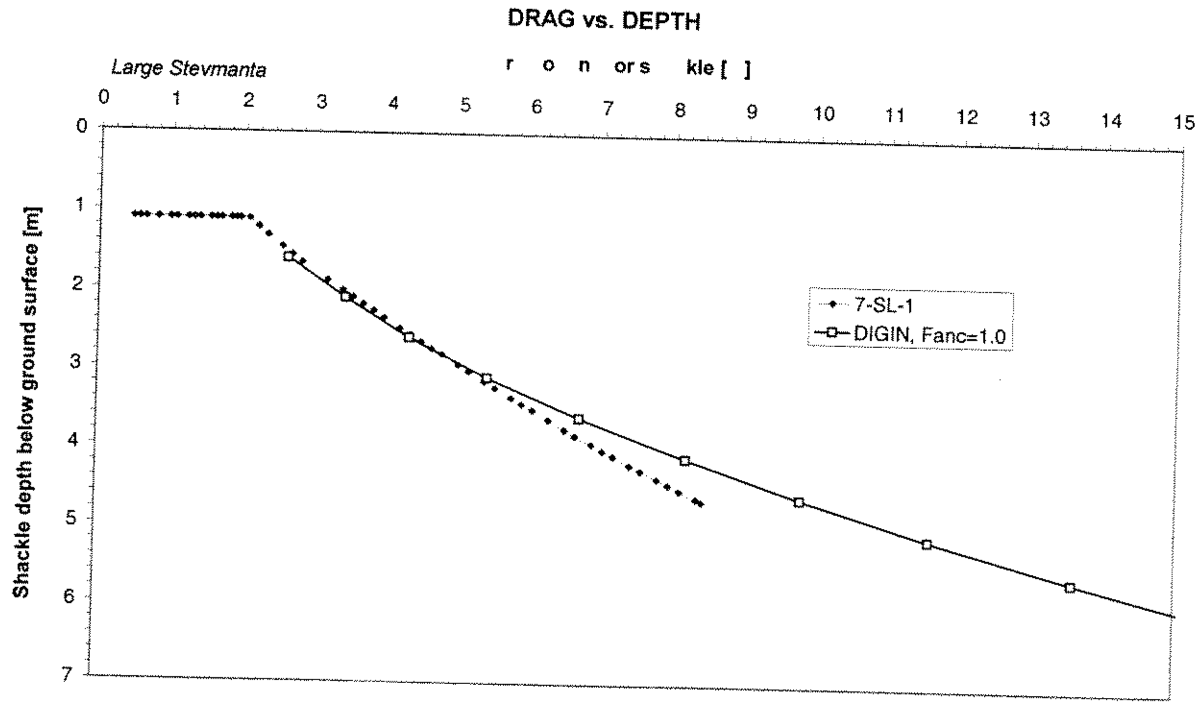


Figure 35 Drag of large Stevmanta anchor (shackle point) for various adhesion resistance

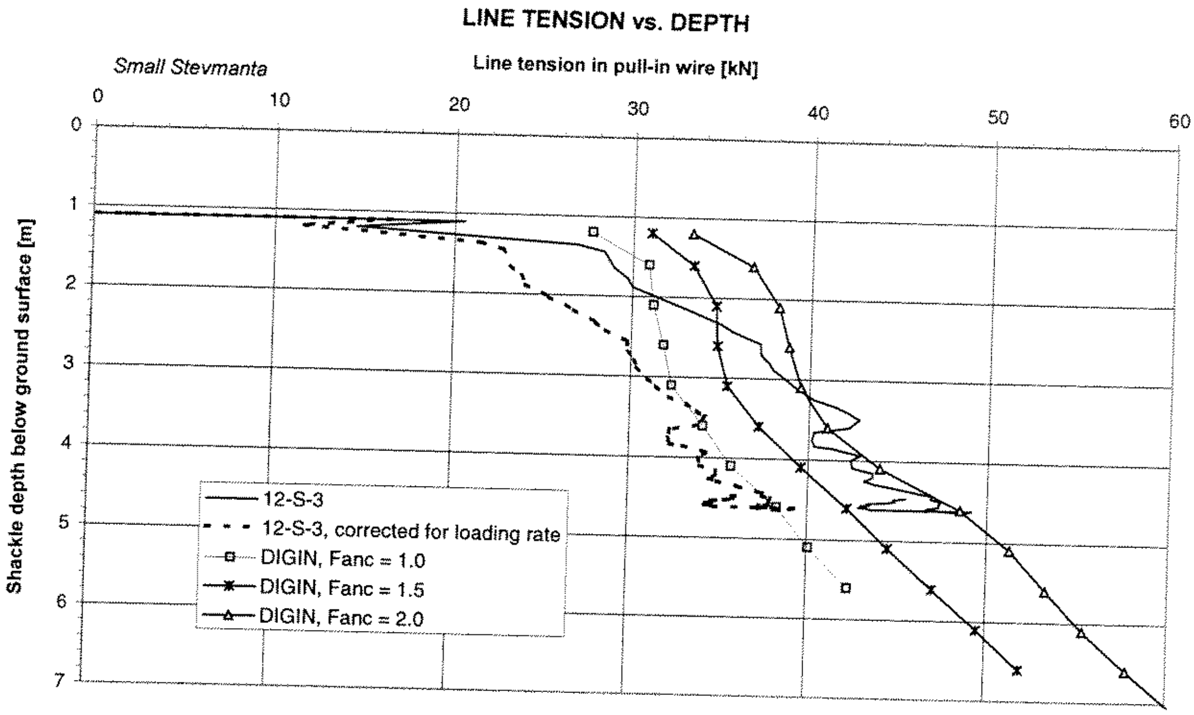


Figure 36 Small Stevmanta – DIGIN Backfitting with various adhesion resistance

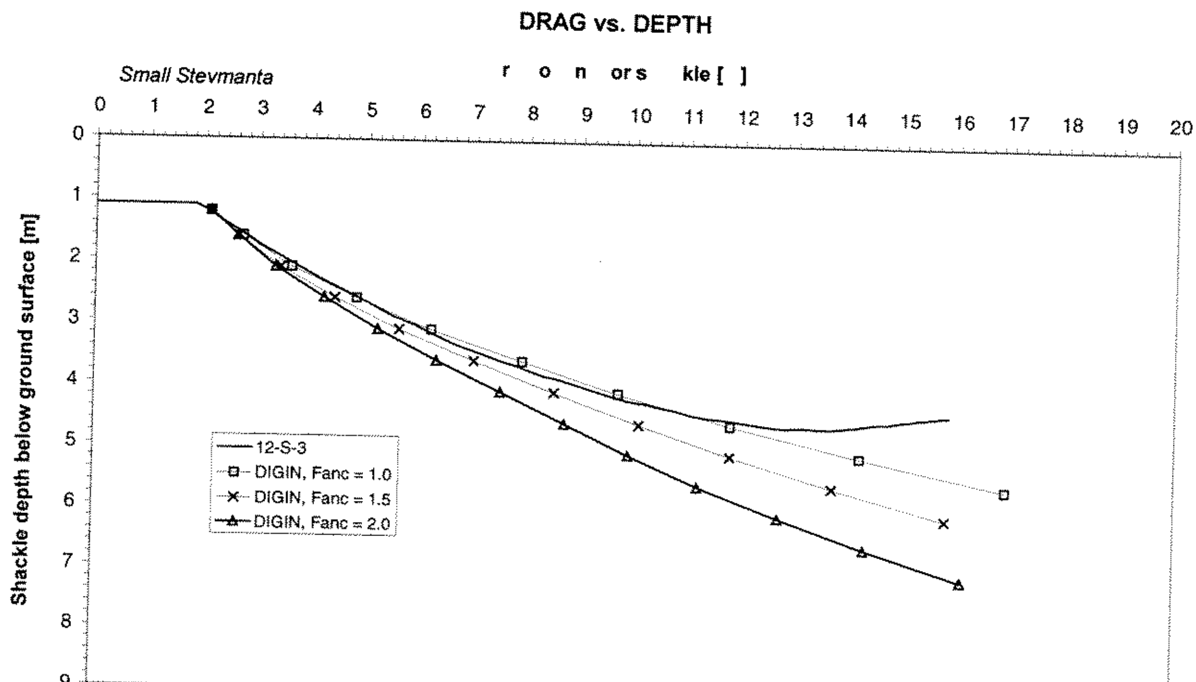


Figure 37 Drag of small Stevmanta anchor (shackle point) for various adhesion resistance

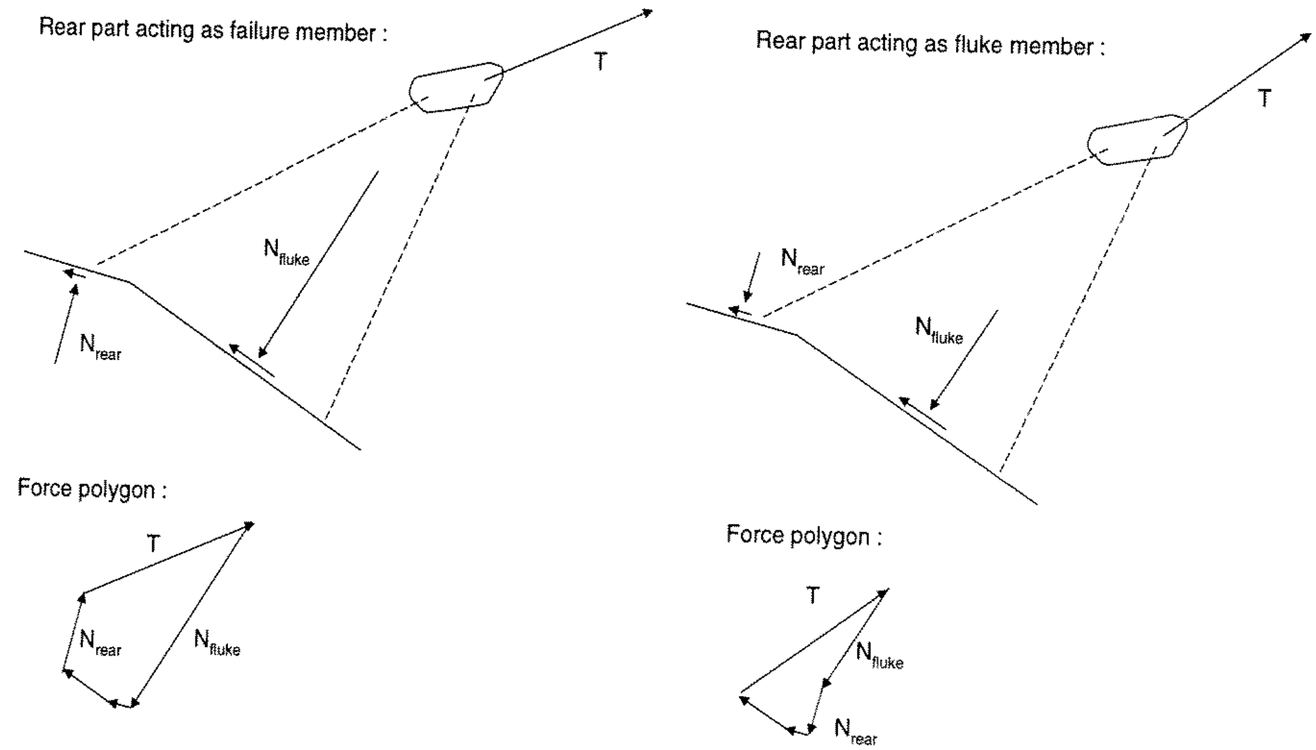
4.8 Discussion of the analysed anchor behaviour in DIGIN

4.8.1 General

The main trend from the DIGIN analysis with the two anchor types is that the Stevmanta can be reasonable well predicted with a calibration factor of about unity, but for the Denla the calibration factor need to be about the sensitivity of the clay. This requires some further explanation.

The difference in the DIGIN predictions is in particular related to how the normal forces are acting on the anchors. Typically the Denla anchor may utilise the entire fluke area to establish a normal force to resist a rotational movement in the restraint mode. The Stevmanta anchor on the other hand has a wedge shape at the rear part of the fluke which should result in a normal soil reaction on the side facing the penetration direction. Thus the normal force needed to stabilise the anchor will need to take on a larger value and forcing the resultant towards the centre of the remaining fluke area which will give a steeper penetration in DIGIN.

The tests performed show that the difference in behaviour is insignificant for the two anchors and that thereof one might expect them to behave in a similar manner also with respect to the normal resistance on the fluke.



Present approach with the Stevmanta

Possible approach for Stevmanta, which will give similar stress distribution on the fluke as the Denla anchor.

Figure 38 Normal resistance at the rear part of the fluke.

4.8.2 Work done by external forces – minimum energy concept

The working principle in DIGIN with respect to accepting an equilibrium solution is that the line tension at the dip-down point shall be the minimum value among those giving moment and force equilibrium of the anchor. In the course of the backfitting analysis of the plate anchors it has become evident that the original DIGIN concept gives a solution in the lower range of the possible orientation of the anchor (i.e. tend to select the least steep penetration). The solution in DIGIN can in this case be characterised by a considerable moment reaction on the fluke, for which the maximum value on the normal resistance considering both moment and normal loading must be considered.

In the other end of the range of possible anchor orientations giving an equilibrium solution is the normal force acting more towards the centre of area of the fluke. However, as this will give a higher force at the dip-down point this is not considered to be the correct solution.

An attempt to look at the work done by external forces to bring the anchor a normalised distance in the direction of the fluke showed that this reverses the picture, i.e. the solution in the upper range (steep penetration) gives the lowest amount of energy. The equation for energy has a simple form and the minimum value is thought for among the possible solutions.

$$E = Ex + Ey = \frac{T_H \cdot Dx}{\sqrt{Dx^2 + Dz^2}} - \frac{T_V \cdot Dz}{\sqrt{Dx^2 + Dz^2}}$$

where

T_V = vertical component of line tension at the anchor shackle
T_H = horizontal component of line tension at the anchor shackle
D_Z = vertical displacement in the penetration direction
D_X = horizontal displacement in the penetration direction

Note that Ey is negative as the vertical component of the line tension at the shackle acts in the opposite direction of the vertical displacement when the anchor penetrates.

Figure 39 shows the resistance with depth from one DIGIN analysis with the large Stevmanta compared to the measured line tension and the line tension tentatively corrected for loading rate. In this analysis the rear part of the fluke is modelled in the same plane as the fluke, and with tip resistance included on the actual projected area. A reasonable match is achieved for a calibration factor of about 1.0

Figure 40 shows the resistance with depth from one DIGIN analysis with the large Denla compared to the measured line tension and the line tension tentatively corrected for loading rate. Here too a reasonable match is achieved for the calibration factor of about 1.0.

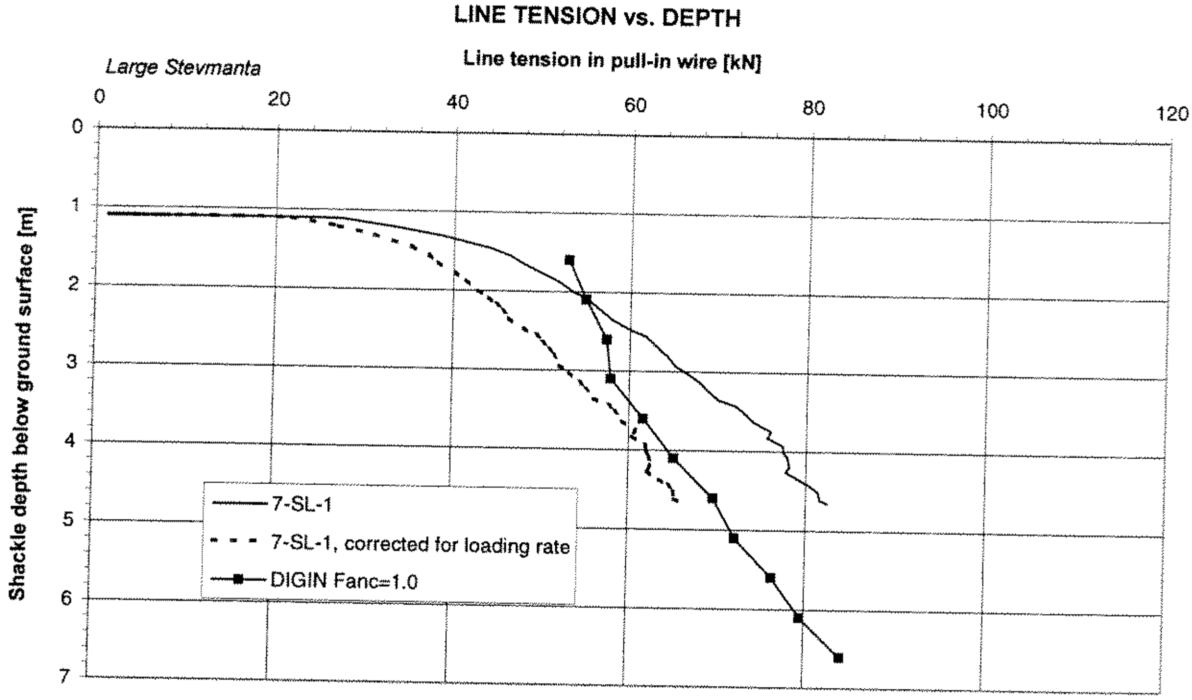


Figure 39 Large Stevmanta – DIGIN Backfitting with "minimum energy concept"

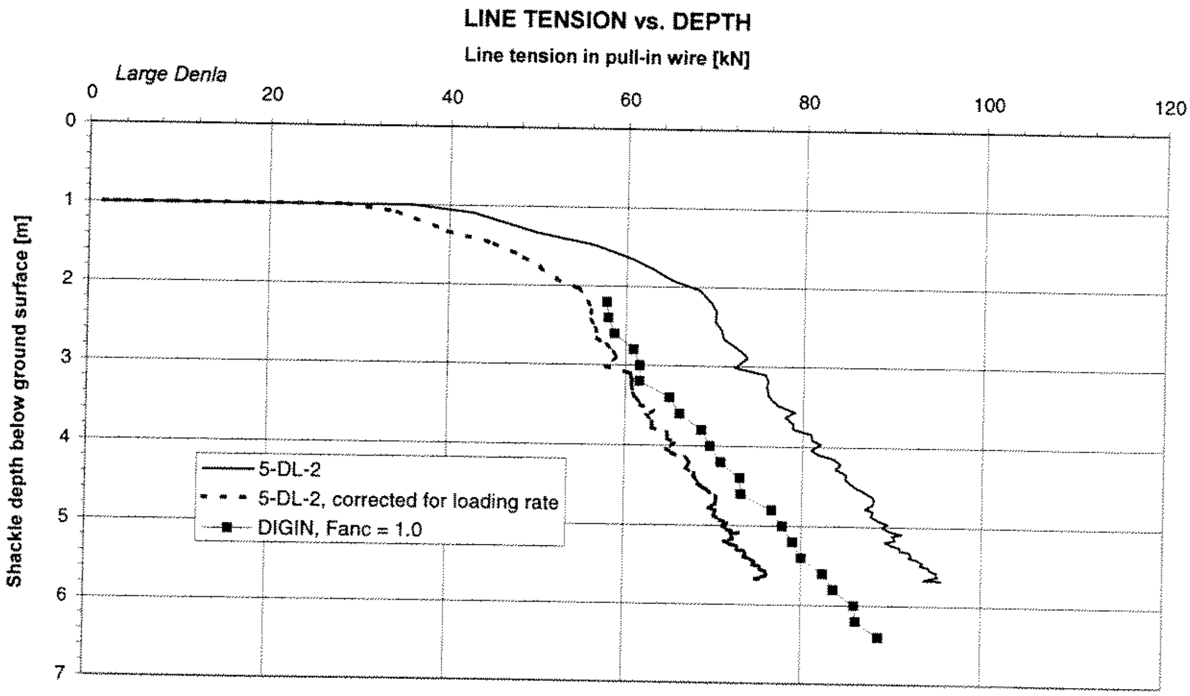


Figure 40 Large Denla – DIGIN Backfitting with "minimum energy concept"

5 REFERENCES

/1/ Randolph, M. F. and Houlsby, G. T. (1984)
The limiting pressure on a circular pile loaded laterally in cohesive soil
Géotechnique 34, No. 4 pg. 613 – 623

/2/ Foxton, P. (Bruce Anchor Ltd.)
Latest developments for vertically loaded anchors
IBC 2nd Annual Conference – Mooring & Anchoring, June 1997, Aberdeen

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APPENDICES

APPENDIX F
DATA LOG FROM TESTS AT ONSØY

Table 8 Anchor test log.

Test No.	ID	Installation		Resumed installation		Pullout	
		Date	Time	Date	Time	Date	Time
1	1-D-1	08-jun-98	20:30:32	08-jun-98	21:04:45	08-jun-98	22:28:00
2	1-D-2	09-jun-98	15:21:45			09-jun-98	16:40:38
3	2-S-1	09-jun-98	20:43:17			10-jun-98	08:37:57
4	2-S-2	10-jun-98	12:27:12			10-jun-98	13:09:02
5	12-S-3	10-jun-98	16:24:54			10-jun-98	17:04:34
6	12-S-4	10-jun-98	18:15:18			10-jun-98	18:35:02
7	11-D-3	10-jun-98	20:54:24			11-jun-98	08:44:11
8	11-D-4	11-jun-98	11:30:39			11-jun-98	11:49:36
9	4-DL-1	11-jun-98	17:23:02			11-jun-98	17:46:02
10	5-DL-2	11-jun-98	21:02:12			12-jun-98	08:28:21
11	9-DL-3	12-jun-98	11:49:20			12-jun-98	12:42:00
12	7-SL-1	12-jun-98	18:53:15	15-jun-98	08:26:01	15-jun-98	09:20:00
13	7-SL-2	15-jun-98	12:33:03			15-jun-98	12:54:00
14	9-D-5	15-jun-98	20:43:12			15-jun-98	21:30:00

LEGEND:

Test ID (Track No.) - (Type/size of test anchor) - (Test No. of that anchor type/size)

D DENLA (small)
DL DENLA (large)

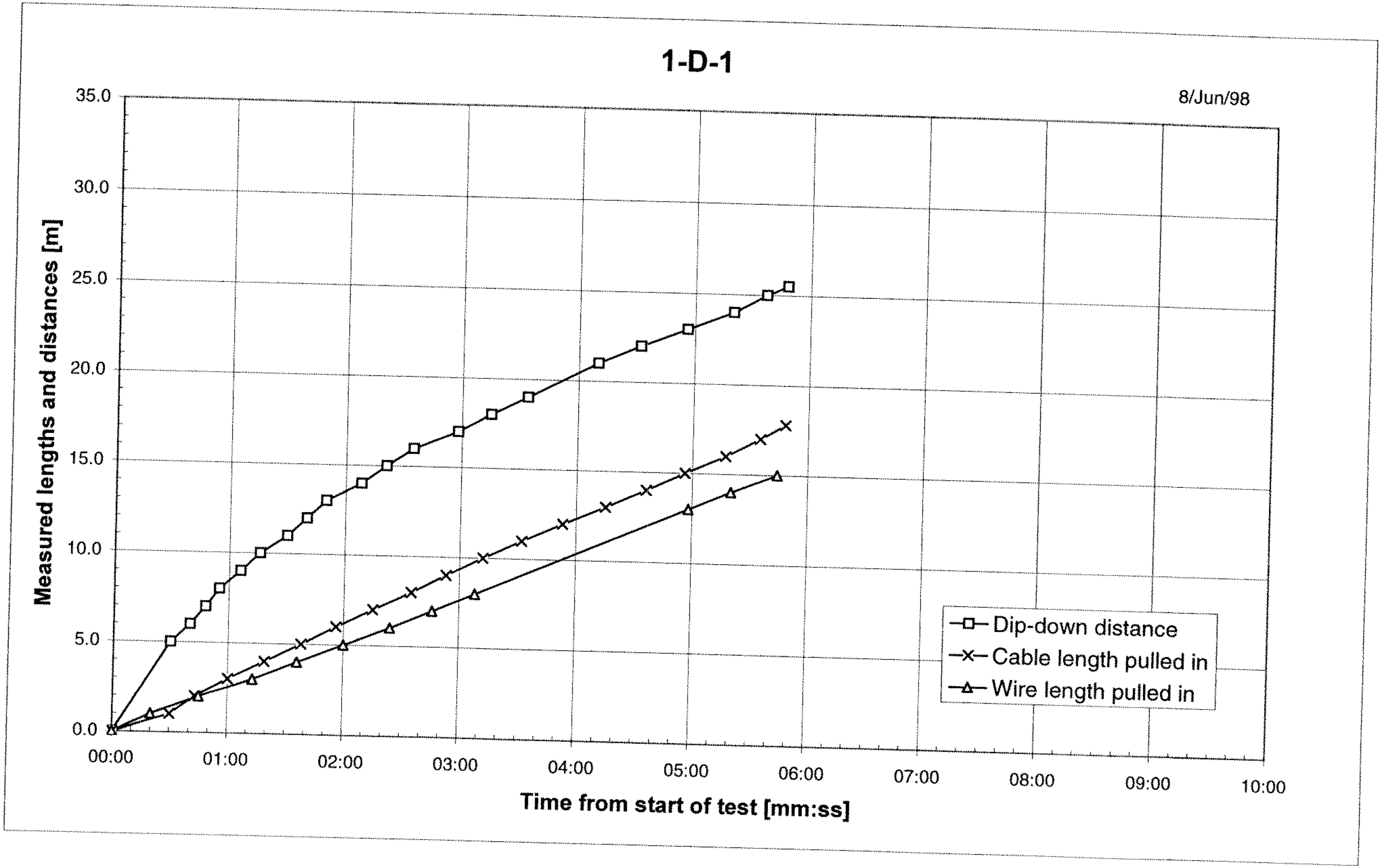
S STEVMANTA (small)
SL STEVMANTA (large)

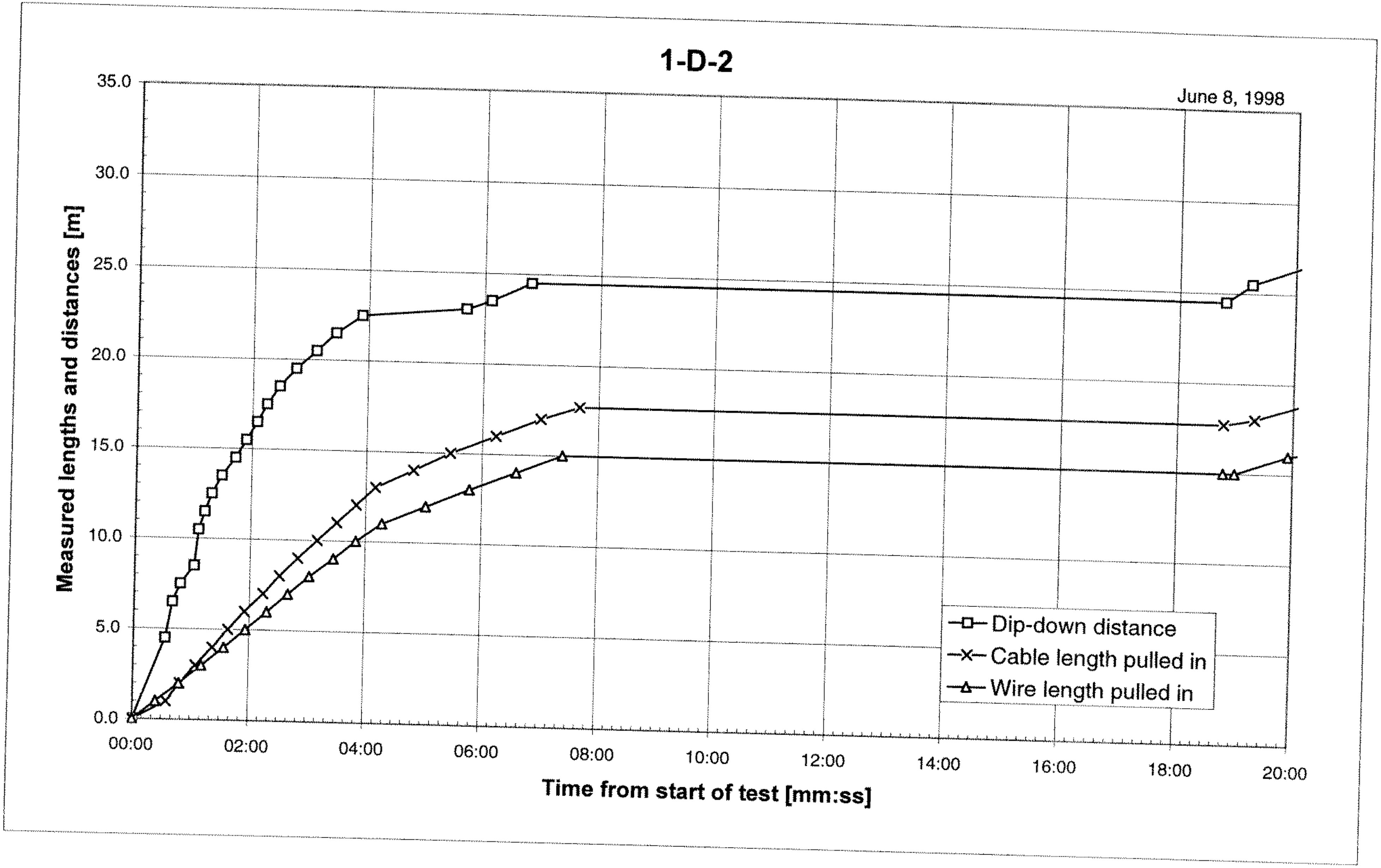
Table 9 Comments related to anchor test log in Table 2.

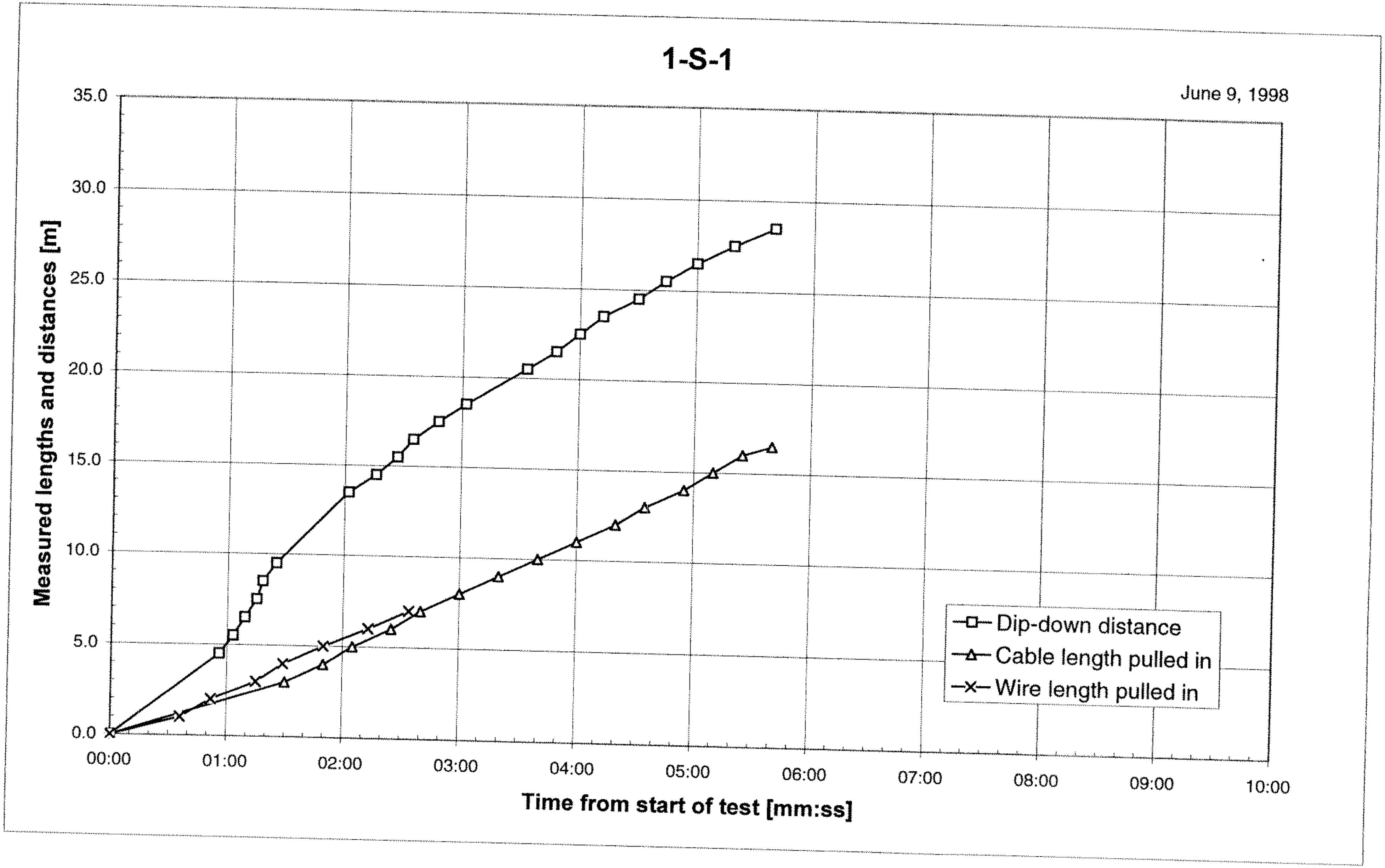
Test No.	ID	Time	Comments
1	1-D-1	20:30:32	Started installation to a few 100 kgs. Stopped.
		20:33	Pushed anchor manually and continued installation to about 1 T. Stopped.
		20:37	Unloaded. Changed shear-pin.
		21:05:14	New start.
		21:11	Stopped after 19.28 m, approx. 5.3 T
		22:28	Started pull-out. Wire for displacement measurement twists around the pull-out wire. Displacement measurement not correct.
		22:34:23	Continued pull-out.
2	1-D-2		Water-pressure at surface: 65.28
		16:40:38	Started pull-out. 87 mins. after start: Pull with low boom sideways to the right. 88 mins. after start: Pull with yet lower boom sideways to the left.
3	2-S-1		Water-pressure reading overflow at reading 65.28 (unknown unit)
		8:23	Pull-out directly upwards. Stable load 2.5 T with 10° angle.
		8:28	Unloading.
4	2-S-2	13.35:40	Pull-out of signal cables.
		13:38:20	First cable out.
		13:39:04	Last cable out.
6	12-S-4	18:33:00	Calibration of displacement transducer.
9	4-DL-1	17:55:25	Used the truck to move shank to retrieval position.
10	5-DL-2	08:05	Discovered defect in cable for angle transducer. New cable OK.
		08:28:21	Pull-out started.
		08:34	Anchor rotated
		08:45	Rotating shank for recovery
11	9-DL-3	12:28	Trigging at approx. 2 T.
		12:42	Pull-out
		13:05	Rotating
		13:20	Prepare for recovery
12	7-SL-1	08:20	Prepare for continued installation
		08:26:01	Continued installation
		08:31	Installation complete
		08:50	Anchor pulled backwards
		09:20	Pull-out started
13	7-SL-2	12:54	Pull-out started
14	9-D-5		Lubricant test

APPENDIX G

MANUAL MEASUREMENTS DURING PENETRATION - ONSØY DATA


1-D-1
8/Jun/98
Measured lengths and distances [m]
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
00:00
01:00
02:00
03:00
04:00
05:00
06:00
07:00
08:00
09:00
10:00
Time from start of test [mm:ss]
Dip-down distance
Cable length pulled in
Wire length pulled in


1-D-2
June 8, 1998
Measured lengths and distances [m]
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
00:00
02:00
04:00
06:00
08:00
10:00
12:00
14:00
16:00
18:00
20:00
Time from start of test [mm:ss]
Dip-down distance
Cable length pulled in
Wire length pulled in


1-S-1
June 9, 1998
Measured lengths and distances [m]
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
00:00
01:00
02:00
03:00
04:00
05:00
06:00
07:00
08:00
09:00
10:00
Time from start of test [mm:ss]
Dip-down distance
Cable length pulled in
Wire length pulled in

APPENDIX C

ANCHOR LINE CALIBRATION - ONSØY DATA

4-DL-1

Time	XDD		Bruce anchor tracker drag	Bruce anchor tracker depth	shackle	uplift	Fluke	Tension	Shackle position X	Shackle position Z
1.330	10.6	0	4.37	2.71	71.9	6.2	29	72.98	5.22	1.36
1.980	14.5	0	6.62	3.58	63.4	6.9	23	77.72	7.33	2.15
2.980	18.6	0	9.84	4.48	57.3	8.0	18.9	84.21	10.44	3.00
4.000	22.5	0	13.05	5.13	53.5	9.5	16.5	87.05	13.59	3.63
5.000	25.5	0	16.19	5.60	50	11.2	13.1	94.3	16.64	4.07
6.020	28.1	0	19.53	5.95	48.7	13.6	11.9	94.53	19.95	4.41

5-DL-2

Time	XDD		Bruce anchor tracker drag	Bruce anchor tracker depth	shackle	uplift	Fluke		Shackle position X	Shackle position Z
1.980	13	0	5.42	3.15	75.8	6.2	25.9	73.63	6.20	1.76
3.000	17.2	0	8.19	4.07	66.4	6.9	22.7	78.83	8.89	2.64
4.000	20.5	0	11.03	4.78	63.8	8.0	19.5	85.39	11.65	3.31
5.020	23.7	0	13.81	5.34	59.3	9.5	16.5	88.97	14.35	3.84
6.020	26.5	0	16.53	5.74	55.3	11.2	14	91.97	17.01	4.22
7.030	28.8	0	19.01	6.04	53.5	13.6	12.3	95.54	19.44	4.50

9-DL-3

Time	XDD		Bruce anchor tracker drag	Bruce anchor tracker depth	shackle	uplift	Fluke		Shackle position X	Shackle position Z
1.970	12.5	0	4.77	2.75	63.8	5.9	27.3	73.46	5.58	1.38
2.970	16.6	0	7.96	3.80	57.7	6.9	21.1	78.74	8.62	2.35
3.980	20.5	0	11.14	4.54	52.1	8.3	17.3	81.42	11.70	3.05
4.720	22.8	0	13.34	4.93	50.4	9.3	17.1	87.67	13.90	3.43
7.920	23.8	0	14.62	5.11	48.7	10.1	15.3	73.89	15.13	3.60
30.830	29.4	0	19.91	5.73	48.7	13.9	12.5	78.32	20.35	4.19

Uncorrected for depth deviation

4-DL-1

					Calibration fac	
F	Uplift	DX	DZ	Shackle	C_{DX}	$C_{Shackle}$
[kN]	[deg]	[m]	[m]	[deg]	[-]	[-]
73.0	6.2	5.38	1.36	18.1	0.93	0.55
77.7	6.9	7.17	2.15	26.6	0.87	0.82
84.2	8.0	8.16	3.00	32.7	0.99	0.95
87.1	9.5	8.91	3.63	36.5	0.95	0.98
94.3	11.2	8.86	4.07	40.0	1.07	1.11
94.5	13.6	8.15	4.41	41.3	1.23	1.05

5-DL-2

					Calibration fac	
F	Uplift	DX	DZ	Shackle	C_{DX}	$C_{Shackle}$
[kN]	[deg]	[m]	[m]	[deg]	[-]	[-]
73.6	5.1	6.80	1.76	14.2	0.86	0.26
78.8	6.0	8.31	2.64	23.6	0.88	0.53
85.4	6.9	8.85	3.31	26.2	1.03	0.56
89.0	8.1	9.35	3.84	30.7	1.04	0.68
92.0	9.7	9.49	4.22	34.7	1.04	0.80
95.5	11.4	9.36	4.50	36.5	1.07	0.83

9-DL-3

					Calibration fac	
F	Uplift	DX	DZ	Shackle	C_{DX}	$C_{Shackle}$
[kN]	[deg]	[m]	[m]	[deg]	[-]	[-]
73.5	5.9	6.92	1.38	26.2	0.50	1.17
78.7	6.9	7.98	2.35	32.3	0.77	1.12
81.4	8.3	8.80	3.05	37.9	0.82	1.23
87.7	9.3	8.90	3.43	39.6	0.84	1.23
73.9	10.1	8.67	3.60	41.3	0.82	1.07
78.3	13.9	9.05	4.19	41.3	0.70	0.90

Uncorrected for depth deviation

4-DL-1

Time	XDD		Bruce anchor tracker drag	Bruce anchor tracker depth	shackle	uplift	Fluke	Tension	Shackle position X	Shackle position Z
1.330	10.6	0	4.37	2.71	71.9	6.2	29	72.98	5.22	1.36
1.980	14.5	0	6.62	3.58	63.4	6.9	23	77.72	7.33	2.15
2.980	18.6	0	9.84	4.48	57.3	8.0	18.9	84.21	10.44	3.00
4.000	22.5	0	13.05	5.13	53.5	9.5	16.5	87.05	13.59	3.63
5.000	25.5	0	16.19	5.60	50	11.2	13.1	94.3	16.64	4.07
6.020	28.1	0	19.53	5.95	48.7	13.6	11.9	94.53	19.95	4.41

5-DL-2

Time	XDD		Bruce anchor tracker drag	Bruce anchor tracker depth	shackle	uplift	Fluke		Shackle position X	Shackle position Z
1.980	13	0	5.42	3.15	75.8	6.2	25.9	73.63	6.20	1.76
3.000	17.2	0	8.19	4.07	66.4	6.9	22.7	78.83	8.89	2.64
4.000	20.5	0	11.03	4.78	63.8	8.0	19.5	85.39	11.65	3.31
5.020	23.7	0	13.81	5.34	59.3	9.5	16.5	88.97	14.35	3.84
6.020	26.5	0	16.53	5.74	55.3	11.2	14	91.97	17.01	4.22
7.030	28.8	0	19.01	6.04	53.5	13.6	12.3	95.54	19.44	4.50

9-DL-3

Time	XDD		Bruce anchor tracker drag	Bruce anchor tracker depth	shackle	uplift	Fluke		Shackle position X	Shackle position Z
1.970	12.5	0	4.77	2.75	63.8	5.9	27.3	73.46	5.58	1.38
2.970	16.6	0	7.96	3.80	57.7	6.9	21.1	78.74	8.62	2.35
3.980	20.5	0	11.14	4.54	52.1	8.3	17.3	81.42	11.70	3.05
4.720	22.8	0	13.34	4.93	50.4	9.3	17.1	87.67	13.90	3.43
7.920	23.8	0	14.62	5.11	48.7	10.1	15.3	73.89	15.13	3.60
30.830	29.4	0	19.91	5.73	48.7	13.9	12.5	78.32	20.35	4.19

Corrected for depth deviation

4-DL-1 corrected

$Corr_{DX}$	$Corr_{DZ}$	F	Uplift	DX	DZ	Shackle	Calibration factor C_{DX}	$C_{Shackle}$	$C_{average}$
[m]	[m]	[kN]	[deg]	[m]	[m]	[deg]	[-]	[-]	[-]
0.19	-0.27	73.0	6.2	5.56	1.63	18.1	1.12	0.45	0.79
0.28	-0.41	77.7	6.9	7.46	2.56	26.6	1.01	0.69	0.85
0.42	-0.61	84.2	8.0	8.58	3.62	32.7	1.12	0.78	0.95
0.56	-0.82	87.1	9.5	9.47	4.44	36.5	1.06	0.79	0.93
0.69	-1.01	94.3	11.2	9.55	5.08	40.0	1.18	0.86	1.02
0.84	-1.22	94.5	13.6	8.99	5.63	41.3	1.31	0.77	1.04

5-DL-2 corrected

$Corr_{DX}$	$Corr_{DZ}$	F	Uplift	DX	DZ	Shackle	Calibration factor C_{DX}	$C_{Shackle}$	$C_{average}$
[m]	[m]	[kN]	[deg]	[m]	[m]	[deg]	[-]	[-]	[-]
0.47	-0.40	73.6	5.1	7.27	2.16	14.2	0.96	0.21	0.59
0.71	-0.61	78.8	6.0	9.02	3.25	23.6	0.94	0.43	0.69
0.95	-0.82	85.4	6.9	9.80	4.13	26.2	1.06	0.46	0.76
1.19	-1.03	89.0	8.1	10.54	4.87	30.7	1.04	0.52	0.78
1.42	-1.23	92.0	9.7	10.92	5.45	34.7	1.02	0.59	0.81
1.64	-1.42	95.5	11.4	11.00	5.92	36.5	1.03	0.60	0.82

9-DL-3 corrected

$Corr_{DX}$	$Corr_{DZ}$	F	Uplift	DX	DZ	Shackle	Calibration factor C_{DX}	$C_{Shackle}$	$C_{average}$
[m]	[m]	[kN]	[deg]	[m]	[m]	[deg]	[-]	[-]	[-]
0.69	-0.16	73.5	5.9	7.61	1.54	26.2	0.46	1.05	0.76
1.15	-0.27	78.7	6.9	9.13	2.61	32.3	0.64	1.02	0.83
1.62	-0.37	81.4	8.3	10.41	3.42	37.9	0.63	1.08	0.86
1.94	-0.45	87.7	9.3	10.84	3.88	39.6	0.61	1.08 *)	0.85
2.12	-0.49	73.9	10.1	10.79	4.09	41.3	0.56	0.93	0.75
2.89	-0.67	78.3	13.9	11.94	4.86	41.3	0.41	0.76	0.59

Correction for depth is based on deviation between measured shackle depth and shackle depth from Bruce Tracker, which for these particular tests were found to be hence -6.2%, -7.4% and - 3.3% for tests 4-DL-1, 5-DL-2 and 9-DL-3, respectively

Correction for drag is based on deviation between measured drag length and drag distance from Bruce Tracker, which for these particular tests were found to be hence 4.2%, 8.6% and 14.5% for tests 4-DL-1, 5-DL-2 and 9-DL-3, respectively

*) Detailed computer listing included

Corrected for depth deviation

DIGIN.INP

```
ONSØY test 76010051                                          HEAD1
9-DL-3.  Trench depth = 1.25m                                HEAD2
Backfitting anchor line at Onsøy                             HEAD3
PJS                                                          SIGN
   3.12      0.0                                             WATDEP,AIRGAP
  3                                                          SOILDES
     0.00     10.50     1.50   20.0                          SOILZ,SOILSU,SOILSR,SOILGAM
     2.75     10.50     1.75   20.0                          ---------------------------
    13.75     22.00     4.40   16.5
 1        1        1       1       1                         CONFIG,LINSEG,PULLOPT,MODE,MOMEQ
    10.1                                                     HORDIST
 1  122.0         1        0.0360    0                       SEGNUM,SEGLEN,SEGTYP,SEGDIA,SEGWID
 0        0        0        0        0.5    0.15             SEGCIRC,SEGWEI,WRA,SEGSTIFF,LINELW,LINELSS
 0                                                           BALNU
 0       0                                                   FLINEMB,FLINMUD
 1                                                           ANCTYP
  3.88        3.88         0.50                              DEPRANGMIN,DEPRANGMAX,DEPSTEP
 87.70       87.70         1.00                              FORANGMIN,FORANGMAX,FORSTEP
###3                                                         INPEND
39.6   10.84    1.08    0.0                                  SPITCH,HDIST,NCFACL,NCVAR
```

DIGIN.RES (extracts)

```
#####      ##  #######  ##  ##    ##
##   ##    ##  ##    ## ##  ###   ##
##    ##   ##  ##       ##  ## #  ##
##    ##   ##  ## ####  ##  ##  # ##
##   ##    ##  ##    ## ##  ##   ###
#####      ##  #######  ##  ##    ##
```

```
Penetration behaviour of deep embedment anchors
"""""""""""""""""""""""""""""""""""""""""""""""
```

```
 ------------------------------------------------------
| Version 5.4    :   20 November  1998                 |
|                                                      |
| Licence        :   DNV                               |
|                                                      |
| Programmed by  :   Det Norske Veritas AS             |
|                    Veritasv. 1                       |
|                    N-1322 Høvik                      |
|                    Norway                            |
|                                                      |
|                    Section for Risers, Mooring       |
|                    and Foundations                   |
|                                                      |
|                    Units: m,kN,deg                   |
 ------------------------------------------------------
```

```
ONSØY test 76010051
9-DL-3.  Trench depth = 1.25m
Backfitting anchor line at Onsøy

Date   :01/06/99
Time   :13:32:43

Analysis responsible : PJS


Echo of input  :
----------------
```

Water depth : 3.1 m
Airgap : .0 m

Soil description

Number of depths : 3

Depth [m]	Su [kN/m2]	Sr [kN/m2]	Gam [kN/m3]
.00	10.50	1.50	20.00
2.75	10.50	1.75	20.00
13.75	22.00	4.40	16.50

Line

Configuration : Embedded part
Dip-down angle : 10.10

Point weights : 0

Number of line segments : 1

No.	Length [m]	Type	Diam. [m]	Width [m]	Circum. [m]	Weight_air [kN/m]	Weight_sub [kN/m]	EA [kN]	dL(water) [m]	dL(soil) [m]
1	122.00	1	.036	.036	.113	.070	.056	.713E+05	.50	.150

Forces
(Line tension at dip-down point)

Range : 87 - 87 kN
Step : 1 kN

Depths

Range : 3.88 - 3.88 m
Step : .50 m

Anchor

Anchor type: Fixed

Interaction parameters:

Line Nc = Default
Femb = .30

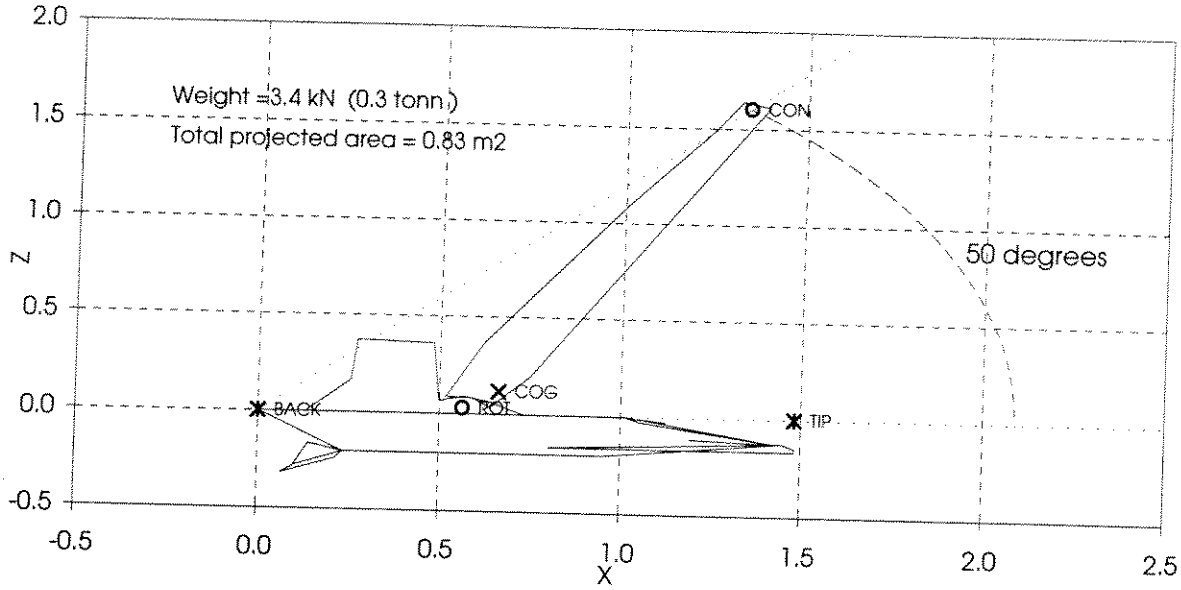
DIGIN.PLT

Line plot for a shackle depth of : 3.9 m
Line tension at upper end : 87.7 kN
Line tension at anchor : 84.1 kN

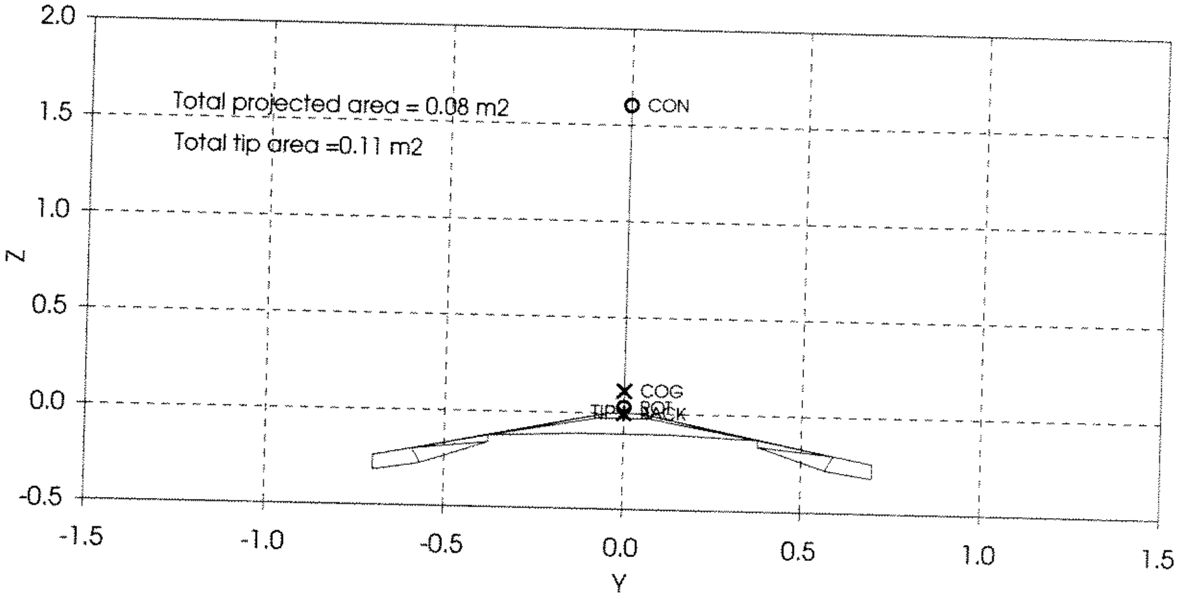
J	S(J)	X(J)	Z(J)	T(J)	ISEG	TETA(J)
1	9.565	8.627	.000	87.700	1	10.10
2	9.415	8.480	-.027	87.645	1	10.32
3	9.265	8.332	-.054	87.591	1	10.59
4	9.115	8.185	-.082	87.536	1	10.93
5	8.965	8.038	-.111	87.482	1	11.35
6	8.815	7.891	-.141	87.427	1	11.81
7	8.665	7.744	-.172	87.372	1	12.26
8	8.515	7.598	-.205	87.318	1	12.72

9	8.365	7.451	-.238	87.263		
10	8.215	7.305	-.273	87.208	1	13.17
11	8.065	7.160	-.309	87.153	1	13.63
12	7.915	7.014	-.346	87.098	1	14.08
13	7.765	6.869	-.384	87.043	1	14.54
14	7.615	6.725	-.424	86.988	1	14.99
15	7.465	6.580	-.464	86.933	1	15.45
16	7.315	6.436	-.506	86.878	1	15.91
17	7.165	6.292	-.549	86.823	1	16.36
18	7.015	6.149	-.593	86.767	1	16.82
19	6.865	6.006	-.638	86.712	1	17.28
20	6.715	5.863	-.684	86.657	1	17.74
21	6.565	5.721	-.731	86.601	1	18.20
22	6.415	5.579	-.780	86.546	1	18.65
23	6.265	5.437	-.830	86.490	1	19.11
24	6.115	5.296	-.880	86.435	1	19.57
25	5.965	5.156	-.932	86.379	1	20.03
26	5.815	5.015	-.985	86.324	1	20.49
27	5.665	4.875	-1.040	86.268	1	20.95
28	5.515	4.736	-1.095	86.212	1	21.41
29	5.365	4.597	-1.151	86.157	1	21.87
30	5.215	4.459	-1.209	86.101	1	22.33
31	5.065	4.320	-1.268	86.045	1	22.80
32	4.915	4.183	-1.327	85.989	1	23.26
33	4.765	4.046	-1.388	85.933	1	23.72
34	4.615	3.909	-1.450	85.877	1	24.18
35	4.465	3.773	-1.513	85.821	1	24.64
36	4.315	3.638	-1.578	85.765	1	25.11
37	4.165	3.503	-1.643	85.709	1	25.57
38	4.015	3.368	-1.709	85.653	1	26.03
39	3.865	3.234	-1.777	85.596	1	26.50
40	3.715	3.101	-1.845	85.540	1	26.96
41	3.565	2.968	-1.915	85.484	1	27.43
42	3.415	2.835	-1.986	85.427	1	27.89
43	3.265	2.704	-2.057	85.371	1	28.36
44	3.115	2.573	-2.130	85.315	1	28.82
45	2.965	2.442	-2.204	85.258	1	29.29
46	2.815	2.312	-2.279	85.201	1	29.75
47	2.665	2.183	-2.355	85.145	1	30.22
48	2.515	2.054	-2.432	85.088	1	30.69
49	2.365	1.926	-2.510	85.032	1	31.15
50	2.215	1.799	-2.590	84.975	1	31.62
51	2.065	1.672	-2.670	84.918	1	32.09
52	1.915	1.546	-2.751	84.861	1	32.56
53	1.765	1.420	-2.833	84.804	1	33.03
54	1.615	1.296	-2.917	84.748	1	33.50
55	1.465	1.172	-3.001	84.691	1	33.97
56	1.315	1.048	-3.086	84.634	1	34.45
57	1.165	.926	-3.173	84.576	1	34.94
58	1.015	.804	-3.260	84.519	1	35.42
59	.865	.683	-3.349	84.462	1	35.92
60	.715	.562	-3.438	84.405	1	36.41
61	.565	.443	-3.529	84.348	1	36.91
62	.415	.324	-3.621	84.290	1	37.42
63	.265	.206	-3.713	84.233	1	37.93
64	.115	.089	-3.807	84.176	1	38.45
65	.000	.000	-3.880	84.132	1	38.97
						39.49

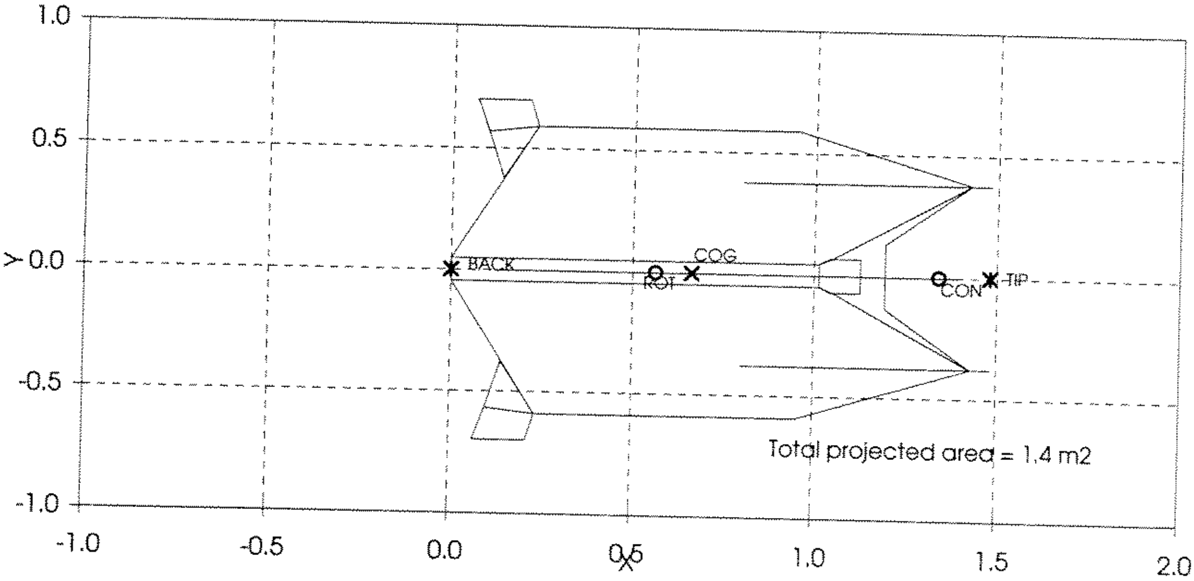
APPENDIX
D
ANCHOR CALIBRATION - DENLA - ONSØY DATA



Weight =3.4 kN (0.3 tonn)
Total projected area = 0.83 m2
50 degrees
CON
COG
ROT
BACK
TIP
Z
X



Total projected area = 0.08 m2
Total tip area =0.11 m2
CON
COG
ROT
TIP
BACK
Z
Y



BACK
COG
ROT
CON
TIP
Total projected area = 1.4 m2
Y
X

DIGIN.INP

```
ONSØY test 76010051                                   HEAD1
Test 5-DL-1: (#12) Large Denla                        HEAD2
Backfitting with Fanc=3.5                             HEAD3
PJS                                                   SIGN
   2.5      0.0                                       WATDEP,AIRGAP
  3                                                   SOILDES
      0.00    10.50    1.50  20.0                     SOILZ,SOILSU,SOILSR,SOILGAM
      3.00    10.50    1.75  20.0                     ---------------------------
     14.00    22.00    4.40  16.5
 3        1        2        1        1                CONFIG,LINSEG,PULLOPT,MODE,MOMEQ
      41.0                                            HORDIST
 1  122.0        1        0.0360    0                 SEGNUM,SEGLEN,SEGTYP,SEGDIA,SEGWID
 0        0        0        0        0.5    0.3       SEGCIRC,SEGWEI,WRA,SEGSTIFF,LINELW,LINELSS
 0                                                    BALNU
 0      0                                             FLINEMB,FLINMUD
 2                                                    ANCTYP
  0.2      6.5      0.2                               DEPRANGMIN,DEPRANGMAX,DEPSTEP
10                                                    ANCDAT
 3.5                                                  FANC
 1        1                                           SCALEW,SCALEL
 0.0                                                  ROTANG
 0                                                    CONOPT
 5.5     2                                            TRIGDEP,TRIGGRP
####                                                  INPEND
```

DIGIN.RES

```
#####     ##  #######  ##  ##    ##
##   ##   ##  ##    ## ##  ###   ##
##    ##  ##  ##       ##  ## #  ##
##    ##  ##  ## ####  ##  ##  # ##
##   ##   ##  ##    ## ##  ##   ###
#####     ##  #######  ##  ##    ##
```

Penetration behaviour of deep embedment anchors
""

```
 ___________________________________________________
| Version 5.4    :  20 November  1998              |
|                                                   |
| Licence        :  DNV                             |
|                                                   |
| Programmed by  :  Det Norske Veritas AS           |
|                   Veritasv. 1                     |
|                   N-1322 Høvik                    |
|                   Norway                          |
|                                                   |
|                   Section for Risers, Mooring     |
|                   and Foundations                 |
|                                                   |
|                   Units: m,kN,deg                 |
|___________________________________________________|
```

ONSØY test 76010051
Test 5-DL-1: (#12) Large Denla
Backfitting with Fanc=3.5

Date   :11/24/98
Time   :14:40:50

Analysis responsible : PJS

Echo of input :

Water depth : 2.5 m
Airgap : .0 m

Soil description

Number of depths : 3

Depth [m]	Su [kN/m2]	Sr [kN/m2]	Gam [kN/m3]
.00	10.50	1.50	20.00
3.00	10.50	1.75	20.00
14.00	22.00	4.40	16.50

Line

Configuration: Total anchor line up to vessel

Pull scenario: Pull from winch
Constant horizontal distance to anchor : 41.000

Point weights : 0

Number of line segments : 1

No.	Length [m]	Type	Diam. [m]	Width [m]	Circum. [m]	Weight_air [kN/m]	Weight_sub [kN/m]	EA [kN]	dL(water) [m]	dL(soil) [m]
1	122.00	1	.036	.036	.113	.070	.056	.713E+05	.50	.300

Depths

Range : .20 - 6.50 m
Step : NA

Anchor

Anchor type: Drag embedment
Anchor name: Bruce Denla Mk3 - NFR large Ancn
Fluke/Shank angle before scaling: 50.05 (Connection/Back/Tip)

Moment equilibrium : Must be found

Fluke mode allowed : Restraint

Line connection:

X = 1.34
Z = 1.60
Grp : 2

Anchor tip:

X = 1.48
Z = .00
Grp : 1

Anchor back:

X = .00
Z = .00
Grp : 1

Weight data:

W = 3.40 kN

COG X = .66
Z = .12

Anchor groups: 2

No.	Definition
1	Fluke
2	Shanck

Anchor members: 14

No.	Group	Nodes	Cross section shape Side	Front	F.Area	X	Y	Z
1	1	6	1	2	.010	.00	-.05	.00
						1.01	-.05	.00
						1.05	-.07	-.03
						1.43	-.38	-.13
						.95	-.59	-.20
						.23	-.59	-.20
	Note:	Coordinate direction changed compared to input						
2	1	6	1	2	.010	.00	.05	.00
						.23	.59	-.20
						.95	.59	-.20
						1.43	.38	-.13
						1.05	.07	-.03
						1.01	.05	.00
3	1	10	1	1	.088	.52	.00	.09
						.62	.00	.36
						1.01	.00	1.10
						1.24	.00	1.49
						1.32	.00	1.64
						1.39	.00	1.61
						1.35	.00	1.52
						.75	.00	.20
						.64	.00	.03
						.59	.00	.08
4	1	6	1	1	.000	1.01	-.05	.00
						1.01	.05	.00
						1.04	.07	-.01
						1.13	.07	-.03
						1.13	-.07	-.03
						1.04	-.07	-.01
	Note:	Coordinate direction changed compared to input						
5	1	6	1	1	.000	1.05	-.07	-.01
						1.43	-.38	-.13
						1.19	-.13	-.11
						1.19	.00	-.11
						1.13	.00	-.03
						1.12	-.07	-.02
	Note:	Coordinate direction changed compared to input						
6	1	6	1	1	.000	1.05	.07	-.01
						1.43	.38	-.13
						1.19	.13	-.11
						1.19	.00	-.11
						1.13	.00	-.03
						1.12	.07	-.03
7	1	4	1	1	.000	.00	-.05	.00
						.00	.05	.00
						1.01	.05	.00
						1.01	-.05	.00
	Note:	Coordinate direction changed compared to input						

8	1	4	1	1	.001	1.45	-.38	-.12
						1.48	-.38	-.15
						1.48	-.38	-.16
						.80	-.38	-.16
9	1	4	1	1	.000	1.45	.38	-.12
						1.48	.38	-.15
						1.48	.38	-.16
						.80	.38	-.16
10	1	3	1	1	.000	.14	-.38	-.16
						.23	-.59	-.20
						.10	-.57	-.28
11	1	4	1	1	.000	.23	-.59	-.20
						.21	-.70	-.24
						.07	-.70	-.32
						.10	-.57	-.28
12	1	3	1	1	.000	.14	.38	-.16
						.23	.59	-.20
						.10	.57	-.28
13	1	4	1	1	.000	.23	.59	-.20
						.10	.57	-.28
						.07	.70	-.32
						.21	.70	-.24

Note: Coordinate direction changed compared to input

14	1	8	1	1	.009	.13	.00	.00
						.25	.00	.16
						.27	.00	.37
						.48	.00	.36
						.50	.00	.06
						.57	.00	.09
						.63	.00	.07
						.73	.00	.00

Interaction parameters:

Line	Nc	=	Default
	Fmud	=	0.7/0.2
	Femb	=	.30
Anchor	Nc	=	Default
	F	=	3.50

No scaling.

Triggering of anchor :

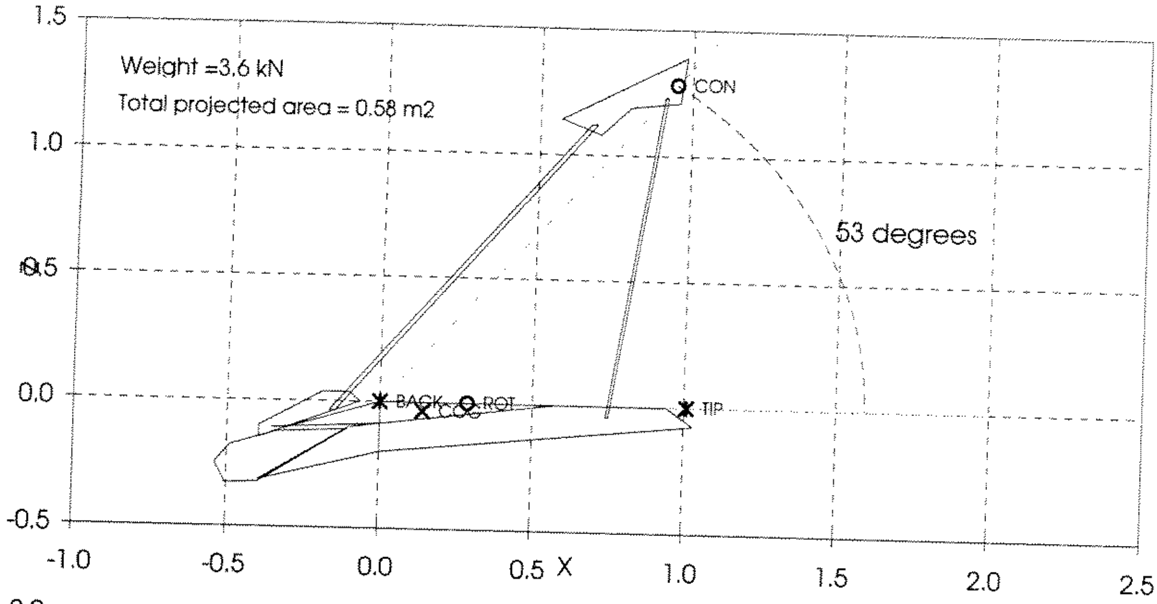
Anchor triggering at depth : 5.50
Anchor group to be rotated : 2

SUMMARY OF CALCULATIONS :

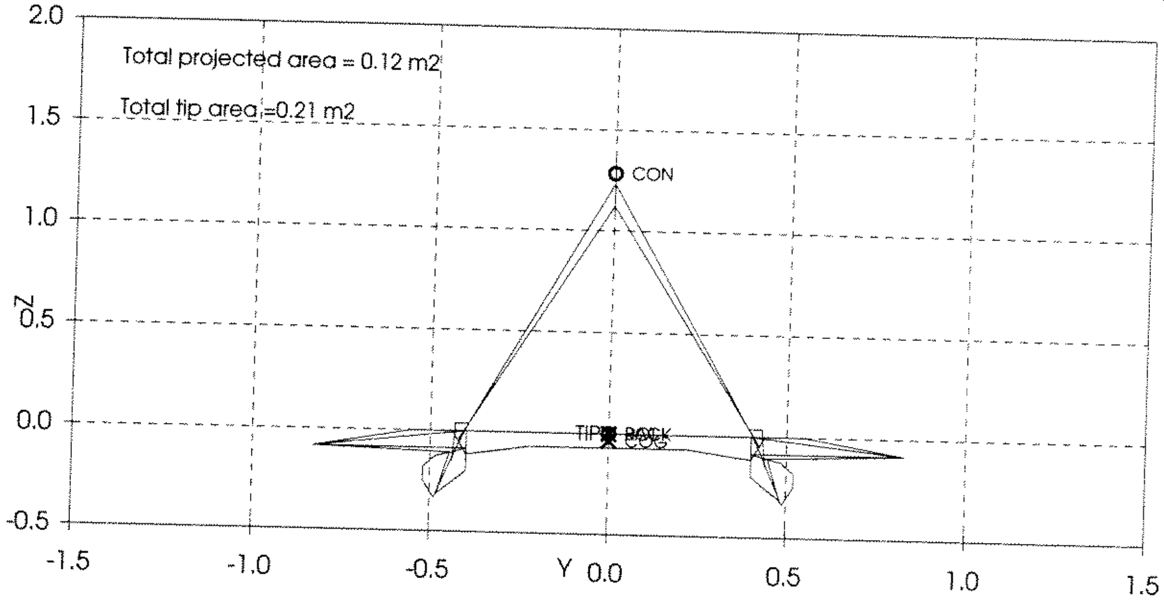
Dep	Tension								Penetr.		Lengths				Distances			
	Fairlead		Seabed				Anchor		Dir.	Orien.	Susp	Seab	Embd	Pull	Susp	Seab	Embd	Pen.
	TF	AngF	TTD	AngTD	TDD	AngDD	TA	AngA	AngD	AngO	LS	LM	LE	LP	DS	DM	DE	DP
.2	No equilibrium found																	
.4	75	4.6	74	3.0	74	3.0	73	12.4	135.0	135.0	37	0	3	81	37	0	3	.5
.6	63	4.8	63	3.0	63	3.0	61	16.5	122.0	122.0	36	0	3	81	36	0	3	.7
.8	60	5.0	60	3.1	60	3.1	58	19.8	115.0	115.0	35	0	4	81	35	0	4	1.1
1.0	59	5.1	58	3.2	58	3.2	57	23.0	109.0	109.0	34	0	4	82	34	0	4	1.6
1.2	59	5.2	59	3.3	59	3.3	57	24.2	108.0	108.0	33	0	5	82	33	0	5	2.2
1.4	60	5.3	60	3.5	60	3.5	58	26.6	106.0	106.0	32	0	5	83	32	0	5	2.8

1.6	61	5.4	61	3.7	61	3.7	59	27.7	105.0	105.0	31	0	6	84	31	0	6	3.5
1.8	62	5.5	62	3.9	62	3.9	59	30.2	101.0	101.0	30	0	6	85	30	0	6	4.4
2.0	63	5.7	63	4.2	63	4.2	60	31.2	100.0	100.0	28	0	7	86	28	0	6	5.5
2.2	65	5.9	65	4.5	65	4.5	62	32.0	100.0	100.0	27	0	7	87	27	0	7	6.6
2.4	67	6.1	66	4.9	66	4.9	64	32.9	99.0	99.0	25	0	7	88	25	0	7	7.8
2.6	69	6.4	69	5.3	69	5.3	66	34.6	98.0	98.0	24	0	8	89	24	0	7	9.2
2.8	70	6.8	70	5.8	70	5.8	67	34.8	97.0	97.0	22	0	8	91	22	0	7	10.7
3.0	72	7.4	71	6.4	71	6.4	68	35.9	96.0	96.0	20	0	8	92	20	0	8	12.4
3.2	74	8.2	73	7.4	73	7.4	70	37.2	95.0	95.0	18	0	8	94	18	0	8	14.5
3.4	75	9.4	75	8.7	75	8.7	72	38.1	94.0	94.0	15	0	8	97	15	0	8	17.1
3.6	77	11.5	77	11.0	77	11.0	74	39.6	93.0	93.0	12	0	8	100	12	0	7	20.3
3.8	81	15.0	81	14.6	81	14.6	77	41.3	93.0	93.0	9	0	8	103	9	0	7	24.1

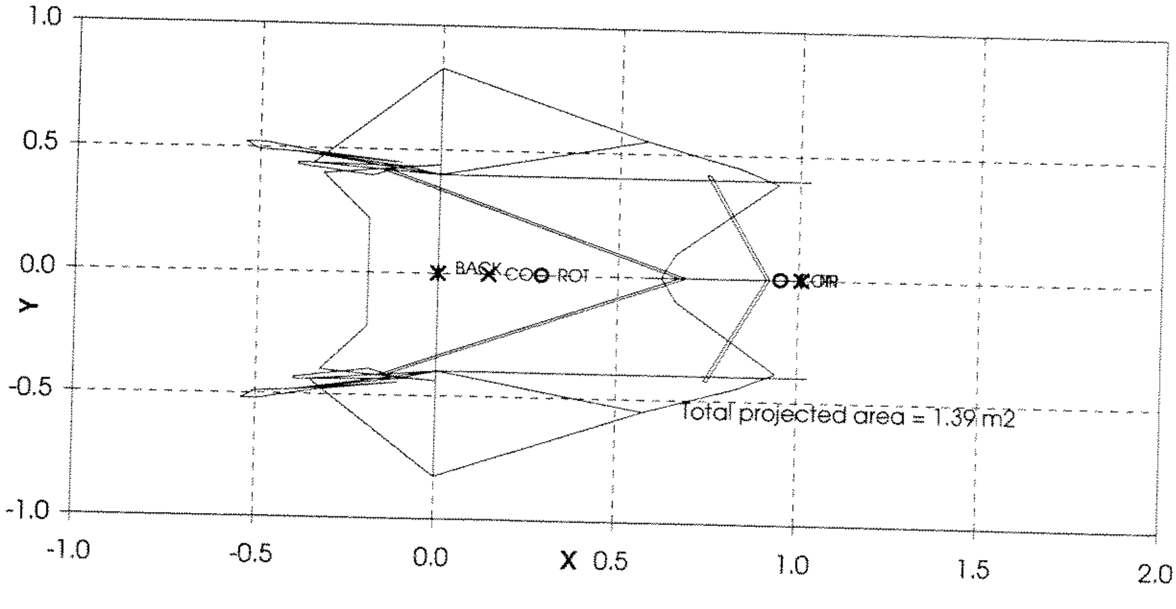
APPENDIX
E
ANCHOR CALIBRATION - STEVMANTA - ONSØY DATA



Weight =3.6 kN
Total projected area = 0.58 m2
CON
53 degrees
BACK
ROT
COG
TIP
X
1.5
1.0
0.5
0.0
-0.5
-1.0
-0.5
0.0
0.5
1.0
1.5
2.0
2.5



Total projected area = 0.12 m2
Total tip area =0.21 m2
CON
Z
Y
2.0
1.5
1.0
0.5
0.0
-0.5
-1.5
-1.0
-0.5
0.0
0.5
1.0
1.5



BACK
ROT
Total projected area = 1.39 m2
Y
X
1.0
0.5
0.0
-0.5
-1.0
-1.0
-0.5
0.0
0.5
1.0
1.5
2.0

DIGIN.INP

```
ONSØY test 76010051                                   HEAD1
7-SL-1 Large Stevmanta                                HEAD2
Backfitting tests from Onsøy                          HEAD3
PJS                                                   SIGN
  2.75      0.0                                       WATDEP,AIRGAP
 3                                                    SOILDES
    0.00    10.50    1.50  20.0                       SOILZ,SOILSU,SOILSR,SOILGAM
    2.90    10.50    1.75  20.0                       ---------------------------
   13.90    22.00    4.40  16.5
 3       1       2       1       1                    CONFIG,LINSEG,PULLOPT,MODE,MOMEQ
    42.6                                              HORDIST
 1  122.0       1       0.0260   0                    SEGNUM,SEGLEN,SEGTYP,SEGDIA,SEGWID
 0        0        0        0        0.5   0.25       SEGCIRC,SEGWEI,WRA,SEGSTIFF,LINELW,LINELSS
 0                                                    BALNU
 0       0                                            FLINEMB,FLINMUD
 2                                                    ANCTYP
  0.0       6.0       0.50                            DEPRANGMIN,DEPRANGMAX,DEPSTEP
17                                                    ANCDAT
 1.0                                                  FANC
 1.8       1.4142                                     SCALEW,SCALEL
 0.0                                                  ROTANG
 0                                                    CONOPT
 11.01     2                                          TRIGDEP,TRIGGRP
####
```

DIGIN.RES

```
#####     ##  #######  ##  ##    ##
##   ##   ##  ##   ##  ##  ###   ##
##    ##  ##  ##       ##  ## #  ##
##    ##  ##  ## ####  ##  ##  # ##
##   ##   ##  ##   ##  ##  ##   ###
#####     ##  #######  ##  ##    ##
```

Penetration behaviour of deep embedment anchors
""

```
 ---------------------------------------------------
| Version 5.4     :  20 November 1998               |
|                                                   |
| Licence         :  DNV                            |
|                                                   |
| Programmed by   :  Det Norske Veritas AS          |
|                    Veritasv. 1                    |
|                    N-1322 Høvik                   |
|                    Norway                         |
|                                                   |
|                    Section for Risers, Mooring    |
|                    and Foundations                |
|                                                   |
|                    Units: m,kN,deg                |
 ---------------------------------------------------
```

ONSØY test 76010051
7-SL-1 Large Stevmanta
Backfitting tests from Onsøy

Date :12/16/98
Time :11:14:18

Analysis responsible : PJS

Echo of input :

Water depth : 2.8 m
Airgap : .0 m

Soil description

Number of depths : 3

Depth [m]	Su [kN/m2]	Sr [kN/m2]	Gam [kN/m3]
.00	10.50	1.50	20.00
2.90	10.50	1.75	20.00
13.90	22.00	4.40	16.50

Line

Configuration: Total anchor line up to vessel

Pull scenario: Pull from winch
Constant horizontal distance to anchor : 42.600

Point weights : 0

Number of line segments : 1

No.	Length [m]	Type	Diam. [m]	Width [m]	Circum. [m]	Weight_air [kN/m]	Weight_sub [kN/m]	EA [kN]	dL(water) [m]	dL(soil) [m]
1	122.00	1	.026	.026	.082	.037	.030	.372E+05	.50	.250

Depths

Range : .00 - 6.00 m
Step : NA

Anchor

Anchor type: Drag embedment
Anchor name: Vryhof Stevmanta, rev 03 - small Ancnam
Fluke/Shank angle before scaling: 54.24 (Connection/Back/Tip)

Moment equilibrium : Must be found

Fluke mode allowed : Restraint

Line connection:

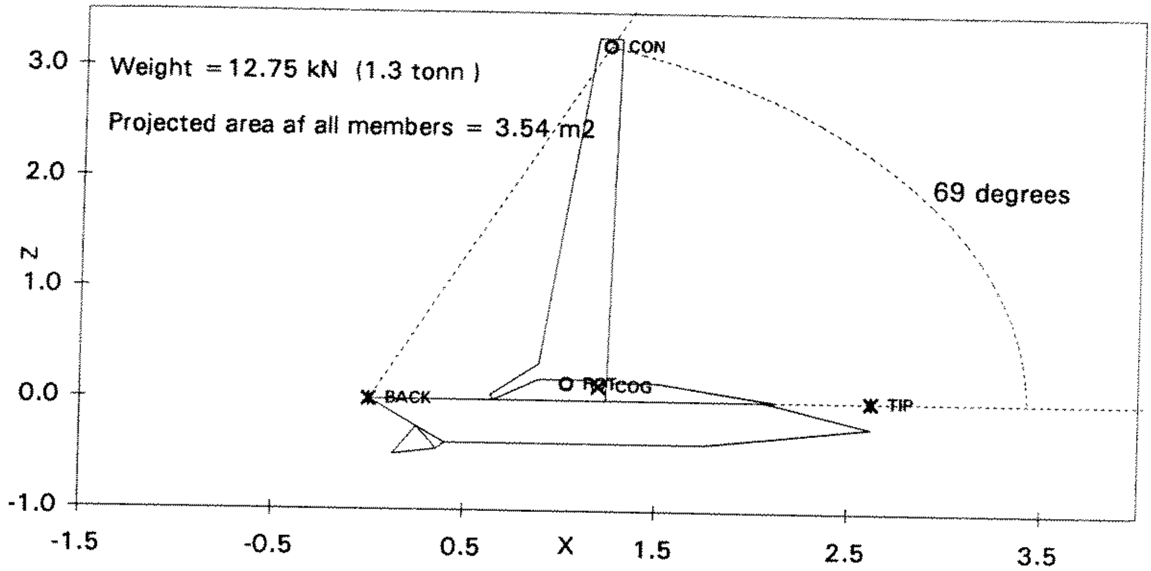
X = .67
Z = .93
Grp : 2

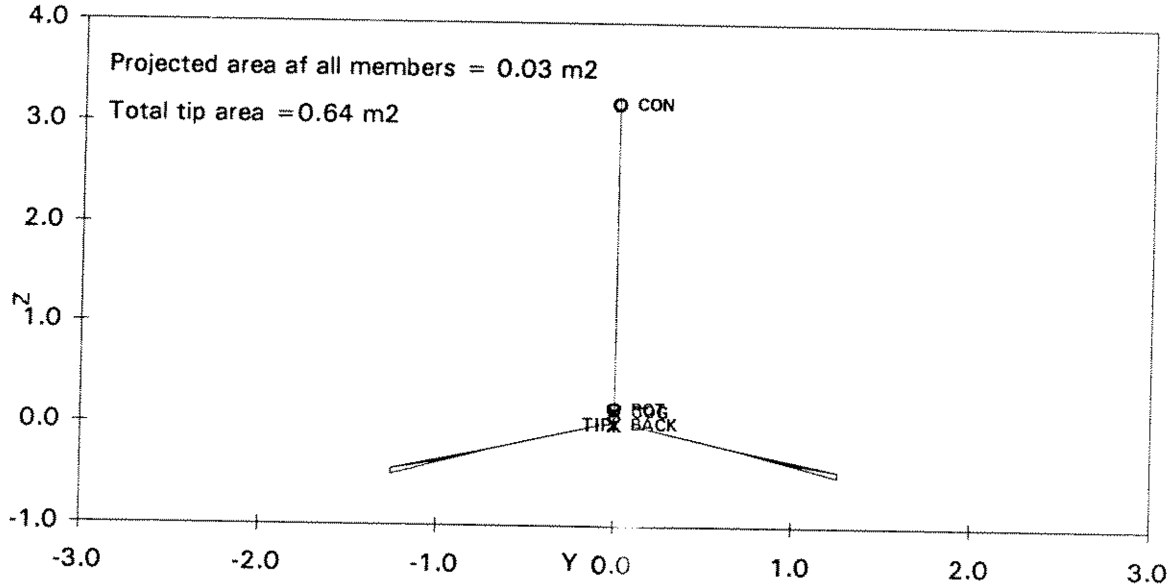
Anchor tip:

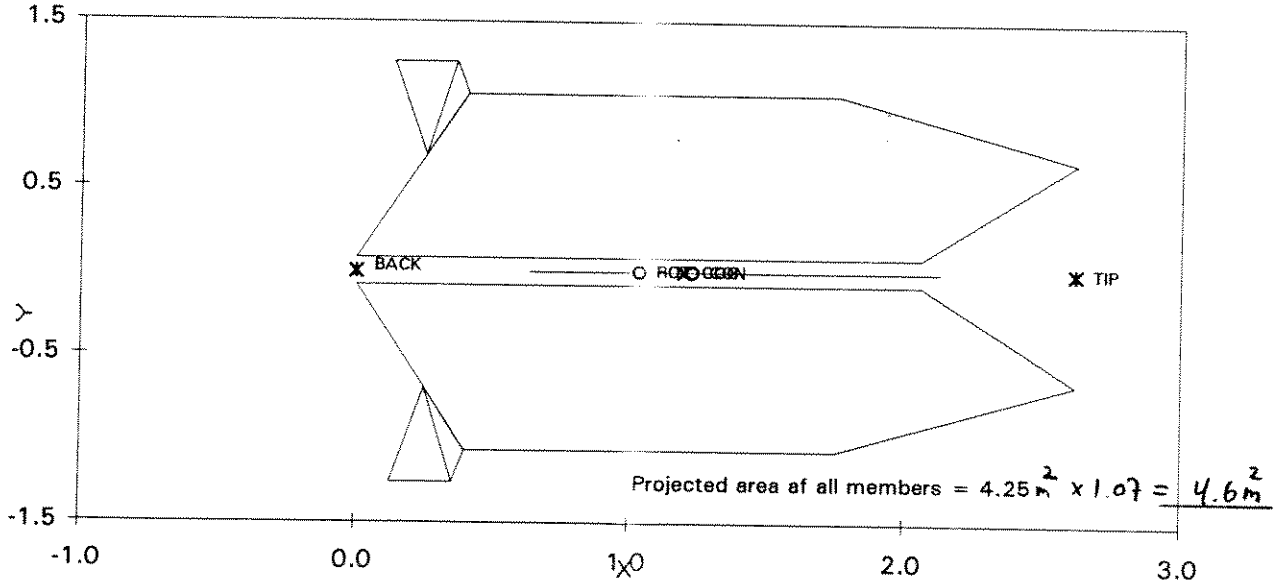
X = .71
Z = .00
Grp : 1

Anchor back:

X = .00
Z = .00
Grp : 1


Weight = 12.75 kN (1.3 tonn)
Projected area af all members = 3.54 m2
69 degrees
CON
BACK
TIP
COG
Z
X
3.0
2.0
1.0
0.0
-1.0
-1.5
-0.5
0.5
1.5
2.5
3.5


Projected area af all members = 0.03 m2
Total tip area = 0.64 m2
CON
BACK
Z
Y
4.0
3.0
2.0
1.0
0.0
-1.0
-3.0
-2.0
-1.0
0.0
1.0
2.0
3.0


BACK
TIP
Projected area af all members = 4.25 m² x 1.07 = 4.6 m²
Y
X
1.5
0.5
-0.5
-1.5
-1.0
0.0
1.0
2.0
3.0

```
#####     ##  #######  ##  ##     ##
##   ##   ##  ##    ## ##  ###    ##
##    ##  ##  ##       ##  ## #   ##
##    ##  ##  ## ####  ##  ##  #  ##
##   ##   ##  ##    ## ##  ##    ###
#####     ##  #######  ##  ##     ##
```

Penetration behaviour of deep embedment anchors
"""

```
Version 5.4    :   20 November  1998

Licence        :   DNV

Programmed by  :   Det Norske Veritas AS
                   Veritasv. 1
                   N-1322 Høvik
                   Norway

                   Section for Risers, Mooring
                   and Foundations

                   Units: m,kN,deg
```

ONSØY test 76010051
Gulf of Mexico South Timbalier Block 295
Backfitting tests from DeepStar

Date   :01/12/99
Time   :18:33:36

Analysis responsible : PJS

Echo of input :

Water depth :   91.4 m
Airgap   :   .0 m

Soil description

Number of depths :   6

Depth [m]	Su [kN/m2]	Sr [kN/m2]	Gam [kN/m3]
.00	3.30	.90	16.50
1.40	3.30	.90	16.50
1.50	3.30	.96	16.50
14.99	33.40	9.60	16.50
15.00	33.40	15.30	16.50
100.00	222.80	89.00	16.50

Line

Configuration: Total anchor line up to vessel

Pull scenario: Bollard pull

Point weights :   0

Number of line segments :   1

No.	Length [m]	Type	Diam. [m]	Width [m]	Circum. [m]	Weight_air [kN/m]	Weight_sub [kN/m]	EA [kN]	dL(water) [m]	dL(soil) [m]
1	853.00	1	.073	.073	.229	.282	.226	.293E+06	.50	.200

Depths

Range : .00 -20.00 m
Step : NA

Anchor

Anchor type: Drag embedment
Anchor name: Bruce Denla Mk2, 1.3t
Fluke/Shank angle before scaling: 69.02 (Connection/Back/Tip)

Moment equilibrium : Must be found

Fluke mode allowed : Restraint

Line connection:

X = 1.23
Z = 3.20
Grp : 2

Anchor tip:

X = 2.62
Z = .00
Grp : 1

Anchor back:

X = .00
Z = .00
Grp : 1

Weight data:

W = 12.80 kN

COG X = 1.20
Z = .13

Anchor groups: 2

No.	Definition
1	Fluke
2	Shanck

Anchor members: 8

No.	Group	Nodes	Cross section shape Side	Front	F.Area	X	Y	Z
1	1	5	2	1	.155	.00	.08	.00
						.40	1.07	-.39
						1.75	1.07	-.39
						2.62	.67	-.23
						2.06	.08	.00
2	1	5	2	1	.155	.00	-.08	.00
						2.06	-.08	.00
						2.62	-.67	-.23
						1.75	-1.07	-.39
						.40	-1.07	-.39

```
  3     1     6     1     1    .297     .65    .00    .00
                                        .63    .00    .04
                                        .89    .00    .33
                                       1.17    .00   3.27
                                       1.28    .00   3.27
                                       1.24    .00    .00
                                      ---------------------
  4     1     3     1     1    .000     .25    .70   -.24
                                        .36   1.26   -.45
                                        .40   1.07   -.39
                                      ---------------------
  5     1     3     1     1    .000     .25   -.70   -.24
                                        .40  -1.07   -.39
                                        .36  -1.26   -.45
                                      ---------------------
  6     1     3     1     1    .000     .25    .70   -.24
                                        .36   1.26   -.45
                                        .13   1.26   -.50
            Note:    Coordinate direction changed compared to input
                                      ---------------------
  7     1     3     1     1    .000     .25   -.70   -.24
                                        .36  -1.26   -.45
                                        .13  -1.26   -.50
                                      ---------------------
  8     1     6     1     1    .041     .65    .00    .00
                                        .89    .00    .19
                                       1.27    .00    .19
                                       1.27    .00    .16
                                       1.51    .00    .16
                                       2.13    .00    .00

 Interaction parameters:

      Line        Nc     = Default
                  Fmud   = 0.7/0.2
                  Femb   =     .30
      Anchor      Nc     = Default
                  F      =    2.00

 Scaling:

      Dimension   Sw     =    1.000
                  Sl     =    1.070

      Rotation    Group =    2
                  Angle =  23.000 deg
                  X     =   1.035 m
                  Z     =    .150 m

 Anchor after scaling :
 ----------------------

      Fluke/Shank angle after scaling :   50.18  (Connection/Back/Tip)

      Line connection:

           X =    2.57
           Z =    3.08
           Grp :   2

      Anchor tip:

           X =    2.80
           Z =     .00
           Grp :   1

      Anchor back:

           X =     .00
           Z =     .00
           Grp :   1
```

Weight data:

W = 12.80 kN

COG X = 1.28
Z = .13

Anchor groups: 2

No.	Definition
1	Fluke
2	Shanck

Anchor members: 8

No.	Group	Nodes	Cross section shape Side	Front	F.Area	X	Y	Z
1	1	5	2	1	.177	.00	.09	.00
						.43	1.14	-.42
						1.88	1.14	-.42
						2.80	.71	-.25
						2.20	.09	.00
2	1	5	2	1	.177	.00	-.09	.00
						2.20	-.09	.00
						2.80	-.71	-.25
						1.88	-1.14	-.42
						.43	-1.14	-.42
3	1	6	1	1	.340	.70	.00	.00
						.68	.00	.05
						.95	.00	.35
						1.25	.00	3.50
						1.37	.00	3.50
						1.33	.00	.00
4	1	3	1	1	.000	.27	.74	-.26
						.38	1.34	-.48
						.43	1.14	-.42
5	1	3	1	1	.000	.27	-.74	-.26
						.43	-1.14	-.42
						.38	-1.34	-.48
6	1	3	1	1	.000	.27	.74	-.26
						.38	1.34	-.48
						.14	1.34	-.54
7	1	3	1	1	.000	.27	-.74	-.26
						.38	-1.34	-.48
						.14	-1.34	-.54
8	1	6	1	1	.047	.70	.00	.00
						.95	.00	.20
						1.36	.00	.20
						1.36	.00	.17
						1.61	.00	.17
						2.28	.00	.00

SUMMARY OF CALCULATIONS :

Dep	Tension								Penetr.		Lengths				Distances			
	Fairlead		Seabed				Anchor		Dir.	Orien.	Susp	Seab	Embd	Pull	Susp	Seab	Embd	Pen.
	TF	AngF	TTD	AngTD	TDD	AngDD	TA	AngA	AngD	AngO	LS	LM	LE	LP	DS	DM	DE	DP

.1	71	44.9	50	.0	22	.0	21	7.6	159.0	159.0	223	628	1	0	196	628	1	.0
1.0	169	28.7	148	.0	126	.0	123	11.5	134.0	134.0	359	481	11	0	344	481	11	.7
2.0	229	24.6	208	.0	189	.0	184	13.8	128.0	128.0	422	411	19	0	409	411	19	1.9
3.0	283	22.0	262	.0	246	.0	240	16.3	121.0	121.0	471	355	26	0	459	355	26	3.3
4.0	347	19.9	327	.0	313	.0	305	18.8	120.0	120.0	523	297	33	0	512	297	32	5.0
5.0	406	18.4	385	.0	374	.0	364	21.2	117.0	117.0	568	246	39	0	558	246	38	6.8
6.0	449	17.5	429	.0	419	.0	408	23.8	111.0	111.0	598	211	44	0	589	211	43	9.1
7.0	496	16.6	475	.0	467	.0	455	26.0	107.0	107.0	627	177	49	0	618	177	48	12.0
8.0	550	15.8	529	.0	523	.0	509	28.1	105.0	105.0	664	135	54	0	655	135	53	15.5
9.0	597	15.1	577	.0	572	.0	557	30.3	102.0	102.0	692	103	59	0	683	103	57	19.6
10.0	649	14.5	629	.0	625	.0	609	32.1	100.0	100.0	721	69	63	0	713	69	62	24.8
11.0	701	13.9	680	.0	679	.0	661	34.1	98.0	98.0	748	37	68	0	741	37	66	31.1
12.0	861	12.5	840	.7	840	.7	822	33.3	104.0	204.0	784	0	71	0	777	0	69	36.3
13.0	1084	11.4	1064	2.0	1064	2.0	1045	31.9	107.0	107.0	784	0	71	0	777	0	70	39.9
14.0	1151	11.1	1130	2.3	1130	2.3	1111	33.3	105.0	105.0	782	0	73	0	776	0	71	43.3
15.0	1218	10.9	1197	2.6	1197	2.6	1177	34.8	103.0	103.0	780	0	75	0	774	0	73	47.4
16.0	1293	10.7	1273	2.9	1273	2.9	1252	36.1	102.0	102.0	779	0	77	0	773	0	75	51.9
17.0	1348	10.5	1327	3.1	1327	3.1	1306	37.5	100.0	100.0	777	0	79	0	771	0	76	57.0
18.0	1421	10.3	1400	3.3	1400	3.3	1378	38.8	99.0	99.0	775	0	81	0	769	0	78	63.0
19.0	1474	10.2	1453	3.4	1453	3.4	1430	40.2	97.0	97.0	773	0	83	0	768	0	79	70.1
20.0	1545	10.1	1524	3.6	1524	3.6	1501	41.5	96.0	96.0	772	0	85	0	766	0	81	78.9

SUMMARY OF ANCHOR PERFORMANCE :

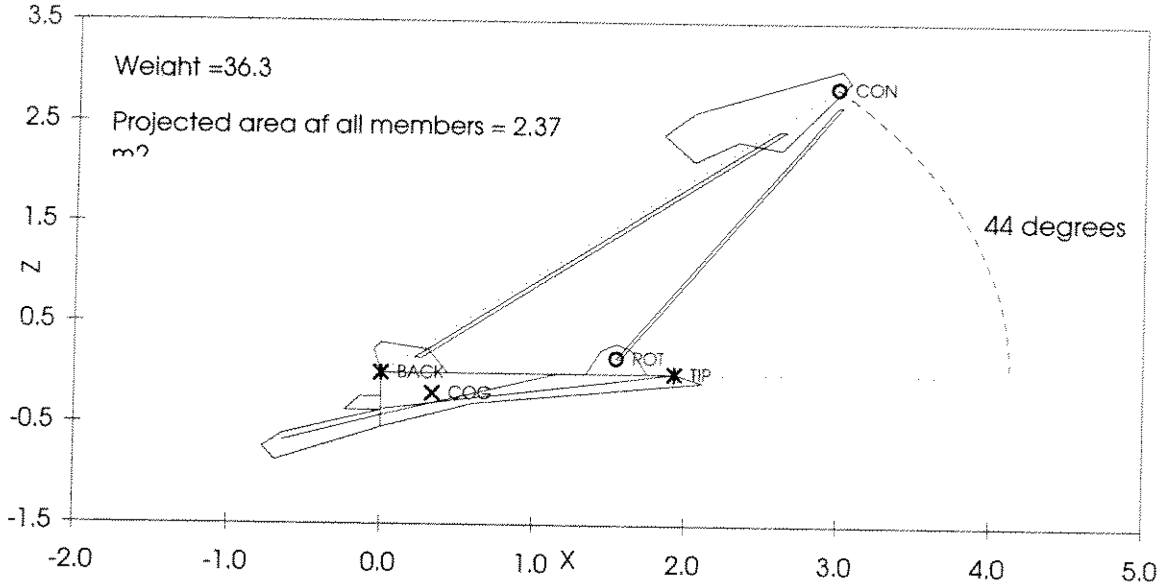
Depth	Anchor tension		Resistance contributions decomposed in pull direction					Restraint	
	TA	AngA	%tip	%slide	%weight	%Nfluke	%bearing	%Nf	%|N|f
.1	21	7.6	8.5	9.6	7.9	74.1	.0	88	89
1.0	123	11.5	17.6	17.6	2.1	65.1	-2.4	51	86
2.0	184	13.8	19.6	19.9	1.7	61.3	-2.6	41	79
3.0	240	16.3	23.2	23.1	1.5	54.7	-2.4	34	80
4.0	305	18.8	22.0	21.4	1.3	57.7	-2.5	31	59
5.0	364	21.2	22.5	21.6	1.3	57.1	-2.5	31	59
6.0	408	23.8	25.4	24.1	1.3	51.5	-2.3	29	76
7.0	455	26.0	26.9	25.3	1.2	48.6	-2.2	29	76
8.0	509	28.1	26.9	25.1	1.2	49.0	-2.2	29	76
9.0	557	30.3	27.6	25.7	1.2	47.7	-2.1	29	76
10.0	609	32.1	27.8	25.7	1.1	47.5	-2.1	29	77
11.0	661	34.1	27.9	25.7	1.1	47.5	-2.1	28	74
12.0	822	33.3	21.8	23.2	.9	56.5	-2.2	32	76
13.0	1045	31.9	17.7	24.6	.6	59.0	-2.0	39	78
14.0	1111	33.3	18.0	25.4	.6	57.9	-1.9	38	85
15.0	1177	34.8	18.3	25.8	.6	57.2	-1.9	37	82
16.0	1252	36.1	18.1	25.5	.6	57.7	-1.9	38	85
17.0	1306	37.5	18.6	26.0	.6	56.8	-1.9	37	82
18.0	1378	38.8	18.5	25.6	.6	57.2	-1.9	37	82
19.0	1430	40.2	19.0	26.1	.6	56.3	-1.9	37	82
20.0	1501	41.5	18.9	25.8	.6	56.8	-1.9	37	82

DEFINITION OF LISTED PARAMETERS:

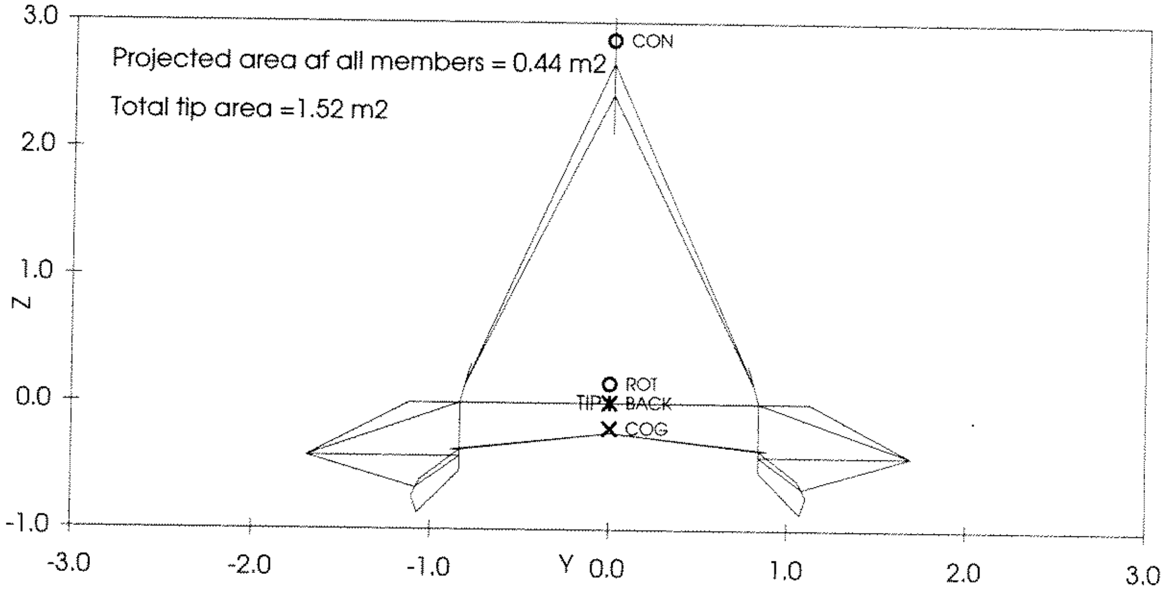
Depth	: Depth of anchor attachment point (shackle pin)	[m]
TF	: Tension at fairlead (upper end of mooring line)	[kN]
TTD	: Tension at touch down point	[kN]
TDD	: Tension at dip down point	[kN]
TA	: Tension at anchor attachment point	[kN]
AngF	: Line angle at fairlead (from horizontal)	[deg]
AngTD	: Line angle at touch down point (from hor.)	[deg]
AngDD	: Line angle at dip down point (from hor.)	[deg]
AngA	: Line angle at anchor attachment point (from hor.)	[deg]
AngD	: Penetration direction of anchor (from vertical)	[deg]
AngO	: Fluke orientation (from ver.)	[deg]
LS	: Length of suspended anchor line	[m]

LM	: Length of anchor line on seabed	[m]
LE	: Length of anchor line embedded in soil	[m]
LP	: Length of anchor line pulled in on pulling device	[m]
DS	: Distance of suspended anchor line	[m]
DM	: Distance of anchor line on seabed = LM	[m]
DE	: Distance of anchor line embedded in soil	[m]
DP	: Dragging distance of anchor from seabed intercept	[m]
%tip	: Tip resistance in percent of TA	[%]
%slide	: Sliding resistance in percent of TA	[%]
%weight	: Anchor weight in percent of TA	[%]
%normal	: Normal resistance in percent of TA	[%]
%intern	: Normal resistance on members not defined as fluke (e.g. internal forces) in percent of TA	[%]
%Nfluke	: Restraint (normal resistance) on fluke members	[%]
%Nf	: Mobilized normal stresses on fluke in percent of maximum normal stresses on fluke	[%]
%|N|f	: Mobilized normal stresses (absolute value) on fluke in percent of maximum normal stresses on fluke	[%]

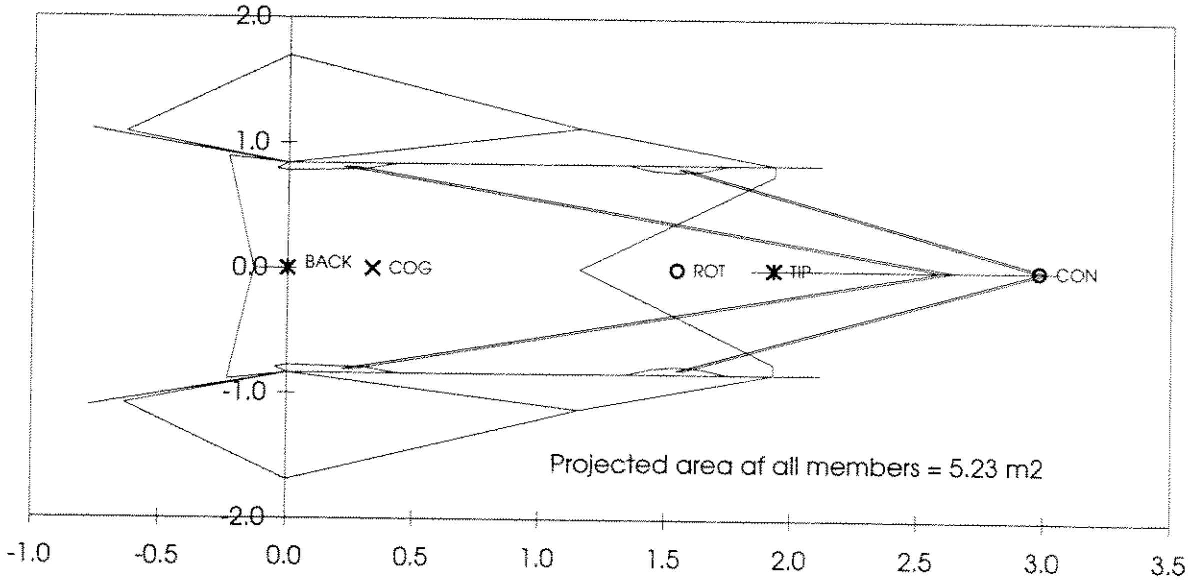
Program completed at Time :18:37:20



Weight =36.3
Projected area af all members = 2.37 m2
44 degrees
CON
ROT
TIP
BACK
COG
Z
X
3.5
2.5
1.5
0.5
-0.5
-1.5
-2.0
-1.0
0.0
1.0
2.0
3.0
4.0
5.0



Projected area af all members = 0.44 m2
Total tip area =1.52 m2
CON
ROT
TIP
BACK
COG
Z
Y
3.0
2.0
1.0
0.0
-1.0
-3.0
-2.0
-1.0
0.0
1.0
2.0
3.0



BACK
COG
ROT
TIP
CON
Projected area af all members = 5.23 m2
2.0
1.0
0.0
-1.0
-2.0
-1.0
-0.5
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5

```
#####     ##  #######  ##  ##    ##
##   ##   ##  ##    ##  ##  ###   ##
##    ##  ##  ##        ##  ## #  ##
##    ##  ##  ## ####   ##  ##  # ##
##   ##   ##  ##    ##  ##  ##   ###
#####     ##  #######  ##  ##    ##
```

Penetration behaviour of deep embedment anchors
"""

Version 5.4	:	20 November 1998
Licence	:	DNV
Programmed by	:	Det Norske Veritas AS Veritasv. 1 N-1322 Høvik Norway Section for Risers, Mooring and Foundations Units: m,kN,deg

ONSØY test 76010051
Gulf of Mexico South Timbalier Block 295
Backfitting tests from DeepStar +37% SuD

Date :01/12/99
Time :19:16:28

Analysis responsible : PJS

Echo of input :

Water depth : 91.4 m
Airgap : .0 m

Soil description

Number of depths : 6

Depth [m]	Su [kN/m2]	Sr [kN/m2]	Gam [kN/m3]
.00	3.30	.90	16.50
1.40	3.30	.90	16.50
1.50	3.30	.96	16.50
14.99	33.40	9.60	16.50
15.00	33.40	15.30	16.50
100.00	222.80	89.00	16.50

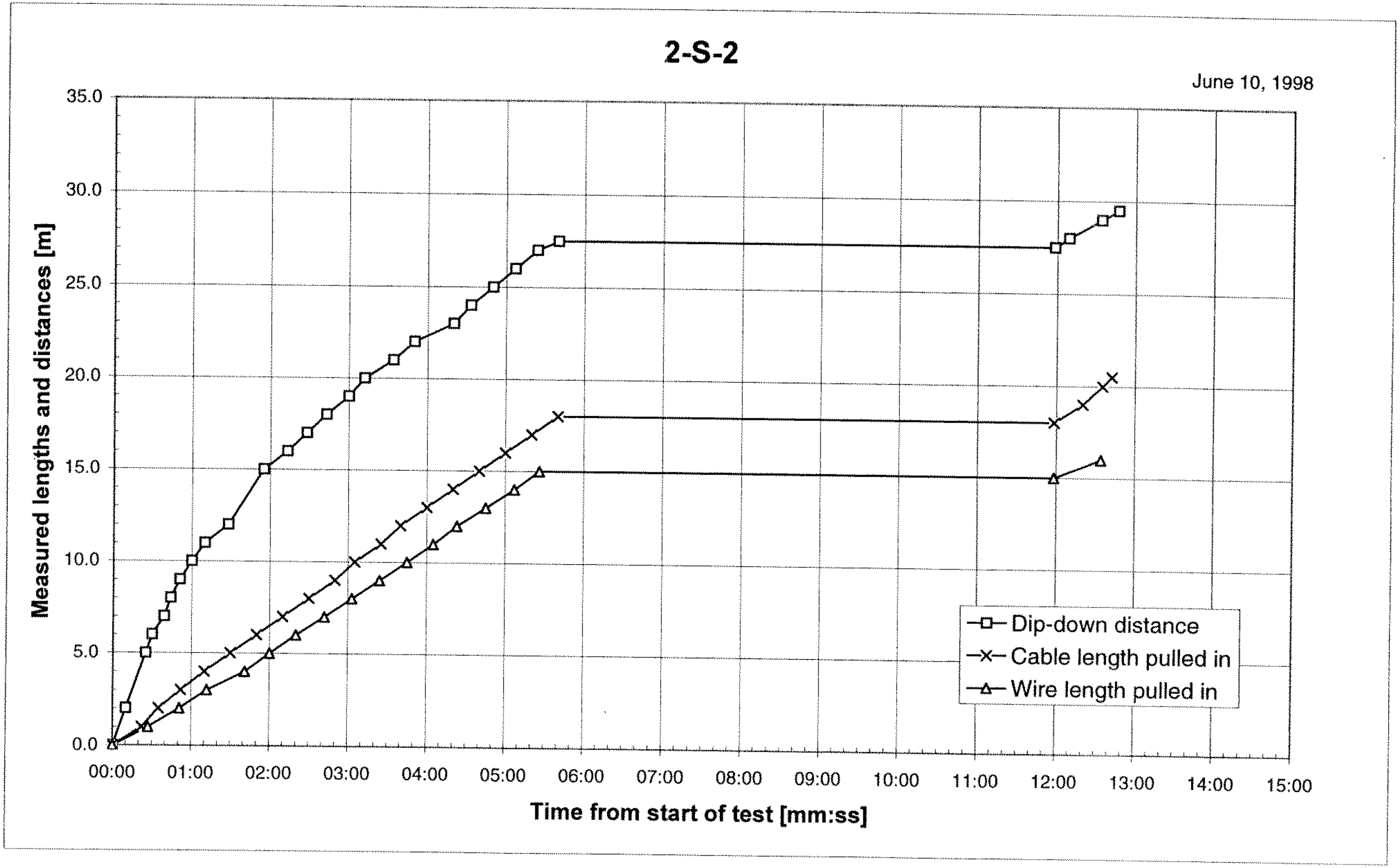
Line

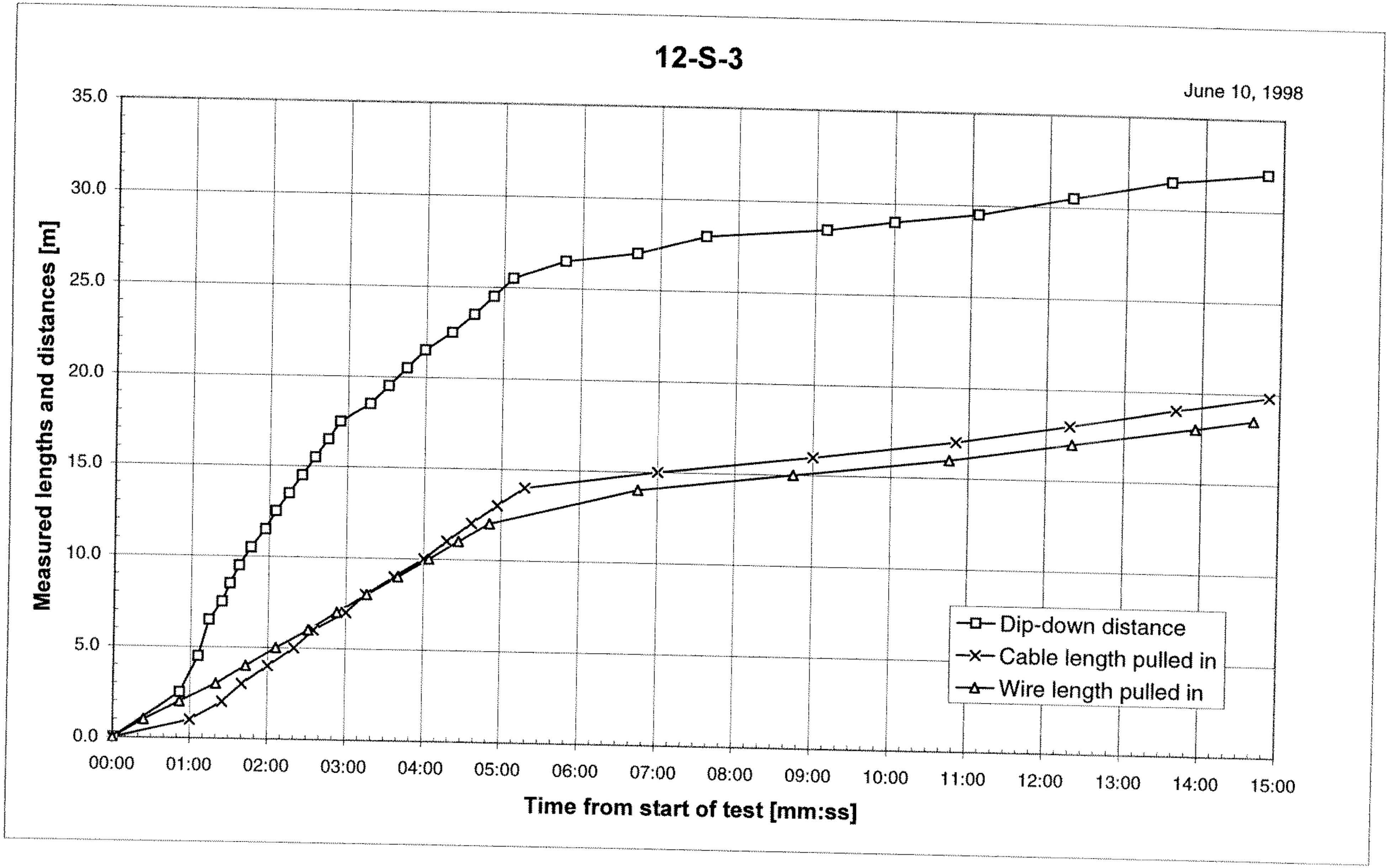
Configuration: Total anchor line up to vessel

Pull scenario: Bollard pull

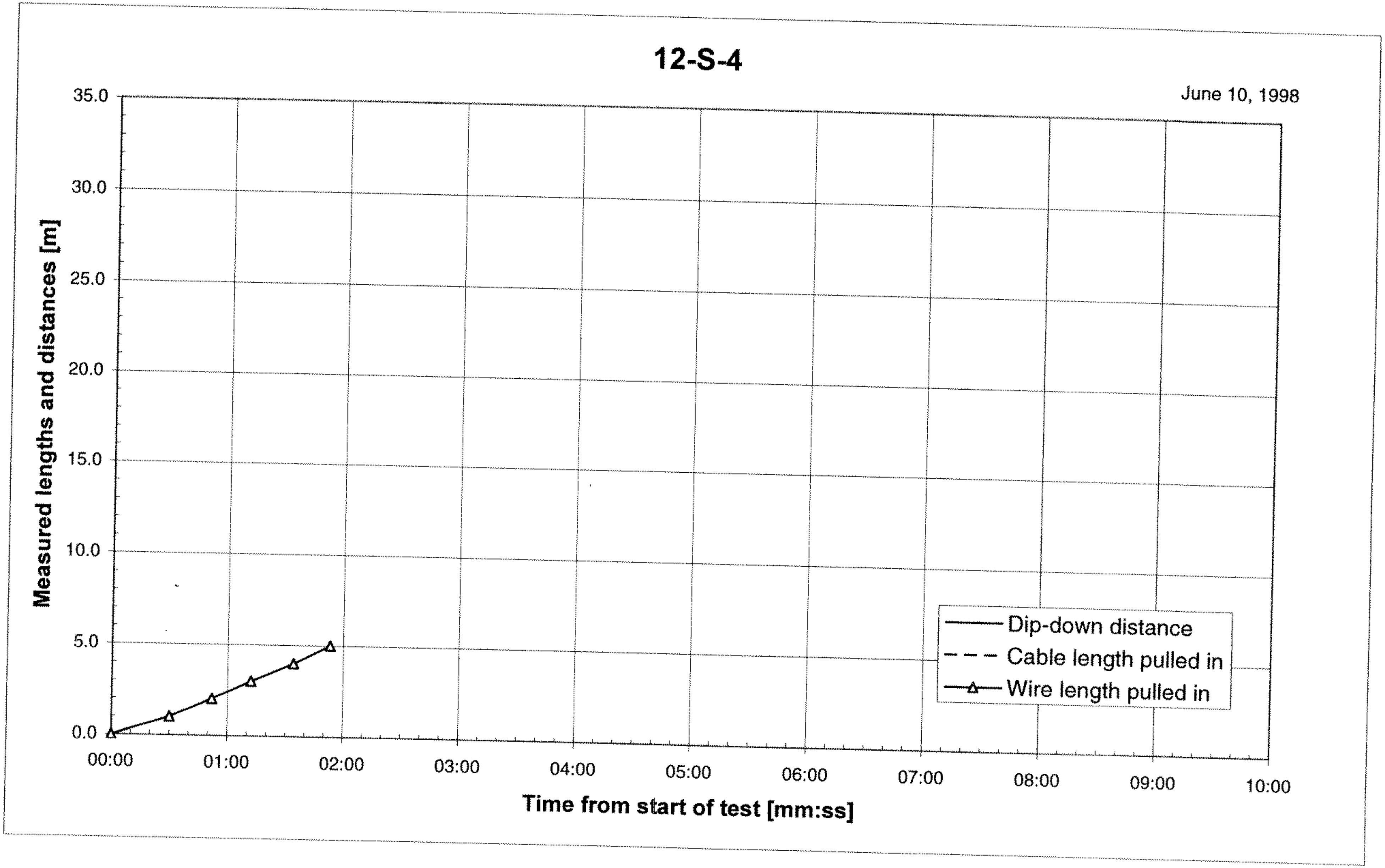
Point weights : 0

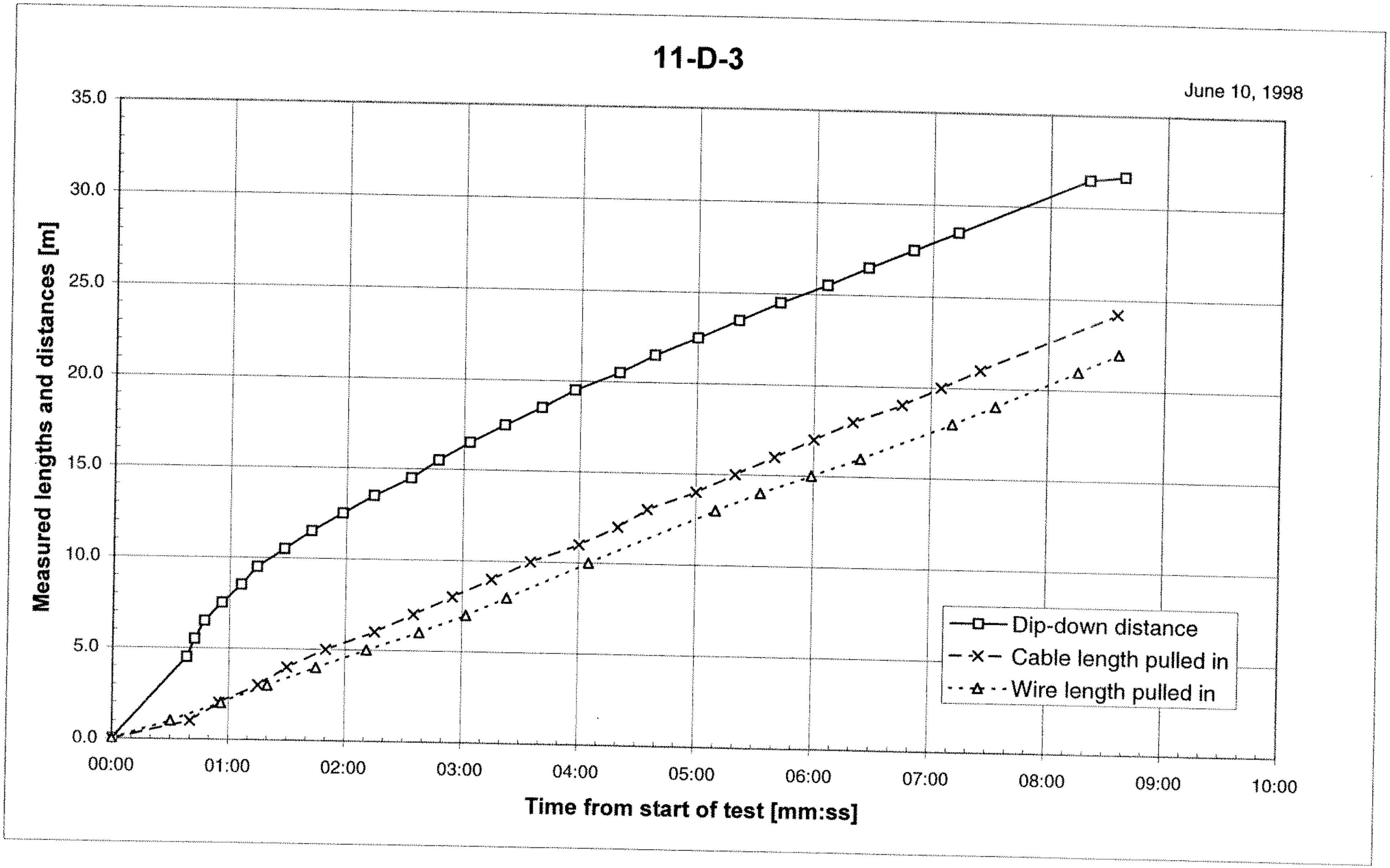
Number of line segments : 1

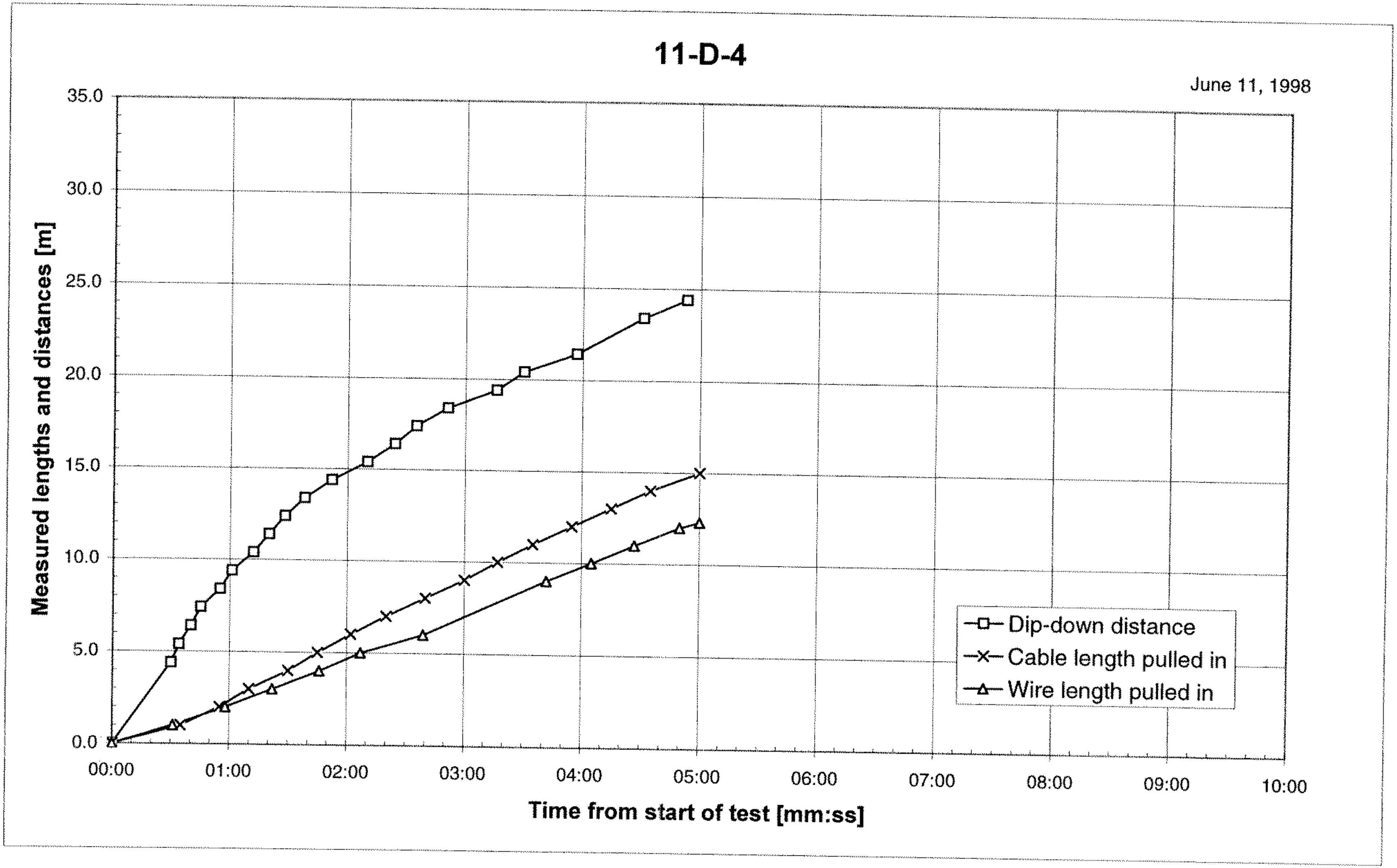

2-S-2
June 10, 1998
Measured lengths and distances [m]
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
00:00
01:00
02:00
03:00
04:00
05:00
06:00
07:00
08:00
09:00
10:00
11:00
12:00
13:00
14:00
15:00
Time from start of test [mm:ss]
Dip-down distance
Cable length pulled in
Wire length pulled in

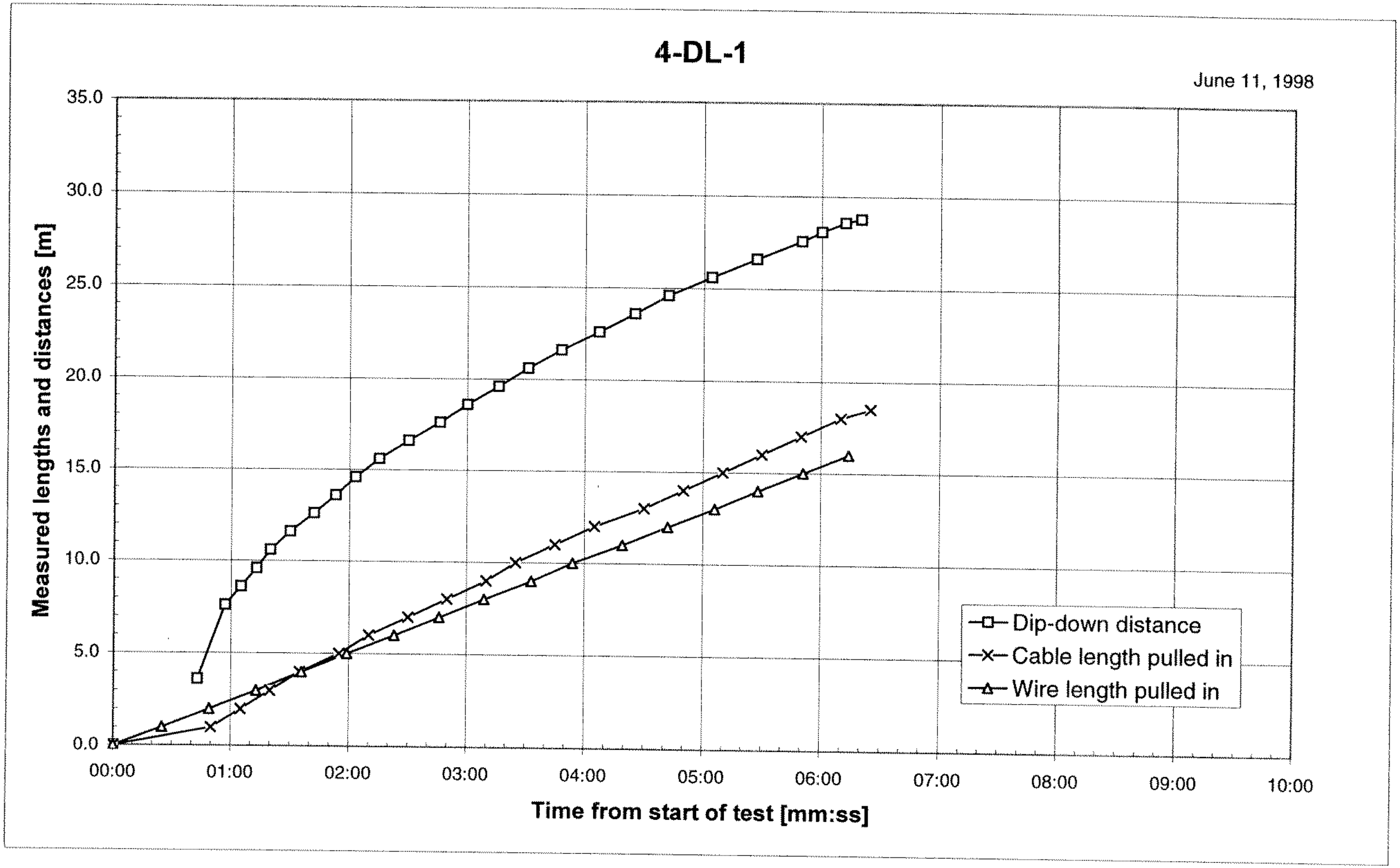


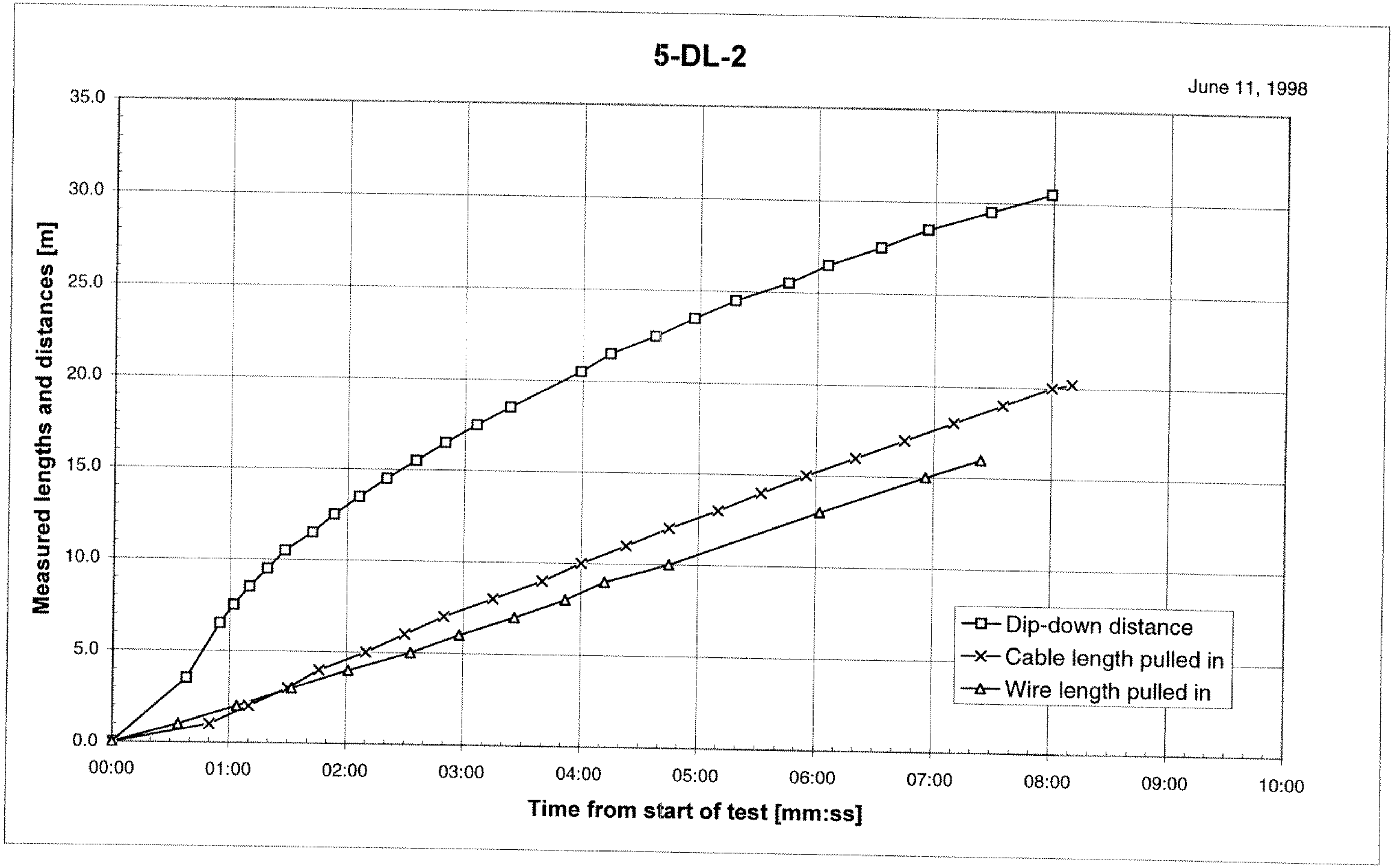
12-S-3
June 10, 1998
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
Measured lengths and distances [m]
00:00
01:00
02:00
03:00
04:00
05:00
06:00
07:00
08:00
09:00
10:00
11:00
12:00
13:00
14:00
15:00
Time from start of test [mm:ss]
Dip-down distance
Cable length pulled in
Wire length pulled in

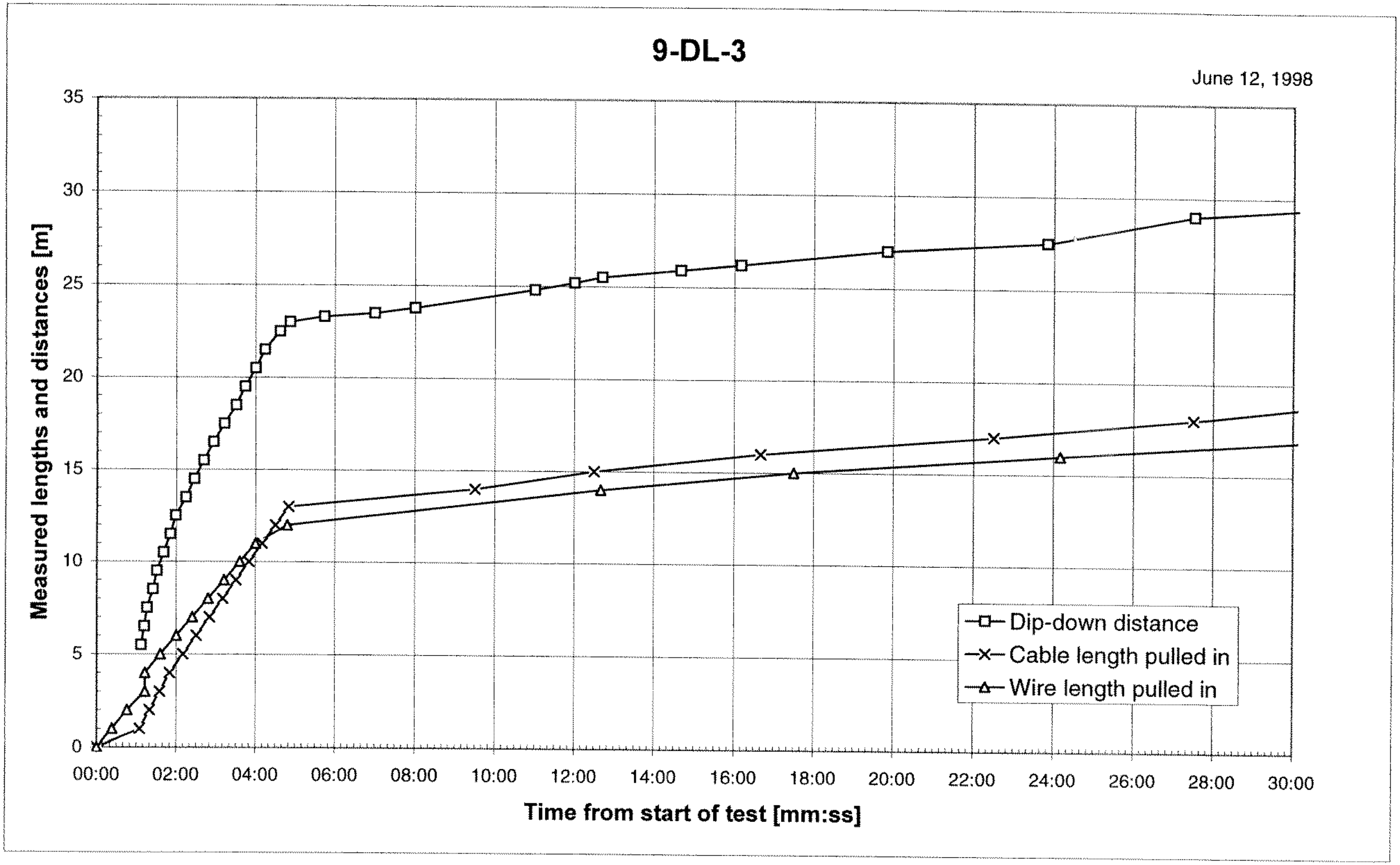

12-S-4
June 10, 1998
Measured lengths and distances [m]
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
00:00
01:00
02:00
03:00
04:00
05:00
06:00
07:00
08:00
09:00
10:00
Time from start of test [mm:ss]
Dip-down distance
Cable length pulled in
Wire length pulled in


11-D-3
June 10, 1998
Measured lengths and distances [m]
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
00:00
01:00
02:00
03:00
04:00
05:00
06:00
07:00
08:00
09:00
10:00
Time from start of test [mm:ss]
Dip-down distance
Cable length pulled in
Wire length pulled in

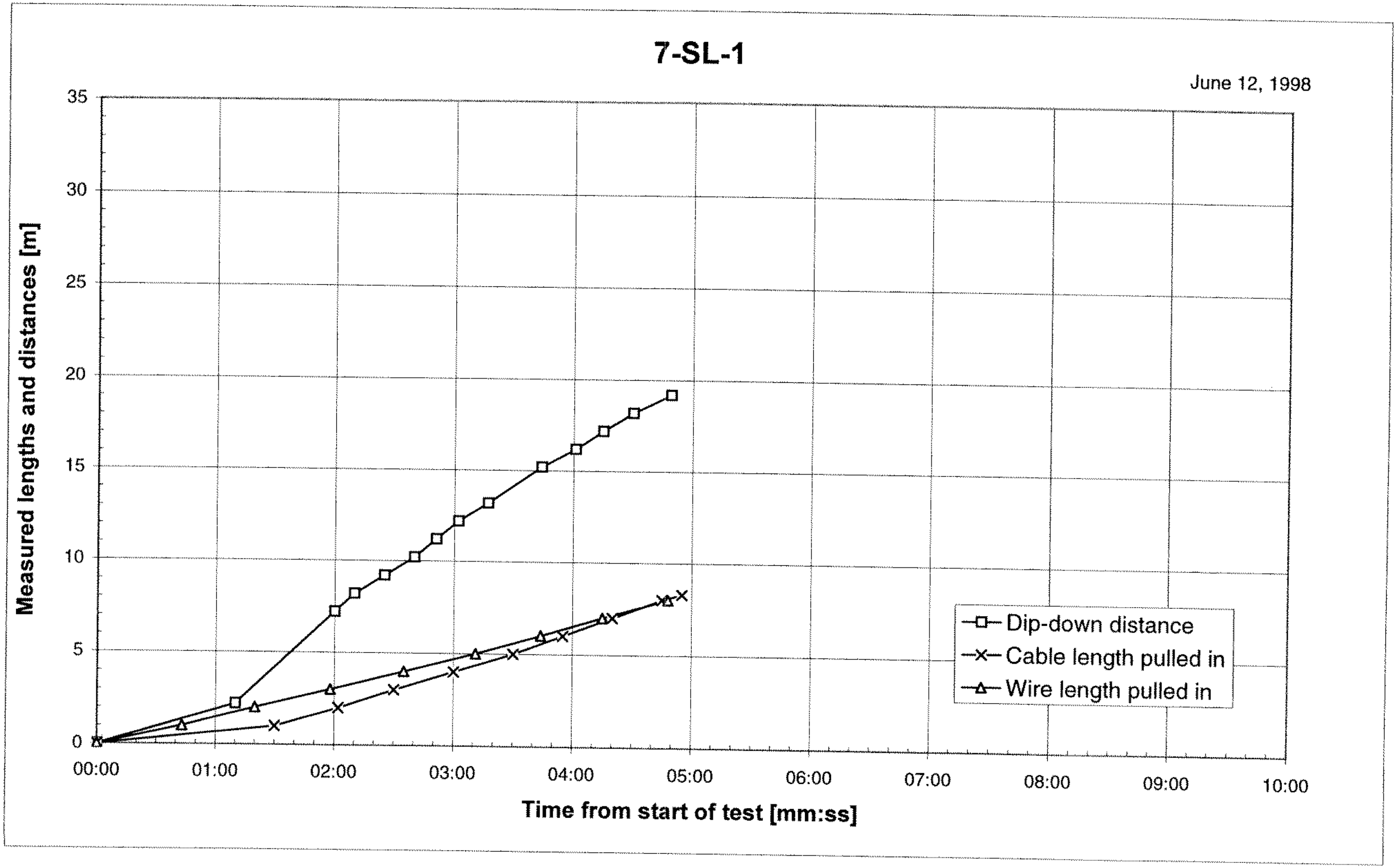

11-D-4
June 11, 1998
Measured lengths and distances [m]
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
00:00
01:00
02:00
03:00
04:00
05:00
06:00
07:00
08:00
09:00
10:00
Time from start of test [mm:ss]
Dip-down distance
Cable length pulled in
Wire length pulled in

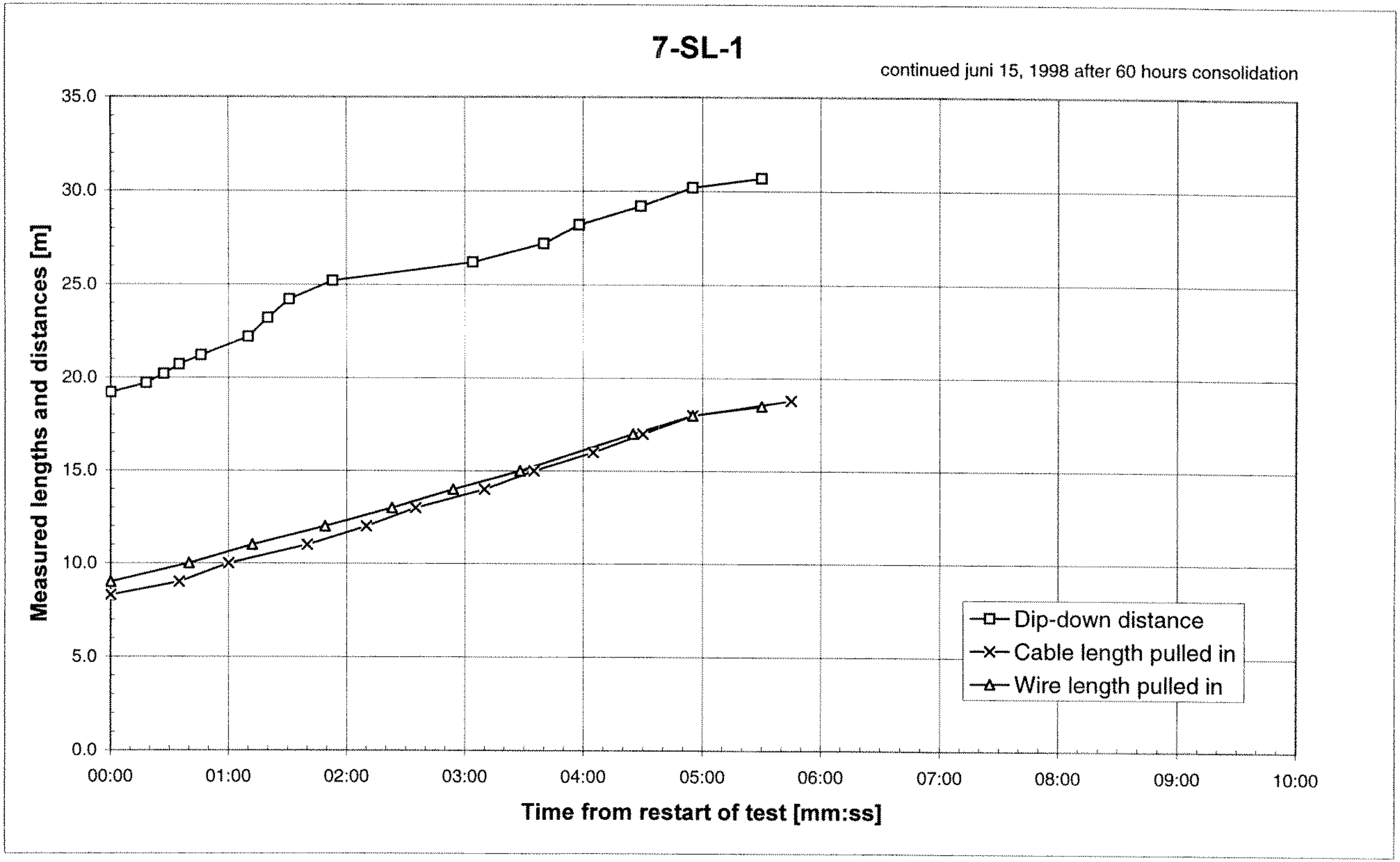

4-DL-1
June 11, 1998
Measured lengths and distances [m]
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
00:00
01:00
02:00
03:00
04:00
05:00
06:00
07:00
08:00
09:00
10:00
Time from start of test [mm:ss]
Dip-down distance
Cable length pulled in
Wire length pulled in

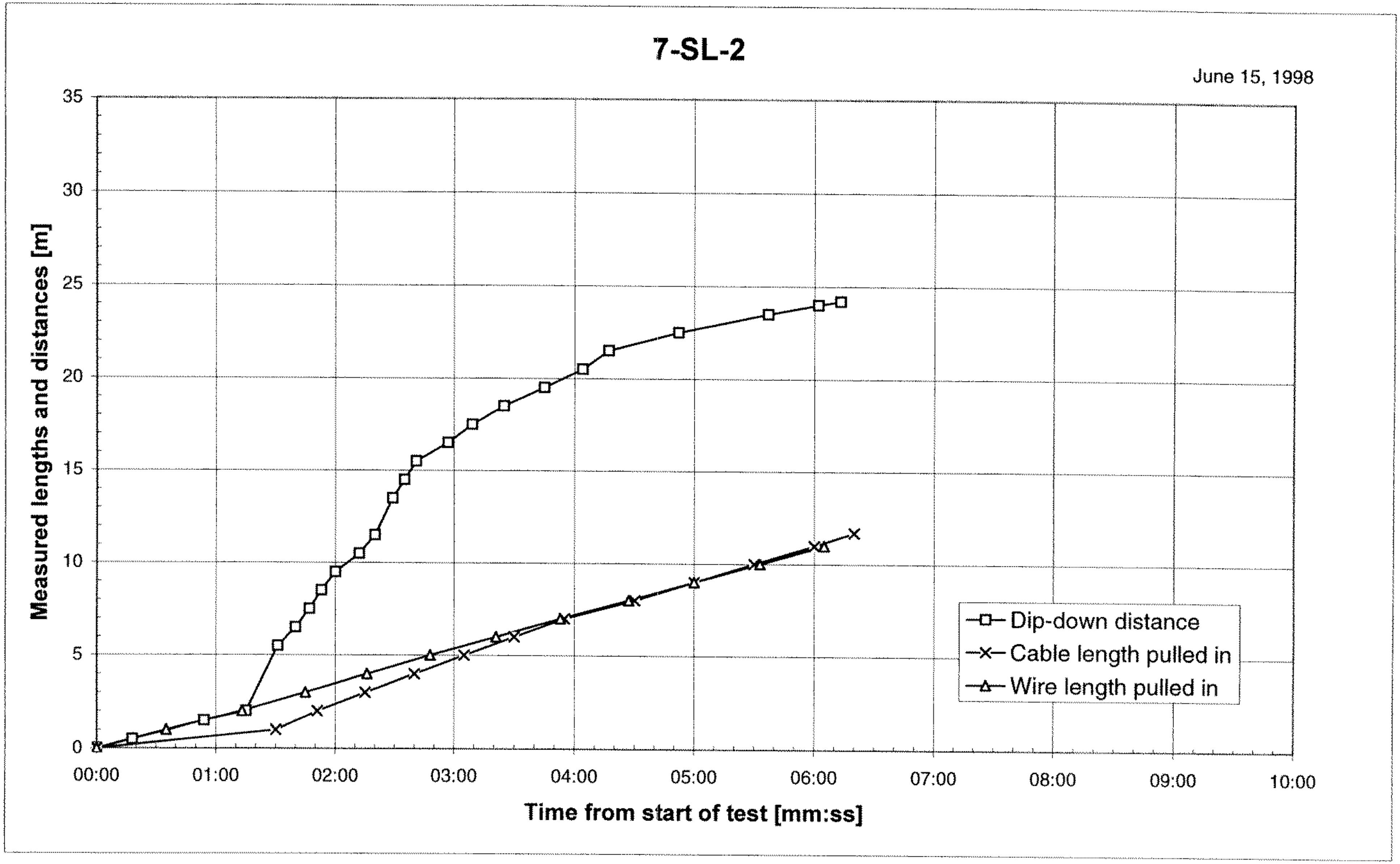

5-DL-2
June 11, 1998
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
Measured lengths and distances [m]
00:00
01:00
02:00
03:00
04:00
05:00
06:00
07:00
08:00
09:00
10:00
Time from start of test [mm:ss]
Dip-down distance
Cable length pulled in
Wire length pulled in

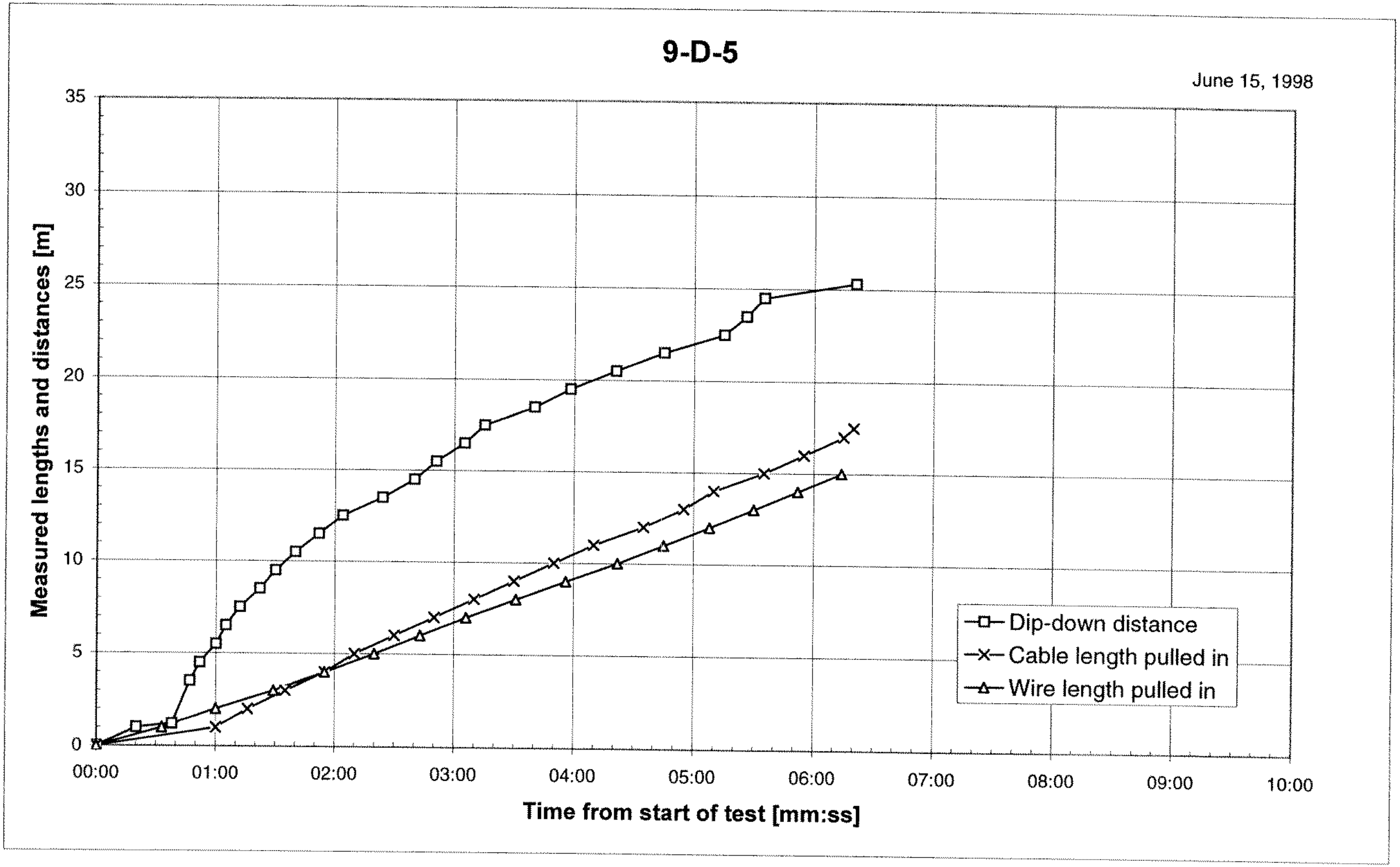


9-DL-3
June 12, 1998
Measured lengths and distances [m]
35
30
25
20
15
10
5
0
00:00
02:00
04:00
06:00
08:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
24:00
26:00
28:00
30:00
Time from start of test [mm:ss]
Dip-down distance
Cable length pulled in
Wire length pulled in


7-SL-1
June 12, 1998
Measured lengths and distances [m]
35
30
25
20
15
10
5
0
00:00
01:00
02:00
03:00
04:00
05:00
06:00
07:00
08:00
09:00
10:00
Time from start of test [mm:ss]
Dip-down distance
Cable length pulled in
Wire length pulled in


7-SL-1
continued juni 15, 1998 after 60 hours consolidation
Measured lengths and distances [m]
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
00:00
01:00
02:00
03:00
04:00
05:00
06:00
07:00
08:00
09:00
10:00
Time from restart of test [mm:ss]
Dip-down distance
Cable length pulled in
Wire length pulled in


7-SL-2
June 15, 1998
Measured lengths and distances [m]
35
30
25
20
15
10
5
0
00:00
01:00
02:00
03:00
04:00
05:00
06:00
07:00
08:00
09:00
10:00
Time from start of test [mm:ss]
Dip-down distance
Cable length pulled in
Wire length pulled in


9-D-5
June 15, 1998
Measured lengths and distances [m]
0
5
10
15
20
25
30
35
00:00
01:00
02:00
03:00
04:00
05:00
06:00
07:00
08:00
09:00
10:00
Time from start of test [mm:ss]
Dip-down distance
Cable length pulled in
Wire length pulled in

APPENDIX H

EXTRACTS FROM ONSØY DATABASE (PENETRATION)

Small denla 1-D-2 Trench deptl 0.9 m

DNV Elapsed time [min]	Bruce Elapsed time [min]	Fluke Pitch [deg]	Shackle pitch [deg]	Probe depth [m]	Probe drag [m]	Shackle depth [m]	Shackle depth from ground surface (+) [m]	Pull-in tension [kN]	Dip-down angle [deg]	
-0.03	0.00	-33	0	-0.12	0.18	0.61	0.90	0.96	15.83	
0.07	0.06	-33.5	0	-0.21	0.33	0.51	0.90	3.98	10.27	
0.15	0.17	-37	0	-0.35	0.54	0.33	0.90	7.35	8.61	
0.25	0.24	-40.2	0	-0.45	0.68	0.19	0.90	11.40	7.01	
0.33	0.33	-43.8	0	-0.63	0.87	-0.03	0.93	18.58	5.79	
0.43	0.43	-42.9	0	-0.86	1.12	-0.25	1.15	30.36	5.31	
0.52	0.52	-41.2	0	-1.08	1.39	-0.45	1.35	37.44	5.23	
0.62	0.62	-38.9	0	-1.34	1.73	-0.69	1.59	40.59	5.23	
0.70	0.70	-35.8	0	-1.54	2.01	-0.85	1.75	44.95	5.32	
0.80	0.81	-34.6	0	-1.77	2.37	-1.07	1.97	46.11	5.47	
0.88	0.87	-33.5	0	-1.91	2.59	-1.19	2.09	48.57	5.57	
0.98	0.98	-31.2	0	-2.12	2.96	-1.38	2.28	50.09	5.76	
1.07	1.07	-30.7	0	-2.29	3.27	-1.54	2.44	50.98	5.91	
1.17	1.16	-29.2	0	-2.44	3.57	-1.68	2.58	50.05	6.05	
1.25	1.25	-29.1	0	-2.59	3.88	-1.82	2.72	48.96	6.24	
1.35	1.36	-27.3	0	-2.76	4.28	-1.98	2.88	48.72	6.41	
1.43	1.43	-26.1	0	-2.86	4.51	-2.07	2.97	49.06	6.45	
1.53	1.53	-25.7	0	-2.99	4.83	-2.20	3.10	49.17	6.61	
1.62	1.62	-24.9	0	-3.12	5.15	-2.31	3.21	49.28	6.77	
1.72	1.71	-24.5	0	-3.24	5.47	-2.43	3.33	48.15	6.90	
1.80	1.81	-24.5	0	-3.36	5.80	-2.55	3.45	47.95	7.06	
1.90	1.91	-24	0	-3.48	6.12	-2.66	3.56	47.57	7.26	
1.98	1.98	-23.6	0	-3.56	6.36	-2.74	3.64	47.44	7.44	
2.08	2.07	-22.3	0	-3.67	6.69	-2.84	3.74	46.86	7.55	
2.17	2.17	-21.8	0	-3.78	7.02	-2.94	3.84	46.63	7.75	
2.27	2.27	-22.5	0	-3.87	7.35	-3.05	3.95	46.16	7.92	
2.35	2.35	-21.6	0	-3.95	7.59	-3.11	4.01	45.92	8.06	
2.45	2.45	-21.3	0	-4.05	7.92	-3.21	4.11	45.72	8.21	
2.53	2.53	-21.2	0	-4.13	8.17	-3.29	4.19	44.92	8.36	
2.63	2.63	-21	0	-4.22	8.50	-3.38	4.28	44.20	8.54	
2.72	2.73	-19	0	-4.31	8.83	-3.45	4.35	44.00	8.71	
2.82	2.83	-18.7	0	-4.41	9.16	-3.54	4.44	43.54	8.87	
2.90	2.91	-18.1	0	-4.47	9.41	-3.60	4.50	43.07	9.07	
3.00	2.99	-18	0	-4.53	9.66	-3.66	4.56	42.17	9.21	
3.08	3.07	-17.8	0	-4.59	9.91	-3.72	4.62	42.14	9.35	
3.18	3.17	-16.6	0	-4.66	10.25	-3.78	4.68	42.08	9.50	
3.27	3.26	-15.4	0	-4.71	10.50	-3.82	4.72	40.78	9.66	
3.37	3.37	-15.3	0	-4.77	10.84	-3.88	4.78	40.45	9.75	
3.45	3.45	-13.8	0	-4.82	11.10	-3.91	4.81	40.71	9.90	
3.55	3.55	-13.2	0	-4.86	11.44	-3.95	4.85	40.02	10.08	
3.63	3.63	-13.5	0	-4.90	11.69	-3.99	4.89	39.58	10.27	
3.73	3.72	-13.4	0	-4.92	11.95	-4.01	4.91	37.92	10.48	
3.82	3.83	-11.1	0	-4.95	12.29	-4.02	4.92	38.07	10.63	
3.92	3.93	-10	0	-4.97	12.64	-4.03	4.93	37.34	10.85	
4.00	4.02	-9	0	-4.98	12.89	-4.03	4.93	36.25	11.01	
4.10	4.09	-7.1	0	-4.98	13.07	-4.02	4.92	31.51	11.13	
4.18	4.18	-5.4	0	-4.98	13.24	-4.01	4.91	31.02	11.17	
4.28	4.28	-6.5	0	-4.98	13.41	-4.01	4.91	29.94	11.21	
4.37	4.38	-4.3	0	-4.97	13.58	-3.99	4.89	29.57	11.23	
4.47	4.49	-3.1	0	-4.96	13.75	-3.97	4.87	28.82	11.28	
4.55	4.53	-3.8	0	-4.96	13.84	-3.97	4.87	28.14	11.29	
4.65	4.63	-2.7	0	-4.95	14.01	-3.96	4.86	26.95	11.33	
4.73	4.74	-1.1	0	-4.94	14.18	-3.93	4.83	26.07	11.36	
4.83	4.85	-0.9	0	-4.92	14.35	-3.91	4.81	25.40	11.42	2.59
4.92	4.90	-0.7	0	-4.91	14.44	-3.91	4.81	24.81	11.44	2.53
5.02	5.01	-0.2	0	-4.89	14.61	-3.89	4.79	24.34	11.47	2.48
5.10	5.12	0.9	0	-4.88	14.78	-3.87	4.77	24.35	11.50	2.48
5.20	5.22	-0.4	0	-4.87	14.95	-3.86	4.76	25.62	11.46	2.61
5.28	5.27	-0.7	0	-4.86	15.04	-3.86	4.76	31.47	11.33	3.21
5.38	5.36	-1.9	0	-4.85	15.21	-3.85	4.75	36.50	11.24	3.72
5.47	5.47	-4	0	-4.84	15.38	-3.86	4.76	39.75	11.20	4.05
5.57	5.60	-5.8	0	-4.84	15.56	-3.87	4.77	41.54	11.19	4.23
5.65	5.66	-5.5	0	-4.84	15.64	-3.86	4.76	43.49	11.21	4.43
5.75	5.72	-5.9	0	-4.83	15.73	-3.87	4.77	45.19	11.22	4.61
5.83	5.84	-6.2	0	-4.83	15.90	-3.87	4.77	45.79	11.29	4.67
5.93	5.91	-6.4	0	-4.83	15.99	-3.87	4.77	46.11	11.40	4.70
6.02	6.03	-7.1	0	-4.83	16.16	-3.88	4.78	46.98	11.52	4.79
6.12	6.16	-7	0	-4.84	16.33	-3.88	4.78	47.17	11.63	4.81
6.20	6.22	-7.5	0	-4.84	16.42	-3.89	4.79	47.78	11.77	4.87
6.30	6.28	-8	0	-4.85	16.50	-3.89	4.79	48.15	11.93	4.91
6.38	6.40	-8.7	0.00	-4.85	16.67	-3.90	4.80	48.69	12.06	4.96
6.48	6.46	-8.6	0.00	-4.85	16.76	-3.91	4.81	48.41	12.17	4.94

6.57	6.58	-8.6	0.00	-4.86	16.93	-3.91	4.81	48.65	12.29	4.96
6.67	6.69	-7.6	0.00	-4.87	17.10	-3.91	4.81	48.97	12.40	4.99
6.75	6.75	-6.7	0.00	-4.88	17.19	-3.91	4.81	49.48	12.51	5.04
6.85	6.87	-8.3	0.00	-4.89	17.36	-3.94	4.84	49.31	12.61	5.03
6.93	6.92	-8.5	0.00	-4.89	17.45	-3.94	4.84	49.20	12.73	5.02
7.03	7.04	-9.0	0.00	-4.89	17.62	-3.95	4.85	49.20	12.90	5.02
7.12	7.10	-8.2	0.00	-4.90	17.70	-3.95	4.85	49.35	12.84	5.03
7.22	7.21	-8.3	0.00	-4.90	17.88	-3.95	4.85	49.45	12.72	5.04
7.30	7.27	-8.2	0.00	-4.90	17.96	-3.95	4.85	49.54	12.74	5.05
7.40	7.39	-7.6	0.00	-4.91	18.13	-3.95	4.85	49.34	12.89	5.03

Small denla 11-D-3 Trench depth 1.1 m

DNV Elapsed time [min]	Bruce Elapsed time [min]	Fluke Pitch [deg]	Shackle pitch [deg]	Probe depth [m]	Probe drag [m]	Shackle depth [m]	Shackle depth from ground surface (+) [m]	Pull-in tension [kN]	Dip-down angle [deg]
-0.03	0.00	-31.4	-76	-0.06	0.20	0.68	1.1	0.81	-20.78
0.05	0.04	-36.4	-76.1	-0.10	0.28	0.58	1.10	1.37	-16.39
0.42	0.47	-41	-82.6	-0.15	0.35	0.48	1.10	18.22	-7.21
0.52	0.51	-59.2	-78	-0.27	0.48	0.11	1.10	23.85	-6.59
0.60	0.60	-51.3	-77.4	-0.47	0.76	0.03	1.10	29.57	-6.34
0.70	0.68	-45.3	-77.2	-0.73	1.10	-0.16	1.26	31.53	-6.22
0.78	0.77	-40.9	-77.1	-0.95	1.37	-0.31	1.41	33.83	-6.27
0.88	0.85	-37.9	-77.1	-1.15	1.65	-0.48	1.58	35.24	-6.25
0.97	0.98	-34.9	-76	-1.39	2.01	-0.68	1.78	36.03	-6.25
1.07	1.07	-32.5	-76.8	-1.52	2.23	-0.79	1.89	36.86	-6.29
1.15	1.15	-30.9	-76.8	-1.68	2.53	-0.94	2.04	36.98	-6.32
1.25	1.24	-29.6	-76	-1.84	2.83	-1.08	2.18	36.92	-6.39
1.33	1.32	-28.7	-76	-1.96	3.06	-1.19	2.29	38.41	-6.46
1.43	1.41	-27.1	-76.7	-2.10	3.38	-1.31	2.41	39.36	-6.51
1.52	1.54	-25.5	-75.9	-2.23	3.69	-1.43	2.53	38.97	-6.55
1.62	1.62	-24.5	-75.9	-2.33	3.93	-1.52	2.62	39.18	-6.58
1.70	1.71	-23.2	-75.9	-2.42	4.18	-1.60	2.70	39.24	-6.64
1.80	1.79	-23.3	-75.9	-2.53	4.50	-1.71	2.81	40.25	-6.71
1.88	1.88	-21.7	-75.9	-2.62	4.74	-1.78	2.88	41.68	-6.74
1.98	1.96	-21.6	-75.9	-2.70	4.99	-1.86	2.96	42.33	-6.78
2.07	2.09	-21.5	-75.9	-2.77	5.24	-1.94	3.04	41.34	-6.90
2.17	2.18	-21.5	-75.9	-2.85	5.48	-2.01	3.11	42.62	-6.85
2.25	2.26	-20.6	-75.9	-2.93	5.73	-2.08	3.18	42.11	-6.94
2.35	2.35	-20.2	-75.9	-3.00	5.98	-2.15	3.25	41.26	-7.04
2.43	2.43	-19.5	-75.9	-3.09	6.31	-2.23	3.33	39.44	-7.13
2.53	2.52	-18.6	-75.9	-3.16	6.56	-2.29	3.39	40.39	-7.18
2.62	2.60	-17.3	-75.7	-3.22	6.81	-2.35	3.45	41.41	-7.25
2.72	2.73	-16.6	-75.9	-3.30	7.14	-2.42	3.52	42.02	-7.33
2.80	2.82	-15.9	-75.7	-3.36	7.39	-2.47	3.57	41.69	-7.44
2.90	2.90	-16.7	-75.9	-3.41	7.65	-2.53	3.63	41.03	-7.51
2.98	2.99	-16	-75.9	-3.46	7.90	-2.58	3.68	41.77	-7.55
3.08	3.07	-16.2	-75.7	-3.51	8.15	-2.63	3.73	42.32	-7.64
3.17	3.16	-15.1	-75.7	-3.56	8.40	-2.67	3.77	42.77	-7.70
3.27	3.29	-14.3	-75.9	-3.64	8.83	-2.74	3.84	43.17	-7.76
3.35	3.37	-14	-75.7	-3.69	9.08	-2.78	3.88	43.01	-7.84
3.45	3.46	-14.1	-75.9	-3.75	9.42	-2.84	3.94	43.39	-7.90
3.53	3.54	-13.9	-75.7	-3.79	9.67	-2.88	3.98	43.64	-7.97
3.63	3.63	-13.3	-75.7	-3.83	9.93	-2.92	4.02	43.61	-8.07
3.72	3.71	-12.6	-75.7	-3.88	10.27	-2.97	4.07	44.27	-8.18
3.82	3.84	-12.3	-75.7	-3.93	10.61	-3.02	4.12	44.28	-8.23
3.90	3.88	-12.7	-75.7	-3.96	10.78	-3.04	4.14	44.33	-8.33
4.00	4.01	-12.7	-75.7	-4.02	11.21	-3.10	4.20	43.95	-8.40
4.08	4.10	-12.3	-75.7	-4.05	11.46	-3.14	4.24	43.13	-8.53
4.18	4.18	-11.9	-75.7	-4.09	11.72	-3.17	4.27	44.33	-8.53
4.27	4.27	-12	-75.7	-4.12	11.97	-3.20	4.30	43.84	-8.66
4.37	4.39	-11	-75.7	-4.17	12.40	-3.24	4.34	44.11	-8.79
4.45	4.44	-10.4	-75.9	-4.19	12.57	-3.25	4.35	44.12	-8.80
4.55	4.57	-10.4	-75.7	-4.23	12.91	-3.29	4.39	44.84	-8.90
4.63	4.65	-9.8	-75.7	-4.25	13.17	-3.32	4.42	44.89	-9.06
4.73	4.74	-10.1	-75.7	-4.29	13.51	-3.35	4.45	44.73	-9.16
4.82	4.82	-10	-75.7	-4.33	13.85	-3.39	4.49	44.53	-9.33
4.92	4.91	-10.2	-75.7	-4.36	14.11	-3.42	4.52	44.21	-9.50
5.00	4.99	-9.3	-75.7	-4.38	14.37	-3.44	4.54	44.31	-9.60
5.10	5.12	-9.1	-75.7	-4.41	14.71	-3.47	4.57	44.77	-9.75
5.18	5.16	-9.1	-75.7	-4.43	14.88	-3.48	4.58	45.55	-9.87
5.28	5.29	-9	-75.7	-4.45	15.22	-3.51	4.61	45.33	-9.97
5.37	5.38	-9.1	-75.7	-4.47	15.48	-3.53	4.63	45.81	-10.12
5.47	5.46	-8.7	-75.7	-4.50	15.82	-3.55	4.65	46.59	-10.23
5.55	5.55	-9.7	-75.7	-4.51	16.00	-3.57	4.67	46.62	-10.40
5.65	5.67	-9.1	-75.9	-4.54	16.42	-3.60	4.70	46.17	-10.51
5.73	5.72	-9.5	-75.7	-4.56	16.60	-3.62	4.72	46.32	-10.67
5.83	5.85	-9	-75.9	-4.58	16.94	-3.64	4.74	46.01	-10.81
5.92	5.93	-9.7	-75.9	-4.60	17.20	-3.67	4.77	45.98	-10.96
6.02	6.02	-8.1	-75.9	-4.63	17.54	-3.68	4.78	46.05	-11.11
6.10	6.10	-7.4	-75.7	-4.64	17.80	-3.69	4.79	45.72	-11.28
6.20	6.19	-7.4	-75.9	-4.66	18.05	-3.70	4.80	45.72	-11.43
6.28	6.27	-6.9	-75.9	-4.67	18.31	-3.71	4.81	46.44	-11.59

6.38	6.40	-7.2	-75.9	-4.68	18.66	-3.73	4.83	44.47	-11.81
6.47	6.49	-7	-75.9	-4.70	18.91	-3.74	4.84	47.04	-11.87
6.57	6.57	-7.1	-75.9	-4.71	19.17	-3.75	4.85	46.99	-12.02
6.65	6.66	-7.0	-75.90	-4.72	19.43	-3.76	4.86	47.33	-12.21
6.75	6.74	-7.2	-75.90	-4.73	19.69	-3.77	4.87	46.69	-12.40
6.83	6.83	-7.3	-75.90	-4.74	19.94	-3.78	4.88	48.57	-12.53
6.93	6.91	-49.0	-75.90	-4.75	20.20	-4.22	5.32	48.41	-12.70
7.02	7.00	-7.1	-75.90	-4.76	20.46	-3.80	4.90	47.98	-12.95
7.12	7.13	-6.5	-75.90	-4.77	20.80	-3.81	4.91	48.48	-13.17
7.20	7.21	-6.8	-75.90	-4.79	21.15	-3.82	4.92	48.24	-13.42
7.30	7.30	-6.1	-75.90	-4.80	21.41	-3.83	4.93	49.13	-13.60
7.38	7.38	-6.0	-75.90	-4.80	21.66	-3.84	4.94	48.93	-13.86
7.48	7.47	-6.1	-75.90	-4.82	22.01	-3.85	4.95	49.22	-14.08
7.57	7.59	-6.8	-75.90	-4.83	22.35	-3.86	4.96	49.54	-14.36
7.67	7.68	-6.1	-75.90	-4.84	22.69	-3.87	4.97	49.74	-14.58
7.75	7.77	-6.0	-75.90	-4.84	22.95	-3.88	4.98	49.88	-14.81
7.85	7.85	-6.3	-75.90	-4.85	23.30	-3.89	4.99	49.61	-15.09
7.93	7.94	-6.3	-75.90	-4.86	23.64	-3.90	5.00	49.80	-15.33
8.03	8.02	-6.0	-76.50	-4.87	23.90	-3.90	5.00	44.19	-15.62
8.12	8.11	-5.0	-75.90	-4.87	24.16	-3.90	5.00	49.58	-15.85
8.22	8.23	-5.7	-75.90	-4.88	24.50	-3.91	5.01	49.75	-16.10
8.30	8.32	-5.7	-75.90	-4.88	24.84	-3.91	5.01	49.48	-16.37
8.40	8.41	-4.6	-75.90	-4.88	25.10	-3.91	5.01	49.87	-16.67
8.48	8.49	-4.7	-75.90	-4.89	25.45	-3.91	5.01	49.40	-17.01
8.58	8.63	-5.1	-75.70	-4.89	25.70	-3.91	5.01	49.43	-17.36
8.67	8.66	-5.0	-75.90	-4.89	25.79	-3.91	5.01	22.06	-18.04

Small denla 11-D-4 Trench deptr 1.1 m

DNV Elapsed time [min]	Bruce Elapsed time [min]	Fluke Pitch [deg]	Shackle pitch [deg]	Probe depth [m]	Probe drag [m]	Shackle depth [m]	Shackle depth from ground surface (+) [m]	Pull-in tension [kN]	Dip-down angle [deg]
0.02	0.05	-37.6	-77.4	-0.11	0.28	0.57	1.1	2.02	-14.25
0.07	0.10	-40.8	-77.7	-0.15	0.35	0.48	1.10	2.81	-11.96
0.12	0.15	-47.4	-78.7	-0.21	0.41	0.34	1.10	3.62	-11.33
0.25	0.25	-56	90	-0.27	0.48	0.16	1.10	12.85	-8.49
0.28	0.28	-53.3	90	-0.33	0.54	0.14	1.10	17.74	-7.56
0.33	0.32	-52.3	90	-0.38	0.61	0.10	1.10	20.77	-7.05
0.37	0.37	-50.5	90	-0.49	0.74	0.01	1.10	23.23	-6.84
0.42	0.43	-46.8	90	-0.67	0.93	-0.11	1.21	26.57	-6.90
0.45	0.45	-45.6	90	-0.72	0.99	-0.15	1.25	28.56	-6.76
0.48	0.47	-44.9	90	-0.78	1.06	-0.20	1.30	30.33	-6.79
0.53	0.53	-41.6	90	-0.95	1.26	-0.32	1.42	32.04	-6.95
0.57	0.57	-40.8	90	-1.05	1.39	-0.42	1.52	31.50	-7.13
0.62	0.62	-39.4	-79.9	-1.16	1.53	-0.51	1.61	32.47	-6.85
0.67	0.67	-36.9	-79.9	-1.31	1.74	-0.63	1.73	32.85	-6.84
0.72	0.72	-35.6	-79.4	-1.40	1.88	-0.71	1.81	33.29	-6.87
0.75	0.75	-36.1	-79.4	-1.45	1.95	-0.76	1.86	33.83	-7.03
0.80	0.78	-34.8	-79.4	-1.54	2.10	-0.84	1.94	34.01	-7.03
0.83	0.83	-34.1	-79	-1.64	2.24	-0.92	2.02	34.98	-7.06
0.87	0.88	-33.1	-79	-1.72	2.39	-1.00	2.10	35.67	-7.10
0.92	0.93	-32.5	-79	-1.81	2.54	-1.08	2.18	36.22	-7.17
0.95	0.95	-32.2	-79	-1.85	2.61	-1.12	2.22	36.64	-7.16
1.00	1.00	-31.4	-78.6	-1.94	2.76	-1.20	2.30	37.17	-7.19
1.05	1.07	-31.4	-79	-2.06	2.99	-1.32	2.42	37.78	-7.31
1.08	1.08	-30	-78.6	-2.10	3.07	-1.34	2.44	37.72	-7.32
1.12	1.12	-30.6	-79	-2.14	3.14	-1.39	2.49	38.41	-7.36
1.17	1.17	-30	-78.6	-2.21	3.30	-1.46	2.56	38.20	-7.45
1.22	1.23	-29.1	-78.6	-2.33	3.53	-1.56	2.66	38.21	-7.56
1.25	1.25	-28.4	-78.6	-2.36	3.61	-1.59	2.69	37.97	-7.56
1.30	1.30	-27.8	-78.3	-2.44	3.76	-1.66	2.76	37.70	-7.70
1.35	1.35	-27	-78.3	-2.51	3.92	-1.72	2.82	38.21	-7.78
1.40	1.40	-27.2	-76.8	-2.58	4.08	-1.79	2.89	38.83	-7.85
1.45	1.47	-26.5	-76.8	-2.68	4.31	-1.89	2.99	38.97	-7.91
1.48	1.48	-26.8	-76.8	-2.71	4.39	-1.93	3.03	38.67	-7.99
1.53	1.53	-25.9	-76.8	-2.78	4.55	-1.98	3.08	39.43	-7.99
1.57	1.58	-25.1	-76.8	-2.84	4.71	-2.04	3.14	39.68	-8.02
1.62	1.62	-25.4	-76.8	-2.87	4.79	-2.07	3.17	39.81	-8.05
1.65	1.67	-25.7	-76.8	-2.93	4.95	-2.14	3.24	40.23	-8.08
1.70	1.72	-24.8	-76.8	-2.99	5.11	-2.19	3.29	40.66	-8.12
1.73	1.73	-25	-76.8	-3.02	5.20	-2.22	3.32	41.00	-8.20
1.77	1.77	-24.3	-76.8	-3.05	5.28	-2.24	3.34	40.86	-8.23
1.82	1.82	-24.1	-75.9	-3.11	5.44	-2.30	3.40	41.02	-8.28
1.85	1.85	-24.3	-76.7	-3.17	5.60	-2.36	3.46	41.02	-8.30
1.90	1.90	-23.3	-75.9	-3.23	5.76	-2.41	3.51	40.20	-8.37
1.95	1.95	-22.6	-76	-3.28	5.92	-2.46	3.56	39.62	-8.44
1.98	1.97	-23.6	-75.9	-3.31	6.01	-2.49	3.59	39.31	-8.45
2.03	2.02	-22	-75.9	-3.36	6.17	-2.53	3.63	37.94	-8.53
2.08	2.08	-21.3	-75.7	-3.44	6.42	-2.60	3.70	37.85	-8.61
2.13	2.12	-20.9	-75.7	-3.46	6.50	-2.62	3.72	38.17	-8.67
2.17	2.17	-21.1	-75.7	-3.51	6.66	-2.67	3.77	38.46	-8.72
2.22	2.22	-21.7	-75.7	-3.56	6.83	-2.72	3.82	38.87	-8.78
2.27	2.27	-21.1	-75.7	-3.61	6.99	-2.77	3.87	38.95	-8.84
2.30	2.30	-21.1	-75.7	-3.63	7.08	-2.79	3.89	39.15	-8.86
2.35	2.35	-21.6	-75.7	-3.68	7.24	-2.84	3.94	38.51	-8.90
2.38	2.37	-20.3	-75.9	-3.70	7.33	-2.85	3.95	38.59	-8.88
2.43	2.42	-20	-75.9	-3.75	7.49	-2.89	3.99	38.74	-8.95
2.47	2.47	-20.3	-75.9	-3.79	7.66	-2.94	4.04	38.61	-9.00
2.52	2.52	-19.2	-75.9	-3.84	7.82	-2.98	4.08	38.86	-9.06 **
2.55	2.55	-19.2	-75.9	-3.86	7.91	-3.00	4.10	38.60	-9.15
2.58	2.57	-19.6	-75.9	-3.88	7.99	-3.02	4.12	38.37	-9.21
2.63	2.62	-19	-75.9	-3.92	8.16	-3.06	4.16	38.07	-9.26
2.68	2.67	-19.6	-75.9	-3.96	8.32	-3.11	4.21	37.97	-9.31
2.72	2.72	-19	-76.7	-4.01	8.49	-3.14	4.24	38.14	-9.35
2.77	2.77	-18.6	-75.9	-4.05	8.66	-3.18	4.28	37.46	-9.45
2.82	2.82	-18.2	-76.7	-4.09	8.82	-3.22	4.32	37.43	-9.50
2.87	2.88	-18.2	-75.9	-4.13	8.99	-3.26	4.36	37.00	-9.62
2.92	2.93	-17.7	-76.6	-4.17	9.16	-3.30	4.40	36.55	-9.71
2.95	2.95	-18.3	-76.7	-4.19	9.24	-3.32	4.42	36.24	-9.79
3.00	3.00	-17.9	-76.6	-4.22	9.41	-3.35	4.45	36.15	-9.88
3.05	3.05	-17.5	-75.9	-4.26	9.58	-3.39	4.49	35.79	-9.99
3.10	3.10	-16.8	-76.7	-4.30	9.75	-3.42	4.52	35.70	-10.07
3.13	3.13	-17.0	-75.90	-4.32	9.83	-3.44	4.54	35.69	-10.14
3.18	3.17	-16.8	-76.60	-4.34	9.91	-3.46	4.56	36.06	-10.15
3.23	3.23	-16.8	-75.90	-4.39	10.17	-3.51	4.61	36.28	-10.24
3.27	3.27	-16.0	-75.90	-4.41	10.25	-3.52	4.62	36.40	-10.28

3.32	3.32	-16.3	-75.90	-4.44	10.42	-3.56	4.66	36.32	-10.38
3.37	3.37	-16.0	-76.60	-4.48	10.59	-3.59	4.69	36.04	-10.42
3.42	3.42	-15.0	-76.60	-4.51	10.76	-3.61	4.71	35.52	-10.50
3.47	3.47	-15.0	-76.60	-4.54	10.93	-3.65	4.75	35.05	-10.61
3.50	3.50	-14.9	-75.90	-4.56	11.01	-3.66	4.76	35.15	-10.67
3.55	3.55	-14.8	-75.90	-4.59	11.18	-3.69	4.79	34.78	-10.72
3.58	3.57	-13.8	-76.60	-4.60	11.26	-3.69	4.79	34.45	-10.80
3.63	3.63	-13.5	-75.90	-4.63	11.43	-3.72	4.82	34.24	-10.87
3.67	3.68	-13.4	-76.60	-4.65	11.60	-3.74	4.84	34.48	-10.90
3.72	3.73	-13.0	-75.90	-4.68	11.77	-3.77	4.87	34.62	-10.99
3.75	3.77	-12.7	-76.50	-4.69	11.86	-3.77	4.87	34.80	-11.04
3.80	3.82	-12.4	-75.90	-4.71	12.03	-3.80	4.90	35.01	-11.12
3.83	3.85	-12.3	-75.90	-4.72	12.12	-3.81	4.91	34.81	-11.23
3.87	3.87	-12.0	-75.90	-4.73	12.20	-3.81	4.91	34.37	-11.34
3.92	3.93	-12.3	-75.90	-4.76	12.37	-3.84	4.94	34.15	-11.47
3.97	3.98	-11.6	-75.90	-4.78	12.54	-3.85	4.95	34.00	-11.68
4.00	4.02	-11.3	-76.50	-4.79	12.63	-3.86	4.96	33.63	-11.74
4.05	4.03	-10.8	-75.90	-4.80	12.71	-3.87	4.97	33.50	-11.87
4.10	4.10	-9.8	-75.90	-4.81	12.88	-3.88	4.98	33.59	-11.97
4.15	4.15	-11.2	-75.90	-4.83	13.06	-3.90	5.00	33.48	-12.09
4.20	4.20	-9.1	-75.90	-4.85	13.23	-3.90	5.00	33.52	-12.22
4.23	4.23	-9.3	-75.90	-4.86	13.31	-3.91	5.01	33.23	-12.31
4.28	4.28	-9.5	-76.50	-4.87	13.48	-3.93	5.03	33.26	-12.37
4.32	4.32	-9.0	-75.90	-4.88	13.57	-3.93	5.03	33.17	-12.47
4.37	4.37	-8.6	-75.90	-4.89	13.74	-3.94	5.04	33.33	-12.53
4.40	4.40	-8.8	-75.90	-4.90	13.83	-3.95	5.05	32.89	-12.62
4.43	4.43	-8.0	-75.90	-4.90	13.91	-3.95	5.05	32.69	-12.69
4.48	4.48	-7.4	-75.90	-4.91	14.08	-3.96	5.06	32.61	-12.81
4.52	4.52	-7.9	-75.90	-4.92	14.17	-3.97	5.07	32.29	-12.87
4.57	4.57	-6.8	-76.50	-4.93	14.34	-3.97	5.07	32.44	-12.97
4.60	4.60	-6.8	-76.50	-4.93	14.43	-3.97	5.07	32.35	-13.08
4.65	4.65	-6.0	-75.90	-4.94	14.60	-3.97	5.07	32.02	-13.14
4.70	4.72	-6.1	-75.90	-4.94	14.77	-3.97	5.07	31.62	-13.30
4.75	4.75	-5.7	-75.90	-4.94	14.86	-3.97	5.07	31.85	-13.33
4.78	4.77	-5.6	-75.90	-4.94	14.94	-3.97	5.07	31.75	-13.41
4.83	4.83	-5.7	-76.50	-4.95	15.12	-3.98	5.08	31.43	-13.49
4.87	4.87	-4.9	-75.90	-4.95	15.20	-3.97	5.07	31.19	-13.57
4.90	4.92	-3.0	-76.50	-4.95	15.37	-3.96	5.06	31.02	-13.61
4.95	4.95	-4.7	-76.50	-4.95	15.46	-3.97	5.07	31.04	-13.73

Small denla 9-D-5 Trench dept 1.0 m

DNV Elapsed time [min]	Bruce Elapsed time [min]	Fluke Pitch [deg]	Shackle pitch [deg]	Probe depth [m]	Probe drag [m]	Shackle depth [m]	Shackle depth from ground surface (+) [m]	Pull-in tension [kN]	Dip-down angle [deg]
0.03	0.03	-15.5	-76	-0.07	0.29	0.82	1.00	-0.29	-16.97
0.08	0.10	-19.5	-76	-0.09	0.37	0.76	1.00	-0.24	-17.05
0.17	0.18	-21.4	-76	-0.13	0.45	0.71	1.00	0.09	-17.07
0.22	0.25	-23.3	-76	-0.16	0.53	0.66	1.00	0.46	-15.24
0.30	0.30	-25.1	-76	-0.20	0.61	0.61	1.00	1.29	-12.27
0.35	0.35	-26.9	-76	-0.23	0.69	0.55	1.00	1.82	-11.43
0.38	0.40	-26.9	-76	-0.28	0.76	0.51	1.00	2.47	-10.92
0.43	0.45	-28.6	-76	-0.32	0.84	0.45	1.00	3.60	-10.31
0.47	0.48	-28.6	-76	-0.36	0.91	0.41	1.00	4.41	-10.03
0.52	0.53	-28.6	-76	-0.41	0.99	0.36	1.00	5.83	-9.45
0.55	0.58	-28.6	-76	-0.45	1.06	0.32	1.00	6.73	-9.19
0.60	0.62	-30.3	-76	-0.50	1.13	0.25	1.00	8.46	-8.35
0.63	0.65	-30.3	-76	-0.54	1.20	0.21	1.00	9.73	-7.93
0.67	0.68	-30.3	-76	-0.59	1.28	0.16	1.00	10.77	-7.55
0.72	0.72	-30.3	-76	-0.64	1.35	0.11	1.00	12.84	-7.26
0.77	0.78	-30.3	-75.7	-0.73	1.49	0.02	1.00	15.00	-7.07
0.82	0.83	-30.3	-76	-0.83	1.63	-0.08	1.08	17.09	-6.85
0.85	0.85	-30.3	-76	-0.88	1.71	-0.13	1.13	18.74	-6.68
0.90	0.88	-30.3	-75.7	-0.93	1.78	-0.17	1.17	20.51	-6.59
0.97	0.97	-30.3	-76	-1.07	1.99	-0.32	1.32	22.88	-6.51
0.98	0.98	-30.3	-76	-1.12	2.06	-0.36	1.36	24.04	-6.47
1.02	1.02	-30.3	-76	-1.16	2.13	-0.41	1.41	25.19	-6.51
1.07	1.07	-28.6	-76	-1.26	2.28	-0.49	1.49	26.81	-6.48
1.10	1.12	-30.3	-76	-1.35	2.42	-0.60	1.60	27.32	-6.48
1.15	1.13	-30.3	-76	-1.39	2.50	-0.64	1.64	28.06	-6.51
1.20	1.20	-28.6	-76	-1.53	2.72	-0.76	1.76	28.66	-6.56
1.22	1.23	-28.6	-76	-1.57	2.79	-0.80	1.80	29.89	-6.63
1.27	1.28	-28.6	-76	-1.66	2.94	-0.89	1.89	30.19	-6.66
1.32	1.33	-26.9	-76	-1.74	3.09	-0.96	1.96	30.98	-6.72
1.35	1.35	-26.9	-76	-1.78	3.17	-1.00	2.00	31.19	-6.76
1.40	1.38	-26.9	-76	-1.83	3.24	-1.04	2.04	31.86	-6.84
1.45	1.43	-25.1	-76	-1.91	3.39	-1.10	2.10	32.74	-6.86
1.50	1.50	-25.1	-76	-2.03	3.62	-1.22	2.22	33.04	-6.91
1.55	1.55	-25.1	-76	-2.10	3.78	-1.30	2.30	33.29	-6.98
1.58	1.58	-25.1	-75.7	-2.14	3.85	-1.34	2.34	33.13	-7.02
1.63	1.63	-23.3	-76	-2.22	4.01	-1.40	2.40	33.17	-7.09
1.67	1.67	-23.3	-76	-2.25	4.08	-1.43	2.43	33.86	-7.12
1.72	1.72	-23.3	-75.7	-2.33	4.24	-1.51	2.51	29.05	-7.08
1.75	1.75	-23.3	-76	-2.36	4.32	-1.54	2.54	34.25	-7.21
1.80	1.80	-23.3	-75.7	-2.43	4.47	-1.61	2.61	34.85	-7.23
1.83	1.83	-23.3	-75.7	-2.47	4.55	-1.65	2.65	35.80	-7.28
1.88	1.88	-23.3	-75.7	-2.54	4.71	-1.72	2.72	36.36	-7.34
1.92	1.93	-21.4	-75.7	-2.61	4.87	-1.77	2.77	36.31	-7.38
1.95	1.95	-21.4	-75.7	-2.64	4.95	-1.80	2.80	35.92	-7.47
2.00	2.00	-21.4	-75.7	-2.71	5.11	-1.87	2.87	36.77	-7.49
2.05	2.05	-21.4	-75.7	-2.77	5.27	-1.93	2.93	37.53	-7.55
2.08	2.08	-21.4	-75.7	-2.80	5.35	-1.96	2.96	37.07	-7.56
2.13	2.13	-19.5	-75.7	-2.86	5.51	-2.01	3.01	38.78	-7.61
2.18	2.18	-21.4	-75.7	-2.92	5.67	-2.08	3.08	39.64	-7.62
2.23	2.23	-19.5	-75.7	-2.98	5.83	-2.13	3.13	38.79	-7.70
2.28	2.28	-19.5	-75.7	-3.04	5.99	-2.18	3.18	38.78	-7.72
2.32	2.33	-19.5	-75.7	-3.10	6.15	-2.24	3.24	38.80	-7.77
2.37	2.38	-19.5	-75.8	-3.15	6.32	-2.29	3.29	38.13	-7.91
2.42	2.43	-17.5	-75.8	-3.20	6.48	-2.33	3.33	38.32	-7.82
2.45	2.45	-17.5	-75.7	-3.23	6.56	-2.36	3.36	38.17	-7.92
2.48	2.48	-17.5	-75.8	-3.26	6.65	-2.38	3.38	37.87	-8.01
2.52	2.53	-17.5	-75.8	-3.30	6.81	-2.43	3.43	37.69	-8.05 **
2.57	2.57	-17.5	-75.8	-3.33	6.89	-2.45	3.45	37.78	-8.12
2.60	2.58	-17.5	-75.8	-3.35	6.98	-2.48	3.48	38.14	-8.16
2.65	2.65	-15.5	-75.8	-3.42	7.22	-2.53	3.53	38.22	-8.29
2.68	2.68	-15.5	-75.8	-3.45	7.31	-2.56	3.56	38.32	-8.35
2.73	2.73	-15.5	-75.8	-3.49	7.47	-2.60	3.60	38.32	-8.46
2.78	2.78	-15.5	-75.8	-3.54	7.64	-2.65	3.65	37.95	-8.63
2.83	2.83	-13.5	-76.2	-3.58	7.80	-2.67	3.67	37.78	-8.64
2.87	2.87	-13.5	-75.8	-3.60	7.89	-2.69	3.69	37.92	-8.71
2.92	2.92	-13.5	-76.2	-3.64	8.06	-2.73	3.73	37.70	-8.75
2.95	2.95	-15.5	-76.2	-3.66	8.14	-2.77	3.77	37.71	-8.84
3.00	3.00	-13.5	-76.2	-3.70	8.31	-2.79	3.79	37.52	-8.93
3.03	3.03	-13.5	-76.2	-3.72	8.39	-2.81	3.81	37.58	-9.05
3.08	3.08	-13.5	-76.2	-3.76	8.56	-2.85	3.85	38.05	-9.23
3.12	3.13	-13.5	-76.20	-3.80	8.73	-2.89	3.89	37.86	-9.27
3.17	3.18	-13.5	-76.20	-3.83	8.89	-2.92	3.92	37.86	-9.30
3.20	3.22	-13.5	-77.10	-3.85	8.98	-2.94	3.94	37.84	-9.39
3.23	3.23	-13.5	-76.20	-3.87	9.06	-2.96	3.96	37.90	-9.47

3.28	3.27	-11.4	-76.20	-3.89	9.15	-2.96	3.96	36.91	-9.51
3.33	3.33	-13.5	-77.10	-3.92	9.31	-3.01	4.01	37.41	-9.57
3.37	3.38	-11.4	-77.10	-3.96	9.48	-3.03	4.03	37.42	-9.56
3.43	3.42	-13.5	-77.10	-3.97	9.57	-3.06	4.06	37.39	-9.61
3.47	3.48	-11.4	-77.10	-4.01	9.74	-3.08	4.08	37.52	-9.69
3.50	3.52	-13.5	-77.10	-4.02	9.82	-3.12	4.12	37.51	-9.76
3.55	3.55	-11.4	-77.10	-4.04	9.90	-3.12	4.12	37.90	-9.89
3.60	3.60	-13.5	-78.40	-4.07	10.07	-3.17	4.17	38.15	-10.05
3.65	3.65	-13.5	-77.10	-4.11	10.24	-3.20	4.20	36.99	-10.12
3.70	3.72	-11.4	-77.10	-4.14	10.41	-3.22	4.22	37.38	-10.21
3.73	3.75	-11.4	-78.40	-4.16	10.49	-3.23	4.23	36.98	-10.27
3.77	3.78	-13.5	-77.10	-4.18	10.58	-3.27	4.27	36.89	-10.30
3.82	3.82	-11.4	-77.10	-4.19	10.66	-3.27	4.27	37.04	-10.35
3.87	3.87	-11.4	-77.10	-4.23	10.83	-3.30	4.30	37.26	-10.46
3.92	3.90	-11.4	-78.40	-4.24	10.92	-3.32	4.32	36.63	-10.58
3.97	3.97	-11.4	-77.10	-4.27	11.09	-3.35	4.35	37.49	-10.66
4.02	4.03	-13.5	-78.40	-4.31	11.25	-3.40	4.40	37.43	-10.71
4.07	4.08	-11.4	-78.40	-4.34	11.42	-3.41	4.41	37.25	-10.79
4.12	4.12	-11.4	-78.40	-4.36	11.51	-3.43	4.43	36.88	-10.89
4.15	4.13	-11.4	-78.40	-4.37	11.59	-3.45	4.45	35.74	-10.94
4.20	4.20	-11.4	-78.40	-4.40	11.76	-3.48	4.48	36.07	-11.02
4.25	4.25	-11.4	-78.40	-4.44	11.93	-3.51	4.51	35.31	-11.13
4.28	4.28	-11.4	-78.40	-4.45	12.02	-3.52	4.52	35.15	-11.18
4.33	4.32	-11.4	-78.40	-4.47	12.10	-3.54	4.54	35.00	-11.38
4.38	4.37	-11.4	-78.40	-4.50	12.27	-3.57	4.57	35.17	-11.48
4.42	4.42	-11.4	-80.50	-4.53	12.44	-3.60	4.60	34.84	-11.50
4.47	4.48	-11.4	-80.50	-4.56	12.61	-3.63	4.63	34.19	-11.60
4.50	4.52	-9.3	-80.50	-4.57	12.69	-3.63	4.63	34.12	-11.65
4.57	4.57	-11.4	-80.50	-4.61	12.86	-3.68	4.68	33.73	-11.78
4.58	4.60	-9.3	-80.50	-4.62	12.95	-3.68	4.68	33.17	-11.85
4.63	4.62	-11.4	-80.50	-4.64	13.03	-3.71	4.71	32.00	-11.96
4.68	4.68	-11.4	-80.50	-4.67	13.20	-3.74	4.74	31.21	-12.12
4.72	4.73	-9.3	-80.50	-4.69	13.37	-3.75	4.75	30.25	-12.21
4.77	4.77	-7.2	-80.50	-4.71	13.45	-3.75	4.75	28.52	-12.35
4.82	4.82	-7.2	-80.50	-4.73	13.63	-3.77	4.77	28.15	-12.45
4.87	4.88	-7.2	-80.50	-4.74	13.80	-3.79	4.79	27.32	-12.57
4.90	4.92	-7.2	-80.50	-4.75	13.88	-3.79	4.79	27.05	-12.64
4.93	4.93	-5.0	-80.50	-4.76	13.97	-3.78	4.78	26.67	-12.72
4.98	4.97	-5.0	-80.50	-4.76	14.05	-3.79	4.79	26.29	-12.77
5.02	5.03	-5.0	-80.50	-4.77	14.23	-3.80	4.80	26.42	-12.75
5.05	5.07	-5.0	-80.50	-4.78	14.31	-3.80	4.80	26.74	-12.82
5.10	5.10	-2.8	-80.50	-4.78	14.40	-3.79	4.79	27.28	-12.88
5.13	5.13	-2.8	-80.50	-4.78	14.48	-3.79	4.79	27.78	-12.98
5.18	5.17	-5.0	-80.50	-4.79	14.57	-3.81	4.81	28.77	-13.20
5.22	5.22	-5.0	-80.50	-4.79	14.65	-3.82	4.82	29.66	-13.22
5.25	5.23	-5.0	-80.50	-4.80	14.74	-3.82	4.82	30.47	-13.39
5.32	5.32	-9.3	-80.50	-4.81	14.91	-3.87	4.87	31.52	-13.39
5.35	5.35	-7.2	-80.50	-4.82	15.00	-3.86	4.86	32.24	-13.59
5.38	5.38	-7.2	-80.50	-4.83	15.08	-3.87	4.87	33.39	-13.68
5.43	5.42	-9.3	-80.50	-4.84	15.17	-3.90	4.90	34.95	-13.97
5.48	5.48	-9.3	-80.50	-4.86	15.34	-3.92	4.92	36.24	-14.19
5.53	5.52	-9.3	-80.50	-4.88	15.42	-3.94	4.94	36.41	-14.59
5.58	5.58	-11.4	-80.50	-4.91	15.59	-3.98	4.98	40.48	-14.74
5.62	5.62	-13.5	-80.50	-4.94	15.76	-4.03	5.03	43.30	-14.73
5.67	5.67	-13.5	-80.50	-4.97	15.93	-4.06	5.06	47.04	-14.67
5.70	5.68	-11.4	-80.50	-4.99	16.02	-4.06	5.06	50.99	-14.72
5.75	5.75	-9.3	-80.50	-5.03	16.27	-4.09	5.09	53.13	-14.68
5.78	5.78	-9.3	-80.50	-5.06	16.44	-4.12	5.12	53.01	-14.72
5.82	5.82	-9.3	-80.50	-5.07	16.52	-4.13	5.13	52.40	-14.68
5.87	5.88	-7.2	-80.50	-5.10	16.78	-4.15	5.15	52.36	-14.73
5.92	5.92	-7.2	-80.50	-5.12	16.95	-4.16	5.16	51.90	-14.74
5.95	5.95	-7.2	-80.50	-5.13	17.04	-4.17	5.17	51.06	-14.78
5.98	5.97	-5.0	-80.50	-5.14	17.12	-4.16	5.16	51.35	-14.78
6.03	6.02	-5.0	-80.50	-5.15	17.29	-4.18	5.18	51.44	-14.86
6.10	6.08	-5.0	-80.50	-5.17	17.55	-4.20	5.20	51.03	-14.90
6.13	6.13	-5.0	-80.50	-5.19	17.72	-4.21	5.21	50.19	-14.90
6.18	6.18	-5.0	-80.50	-5.20	17.89	-4.22	5.22	50.46	-15.05
6.22	6.22	-5.0	-80.50	-5.20	17.98	-4.23	5.23	50.20	-15.08
6.27	6.27	-2.8	-80.50	-5.21	18.15	-4.22	5.22	50.33	-15.07
19.47	19.47	-2.8	-80.50	-5.21	18.24	-4.22	5.22	44.15	1.83
19.50	19.50	-2.8	-84.00	-5.21	18.32	-4.22	5.22	52.37	1.83
19.55	19.55	-2.8	-84.00	-5.22	18.50	-4.23	5.23	53.66	1.83
19.60	19.62	-2.8	-80.50	-5.23	18.67	-4.24	5.24	51.83	1.83
19.65	19.67	-2.8	-84.00	-5.23	18.84	-4.24	5.24	51.82	1.83
19.70	19.72	-0.6	-84.00	-5.24	19.01	-4.23	5.23	51.21	1.83
19.73	19.75	-2.8	-84.00	-5.24	19.10	-4.25	5.25	49.44	1.83
19.78	19.78	-0.6	-84.00	-5.24	19.18	-4.23	5.23	50.58	1.83
19.82	19.83	-0.6	-84.00	-5.24	19.36	-4.24	5.24	51.19	1.83
19.87	19.87	-0.6	-84.00	-5.24	19.44	-4.24	5.24	50.73	1.83

19.90	19.90	-0.6	-84.00	-5.24	19.53	-4.24	5.24	51.79	1.82
19.95	19.95	-0.6	-84.00	-5.24	19.70	-4.24	5.24	52.24	1.83
19.98	19.98	-0.6	-84.00	-5.24	19.79	-4.24	5.24	52.54	1.83
20.03	20.03	-0.6	-84.00	-5.24	19.96	-4.24	5.24	52.09	1.83
20.07	20.07	-0.6	-84.00	-5.24	20.04	-4.24	5.24	51.86	1.83
20.10	20.10	-0.6	-84.00	-5.24	20.13	-4.23	5.23	51.59	1.83
20.15	20.15	1.6	-84.00	-5.24	20.30	-4.22	5.22	52.37	1.83
20.20	20.18	1.6	-84.00	-5.24	20.39	-4.21	5.21	52.25	1.83
20.23	20.22	1.6	-84.00	-5.23	20.47	-4.21	5.21	53.23	1.83
20.28	20.27	-0.6	-84.00	-5.23	20.65	-4.22	5.22	53.23	1.83
20.33	20.33	1.6	-84.00	-5.22	20.82	-4.20	5.20	53.66	1.83
20.38	20.38	1.6	-84.00	-5.22	20.99	-4.20	5.20	52.78	1.83
20.43	20.43	1.6	-84.00	-5.21	21.16	-4.19	5.19	53.89	1.83

Large denla 4-DL-1 Trench depth 1.2 m

DNV Elapsed time [min]	Bruce Elapsed time [min]	Fluke Pitch [deg]	Shackle pitch [deg]	Probe depth [m]	Probe drag [m]	Shackle depth [m]	Shackle depth from ground surface (+) [m]	Pull-in tension [kN]	Dip-down angle [deg]
-0.13	-0.12	-19.1	90	-0.04	0.30	1.27	1.20	0.67	-16.16
-0.03	0.03	-30.4	90	-0.12	0.54	1.09	1.20	0.67	-16.16
0.05	0.07	-31.6	90	-0.16	0.62	1.04	1.20	1.02	-14.26
0.15	0.17	-34.5	90	-0.28	0.85	0.88	1.20	1.39	-12.64
0.23	0.25	-36.3	90	-0.38	0.99	0.77	1.20	3.78	-10.45
0.33	0.33	-39.8	90	-0.48	1.13	0.62	1.20	7.25	-9.43
0.42	0.40	-44	90	-0.54	1.19	0.51	1.20	10.67	-8.34
0.52	0.53	-45.8	90	-0.83	1.50	0.19	1.20	16.73	-7.25
0.60	0.60	-42.5	90	-1.06	1.76	0.01	1.20	35.99	-5.97
0.70	0.70	-40.6	90	-1.33	2.09	-0.24	1.44	46.77	-5.80
0.78	0.77	-38.4	90	-1.55	2.37	-0.42	1.62	55.04	-5.71
0.88	0.87	-36.8	90	-1.80	2.72	-0.65	1.85	63.30	-5.70
0.97	0.98	-34.3	90	-2.03	3.08	-0.86	2.06	66.52	-5.75
1.07	1.07	-33.9	80.5	-2.21	3.37	-1.03	2.23	69.93	-5.84
1.15	1.15	-31.9	81.1	-2.37	3.67	-1.18	2.38	72.24	-5.96
1.25	1.25	-30.5	75.8	-2.57	4.06	-1.36	2.56	72.00	-6.12
1.33	1.33	-29	71.9	-2.71	4.37	-1.49	2.69	72.98	-6.21
1.43	1.42	-26.9	71.9	-2.85	4.68	-1.60	2.80	72.81	-6.31
1.52	1.52	-27.3	68.7	-2.98	5.00	-1.74	2.94	73.21	-6.39
1.62	1.62	-26.4	68.7	-3.11	5.32	-1.86	3.06	73.78	-6.52
1.70	1.70	-25.2	65.9	-3.23	5.64	-1.97	3.17	74.68	-6.57
1.80	1.80	-24.2	65.9	-3.35	5.96	-2.08	3.28	76.42	-6.66
1.88	1.87	-24.8	65.9	-3.44	6.21	-2.17	3.37	77.34	-6.78
1.98	1.98	-23	63.4	-3.58	6.62	-2.29	3.49	77.72	-6.86
2.07	2.07	-24.1	63.8	-3.66	6.86	-2.39	3.59	77.79	-6.95
2.17	2.17	-22.3	63.4	-3.76	7.19	-2.48	3.68	78.35	-7.06
2.25	2.27	-21.7	61.5	-3.86	7.52	-2.57	3.77	80.18	-7.13
2.35	2.33	-21.5	61.5	-3.94	7.76	-2.64	3.84	81.20	-7.24
2.43	2.42	-21.2	61.1	-4.01	8.01	-2.71	3.91	81.19	-7.37
2.53	2.52	-20.7	61.1	-4.10	8.34	-2.80	4.00	81.91	-7.48
2.62	2.62	-21	59.3	-4.19	8.67	-2.89	4.09	82.94	-7.53
2.72	2.72	-19.9	59	-4.28	9.01	-2.97	4.17	82.67	-7.66
2.80	2.80	-20.2	59	-4.34	9.26	-3.04	4.24	83.46	-7.77
2.90	2.90	-20.2	57.3	-4.42	9.59	-3.12	4.32	83.77	-7.89
2.98	2.98	-18.9	57.3	-4.48	9.84	-3.17	4.37	84.21	-8.02
3.08	3.08	-19	57.3	-4.56	10.18	-3.24	4.44	84.95	-8.16
3.17	3.17	-20.1	57.3	-4.61	10.43	-3.31	4.51	85.36	-8.28
3.27	3.27	-18.2	57.3	-4.69	10.77	-3.37	4.57	86.15	-8.41
3.35	3.35	-18.8	57.3	-4.74	11.02	-3.42	4.62	87.19	-8.51
3.45	3.45	-17.9	55.3	-4.81	11.36	-3.49	4.69	88.57	-8.65
3.53	3.53	-17.8	55.3	-4.86	11.61	-3.54	4.74	88.94	-8.79
3.63	3.63	-17.1	55.3	-4.93	11.95	-3.60	4.80	89.21	-8.95
3.72	3.72	-17	55.3	-4.98	12.20	-3.65	4.85	89.48	-9.12
3.82	3.82	-15.9	55.3	-5.02	12.45	-3.68	4.88	88.73	-9.26
3.90	3.90	-16.2	53.5	-5.07	12.71	-3.73	4.93	90.03	-9.38
4.00	4.00	-16.5	53.5	-5.13	13.05	-3.80	5.00	87.05	-10.88
4.08	4.08	-16.8	53.5	-5.18	13.30	-3.84	5.04	89.14	-9.61
4.18	4.17	-15.6	53.5	-5.22	13.55	-3.88	5.08	89.88	-9.75
4.27	4.27	-16.7	53.5	-5.28	13.89	-3.95	5.15	90.33	-9.84
4.37	4.38	-15.6	51.7	-5.33	14.23	-3.99	5.19	89.78	-9.96
4.45	4.45	-15.4	51.7	-5.37	14.49	-4.03	5.23	89.32	-10.13
4.55	4.57	-14.7	51.7	-5.42	14.83	-4.07	5.27	89.89	-10.27
4.63	4.62	-14.8	51.7	-5.44	15.00	-4.09	5.29	90.34	-10.44
4.73	4.73	-14.1	51.7	-5.49	15.34	-4.13	5.33	91.05	-10.64
4.82	4.83	-14.1	50	-5.53	15.68	-4.18	5.38	92.86	-10.80
4.92	4.92	-14.2	50	-5.56	15.94	-4.21	5.41	93.18	-11.02
5.00	4.98	-13.1	50	-5.60	16.19	-4.23	5.43	94.30	-11.23
5.10	5.10	-13.6	50.4	-5.64	16.53	-4.28	5.48	93.62	-11.48
5.18	5.18	-13.2	50.4	-5.67	16.79	-4.31	5.51	94.62	-11.71
5.28	5.27	-13.8	50	-5.70	17.05	-4.35	5.55	94.44	-11.91
5.37	5.37	-12.8	50.4	-5.74	17.39	-4.38	5.58	94.36	-12.13
5.47	5.47	-12.6	50.4	-5.78	17.73	-4.42	5.62	94.62	-12.31
5.55	5.55	-12.4	48.7	-5.81	17.99	-4.45	5.65	94.52	-12.53
5.65	5.65	-12.3	48.7	-5.85	18.33	-4.48	5.68	94.84	-12.72
5.73	5.73	-12.4	48.7	-5.87	18.58	-4.50	5.70	93.70	-12.96
5.83	5.83	-11.2	48.3	-5.90	18.93	-4.53	5.73	94.67	-13.20
5.92	5.92	-12.2	48.7	-5.92	19.18	-4.56	5.76	94.81	-13.41

6.02	6.03	-11.9	48.7	-5.95	19.53	-4.58	5.78	94.53	-13.64
6.10	6.08	-11.2	48.7	-5.97	19.70	-4.59	5.79	95.60	-13.89
6.20	6.17	-11.2	47.1	-5.98	19.87	-4.61	5.81	96.42	-14.17
6.28								96.86	-14.45
6.38								59.88	-14.77
6.47								37.24	-15.12
6.57								34.45	-15.24
6.65								27.74	-15.76
6.75								19.95	-16.02
6.83								16.06	-16.49
6.93								13.62	-17.01
7.02								13.57	-17.08
7.12								13.62	-17.05
7.20								13.68	-17.05

Large denla 5-DL-2 Trench deptr 1 m

DNV Elapsed time [min]	Bruce Elapsed time [min]	Fluke Pitch [deg]	Shackle pitch [deg]	Probe depth [m]	Probe drag [m]	Shackle depth [m]	Shackle depth from ground surface (+) [m]	Pull-in tension [kN]	Dip-down angle [deg]
-0.03	0.00	-30.9	90	-0.18	0.53	1.02	1.00	1.92	-17.37
0.07	0.07	-31.7	90	-0.26	0.68	0.94	1.00	3.58	-20.18
0.15	0.12	-33.7	90	-0.31	0.75	0.87	1.00	4.97	-21.62
0.25	0.25	-37.7	90	-0.45	0.97	0.68	1.00	8.11	-22.96
0.33	0.33	-39.3	90	-0.55	1.10	0.56	1.00	11.77	-24.25
0.43	0.45	-42.6	90	-0.72	1.30	0.35	1.00	16.01	-25.58
0.52	0.52	-43.3	90	-0.84	1.43	0.22	1.00	23.43	-26.69
0.62	0.62	-42.3	90	-1.01	1.62	0.06	1.00	35.71	-29.20
0.70	0.70	-41.4	90	-1.18	1.81	-0.09	1.09	42.69	-32.21
0.80	0.82	-39	90	-1.45	2.15	-0.33	1.33	49.82	-33.19
0.88	0.88	-38.5	90	-1.60	2.36	-0.48	1.48	56.27	-33.95
0.98	0.98	-36.2	90	-1.79	2.64	-0.64	1.64	60.51	-33.81
1.07	1.07	-35.1	90	-1.93	2.86	-0.77	1.77	62.85	-33.41
1.17	1.17	-32.4	90	-2.11	3.15	-0.92	1.92	65.13	-36.48
1.25	1.25	-32.2	90	-2.23	3.38	-1.04	2.04	68.20	-37.53
1.35	1.35	-32.5	90	-2.40	3.68	-1.21	2.21	69.54	-39.40
1.43	1.43	-31.2	90	-2.51	3.91	-1.31	2.31	70.08	-39.85
1.53	1.53	-29.6	82.6	-2.66	4.23	-1.44	2.44	70.01	-40.90
1.62	1.62	-28.9	81.1	-2.76	4.46	-1.54	2.54	70.70	-38.66
1.72	1.73	-27.2	81.1	-2.90	4.78	-1.66	2.66	70.94	-41.33
1.80	1.82	-26.5	75.8	-2.99	5.02	-1.75	2.75	72.19	-41.49
1.90	1.90	-26.5	75.8	-3.09	5.26	-1.84	2.84	73.24	-42.54
1.98	1.97	-25.9	75.8	-3.15	5.42	-1.90	2.90	73.63	-43.21
2.08	2.08	-25.7	75.8	-3.27	5.74	-2.01	3.01	72.24	-43.25
2.17	2.17	-25.3	75.8	-3.36	5.98	-2.10	3.10	75.65	-42.98
2.27	2.27	-24.9	71.9	-3.45	6.23	-2.18	3.18	75.96	-43.83
2.35	2.35	-24.1	72.5	-3.53	6.47	-2.26	3.26	75.85	-45.78
2.45	2.47	-24.4	68.7	-3.64	6.80	-2.37	3.37	76.05	-45.62
2.53	2.53	-24	72.5	-3.69	6.96	-2.42	3.42	76.46	-45.54
2.63	2.62	-23.3	69.3	-3.77	7.20	-2.49	3.49	77.16	-49.63
2.72	2.72	-22.8	69.3	-3.85	7.45	-2.56	3.56	79.00	-51.47
2.82	2.82	-22.4	68.7	-3.92	7.70	-2.64	3.64	77.97	-51.09
2.90	2.90	-22.5	69.3	-3.99	7.95	-2.71	3.71	78.83	-6.42
3.00	3.00	-22.7	66.4	-4.07	8.19	-2.78	3.78	78.83	-6.58
3.08	3.08	-21.8	66.4	-4.14	8.44	-2.84	3.84	80.89	-6.96
3.18	3.18	-21.8	66.4	-4.20	8.69	-2.91	3.91	81.05	-8.45
3.27	3.27	-20.3	66.4	-4.27	8.94	-2.97	3.97	81.94	-9.64
3.37	3.37	-21.8	66.4	-4.34	9.19	-3.05	4.05	80.91	-11.76
3.45	3.45	-20.3	66.4	-4.40	9.44	-3.10	4.10	81.67	-13.29
3.55	3.55	-19.9	63.4	-4.46	9.69	-3.16	4.16	83.49	-14.08
3.63	3.63	-20.1	63.8	-4.52	9.94	-3.22	4.22	84.18	-14.24
3.73	3.72	-20.1	63.8	-4.59	10.19	-3.28	4.28	83.70	-16.68
3.82	3.83	-19.1	63.8	-4.66	10.53	-3.35	4.35	84.87	-19.01
3.92	3.92	-19.2	63.8	-4.72	10.78	-3.41	4.41	84.77	-17.84
4.00	4.02	-19.5	63.8	-4.78	11.03	-3.47	4.47	85.39	-18.46
4.10	4.10	-19.4	63.8	-4.83	11.28	-3.52	4.52	86.02	-23.25
4.18	4.17	-18.2	61.5	-4.87	11.45	-3.55	4.55	86.70	-19.17
4.28	4.28	-19.4	61.5	-4.95	11.78	-3.63	4.63	87.88	-23.42
4.37	4.38	-17.9	61.5	-5.00	12.04	-3.67	4.67	87.97	-25.46
4.47	4.47	-18	61.5	-5.05	12.29	-3.73	4.73	87.86	-25.80
4.55	4.55	-18.1	61.5	-5.10	12.54	-3.78	4.78	87.02	-24.64
4.65	4.65	-16.7	61.5	-5.15	12.80	-3.81	4.81	87.89	-24.53
4.73	4.73	-18.1	61.5	-5.19	13.05	-3.87	4.87	87.67	-25.07
4.83	4.87	-17.3	59.3	-5.26	13.39	-3.93	4.93	88.61	-26.42
4.92	4.92	-18.1	59.3	-5.29	13.56	-3.97	4.97	89.45	-30.61
5.02	5.02	-16.5	59.3	-5.34	13.81	-4.00	5.00	88.97	-35.33
5.10	5.10	-16.9	59.3	-5.38	14.06	-4.05	5.05	89.69	-38.82
5.20	5.20	-16	59.3	-5.43	14.32	-4.09	5.09	91.13	-39.75
5.28	5.27	-15.5	57.3	-5.45	14.49	-4.11	5.11	90.05	-9.55
5.38	5.38	-15.8	57.3	-5.51	14.83	-4.17	5.17	90.39	-9.48
5.47	5.48	-14.8	57.3	-5.54	15.08	-4.19	5.19	89.27	-10.07
5.57	5.57	-15.2	57.3	-5.58	15.34	-4.23	5.23	89.98	-9.90
5.65	5.63	-15	57.3	-5.60	15.51	-4.26	5.26	90.87	-13.63
5.75	5.77	-14.6	57.3	-5.65	15.85	-4.30	5.30	90.99	-20.83
5.83	5.83	-14.1	57.3	-5.67	16.02	-4.32	5.32	91.95	-22.48
5.93	5.92	-15.3	57.3	-5.71	16.28	-4.36	5.36	92.12	-12.49
6.02	6.02	-14	55.3	-5.74	16.53	-4.39	5.39	91.97	-20.10

6.12	6.12	-13.8	55.3	-5.77	16.79	-4.42	5.42	92.92	-29.64
6.20	6.22	-14.9	57.3	-5.81	17.04	-4.46	5.46	93.44	-30.17
6.30	6.32	-14.2	55.3	-5.84	17.30	-4.49	5.49	93.26	-33.08
6.38	6.38	-13.9	55.30	-5.86	17.47	-4.51	5.51	94.07	-35.08
6.48	6.47	-14.4	55.30	-5.90	17.73	-4.55	5.55	94.28	-34.29
6.57	6.57	-13.3	55.30	-5.93	17.98	-4.57	5.57	95.01	-35.11
6.67	6.68	-14.2	55.30	-5.97	18.32	-4.62	5.62	94.99	-37.80
6.75	6.75	-12.4	55.30	-5.99	18.49	-4.63	5.63	95.14	-40.42
6.85	6.85	-12.6	55.30	-6.02	18.75	-4.65	5.65	94.10	-12.00
6.93	6.92	-12.7	53.50	-6.04	18.92	-4.67	5.67	93.63	-17.55
7.03	6.95	-12.3	53.50	-6.04	19.01	-4.68	5.68	95.54	-20.98

Large denla 9-DL-3 Trench depth 1.25 m

DNV Elapsed time [min]	Bruce Elapsed time [min]	Fluke Pitch [deg]	Shackle pitch [deg]	Probe depth [m]	Probe drag [m]	Shackle depth [m]	Shackle depth from ground surface (+) [m]	Pull-in tension [kN]	Dip-down angle [deg]
0.22	0.20	-17.3	65.9	0.00	0.00	1.33	1.25	1.31	-15.37
0.32	0.32	-19.9	71.9	-0.03	0.13	1.28	1.25	1.45	-14.18
0.40	0.42	-25.9	76.6	-0.07	0.29	1.18	1.25	1.79	-13.12
0.50	0.50	-30.6	90	-0.14	0.45	1.07	1.25	2.50	-11.34
0.58	0.57	-30.7	90	-0.21	0.61	0.99	1.25	4.52	-9.66
0.68	0.67	-33.6	90	-0.34	0.83	0.84	1.25	7.81	-8.69
0.77	0.78	-37.2	90	-0.48	1.05	0.66	1.25	11.26	-7.71
0.87	0.87	-39.3	90	-0.63	1.26	0.48	1.25	17.49	-6.77
0.95	0.95	-41	90	-0.79	1.46	0.30	1.25	25.64	-6.07
1.05	1.07	-40.9	82.6	-1.01	1.72	0.08	1.25	37.12	-5.65
1.13	1.13	-39.8	82.6	-1.17	1.92	-0.07	1.32	45.51	-5.68
1.23	1.22	-38.5	76.6	-1.38	2.20	-0.26	1.51	52.69	-5.40
1.32	1.33	-36.6	76.6	-1.62	2.55	-0.48	1.73	58.43	-5.38
1.42	1.42	-34.3	72.5	-1.80	2.85	-0.63	1.88	62.33	-5.41
1.50	1.50	-33.3	72.5	-1.98	3.14	-0.80	2.05	65.00	-5.45
1.60	1.60	-31.1	69.3	-2.18	3.52	-0.98	2.23	67.47	-5.53
1.68	1.68	-30.9	70.1	-2.33	3.83	-1.13	2.38	68.95	-5.60
1.78	1.78	-28.6	66.4	-2.48	4.14	-1.25	2.50	70.35	-5.68
1.87	1.88	-28	63.8	-2.61	4.46	-1.38	2.63	72.38	-5.73
1.97	1.97	-27.3	63.8	-2.75	4.77	-1.51	2.76	73.46	-5.85
2.05	2.07	-26.6	61.5	-2.87	5.09	-1.63	2.88	74.18	-5.94
2.15	2.15	-25.6	61.5	-3.00	5.42	-1.74	2.99	74.18	-6.06
2.23	2.23	-25.3	62	-3.08	5.66	-1.82	3.07	73.50	-6.22
2.33	2.32	-24.7	59.3	-3.17	5.90	-1.90	3.15	66.52	-6.04
2.42	2.43	-24.1	59.8	-3.28	6.23	-2.01	3.26	74.84	-6.43
2.52	2.52	-23.5	59.8	-3.36	6.47	-2.08	3.33	76.09	-6.44
2.60	2.60	-23.7	59.8	-3.44	6.72	-2.16	3.41	77.06	-6.53
2.70	2.70	-23.2	57.7	-3.54	7.05	-2.26	3.51	78.47	-6.63
2.78	2.77	-22.9	57.7	-3.61	7.30	-2.33	3.58	77.14	-6.76
2.88	2.87	-22.5	57.7	-3.71	7.63	-2.42	3.67	78.44	-6.83
2.97	2.97	-21.1	57.7	-3.80	7.96	-2.50	3.75	78.74	-6.94
3.07	3.07	-21	55.8	-3.89	8.29	-2.59	3.84	78.71	-7.05
3.15	3.15	-20.2	55.8	-3.95	8.54	-2.65	3.90	79.32	-7.22
3.25	3.25	-20.2	55.8	-4.04	8.87	-2.73	3.98	81.13	-7.25
3.33	3.33	-20.4	55.8	-4.10	9.12	-2.80	4.05	81.25	-7.36
3.43	3.43	-20	53.9	-4.18	9.46	-2.88	4.13	81.81	-7.45
3.52	3.52	-18.6	53.5	-4.24	9.71	-2.92	4.17	81.29	-7.56
3.62	3.62	-19.1	53.9	-4.31	10.04	-3.00	4.25	81.27	-7.71
3.70	3.70	-18.5	53.9	-4.37	10.30	-3.05	4.30	81.68	-7.87
3.80	3.80	-18.1	52.1	-4.44	10.63	-3.12	4.37	81.36	-7.98
3.88	3.88	-17.7	52.1	-4.49	10.89	-3.16	4.41	82.47	-8.10
3.98	3.97	-17.3	52.1	-4.54	11.14	-3.21	4.46	81.42	-8.25
4.07	4.07	-17.6	52.1	-4.58	11.39	-3.26	4.51	83.53	-8.34
4.17	4.15	-17.2	52.1	-4.63	11.65	-3.30	4.55	84.38	-8.50
4.25	4.27	-17	52.1	-4.69	11.99	-3.36	4.61	83.74	-8.65
4.35	4.35	-17.6	52.1	-4.74	12.24	-3.41	4.66	84.29	-8.80
4.43	4.43	-16.7	50.4	-4.78	12.49	-3.45	4.70	84.41	-8.96
4.53	4.53	-15.5	50.4	-4.83	12.75	-3.48	4.73	84.74	-9.10
4.62	4.62	-16.3	50.4	-4.87	13.00	-3.53	4.78	85.53	-9.20
4.72	4.72	-17.1	50.4	-4.93	13.34	-3.60	4.85	87.67	-9.34
4.80	4.80	-15.5	50.4	-4.97	13.60	-3.62	4.87	88.35	-9.47
4.90	4.92	-15	48.7	-5.02	13.94	-3.67	4.92	88.76	-9.61
5.08	5.10	-14.5	48.7	-5.03	14.02	-3.68	4.93	69.94	-9.79
5.35	5.32	-14.1	48.7	-5.04	14.11	-3.69	4.94	70.15	-9.83
5.63	5.63	-14.3	48.7	-5.05	14.19	-3.70	4.95	67.78	-9.86
6.18	6.13	-14.5	48.7	-5.06	14.28	-3.71	4.96	69.49	-9.89
6.63	6.65	-14.2	48.7	-5.07	14.36	-3.72	4.97	70.56	-9.96
7.18	7.20	-15.2	48.7	-5.09	14.45	-3.74	4.99	70.87	-10.01
7.55	7.58	-14.5	48.7	-5.10	14.53	-3.75	5.00	74.14	-10.05
7.92	7.93	-15.3	48.7	-5.11	14.62	-3.76	5.01	73.89	-10.11
8.28	8.27	-15.2	48.7	-5.12	14.70	-3.78	5.03	74.03	-10.16
8.65	8.62	-13.7	49.1	-5.13	14.79	-3.78	5.03	73.95	-10.23
9.02	9.02	-14.9	48.7	-5.14	14.87	-3.80	5.05	72.67	-10.31
9.30	9.27	-15.6	48.7	-5.16	14.96	-3.82	5.07	77.74	-10.33
9.48	9.48	-15	48.7	-5.17	15.04	-3.82	5.07	77.60	-10.40
9.67	9.70	-15.7	48.7	-5.18	15.13	-3.84	5.09	77.49	-10.44
9.93	9.93	-14.3	48.7	-5.20	15.21	-3.84	5.09	77.07	-10.49

10.12	10.17	-14.9	48.7	-5.21	15.30	-3.86	5.11	77.26	-10.53
10.40	10.40	-15.1	48.7	-5.22	15.38	-3.88	5.13	76.91	-10.61
10.67	10.63	-15.6	48.7	-5.23	15.47	-3.89	5.14	77.21	-10.67
10.85	10.87	-15.4	48.70	-5.25	15.55	-3.90	5.15	77.13	-10.73
11.13	11.10	-14.5	48.70	-5.26	15.64	-3.91	5.16	76.80	-10.79
11.32	11.35	-15.0	48.70	-5.27	15.73	-3.93	5.18	76.65	-10.83
11.58	11.57	-14.7	48.70	-5.28	15.81	-3.93	5.18	77.83	-10.90
11.77	11.78	-15.0	49.10	-5.29	15.90	-3.95	5.20	77.81	-10.94
12.05	12.00	-14.2	48.70	-5.30	15.98	-3.95	5.20	77.69	-10.99
12.23	12.20	-14.2	48.70	-5.32	16.07	-3.96	5.21	77.56	-11.03
12.42	12.42	-14.9	48.70	-5.33	16.15	-3.98	5.23	78.22	-11.08
12.60	12.62	-14.0	48.70	-5.34	16.24	-3.98	5.23	77.84	-11.12
12.78	12.82	-14.2	48.70	-5.35	16.32	-4.00	5.25	78.10	-11.16
13.05	13.05	-13.8	49.10	-5.36	16.41	-4.00	5.25	73.87	-11.28
13.52	13.52	-13.5	48.70	-5.37	16.49	-4.01	5.26	73.27	-11.32
13.97	13.97	-14.9	48.70	-5.38	16.58	-4.03	5.28	74.04	-11.35
14.52	14.48	-14.7	48.70	-5.39	16.66	-4.04	5.29	74.72	-11.42
14.88	14.85	-13.9	48.70	-5.40	16.75	-4.04	5.29	78.33	-11.48
15.17	15.15	-13.6	48.70	-5.41	16.83	-4.05	5.30	78.42	-11.55
15.53	15.50	-14.2	48.70	-5.42	16.92	-4.07	5.32	72.41	-11.62
16.08	16.10	-14.7	48.70	-5.43	17.01	-4.08	5.33	76.62	-11.66
16.45	16.40	-13.8	48.70	-5.44	17.09	-4.08	5.33	82.12	-11.73
16.63	16.62	-15.2	48.70	-5.45	17.18	-4.10	5.35	79.97	-11.81
16.90	16.88	-14.0	48.70	-5.46	17.26	-4.11	5.36	75.09	-11.90
17.37	17.32	-13.9	48.70	-5.47	17.35	-4.12	5.37	75.81	-11.98
17.73	17.73	-13.5	47.10	-5.48	17.43	-4.12	5.37	74.38	-12.02
18.18	18.18	-13.6	47.10	-5.49	17.52	-4.13	5.38	77.21	-12.13
18.65	18.62	-14.1	47.10	-5.50	17.60	-4.15	5.40	75.93	-12.22
19.10	19.08	-13.9	47.10	-5.51	17.69	-4.16	5.41	76.29	-12.28
19.83	19.85	-13.6	47.50	-5.53	17.86	-4.17	5.42	77.91	-12.37
20.20	20.25	-14.0	47.10	-5.54	17.95	-4.18	5.43	75.83	-12.43
20.67	20.67	-13.1	47.10	-5.55	18.03	-4.19	5.44	78.29	-12.48
21.12	21.10	-13.8	47.10	-5.56	18.12	-4.20	5.45	78.07	-12.57
21.48	21.53	-13.4	47.10	-5.57	18.20	-4.21	5.46	77.29	-12.60
21.95	21.97	-13.1	47.10	-5.58	18.29	-4.22	5.47	77.63	-12.68
22.40	22.40	-13.3	47.10	-5.59	18.37	-4.23	5.48	76.92	-12.78
22.77	22.77	-12.5	47.50	-5.60	18.46	-4.23	5.48	78.60	-12.83
23.32	23.32	-13.4	47.10	-5.61	18.54	-4.25	5.50	77.05	-12.90
23.78	23.75	-12.9	47.10	-5.62	18.63	-4.25	5.50	77.48	-12.96
24.23	24.23	-12.5	47.10	-5.63	18.71	-4.26	5.51	76.49	-13.05
24.78	24.80	-14.6	47.10	-5.63	18.80	-4.29	5.54	76.83	-13.11
25.33	25.35	-12.8	47.50	-5.64	18.89	-4.28	5.53	78.42	-13.16
25.80	25.78	-12.5	47.10	-5.65	18.97	-4.29	5.54	77.53	-13.23
26.25	26.23	-12.9	45.50	-5.66	19.06	-4.30	5.55	77.36	-13.30
26.72	26.67	-13.1	45.50	-5.66	19.14	-4.30	5.55	77.50	-13.35
27.08	27.05	-12.4	45.50	-5.67	19.23	-4.31	5.56	81.08	-13.38
27.27	27.30	-12.5	45.50	-5.68	19.31	-4.31	5.56	82.92	-13.42
27.72	27.73	-12.6	45.90	-5.69	19.40	-4.32	5.57	75.09	-13.52
28.27	28.32	-12.0	45.90	-5.69	19.49	-4.32	5.57	74.90	-13.56
29.00	29.03	-12.0	45.50	-5.70	19.57	-4.33	5.58	80.13	-13.59
29.37	29.38	-12.9	45.50	-5.71	19.66	-4.34	5.59	78.87	-13.68
29.92	29.93	-12.4	45.90	-5.71	19.74	-4.35	5.60	79.65	-13.74
30.38	30.35	-12.4	45.90	-5.72	19.83	-4.35	5.60	78.42	-13.85
30.83	30.80	-12.5	45.50	-5.73	19.91	-4.36	5.61	78.32	-13.87
31.30	31.28	-11.8	45.90	-5.73	20.00	-4.36	5.61	78.00	-13.96
31.38	31.43	-12.5	45.90	-5.74	20.09	-4.37	5.62	78.12	-13.95
31.48	31.47	-13.7	47.10	-5.75	20.17	-4.39	5.64	107.30	-14.02
31.57	31.57	-12.2	47.50	-5.77	20.43	-4.41	5.66	105.50	-14.29
31.67	31.60	-13.7	47.10	-5.78	20.51	-4.43	5.68	64.89	-14.59

Large denla 2-S-1 Trench depth 1.2 m

DNV Elapsed time [min]	Bruce Elapsed time [min]	Fluke Pitch [deg]	Shackle pitch [deg]	Probe depth [m]	Probe drag [m]	Shackle depth [m]	From ground surface ground surface (+) [m]	Pull-in tension [kN]	Dip-down angle [deg]
0.02	0.00	-2.2	0	0.00	0.04	0.86	1.20	0.36	13.42
0.12	0.11	-5.6	0	-0.03	0.30	0.81	1.20	1.96	14.12
0.20	0.19	-6.1	0	-0.05	0.47	0.78	1.20	2.72	11.94
0.30	0.31	-11.1	0	-0.09	0.73	0.70	1.20	2.82	11.89
0.38	0.39	-13.5	0	-0.13	0.89	0.65	1.20	4.59	10.12
0.48	0.47	-16	0	-0.17	1.06	0.57	1.20	5.40	9.61
0.57	0.56	-20.5	0	-0.24	1.22	0.46	1.20	7.01	9.07
0.67	0.67	-26.6	0	-0.36	1.44	0.28	1.20	9.38	8.05
0.75	0.74	-29.8	0	-0.46	1.59	0.15	1.20	12.43	7.01
0.85	0.87	-30.5	0	-0.61	1.80	-0.01	1.21	17.27	6.14
0.93	0.93	-30.8	0	-0.70	1.94	-0.11	1.31	24.61	5.55
1.03	1.03	-30.5	0	-0.89	2.23	-0.29	1.49	27.44	5.62
1.12	1.13	-29.9	0	-1.08	2.52	-0.47	1.67	32.79	5.39
1.22	1.22	-30.3	0	-1.25	2.81	-0.66	1.86	35.12	5.29
1.30	1.31	-29.2	0	-1.39	3.03	-0.78	1.98	37.79	5.42
1.40	1.41	-28.4	0	-1.56	3.33	-0.94	2.14	39.84	5.60
1.48	1.43	-28.3	0	-1.60	3.41	-0.98	2.18	41.78	5.64
1.58	1.59	-26.6	0	-1.89	3.94	-1.25	2.45	43.74	5.57
1.67	1.66	-26.4	0	-2.00	4.17	-1.36	2.56	44.51	5.65
1.77	1.77	-25.8	0	-2.15	4.48	-1.50	2.70	45.73	5.68
1.85	1.84	-24.7	0	-2.26	4.71	-1.60	2.80	46.28	5.76
1.95	1.96	-23.5	0	-2.43	5.11	-1.76	2.96	45.64	5.94
2.03	2.03	-21.2	0	-2.51	5.35	-1.81	3.01	45.86	5.91
2.32	2.32	-24.1	0	-2.80	6.25	-2.14	3.34	44.49	6.16
2.40	2.40	-23.6	0	-2.89	6.49	-2.22	3.42	46.00	6.21
2.50	2.51	-23.7	0	-3.00	6.82	-2.33	3.53	46.78	6.29
2.58	2.58	-23.5	0	-3.07	7.07	-2.40	3.60	47.01	6.44
2.68	2.69	-23	0	-3.17	7.40	-2.49	3.69	47.53	6.55
2.77	2.77	-22.6	0	-3.24	7.64	-2.56	3.76	47.64	6.64
2.87	2.88	-23.1	0	-3.32	7.98	-2.64	3.84	47.88	6.73
2.95	2.96	-22.9	0	-3.38	8.23	-2.70	3.90	47.48	6.85
3.05	3.04	-23.1	0	-3.44	8.48	-2.77	3.97	47.99	6.97
3.13	3.12	-21.8	0	-3.50	8.73	-2.81	4.01	48.10	7.07
3.23	3.25	-22	0	-3.54	9.07	-2.85	4.05	48.82	7.13
3.32	3.33	-22.6	0	-3.51	9.33	-2.82	4.02	48.02	7.27
3.42	3.42	-22.6	0	-3.53	9.58	-2.85	4.05	48.98	7.32
3.50	3.49	-21.4	0	-3.53	9.84	-2.84	4.04	49.84	7.46
3.60	3.61	-21.8	0	-3.50	10.18	-2.81	4.01	50.26	7.58
3.68	3.69	-21.1	0	-3.47	10.44	-2.77	3.97	49.64	7.74
3.78	3.77	-21.1	0	-3.50	10.69	-2.80	4.00	50.43	7.85
3.87	3.87	-20.8	0	-3.46	11.03	-2.76	3.96	50.61	8.00
3.97	3.98	-20.5	0	-3.41	11.37	-2.71	3.91	51.42	8.17
4.05	4.06	-20.6	0	-3.38	11.63	-2.68	3.88	51.67	8.34
4.15	4.14	-20.5	0	-3.35	11.88	-2.64	3.84	51.68	8.48
4.23	4.22	-20.9	0	-3.31	12.14	-2.61	3.81	52.38	8.63
4.33	4.32	-19.9	0	-3.26	12.48	-2.55	3.75	52.75	8.79
4.42	4.42	-20	0	-3.21	12.82	-2.50	3.70	52.37	8.98
4.52	4.52	-19.7	0	-3.16	13.16	-2.45	3.65	52.59	9.14
4.60	4.60	-19.1	0	-3.13	13.41	-2.41	3.61	53.22	9.26
4.70	4.71	-19.4	0	-3.08	13.76	-2.37	3.57	53.66	9.46
4.78	4.78	-19.2	0	-3.05	14.01	-2.33	3.53	53.73	9.70
4.88	4.88	-19.2	0	-3.00	14.35	-2.28	3.48	53.84	9.90
4.97	4.96	-19.1	0	-2.96	14.61	-2.24	3.44	53.70	10.09
5.07	5.07	-17.6	0	-2.91	14.95	-2.18	3.38	53.42	10.30
5.15	5.15	-17.8	0	-2.87	15.20	-2.14	3.34	53.73	10.46
5.25	5.25	-18	0	-2.82	15.54	-2.09	3.29	54.33	10.65
5.33	5.33	-18	0	-2.78	15.80	-2.06	3.26	54.92	10.88
5.43	5.44	-17.6	0	-2.74	16.14	-2.00	3.20	55.60	11.10
5.52	5.50	-17.9	0	-2.71	16.31	-1.98	3.18	56.11	11.36

Large denla 2-S-2 Trench depth 0.95 m

DNV Elapsed time [min]	Bruce Elapsed time [min]	Fluke Pitch [deg]	Shackle pitch [deg]	Probe depth [m]	Probe drag [m]	Shackle depth [m]	From ground surface ground surface (+) [m]	Pull-in tension [kN]	Dip-down angle [deg]
0.00	0.00	-35.1	0	-0.03	0.03	0.67	0.95	-2.37	-13.27
0.08	0.08	-36.3	0	-0.15	0.16	0.54	0.95	6.75	-7.76
0.18	0.19	-35.1	0	-0.36	0.43	0.34	0.95	12.18	-5.95
0.27	0.27	-33.5	0	-0.57	0.70	0.15	0.95	21.59	-5.36
0.37	0.37	-31.6	0	-0.76	0.98	-0.03	0.98	26.03	-5.20
0.45	0.46	-30.7	0	-0.96	1.27	-0.21	1.16	28.34	-5.13
0.55	0.55	-30.4	0	-1.14	1.56	-0.39	1.34	31.59	-5.02
0.63	0.62	-28.7	0	-1.28	1.78	-0.51	1.46	33.92	-5.12
0.73	0.74	-28.2	0	-1.50	2.15	-0.72	1.67	35.97	-5.18
0.82	0.83	-26.7	0	-1.67	2.45	-0.88	1.83	40.50	-5.17
0.92	0.93	-26.9	0	-1.84	2.75	-1.05	2.00	38.75	-5.35
1.00	1.00	-26.3	0	-1.96	2.97	-1.17	2.12	39.89	-5.48
1.10	1.10	-25.6	0	-2.12	3.28	-1.32	2.27	40.99	-5.57
1.18	1.18	-24.7	0	-2.23	3.51	-1.42	2.37	41.10	-5.65
1.28	1.28	-24.5	0	-2.30	3.67	-1.49	2.44	40.39	-5.78
1.37	1.36	-23.9	0	-2.41	3.90	-1.59	2.54	37.89	-6.12
1.47	1.47	-23.1	0	-2.54	4.22	-1.72	2.67	39.81	-5.95
1.55	1.55	-23.5	0	-2.64	4.46	-1.82	2.77	40.60	-5.98
1.65	1.66	-22.9	0	-2.76	4.78	-1.93	2.88	40.49	-6.19
1.73	1.74	-22.9	0	-2.84	5.02	-2.02	2.97	40.70	-6.28
1.83	1.83	-22.9	0	-2.93	5.27	-2.10	3.05	40.69	-6.38
1.92	1.91	-22.9	0	-3.01	5.51	-2.18	3.13	41.14	-6.50
2.02	2.03	-22.5	0	-3.10	5.84	-2.28	3.23	40.36	-6.63
2.10	2.11	-22.3	0	-3.17	6.09	-2.34	3.29	41.21	-6.68
2.20	2.20	-21	0	-3.24	6.34	-2.40	3.35	41.00	-6.83
2.28	2.28	-21.2	0	-3.31	6.59	-2.47	3.42	40.35	-6.96
2.38	2.39	-21.8	0	-3.39	6.92	-2.55	3.50	40.75	-7.11
2.47	2.47	-21.2	0	-3.44	7.18	-2.60	3.55	40.41	-7.23
2.57	2.56	-21.6	0	-3.50	7.43	-2.66	3.61	39.34	-7.40
2.65	2.64	-21	0	-3.55	7.68	-2.71	3.66	41.36	-7.50
2.75	2.75	-21.4	0	-3.62	8.02	-2.78	3.73	41.85	-7.69
2.83	2.83	-21.6	0	-3.67	8.27	-2.83	3.78	42.17	-7.86
2.93	2.94	-20.6	0	-3.73	8.61	-2.89	3.84	42.82	-7.95
3.02	3.02	-21.5	0	-3.78	8.86	-2.94	3.89	42.56	-8.11
3.12	3.12	-20.8	0	-3.84	9.20	-2.99	3.94	42.71	-8.34
3.20	3.20	-20.8	0	-3.87	9.46	-3.02	3.97	43.06	-8.48
3.30	3.31	-20.4	0	-3.84	9.80	-2.99	3.94	43.11	-8.60
3.38	3.39	-20.3	0	-3.78	10.05	-2.93	3.88	43.36	-8.73
3.48	3.47	-20.2	0	-3.72	10.30	-2.87	3.82	43.50	-8.86
3.57	3.57	-20.3	0	-3.63	10.63	-2.78	3.73	43.85	-9.06
3.67	3.68	-19.4	0	-3.53	10.96	-2.67	3.62	43.59	-9.25
3.75	3.75	-19.9	0	-3.46	11.21	-2.60	3.55	42.47	-9.42
3.85	3.85	-17.5	0	-3.36	11.54	-2.48	3.43	41.20	-9.63
3.93	3.94	-15.5	0	-3.26	11.87	-2.36	3.31	37.80	-9.83
4.03	4.04	-13.2	0	-3.17	12.11	-2.26	3.21	33.83	-9.97
4.12	4.11	-11.3	0	-3.12	12.28	-2.19	3.14	33.40	-10.02
4.22	4.22	-13.1	0	-3.03	12.52	-2.12	3.07	35.88	-10.07
4.30	4.30	-13.1	0	-2.97	12.68	-2.06	3.01	39.55	-10.18
4.40	4.40	-15.9	0	-2.89	12.93	-2.01	2.96	42.47	-10.48
4.48	4.48	-16	0	-2.84	13.09	-1.95	2.90	45.37	-10.77
4.58	4.57	-16.7	0	-2.76	13.34	-1.88	2.83	48.17	-11.04
4.67	4.66	-17.1	0	-2.71	13.50	-1.84	2.79	50.74	-11.34
4.77	4.78	-17.3	0	-2.61	13.83	-1.74	2.69	48.98	-11.65
4.85	4.84	-16.9	0	-2.56	13.99	-1.68	2.63	52.02	-11.85
4.95	4.96	-17.6	0	-2.46	14.32	-1.59	2.54	51.49	-12.10
5.03	5.02	-17.3	0	-2.41	14.49	-1.54	2.49	51.45	-12.33
5.13	5.13	-15.8	0	-2.31	14.82	-1.42	2.37	51.52	-12.57
5.22	5.21	-16.6	0	-2.23	15.06	-1.35	2.30	51.96	-12.81
5.32	5.32	-17.2	0	-2.13	15.39	-1.26	2.21	51.97	-13.11
5.40	5.41	-16.3	0	-2.06	15.64	-1.17	2.12	52.48	-13.39
5.50	5.49	-16.8	0	-1.98	15.88	-1.10	2.05	53.09	-13.68
5.58	5.57	-16.4	0	-1.92	16.13	-1.03	1.98	54.02	-13.96
12.00	12.02	-16	0	-1.87	16.30	-0.99	1.94	8.68	-14.65
12.10	12.10	-16.3	0	-1.82	16.55	-0.93	1.88	56.82	-14.34
12.18	12.18	-15.7	0	-1.76	16.80	-0.87	1.82	56.17	-14.50
12.28	12.28	-15.4	0	-1.69	17.14	-0.80	1.75	55.30	-14.88
12.37	12.36	-14.4	0	-1.63	17.39	-0.73	1.68	55.60	-15.02

12.47	12.47	-13.3	0	-1.53	17.81	-0.62	1.57	55.57	-15.10
12.55	12.55	-13.5	0	-1.47	18.06	-0.56	1.51	54.75	-14.96
12.65	12.67	-13	0	-1.36	18.48	-0.45	1.40	54.79	-15.17

Large denla 12-S-3 Trench deptl 1.1 m From ground surface

DNV Elapsed time [min]	Bruce Elapsed time [min]	Fluke Pitch [deg]	Shackle pitch [deg]	Probe depth [m]	Probe drag [m]	Shackle depth [m]	ground surface (+) [m]	Pull-in tension [kN]	Dip-down angle [deg]
0.00	0.00	-1.4	0	0.00	0.04	1.00	1.10	0.22	-8.36
0.08	0.07	-2.1	0	0.00	0.21	1.00	1.10	1.66	-14.26
0.17	0.16	-2.9	0	0.00	0.39	0.99	1.10	1.60	-14.72
0.30	0.29	-8.5	0	-0.01	0.64	0.93	1.10	2.25	-12.25
0.40	0.42	-16.9	0	-0.07	0.90	0.81	1.10	2.82	-11.22
0.48	0.47	-19.8	0	-0.10	0.98	0.76	1.10	3.87	-9.94
0.60	0.57	-26	0	-0.17	1.13	0.63	1.10	4.83	-9.26
0.70	0.68	-30.5	0	-0.27	1.27	0.48	1.10	6.94	-8.57
0.78	0.77	-33	0	-0.38	1.41	0.35	1.10	9.09	-7.56
0.88	0.87	-33.5	0	-0.54	1.61	0.18	1.10	13.65	-6.22
0.97	0.97	-32.1	0	-0.69	1.82	0.04	1.10	20.55	-5.41
1.05	1.06	-31.7	0	-0.84	2.03	-0.10	1.20	14.53	-5.10
1.17	1.17	-30.2	0	-1.02	2.32	-0.27	1.37	26.88	-4.96
1.22	1.22	-29.3	0	-1.11	2.47	-0.35	1.45	28.38	-5.17
1.35	1.35	-27.9	0	-1.32	2.84	-0.54	1.64	28.95	-5.38
1.45	1.44	-28.2	0	-1.45	3.07	-0.67	1.77	29.69	-5.17
1.53	1.52	-27.2	0	-1.57	3.29	-0.78	1.88	30.00	-5.38
1.62	1.63	-26	0	-1.73	3.60	-0.93	2.03	31.67	-5.30
1.73	1.73	-25.4	0	-1.89	3.91	-1.08	2.18	33.43	-5.34
1.83	1.84	-25	0	-2.04	4.21	-1.23	2.33	34.99	-5.43
1.92	1.92	-23.7	0	-2.15	4.45	-1.33	2.43	35.70	-5.40
2.02	2.03	-23.2	0	-2.29	4.76	-1.47	2.57	37.18	-5.45
2.12	2.13	-22.8	0	-2.43	5.08	-1.60	2.70	37.24	-5.65
2.22	2.21	-23.2	0	-2.53	5.31	-1.71	2.81	37.71	-5.75
2.27	2.27	-24.4	0	-2.59	5.47	-1.78	2.88	37.91	-5.77
2.40	2.41	-22	0	-2.76	5.87	-1.92	3.02	38.71	-5.93
2.50	2.50	-21.9	0	-2.85	6.11	-2.02	3.12	39.29	-5.93
2.60	2.61	-22.8	0	-2.98	6.43	-2.15	3.25	40.24	-6.06
2.70	2.70	-22.7	0	-3.07	6.67	-2.24	3.34	41.45	-6.06
2.80	2.79	-21.3	0	-3.16	6.91	-2.32	3.42	42.20	-6.17
2.88	2.87	-20.1	0	-3.24	7.16	-2.39	3.49	42.79	-6.30
2.98	2.97	-20.3	0	-3.34	7.49	-2.49	3.59	42.25	-6.45
3.07	3.06	-19	0	-3.42	7.73	-2.56	3.66	40.32	-6.49
3.18	3.18	-20.7	0	-3.50	8.07	-2.66	3.76	40.19	-6.55
3.27	3.27	-22.4	0	-3.57	8.32	-2.74	3.84	40.34	-6.64
3.33	3.33	-19.6	0	-3.61	8.48	-2.76	3.86	41.27	-6.68
3.45	3.45	-19.1	0	-3.70	8.81	-2.84	3.94	42.88	-6.78
3.55	3.54	-18.7	0	-3.77	9.06	-2.91	4.01	42.36	-6.92
3.65	3.66	-19.9	0	-3.85	9.40	-3.00	4.10	42.47	-7.04
3.75	3.75	-20.2	0	-3.91	9.65	-3.06	4.16	43.59	-7.17
3.85	3.84	-19.7	0	-3.97	9.90	-3.11	4.21	43.59	-7.25
3.95	3.96	-20.2	0	-4.01	10.24	-3.16	4.26	43.13	-7.37
4.03	4.02	-20.5	0	-4.04	10.41	-3.19	4.29	43.69	-7.50
4.15	4.14	-18.5	0	-4.12	10.74	-3.25	4.35	45.14	-7.60
4.25	4.26	-20.2	0	-4.18	11.08	-3.33	4.43	46.87	-7.64
4.35	4.35	-19.4	0	-4.23	11.33	-3.37	4.47	46.86	-7.74
4.45	4.46	-19.9	0	-4.25	11.67	-3.40	4.50	47.45	-7.86
4.55	4.54	-18.5	0	-4.29	11.93	-3.43	4.53	47.30	-8.00
4.65	4.66	-18.3	0	-4.34	12.27	-3.47	4.57	47.30	-8.16
4.73	4.72	-17.9	0	-4.36	12.44	-3.49	4.59	46.65	-8.25
4.85	4.84	-17.3	0	-4.40	12.78	-3.52	4.62	46.53	-8.42
4.95	4.96	-18.1	0	-4.37	13.12	-3.50	4.60	46.94	-8.56
5.05	5.05	-18.3	0	-4.39	13.38	-3.52	4.62	47.77	-8.71
5.15	5.14	-16.1	0	-4.41	13.64	-3.53	4.63	48.76	-8.80
5.25	5.29	-17	0	-4.39	13.81	-3.51	4.61	49.09	-8.93
5.43	5.42	-18.3	0	-4.38	13.89	-3.51	4.61	43.49	-9.13
5.55	5.56	-17.5	0	-4.36	13.98	-3.49	4.59	43.17	-9.27
5.73	5.72	-16.9	0	-4.37	14.06	-3.49	4.59	42.86	-9.24
5.93	5.87	-17.1	0	-4.36	14.15	-3.48	4.58	43.23	-9.24
6.03	6.04	-16.9	0	-4.35	14.23	-3.47	4.57	42.97	-9.06
6.23	6.20	-17.4	0	-4.33	14.32	-3.46	4.56	43.41	-9.29
6.33	6.36	-17.4	0	-4.32	14.40	-3.44	4.54	43.31	-9.36
6.53	6.52	-17.4	0	-4.31	14.49	-3.43	4.53	43.43	-9.37
6.73	6.69	-18.4	0	-4.29	14.57	-3.43	4.53	44.23	-9.41
6.83	6.84	-17	0	-4.30	14.66	-3.42	4.52	44.32	-9.48
7.03	7.01	-18.4	0	-4.29	14.74	-3.42	4.52	44.33	-9.51
7.13	7.16	-17.9	0	-4.28	14.83	-3.41	4.51	44.85	-9.51
7.33	7.32	-17.5	0	-4.27	14.91	-3.39	4.49	44.83	-9.64
7.43	7.48	-17.5	0	-4.26	15.00	-3.38	4.48	44.77	-9.70
7.93	7.95	-18.4	0	-4.24	15.17	-3.37	4.47	45.43	-9.75
8.13	8.20	-17.6	0.00	-4.22	15.25	-3.35	4.45	45.49	-9.82
8.33	8.36	-18.1	0.00	-4.22	15.34	-3.35	4.45	45.05	-9.90
8.53	8.52	-18.3	0.00	-4.20	15.42	-3.34	4.44	45.74	-9.97
8.63	8.67	-17.8	0.00	-4.19	15.51	-3.32	4.42	46.58	-9.99

8.83	8.82	-18.9	0.00	-4.18	15.60	-3.32	4.42	46.73	-10.09
8.93	8.97	-18.1	0.00	-4.18	15.68	-3.31	4.41	46.61	-10.08
9.13	9.12	-18.7	0.00	-4.17	15.77	-3.30	4.40	46.96	-10.22
9.28	9.28	-17.1	0.00	-4.18	15.85	-3.30	4.40	47.49	-10.24
9.50	9.48	-17.7	0.00	-4.17	15.94	-3.30	4.40	46.00	-10.37
9.60	9.63	-18.4	0.00	-4.16	16.02	-3.29	4.39	48.08	-10.38
9.80	9.84	-18.8	0.00	-4.15	16.11	-3.29	4.39	45.30	-10.46
9.98	9.99	-18.4	0.00	-4.14	16.19	-3.28	4.38	48.48	-10.46
10.10	10.14	-18.5	0.00	-4.14	16.28	-3.27	4.37	48.54	-10.53
10.30	10.30	-17.6	0.00	-4.13	16.37	-3.26	4.36	48.28	-10.57
10.50	10.48	-17.8	0.00	-4.12	16.45	-3.25	4.35	48.25	-10.62
10.60	10.63	-17.0	0.00	-4.11	16.54	-3.23	4.33	47.72	-10.69
10.80	10.77	-16.8	0.00	-4.10	16.62	-3.22	4.32	49.15	-10.74
10.90	10.90	-17.5	0.00	-4.10	16.71	-3.22	4.32	48.42	-10.81
11.00	11.04	-16.9	0.00	-4.09	16.79	-3.21	4.31	48.98	-10.87
11.10	11.16	-17.3	0.00	-4.08	16.88	-3.20	4.30	49.02	-10.91
11.30	11.29	-16.8	0.00	-4.07	16.96	-3.19	4.29	49.25	-11.01
11.38	11.42	-16.8	0.00	-4.07	17.05	-3.19	4.29	49.22	-11.08
11.50	11.55	-17.5	0.00	-4.06	17.14	-3.18	4.28	49.39	-11.14
11.60	11.67	-16.7	0.00	-4.05	17.22	-3.17	4.27	49.38	-11.18
11.78	11.80	-17.5	0.00	-4.04	17.31	-3.17	4.27	49.73	-11.28
11.88	11.92	-16.4	0.00	-4.04	17.39	-3.15	4.25	49.96	-11.34
12.08	12.04	-16.7	0.00	-4.03	17.48	-3.15	4.25	50.49	-11.46
12.18	12.16	-16.7	0.00	-4.02	17.56	-3.14	4.24	50.20	-11.51
12.27	12.29	-16.9	0.00	-4.01	17.65	-3.13	4.23	50.47	-11.56
12.43	12.41	-16.8	0.00	-4.01	17.74	-3.13	4.23	50.70	-11.63
12.55	12.55	-17.0	0.00	-4.00	17.82	-3.12	4.22	50.53	-11.71
12.65	12.67	-15.8	0.00	-3.99	17.91	-3.10	4.20	50.69	-11.74
12.83	12.87	-16.8	0.00	-3.99	17.99	-3.11	4.21	50.65	-11.82
13.03	13.00	-16.7	0.00	-3.98	18.08	-3.10	4.20	50.90	-11.96
13.12	13.13	-16.4	0.00	-3.97	18.16	-3.09	4.19	51.24	-12.01
13.22	13.25	-17.0	0.00	-3.97	18.25	-3.09	4.19	51.52	-12.08
13.42	13.38	-15.8	0.00	-3.96	18.34	-3.07	4.17	51.30	-12.22
13.48	13.50	-17.1	0.00	-3.95	18.42	-3.07	4.17	51.24	-12.24
13.60	13.63	-16.4	0.00	-3.94	18.51	-3.06	4.16	51.46	-12.30
13.70	13.75	-16.3	0.00	-3.93	18.59	-3.05	4.15	51.39	-12.39
13.90	13.88	-16.2	0.00	-3.93	18.68	-3.04	4.14	51.12	-12.50
14.00	14.00	-16.1	0.00	-3.92	18.76	-3.03	4.13	51.08	-12.56
14.10	14.12	-15.7	0.00	-3.91	18.85	-3.02	4.12	51.47	-12.61
14.18	14.23	-15.5	0.00	-3.91	18.94	-3.01	4.11	51.56	-12.62
14.30	14.36	-15.8	0.00	-3.90	19.02	-3.01	4.11	51.50	-12.66
14.50	14.48	-15.9	0.00	-3.89	19.11	-3.00	4.10	51.34	-12.73
14.60	14.61	-15.8	0.00	-3.88	19.19	-2.99	4.09	51.12	-12.84

Large denla 12-S-4 Trench deptł 1.5 m

DNV Elapsed time [min]	Bruce Elapsed time [min]	Fluke Pitch [deg]	Shackle pitch [deg]	Probe depth [m]	Probe drag [m]	Shackle depth [m]	From ground surface ground surface (+) [m]	Pull-in tension [kN]	Dip-down angle [deg]
-0.03	0.00	-37	0	-0.32	0.54	0.35	1.50	4.35	-7.15
0.05	0.04	-36	0	-0.44	0.67	0.25	1.50	15.94	-6.73
0.15	0.14	-33.7	0	-0.59	0.88	0.13	1.50	21.83	-6.98
0.23	0.22	-31.6	0	-0.78	1.17	-0.04	1.54	26.86	-6.82
0.33	0.33	-30.2	0	-1.00	1.54	-0.25	1.75	29.14	-7.43
0.42	0.42	-28.4	0	-1.17	1.84	-0.40	1.90	31.12	-7.52
0.52	0.51	-28.2	0	-1.33	2.14	-0.56	2.06	31.88	-7.64
0.60	0.61	-27	0	-1.48	2.45	-0.70	2.20	33.01	-6.65
0.70	0.69	-26.1	0	-1.64	2.76	-0.84	2.34	34.40	-9.42
0.78	0.79	-26.1	0	-1.79	3.07	-0.99	2.49	36.95	-9.44
0.88	0.88	-24.9	0	-1.93	3.38	-1.13	2.63	38.53	-9.53
0.97	0.97	-24.7	0	-2.08	3.69	-1.27	2.77	40.17	-10.04
1.07	1.06	-25.5	0	-2.22	4.00	-1.42	2.92	41.93	-10.19
1.15	1.15	-23.5	0	-2.36	4.32	-1.54	3.04	42.04	-10.70
1.25	1.26	-22.8	0	-2.53	4.71	-1.70	3.20	42.81	-11.07
1.33	1.33	-22.5	0	-2.63	4.95	-1.80	3.30	44.01	-11.12
1.43	1.44	-22.8	0	-2.78	5.35	-1.96	3.46	43.92	0.00
1.52	1.53	-20.9	0	-2.90	5.68	-2.06	3.56	45.85	0.00
1.62	1.61	-19.7	0	-3.02	6.00	-2.16	3.66	48.02	0.00
1.70	1.70	-20.2	0	-3.13	6.33	-2.28	3.78	50.29	0.00
1.80	1.79	-19.5	0	-3.23	6.65	-2.37	3.87	51.10	0.00
1.88	1.85	-18.2	0	-3.30	6.90	-2.43	3.93	44.07	0.00

Large Stevman 7-SL-1 | Trench depth 1.1 m

DNV Elapsed time [min]	Bruce Elapsed time [min]	Fluke Pitch [deg]	Shackle pitch [deg]	Probe depth [m]	Probe drag [m]	Shackle depth [m]	Shackle depth from ground surface (+) [m]	Pull-in tension [kN]	Dip-down angle [deg]
0.00	0.03	-12.9	33.6	-0.07	0.47	1.04	1.10	1.70	-11.70
0.10	0.10	-13.4	35	-0.09	0.55	1.02	1.10	2.69	-9.10
0.17	0.17	-14	36.3	-0.10	0.64	1.00	1.10	2.78	-9.57
0.27	0.27	-15.3	37.7	-0.13	0.81	0.96	1.10	3.51	-9.29
0.37	0.38	-16.8	40.6	-0.17	0.97	0.90	1.10	4.14	-9.07
0.47	0.45	-18.3	40.6	-0.19	1.06	0.86	1.10	4.99	-8.78
0.55	0.57	-21.2	43.7	-0.25	1.22	0.78	1.10	5.52	-8.77
0.65	0.63	-22.8	45.2	-0.28	1.30	0.73	1.10	6.47	-8.48
0.73	0.72	-25.3	46.9	-0.31	1.38	0.67	1.10	7.73	-8.42
0.82	0.85	-30.3	48.6	-0.39	1.53	0.53	1.10	8.67	-8.59
0.90	0.92	-32.2	50.2	-0.44	1.60	0.46	1.10	9.51	-8.19
1.02	0.98	-33.4	53.9	-0.49	1.67	0.39	1.10	11.13	-7.82
1.10	1.12	-37.4	74.9	-0.60	1.81	0.23	1.10	13.20	-7.07
1.20	1.20	-38.5	74.7	-0.65	1.87	0.16	1.10	16.36	-6.42
1.28	1.27	-38.6	80.1	-0.71	1.93	0.10	1.10	19.90	-6.17
1.38	1.37	-37.7	80.1	-0.83	2.06	-0.01	1.11	27.13	-5.88
1.47	1.47	-37.1	79.8	-0.94	2.19	-0.11	1.21	33.63	-4.98
1.55	1.55	-36.6	79.8	-1.05	2.32	-0.22	1.32	38.73	-4.83
1.65	1.65	-35.3	79.8	-1.21	2.52	-0.36	1.46	44.09	-4.77
1.75	1.73	-35	80	-1.32	2.66	-0.46	1.56	46.44	-4.87
1.83	1.82	-34.4	79.8	-1.42	2.80	-0.55	1.65	47.77	-4.84
2.02	2.00	-32.8	74.9	-1.66	3.15	-0.78	1.88	51.81	-4.73
2.12	2.13	-31.7	74.7	-1.81	3.37	-0.90	2.00	53.48	-4.72
2.20	2.22	-31.1	74.7	-1.90	3.51	-0.99	2.09	55.03	-4.92
2.30	2.28	-30.6	74.7	-1.99	3.66	-1.08	2.18	56.00	-4.95
2.38	2.37	-29.9	74.8	-2.08	3.80	-1.16	2.26	56.90	-4.92
2.48	2.47	-30	74.7	-2.17	3.95	-1.25	2.35	57.91	-5.07
2.57	2.58	-29.9	74.7	-2.31	4.17	-1.38	2.48	60.02	-5.24
2.67	2.67	-29.2	70.9	-2.39	4.32	-1.46	2.56	61.76	-5.20
2.75	2.75	-29.7	70.9	-2.48	4.47	-1.55	2.65	62.64	-5.42
2.83	2.85	-29.7	70.9	-2.56	4.62	-1.64	2.74	63.50	-5.25
2.93	2.93	-28.5	70.9	-2.65	4.77	-1.71	2.81	64.25	-5.34
3.03	3.05	-28.9	70.9	-2.78	4.99	-1.84	2.94	65.18	-5.35
3.12	3.12	-28.7	70.9	-2.86	5.14	-1.92	3.02	66.51	-5.46
3.22	3.23	-28.6	70.9	-2.99	5.36	-2.05	3.15	68.03	-5.45
3.30	3.32	-28.4	70.9	-3.08	5.51	-2.13	3.23	68.72	-5.55
3.40	3.42	-28.4	70.9	-3.20	5.74	-2.26	3.36	70.08	-5.67
3.48	3.50	-27.9	67.7	-3.28	5.89	-2.33	3.43	72.08	-5.81
3.58	3.57	-27	70.9	-3.37	6.04	-2.41	3.51	72.89	-5.69
3.67	3.68	-27.1	67.7	-3.49	6.27	-2.53	3.63	74.10	-5.81
3.77	3.78	-27	67.7	-3.61	6.50	-2.65	3.75	76.03	-5.86
3.85	3.87	-26.8	67.7	-3.69	6.65	-2.73	3.83	75.62	-5.95
3.95	3.97	-25.7	67.7	-3.81	6.88	-2.83	3.93	77.40	-5.98
4.03	4.03	-26	67.7	-3.89	7.03	-2.91	4.01	77.46	-5.84
4.13	4.12	-25.1	67.7	-3.96	7.19	-2.98	4.08	77.88	-6.12
4.22	4.23	-25.4	64.9	-4.08	7.42	-3.10	4.20	78.14	-6.17
4.32	4.32	-24.9	64.9	-4.15	7.57	-3.16	4.26	77.76	-6.24
4.40	4.42	-24.2	64.9	-4.26	7.81	-3.27	4.37	79.44	-6.21
4.50	4.50	-24.1	64.9	-4.33	7.96	-3.34	4.44	80.57	-6.33
4.58	4.57	-24.6	64.9	-4.40	8.12	-3.42	4.52	81.38	-6.47
4.68	4.68	-23.9	64.9	-4.51	8.35	-3.51	4.61	81.59	-6.68
4.77	4.73	-24.1	64.9	-4.55	8.43	-3.55	4.65	82.43	-6.60

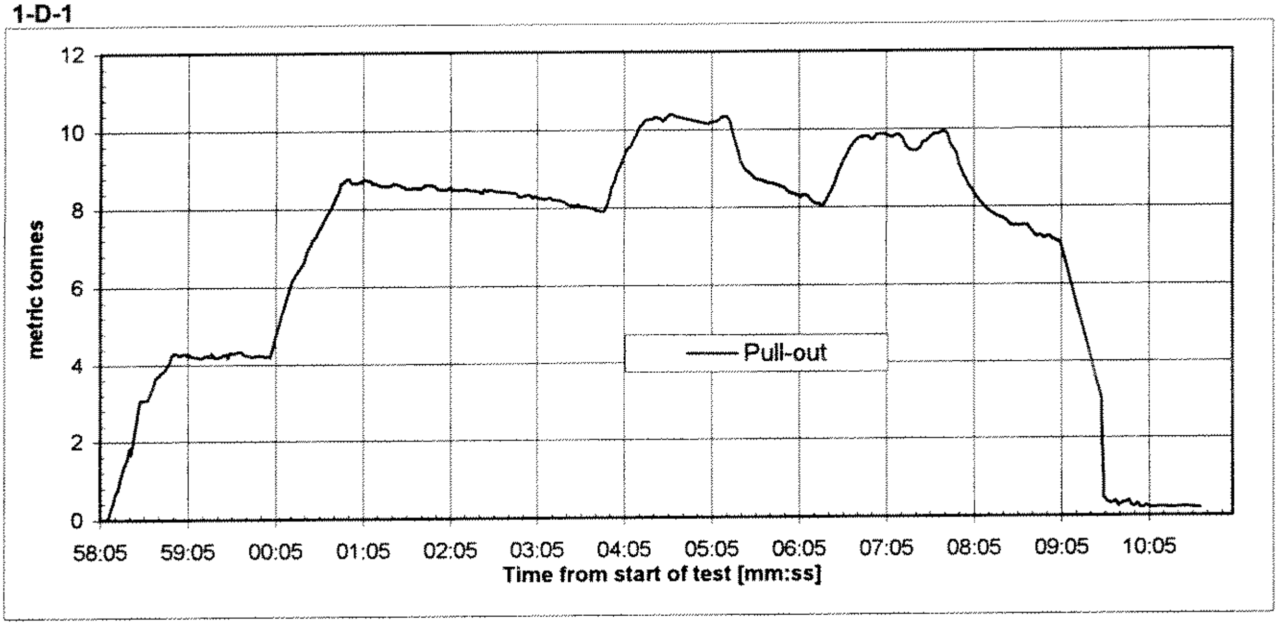
Large Stevman 7-SL-2 Trench depth 1.1 m

DNV Elapsed time [min]	Bruce Elapsed time [min]	Fluke Pitch [deg]	Shackle pitch [deg]	Probe depth [m]	Probe drag [m]	Shackle depth [m]	Shackle depth from ground surface (+) [m]	Pull-in tension [kN]	Dip-down angle [deg]
0.30	0.30	-10.4	80.4	0.00	0.00	1.14	1.10	3.27	10.44
0.38	0.38	-10.6	68.2	-0.01	0.04	1.13	1.10	3.82	10.39
0.43	0.43	-11.1	52.7	-0.02	0.13	1.11	1.10	4.43	10.12
0.52	0.50	-13	45.9	-0.04	0.21	1.07	1.10	5.24	9.91
0.55	0.57	-13.5	47.5	-0.06	0.30	1.05	1.10	5.49	9.80
0.63	0.62	-14.6	42.8	-0.08	0.38	1.02	1.10	6.26	9.61
0.68	0.70	-15.5	42.8	-0.11	0.46	0.98	1.10	7.17	9.40
0.83	0.82	-18.5	47.5	-0.13	0.54	0.92	1.10	9.31	8.65
0.88	0.88	-20.6	49.2	-0.17	0.62	0.87	1.10	9.91	8.55
0.93	0.95	-21.8	62.9	-0.20	0.70	0.82	1.10	10.88	8.18
1.02	1.03	-23.9	75.1	-0.24	0.77	0.75	1.10	13.14	7.40
1.07	1.10	-25.9	90	-0.29	0.85	0.69	1.10	14.03	7.31
1.17	1.17	-27.5	90	-0.33	0.92	0.62	1.10	17.29	6.69
1.25	1.23	-30	90	-0.38	0.99	0.54	1.10	21.57	6.45
1.28	1.30	-31.6	90	-0.44	1.06	0.47	1.10	23.96	6.23
1.38	1.37	-32.9	90	-0.49	1.13	0.40	1.10	31.79	5.43
1.43	1.42	-34.4	90	-0.55	1.19	0.32	1.10	34.65	5.36
1.48	1.48	-35.2	90	-0.61	1.25	0.25	1.10	38.08	5.11
1.52	1.55	-37.1	90	-0.67	1.31	0.16	1.10	39.85	5.28
1.62	1.60	-37.3	90	-0.73	1.38	0.10	1.10	44.39	5.24
1.65	1.63	-36.8	90	-0.78	1.44	0.05	1.10	45.21	5.08
1.70	1.68	-36.5	90	-0.84	1.51	0.00	1.10	46.15	5.20
1.75	1.73	-36.8	90	-0.90	1.57	-0.06	1.16	43.14	5.53
1.80	1.80	-36.4	90	-1.01	1.70	-0.17	1.27	47.86	5.55
1.83	1.83	-35.2	90	-1.06	1.77	-0.21	1.31	48.75	5.26
1.88	1.88	-35.7	90	-1.12	1.83	-0.27	1.37	49.95	5.32
1.92	1.92	-35.1	90	-1.17	1.90	-0.31	1.41	50.66	5.44
1.97	1.95	-35	90	-1.23	1.97	-0.37	1.47	51.27	5.44
2.00	1.98	-34.5	90	-1.28	2.04	-0.41	1.51	51.94	5.49
2.03	2.02	-35	90	-1.33	2.10	-0.47	1.57	52.35	5.53
2.08	2.07	-35	90	-1.39	2.17	-0.53	1.63	52.88	5.61
2.12	2.10	-34.1	90	-1.44	2.24	-0.57	1.67	53.44	5.67
2.17	2.17	-34.4	90	-1.55	2.37	-0.68	1.78	54.16	5.77
2.22	2.23	-34	90	-1.66	2.50	-0.79	1.89	54.57	5.78
2.25	2.27	-34.1	90	-1.71	2.57	-0.84	1.94	54.97	5.84
2.30	2.30	-33.9	90	-1.77	2.64	-0.89	1.99	56.03	5.96
2.35	2.33	-33.8	90	-1.82	2.70	-0.95	2.05	55.76	6.09
2.40	2.38	-34	90	-1.88	2.77	-1.01	2.11	58.24	5.95
2.45	2.45	-34.1	90	-1.99	2.90	-1.12	2.22	58.58	6.08
2.48	2.48	-33.9	90	-2.05	2.96	-1.17	2.27	58.86	6.19
2.53	2.52	-33.4	90	-2.10	3.03	-1.22	2.32	59.49	6.23
2.57	2.57	-33.4	90	-2.16	3.09	-1.28	2.38	59.87	6.36
2.62	2.63	-33.3	90	-2.27	3.22	-1.39	2.49	60.22	6.34
2.65	2.68	-33	90	-2.33	3.29	-1.44	2.54	60.44	6.37
2.70	2.72	-33.2	90	-2.38	3.35	-1.50	2.60	60.69	6.41
2.73	2.75	-32.9	90	-2.44	3.42	-1.55	2.65	61.00	6.47
2.78	2.78	-32.7	90	-2.49	3.49	-1.60	2.70	62.19	6.54
2.83	2.82	-32.3	90	-2.55	3.55	-1.65	2.75	62.46	6.59
2.88	2.88	-32.1	90	-2.66	3.68	-1.76	2.86	63.05	6.64
2.93	2.93	-32.7	90	-2.71	3.75	-1.82	2.92	63.70	6.72
2.97	2.97	-32.8	90	-2.77	3.82	-1.88	2.98	64.10	6.80
3.02	3.03	-32.3	90	-2.88	3.95	-1.98	3.08	63.85	6.88
3.05	3.07	-31.9	90	-2.93	4.02	-2.03	3.13	64.36	6.91
3.08	3.10	-31.8	90	-2.99	4.08	-2.08	3.18	65.13	6.94
3.13	3.15	-31.6	90	-3.04	4.15	-2.14	3.24	65.60	6.97
3.18	3.18	-31.7	90	-3.09	4.22	-2.19	3.29	66.01	7.08
3.22	3.22	-31.1	90	-3.15	4.29	-2.24	3.34	66.18	7.13
3.27	3.25	-31.9	90	-3.20	4.35	-2.30	3.40	65.94	7.23
3.30	3.28	-31.3	90	-3.25	4.42	-2.34	3.44	66.13	7.26
3.35	3.35	-30.8	90	-3.36	4.56	-2.44	3.54	66.76	7.33
3.38	3.38	-30.7	90	-3.41	4.62	-2.50	3.60	67.18	7.38
3.43	3.42	-30.5	90	-3.46	4.69	-2.55	3.65	67.36	7.48
3.48	3.48	-29.8	90	-3.57	4.83	-2.64	3.74	67.22	7.57
3.52	3.52	-29.7	90	-3.62	4.90	-2.69	3.79	67.15	7.58
3.57	3.58	-29.8	90	-3.72	5.04	-2.79	3.89	66.76	7.64
3.60	3.62	-29.5	90	-3.77	5.11	-2.84	3.94	66.96	7.72
3.65	3.65	-30	90	-3.82	5.18	-2.90	4.00	67.27	7.78

3.68	3.68	-29.5	90	-3.87	5.25	-2.94	4.04	66.97	7.84
3.73	3.72	-29.6	90	-3.92	5.32	-2.99	4.09	67.52	7.90
3.77	3.78	-29.2	90	-4.02	5.46	-3.09	4.19	67.83	7.96
3.82	3.82	-29.5	90.00	-4.07	5.53	-3.14	4.24	65.29	8.23
3.87	3.87	-29.6	90.00	-4.12	5.60	-3.19	4.29	68.54	8.20
3.92	3.93	-28.6	90.00	-4.22	5.74	-3.28	4.38	69.38	8.27
3.95	3.97	-28.3	90.00	-4.27	5.81	-3.32	4.42	77.30	8.28
4.00	4.00	-28.8	90.00	-4.32	5.88	-3.38	4.48	86.26	8.57
4.03	4.03	-29.2	90.00	-4.37	5.95	-3.43	4.53	89.87	8.44
4.08	4.08	-28.4	90.00	-4.41	6.02	-3.47	4.57	100.38	8.56
4.13	4.12	-28.4	90.00	-4.46	6.09	-3.52	4.62	109.45	8.63
4.18	4.15	-28.5	90.00	-4.51	6.16	-3.57	4.67	115.80	8.78
4.23	4.23	-28.6	90.00	-4.56	6.24	-3.62	4.72	108.68	8.91
4.27	4.30	-29.5	90.00	-4.61	6.31	-3.68	4.78	112.81	8.94
4.37	4.38	-28.9	90.00	-4.66	6.38	-3.72	4.82	111.11	9.21
4.42	4.42	-30.1	90.00	-4.71	6.44	-3.79	4.89	112.32	9.34
4.47	4.45	-30.4	90.00	-4.76	6.51	-3.84	4.94	113.97	9.40
4.50	4.50	-30.4	90.00	-4.81	6.58	-3.89	4.99	111.72	9.46
4.55	4.53	-29.4	90.00	-4.86	6.65	-3.93	5.03	109.17	9.54
4.58	4.57	-28.8	90.00	-4.91	6.72	-3.97	5.07	108.39	9.61
4.63	4.62	-29.2	90.00	-4.96	6.79	-4.02	5.12	107.50	9.72
4.67	4.67	-28.4	90.00	-5.01	6.87	-4.06	5.16	106.69	9.64
4.72	4.75	-27.3	90.00	-5.05	6.94	-4.10	5.20	105.85	9.74
4.80	4.80	-27.8	90.00	-5.10	7.01	-4.15	5.25	104.20	9.87
4.85	4.85	-27.3	90.00	-5.15	7.08	-4.19	5.29	103.66	9.94
4.90	4.90	-26.6	90.00	-5.19	7.16	-4.23	5.33	102.65	10.01
4.95	4.93	-26.3	90.00	-5.24	7.23	-4.27	5.37	102.56	10.09
5.00	4.98	-26.2	90.00	-5.28	7.30	-4.31	5.41	102.53	10.12
5.03	5.02	-26.1	90.00	-5.32	7.38	-4.35	5.45	102.23	10.10
5.08	5.07	-25.8	90.00	-5.36	7.46	-4.39	5.49	102.70	10.18
5.12	5.12	-25.1	90.00	-5.40	7.53	-4.42	5.52	102.70	10.17
5.15	5.15	-25.0	90.00	-5.44	7.61	-4.46	5.56	103.11	10.19
5.23	5.23	-25.2	90.00	-5.48	7.68	-4.50	5.60	102.97	10.25
5.28	5.28	-25.2	90.00	-5.52	7.76	-4.53	5.63	103.03	10.28
5.33	5.33	-25.0	90.00	-5.55	7.84	-4.57	5.67	103.51	10.28
5.38	5.38	-25.2	90.00	-5.59	7.92	-4.60	5.70	104.34	10.37
5.47	5.45	-24.9	90.00	-5.62	8.00	-4.63	5.73	105.72	10.57
5.50	5.52	-24.7	90.00	-5.65	8.08	-4.67	5.77	106.15	10.65
5.87	5.88	-22.2	90.00	-5.68	8.16	-4.67	5.77	104.98	11.55
6.12	6.13	-19.1	90.00	-5.71	8.24	-4.66	5.76	91.13	12.03
6.15	6.17	-19.1	90.00	-5.74	8.32	-4.69	5.79	89.80	12.10
6.20	6.22	-18.3	90.00	-5.77	8.40	-4.72	5.82	88.43	12.08
6.25	6.25	-18.1	90.00	-5.81	8.48	-4.75	5.85	68.37	12.27
6.28	6.28	-17.1	90.00	-5.84	8.56	-4.77	5.87	66.06	12.04
6.33	6.32	-16.9	90.00	-5.87	8.64	-4.79	5.89	57.99	12.10
6.38	6.38	-16.4	85.80	-5.93	8.80	-4.85	5.95	52.52	12.09
6.43	6.42	-16.5	90.00	-5.95	8.88	-4.88	5.98	49.44	12.13

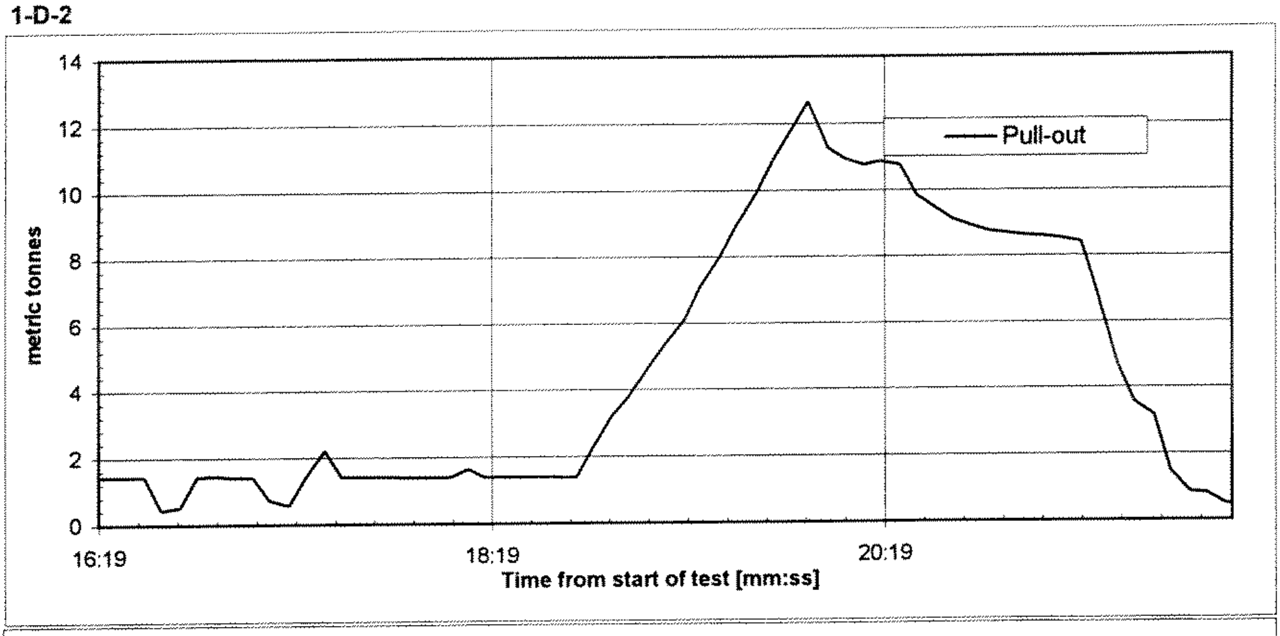
APPENDIX
I
EXTRACTS FROM ONSØY DATABASE (PULL-OUT)

1-D-1

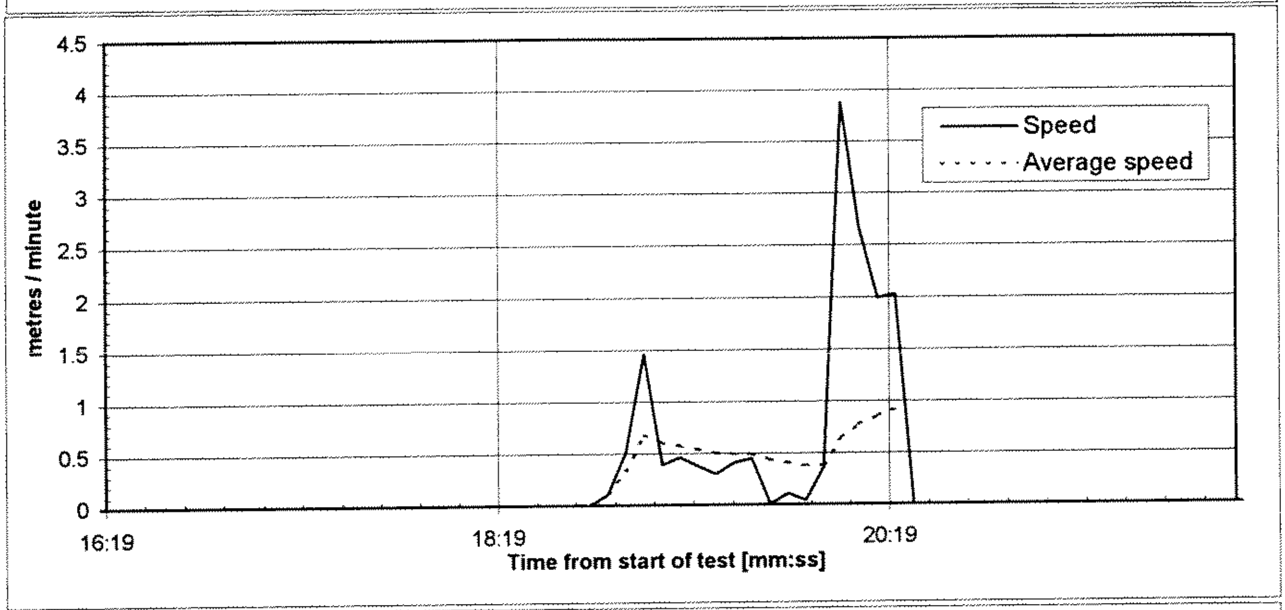


12
10
8
6
4
2
0
metric tonnes
Pull-out
58:05
59:05
00:05
01:05
02:05
03:05
04:05
05:05
06:05
07:05
08:05
09:05
10:05
Time from start of test [mm:ss]

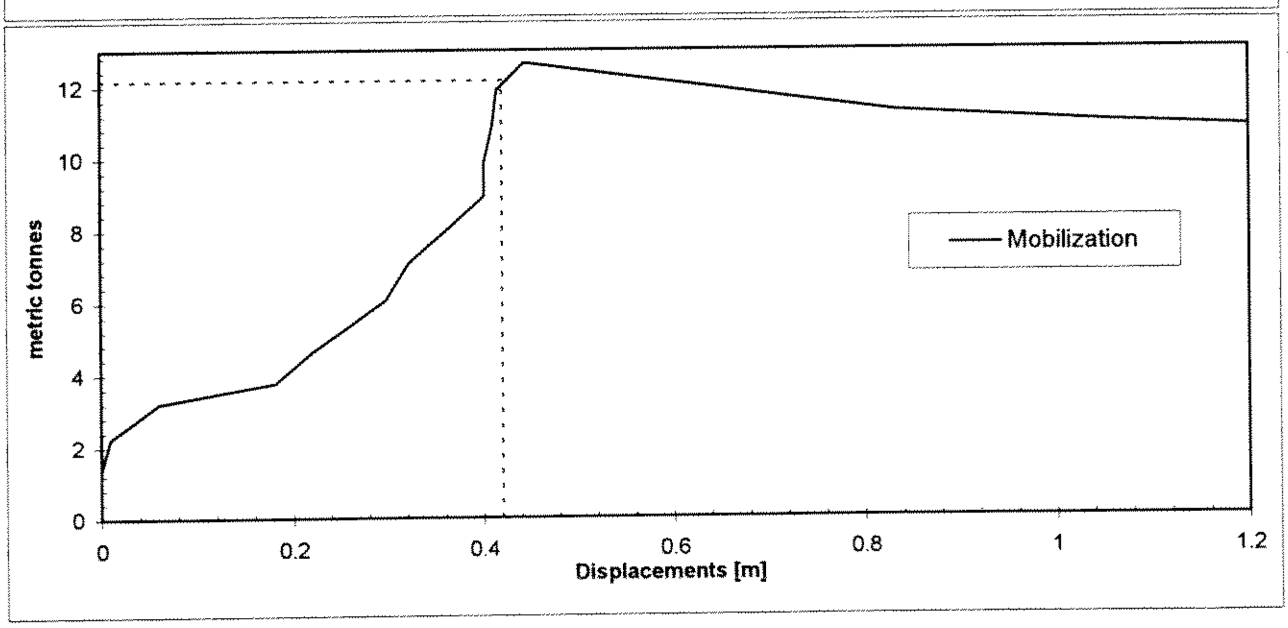
1-D-2



14
12
10
8
6
4
2
0
metric tonnes
Pull-out
16:19
18:19
20:19
Time from start of test [mm:ss]

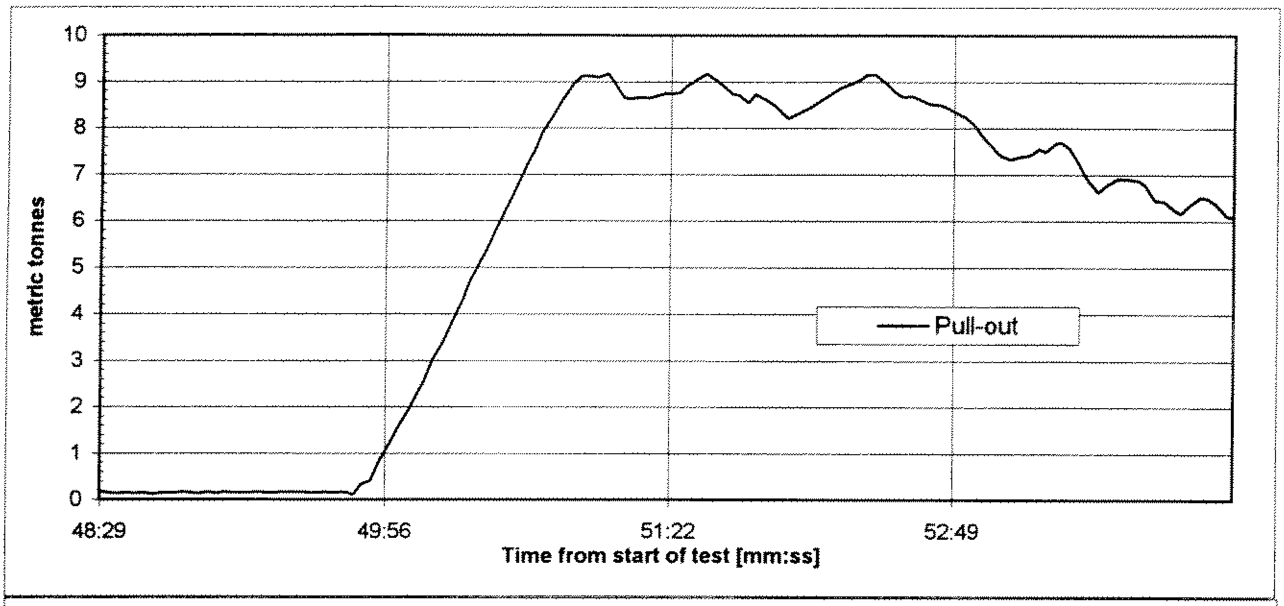


4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
metres / minute
Speed
Average speed
16:19
18:19
20:19
Time from start of test [mm:ss]

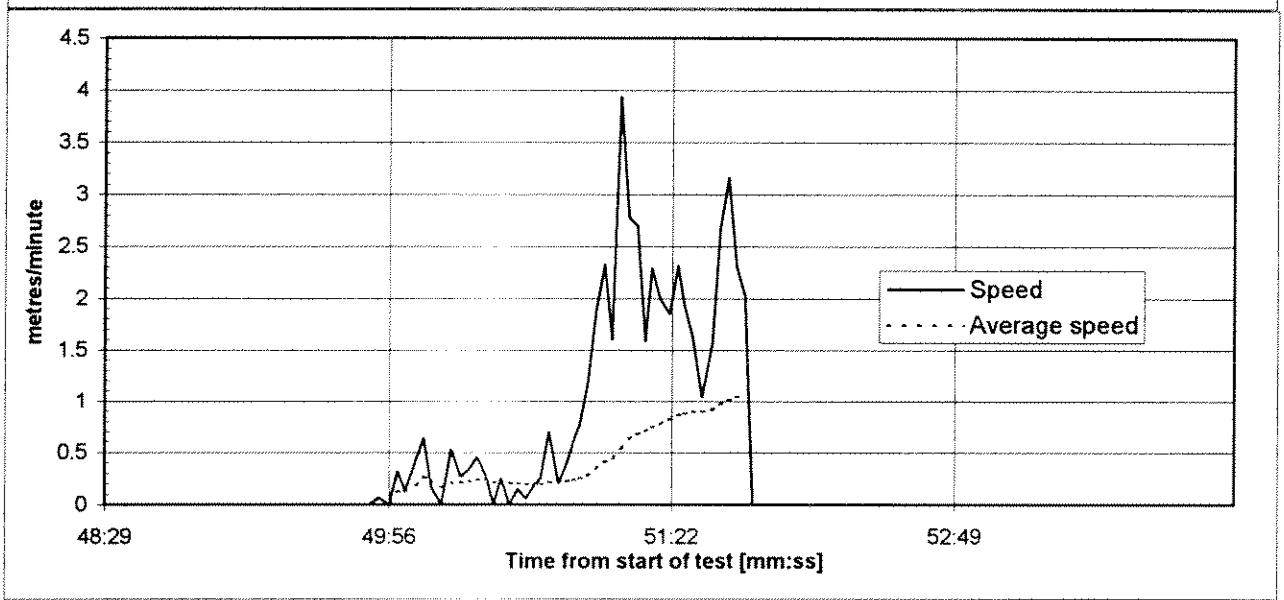


12
10
8
6
4
2
0
metric tonnes
Mobilization
0
0.2
0.4
0.6
0.8
1
1.2
Displacements [m]

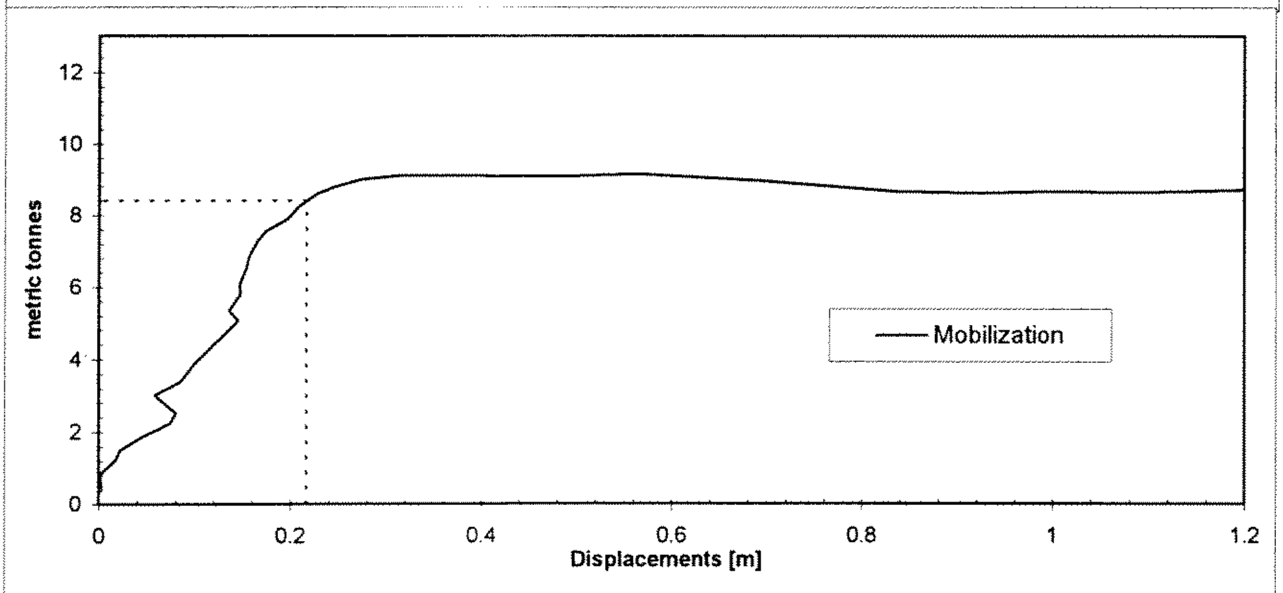
11-D-3



10
9
8
7
6
5
4
3
2
1
0
metric tonnes
Pull-out
48:29
49:56
51:22
52:49
Time from start of test [mm:ss]

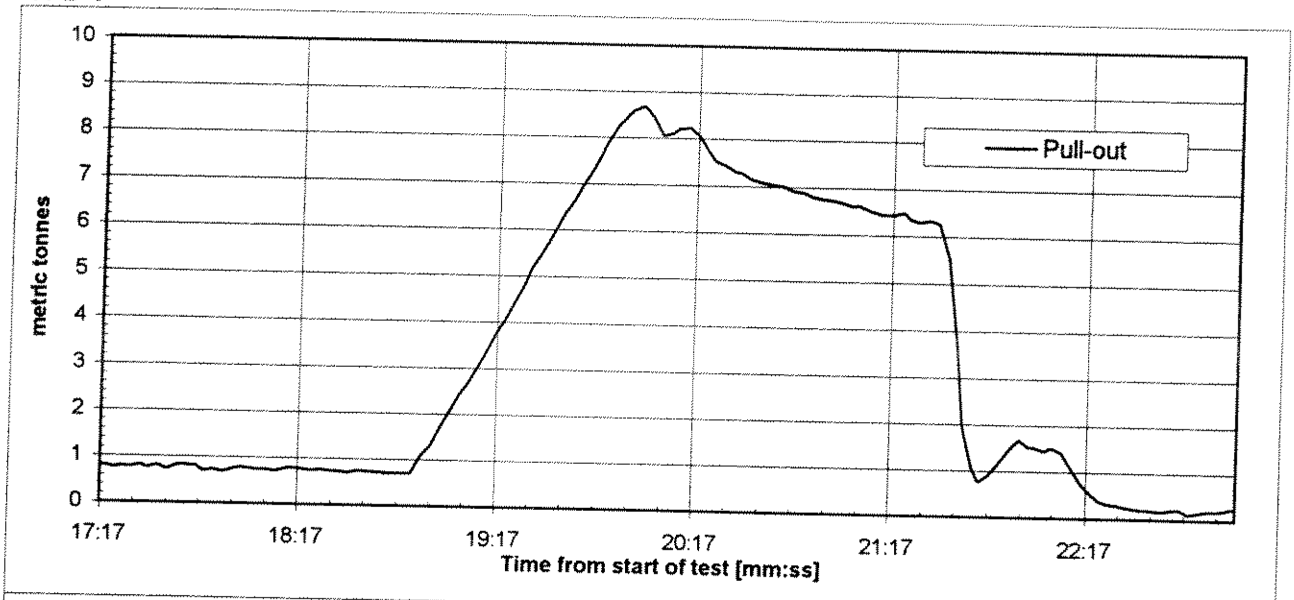


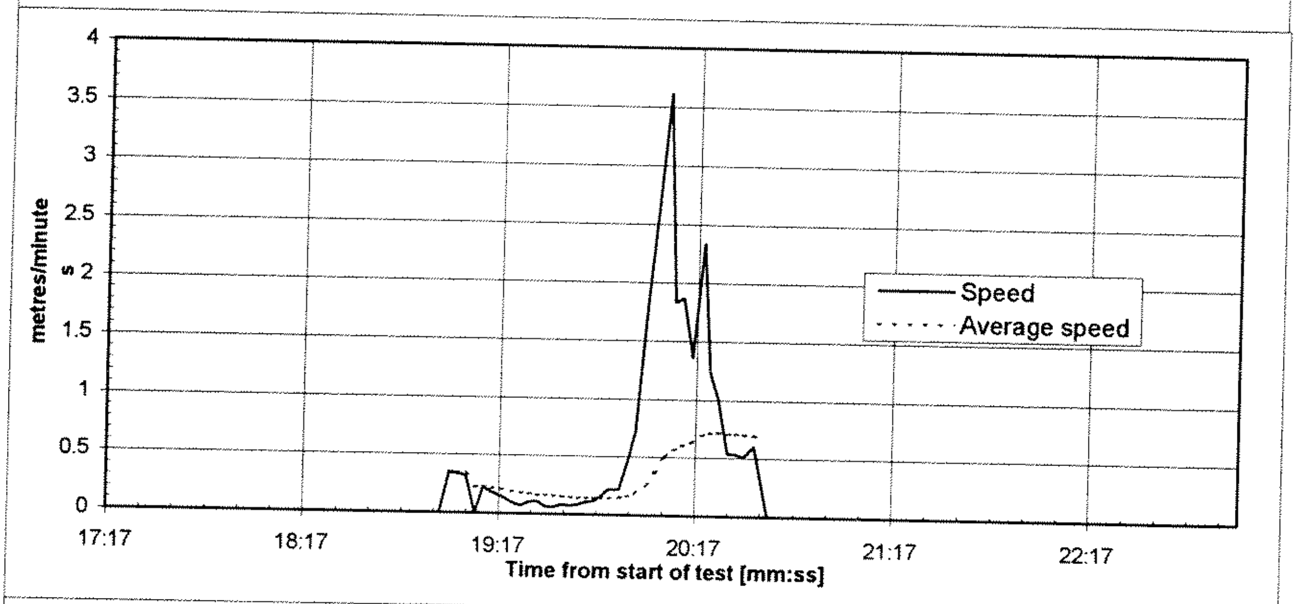
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
metres/minute
Speed
Average speed
48:29
49:56
51:22
52:49
Time from start of test [mm:ss]

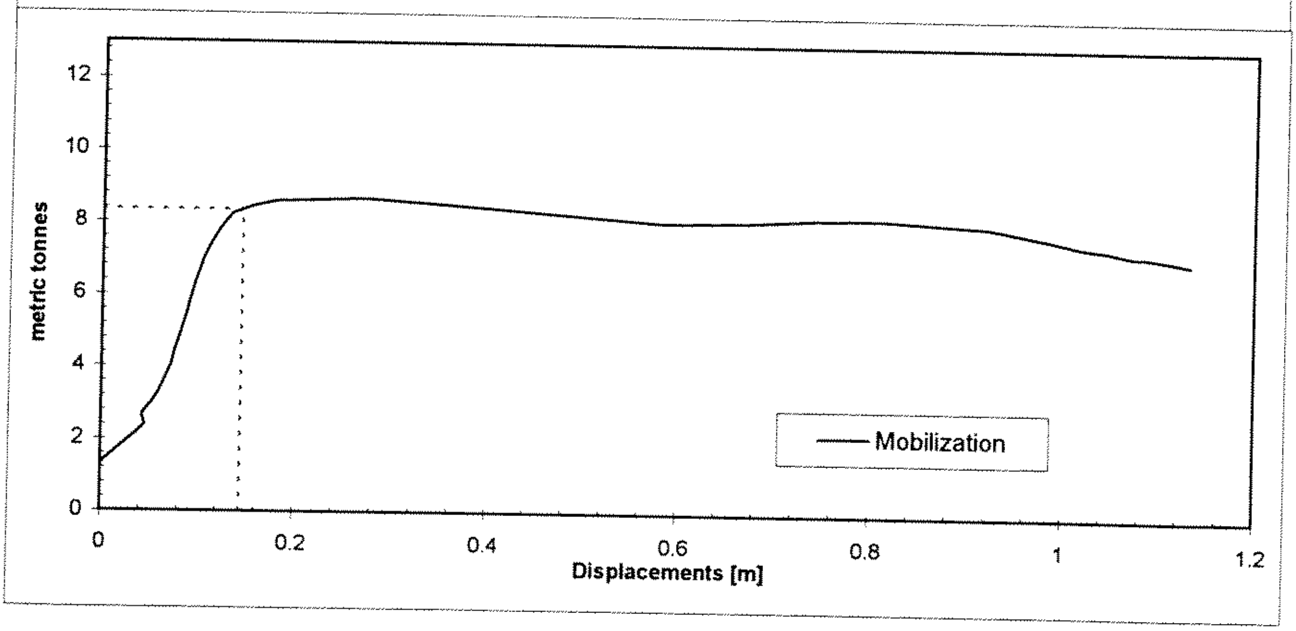


12
10
8
6
4
2
0
metric tonnes
Mobilization
0
0.2
0.4
0.6
0.8
1
1.2
Displacements [m]

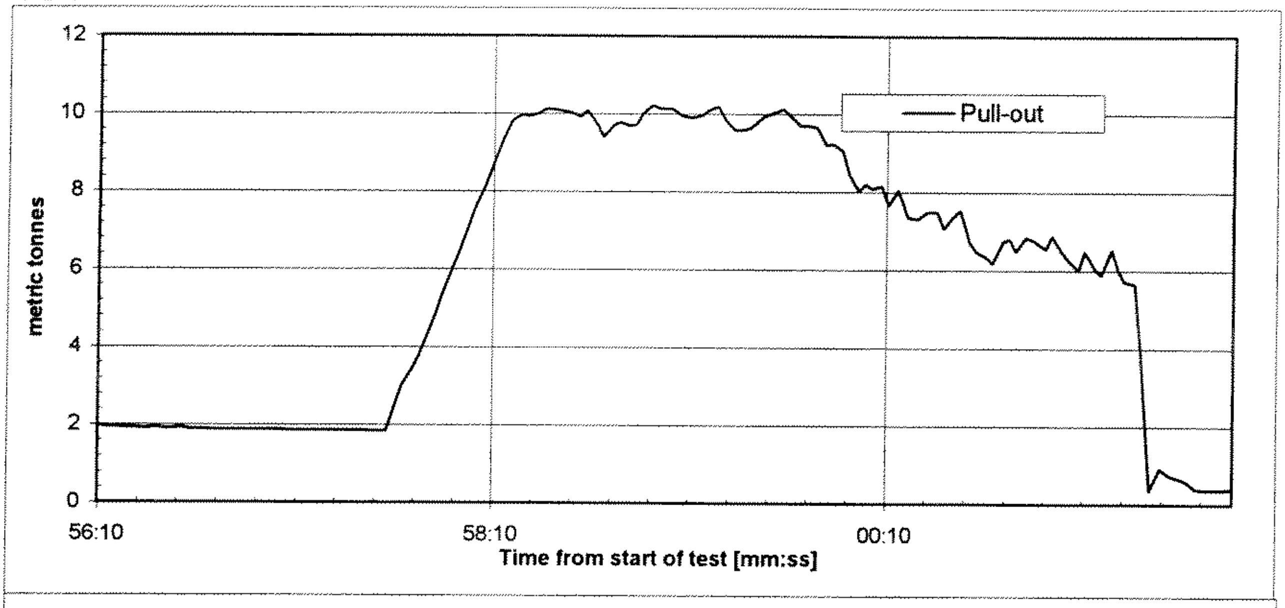
11-D-4


10
9
8
7
6
5
4
3
2
1
0
metric tonnes
17:17
18:17
19:17
20:17
21:17
22:17
Time from start of test [mm:ss]
Pull-out

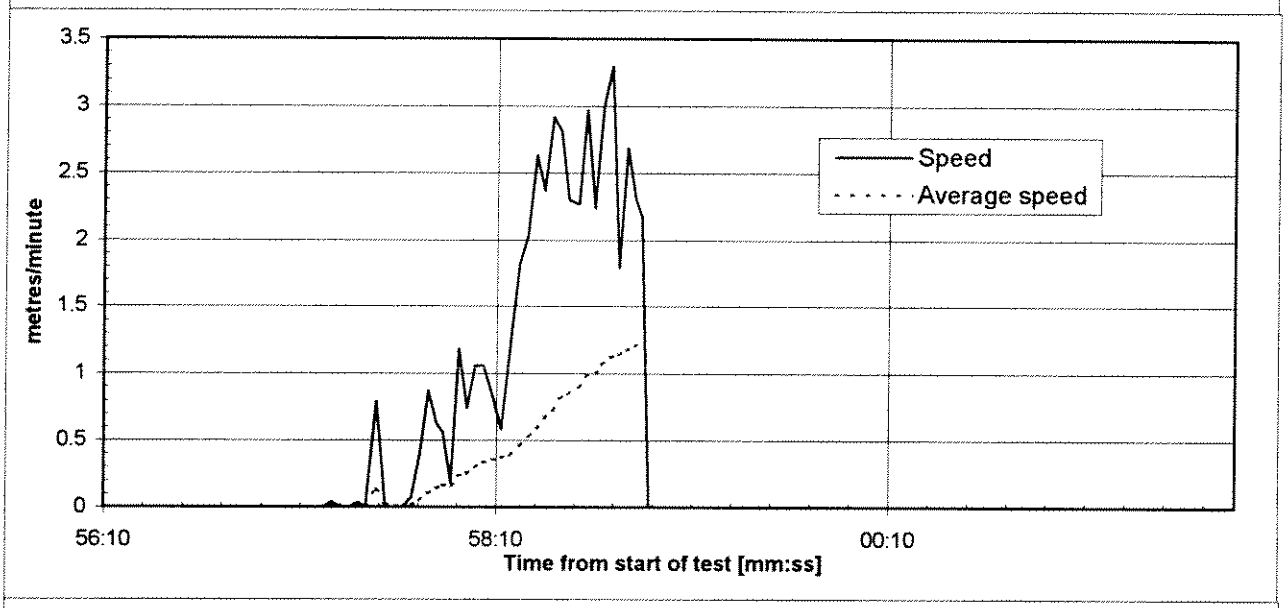

4
3.5
3
2.5
2
1.5
1
0.5
0
metres/minutes
17:17
18:17
19:17
20:17
21:17
22:17
Time from start of test [mm:ss]
Speed
Average speed


12
10
8
6
4
2
0
metric tonnes
0
0.2
0.4
0.6
0.8
1
1.2
Displacements [m]
Mobilization

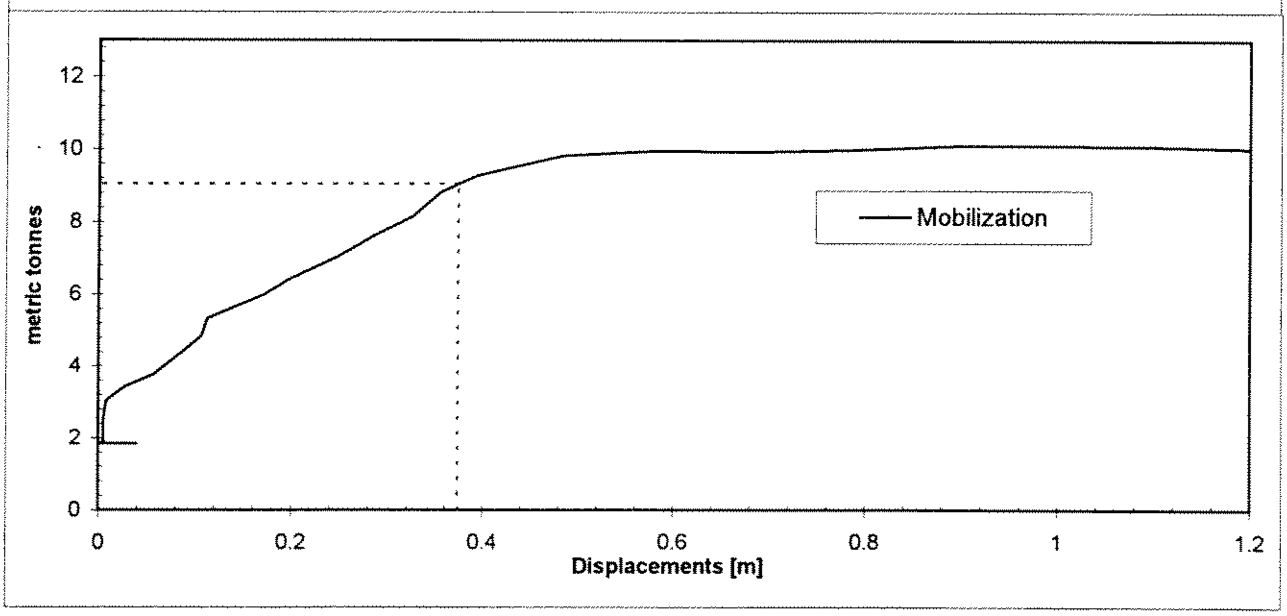
9-D-5



12
10
8
6
4
2
0
metric tonnes
Pull-out
56:10
58:10
00:10
Time from start of test [mm:ss]

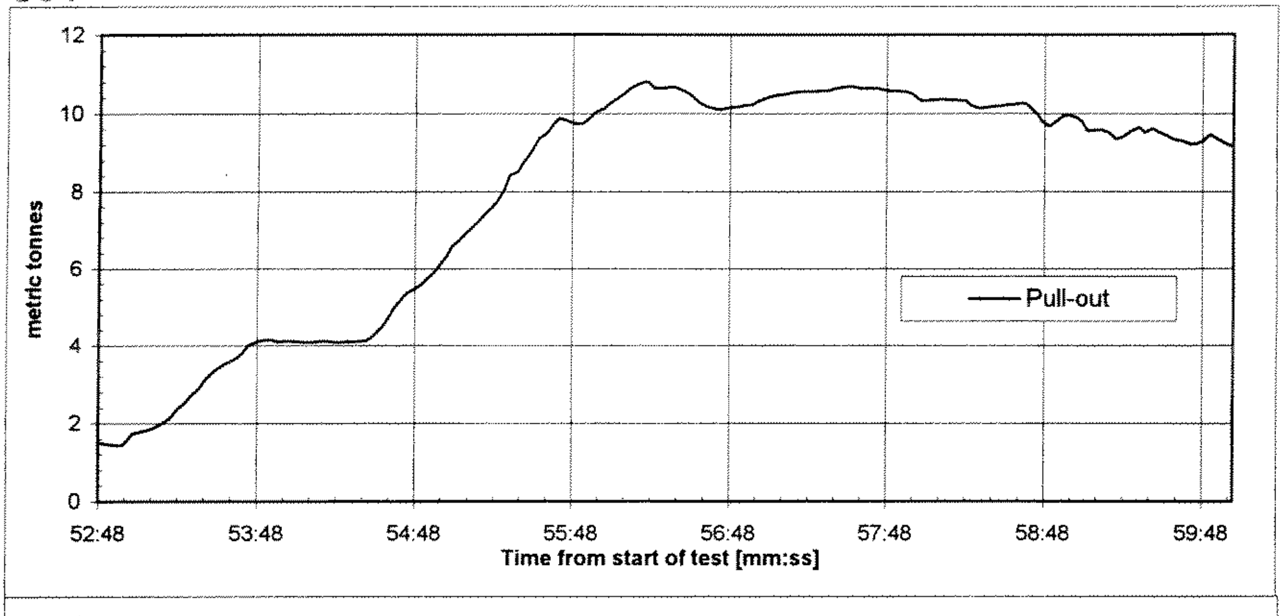


3.5
3
2.5
2
1.5
1
0.5
0
metres/minute
Speed
Average speed
56:10
58:10
00:10
Time from start of test [mm:ss]

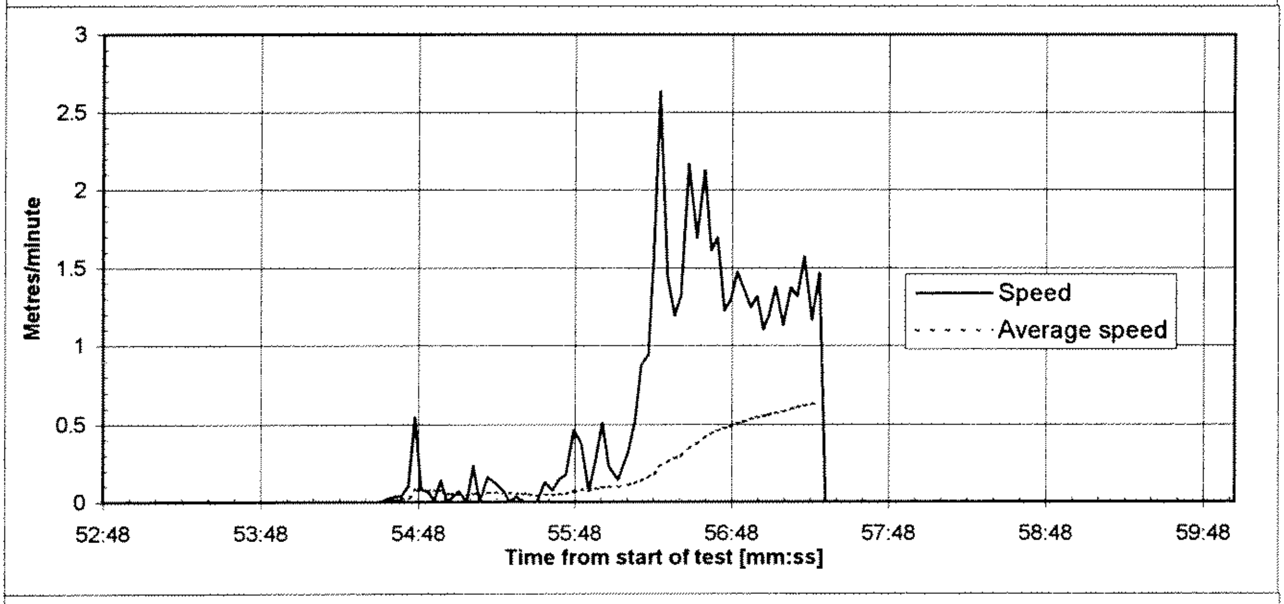


12
10
8
6
4
2
0
metric tonnes
Mobilization
0
0.2
0.4
0.6
0.8
1
1.2
Displacements [m]

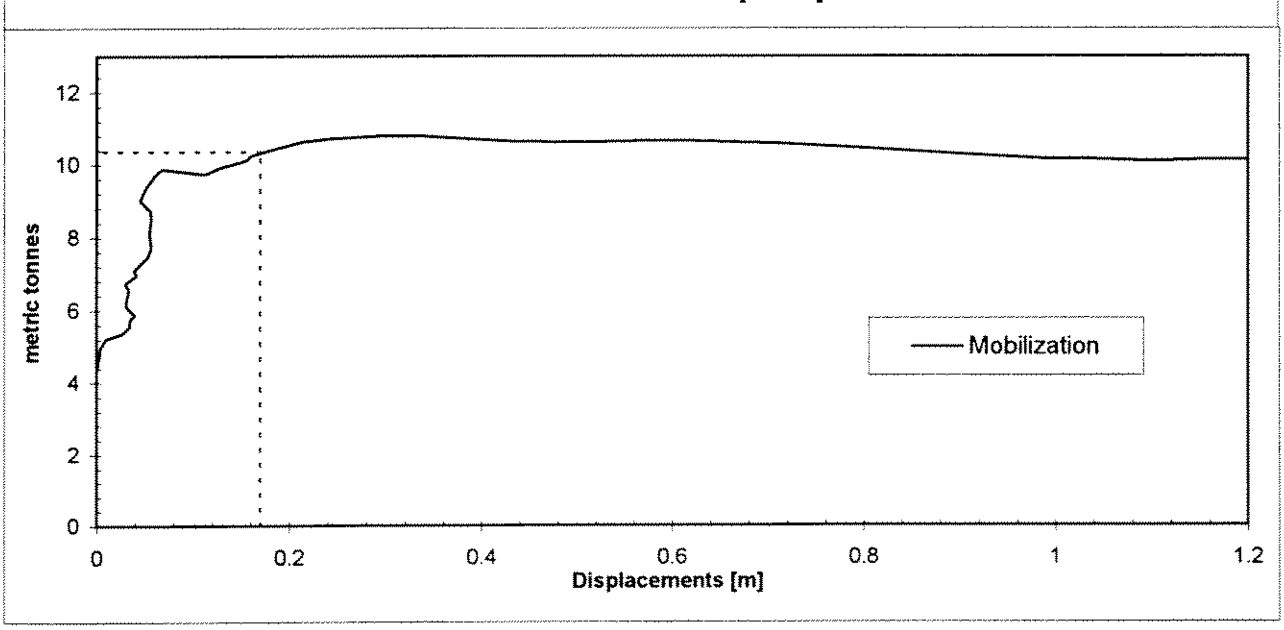
2-S-1



metric tonnes
12
10
8
6
4
2
0
52:48
53:48
54:48
55:48
56:48
57:48
58:48
59:48
Time from start of test [mm:ss]
Pull-out

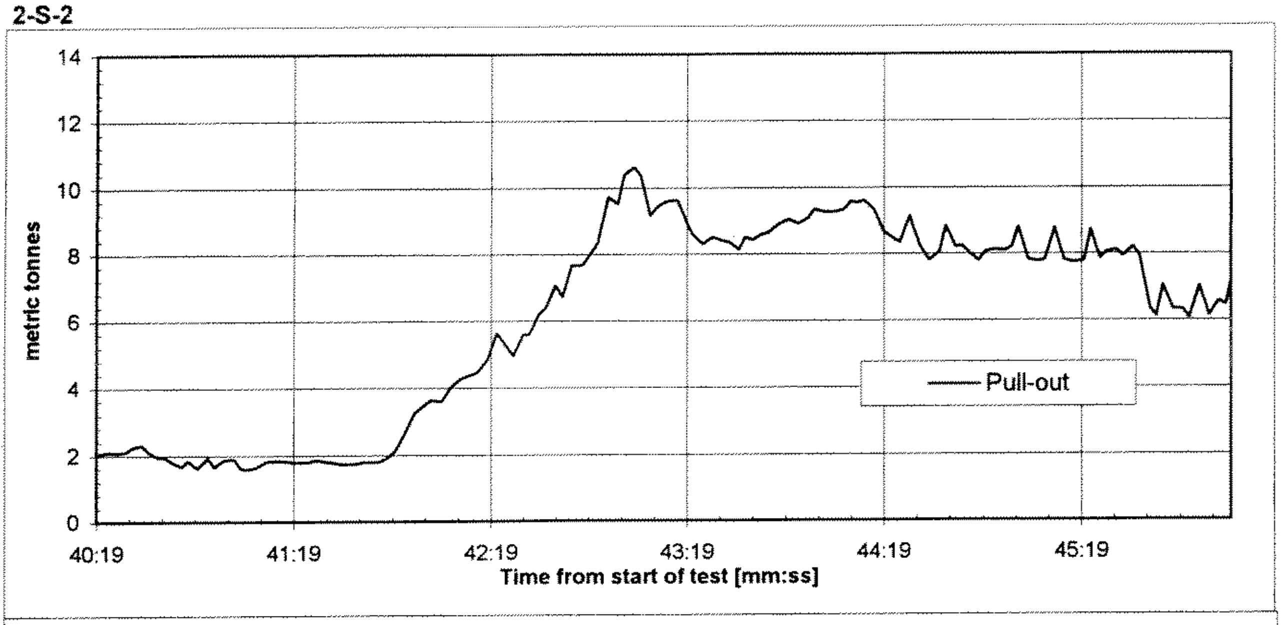


Metres/minute
3
2.5
2
1.5
1
0.5
0
52:48
53:48
54:48
55:48
56:48
57:48
58:48
59:48
Time from start of test [mm:ss]
Speed
Average speed

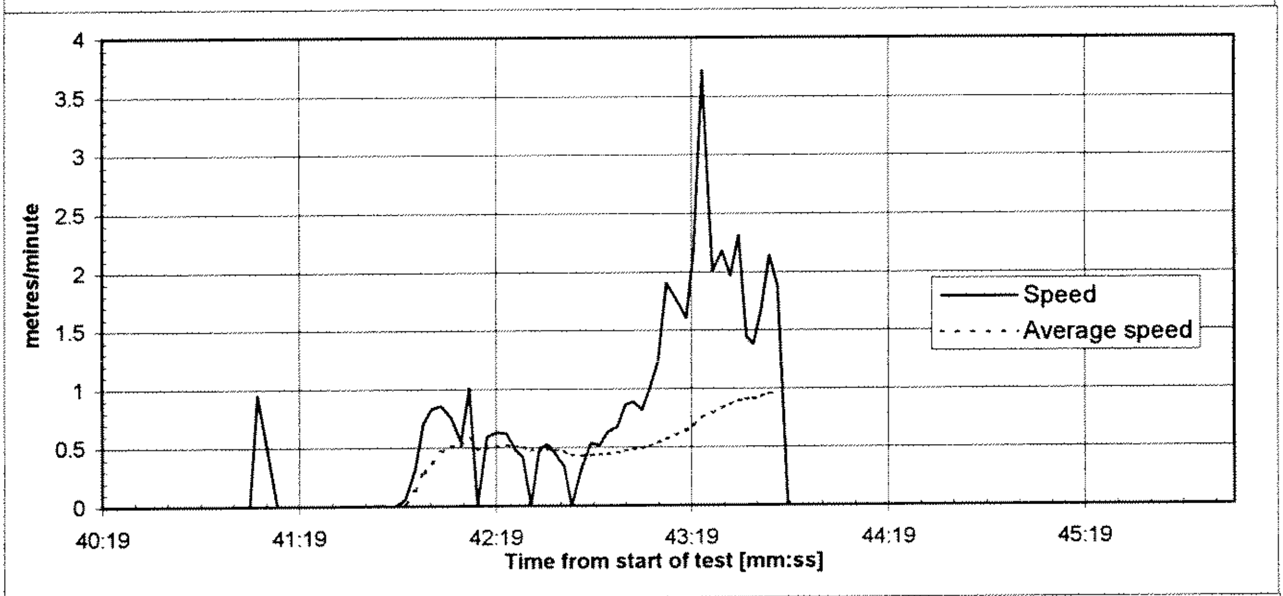


metric tonnes
12
10
8
6
4
2
0
0
0.2
0.4
0.6
0.8
1
1.2
Displacements [m]
Mobilization

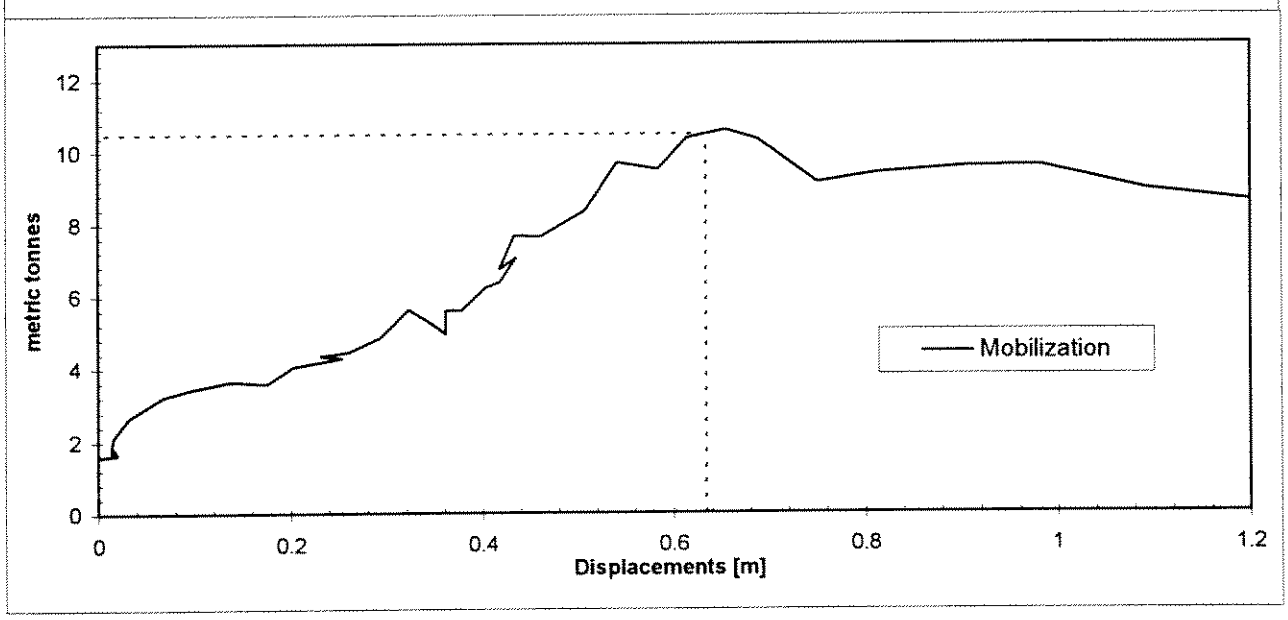
2-S-2



metric tonnes
14
12
10
8
6
4
2
0
40:19
41:19
42:19
43:19
44:19
45:19
Time from start of test [mm:ss]
Pull-out

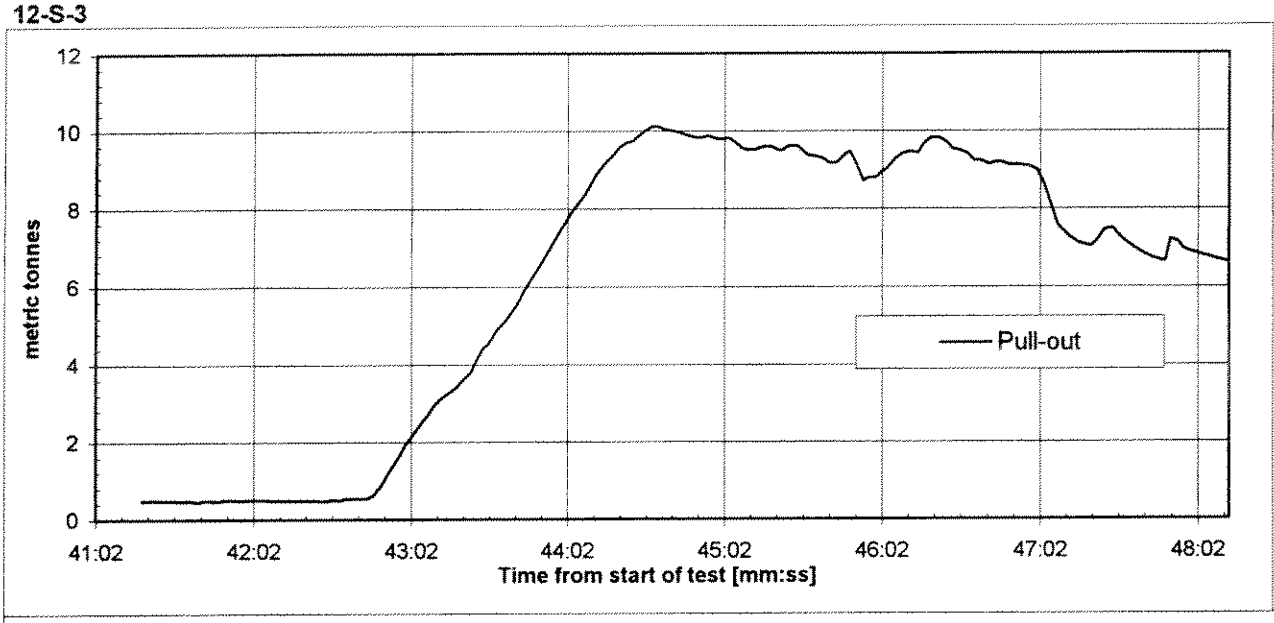


metres/minute
4
3.5
3
2.5
2
1.5
1
0.5
0
40:19
41:19
42:19
43:19
44:19
45:19
Time from start of test [mm:ss]
Speed
Average speed

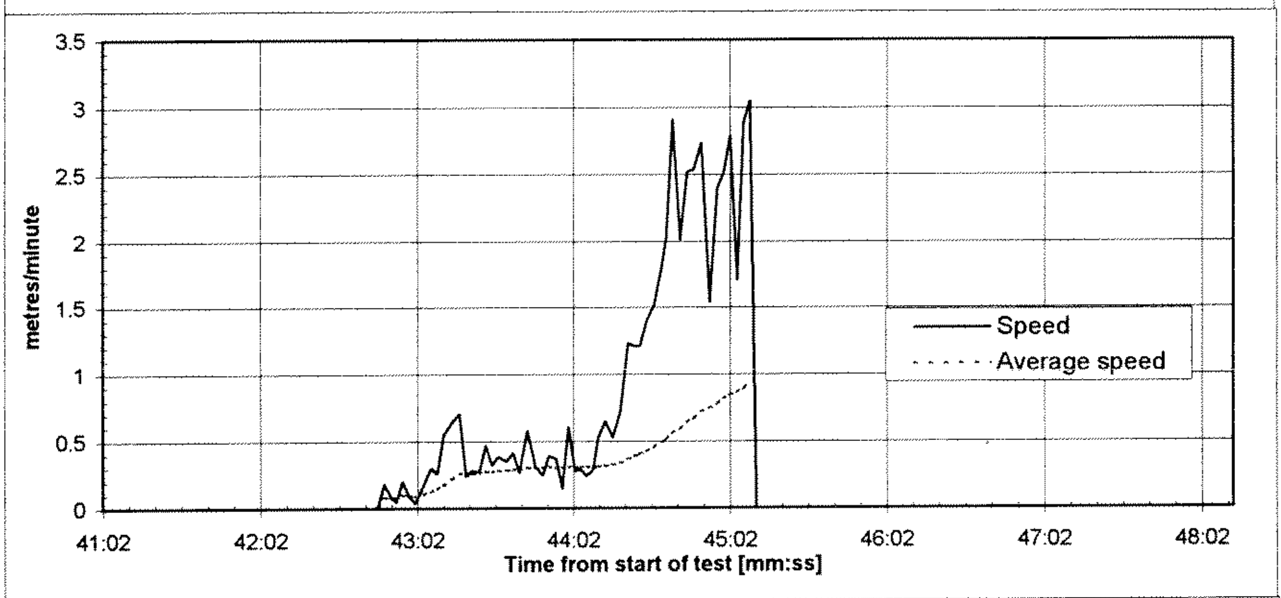


metric tonnes
12
10
8
6
4
2
0
0
0.2
0.4
0.6
0.8
1
1.2
Displacements [m]
Mobilization

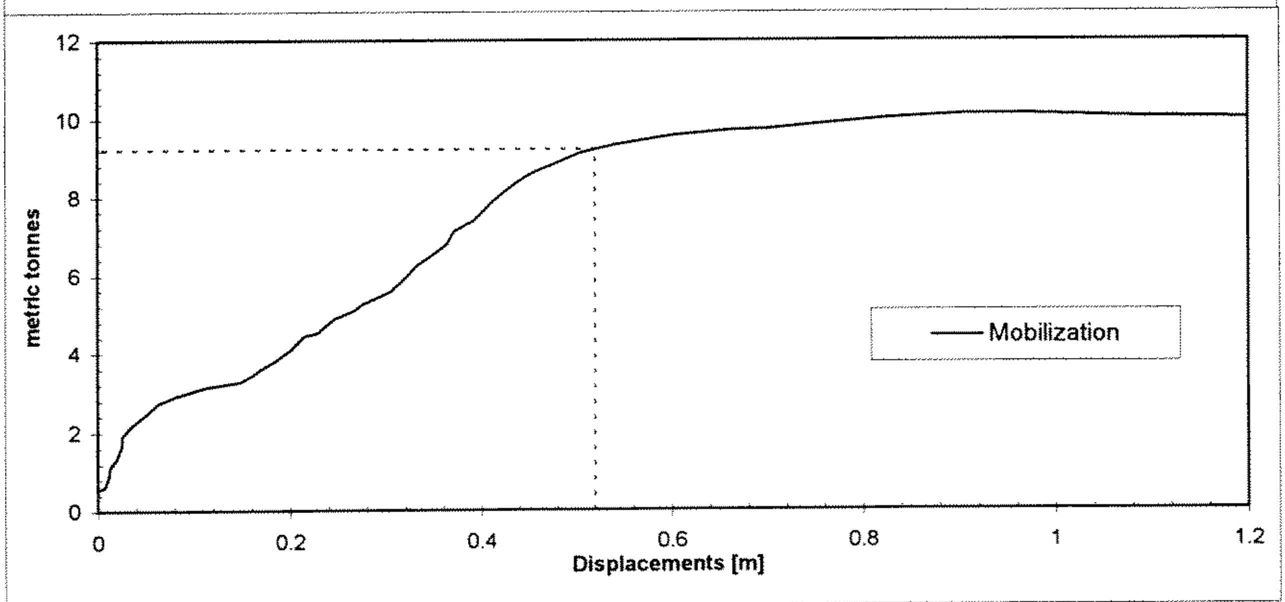
12-S-3



metric tonnes
12
10
8
6
4
2
0
41:02
42:02
43:02
44:02
45:02
46:02
47:02
48:02
Time from start of test [mm:ss]
Pull-out

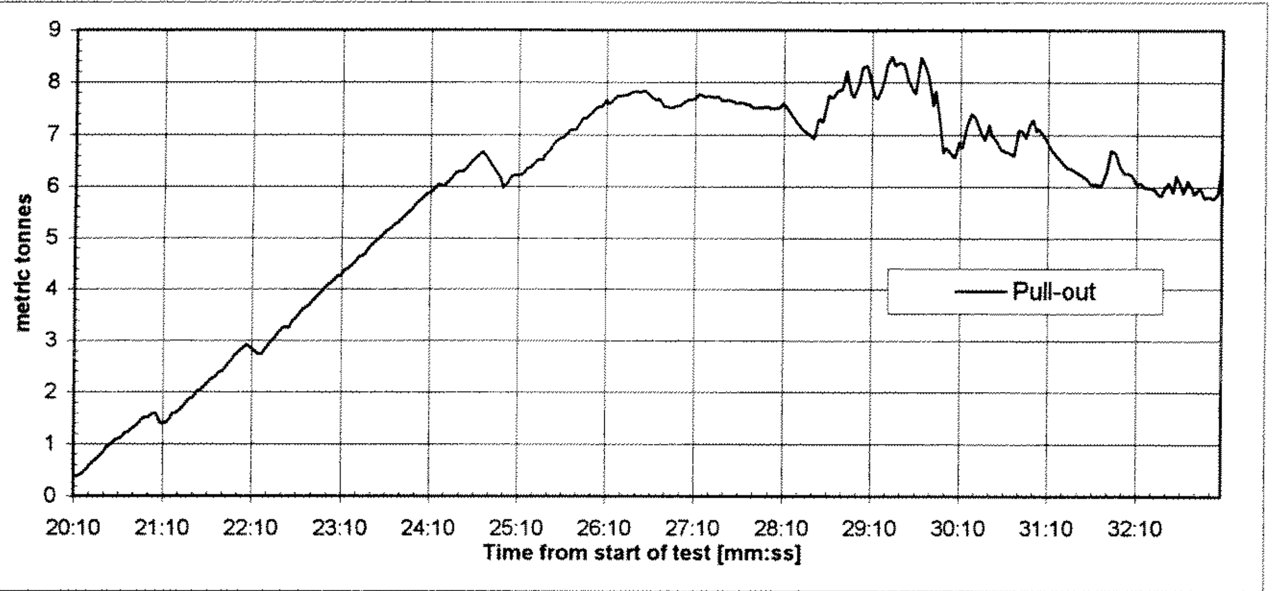


metres/minute
3.5
3
2.5
2
1.5
1
0.5
0
41:02
42:02
43:02
44:02
45:02
46:02
47:02
48:02
Time from start of test [mm:ss]
Speed
Average speed

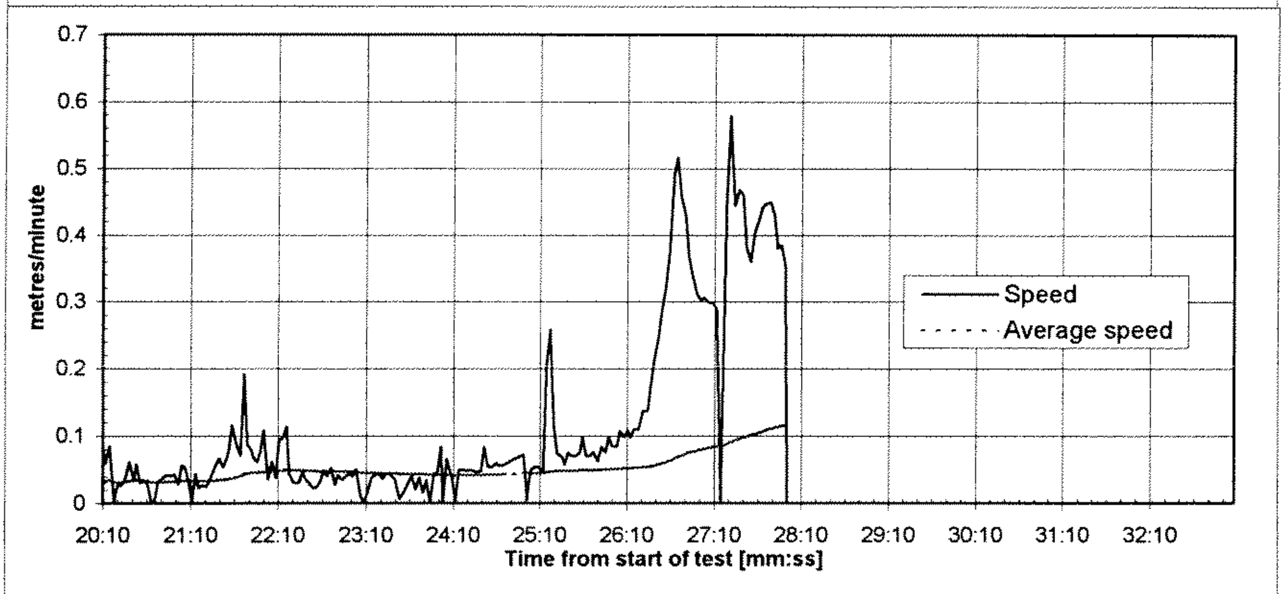


metric tonnes
12
10
8
6
4
2
0
0
0.2
0.4
0.6
0.8
1
1.2
Displacements [m]
Mobilization

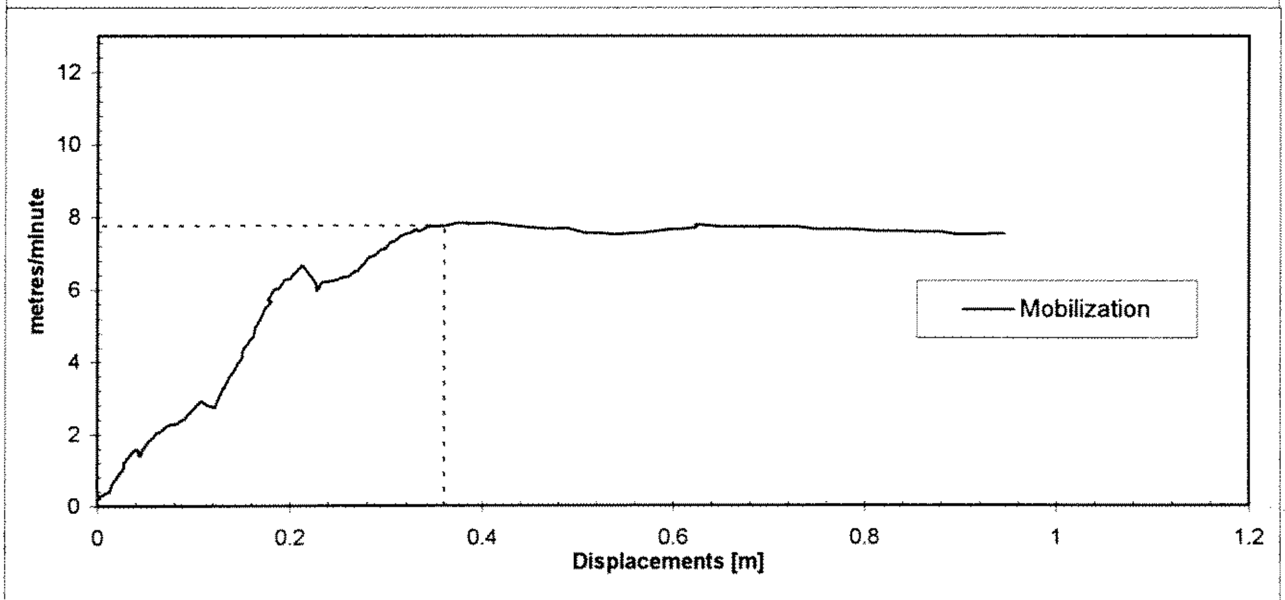
12-S-4



9
8
7
6
5
4
3
2
1
0
metric tonnes
Pull-out
20:10
21:10
22:10
23:10
24:10
25:10
26:10
27:10
28:10
29:10
30:10
31:10
32:10
Time from start of test [mm:ss]

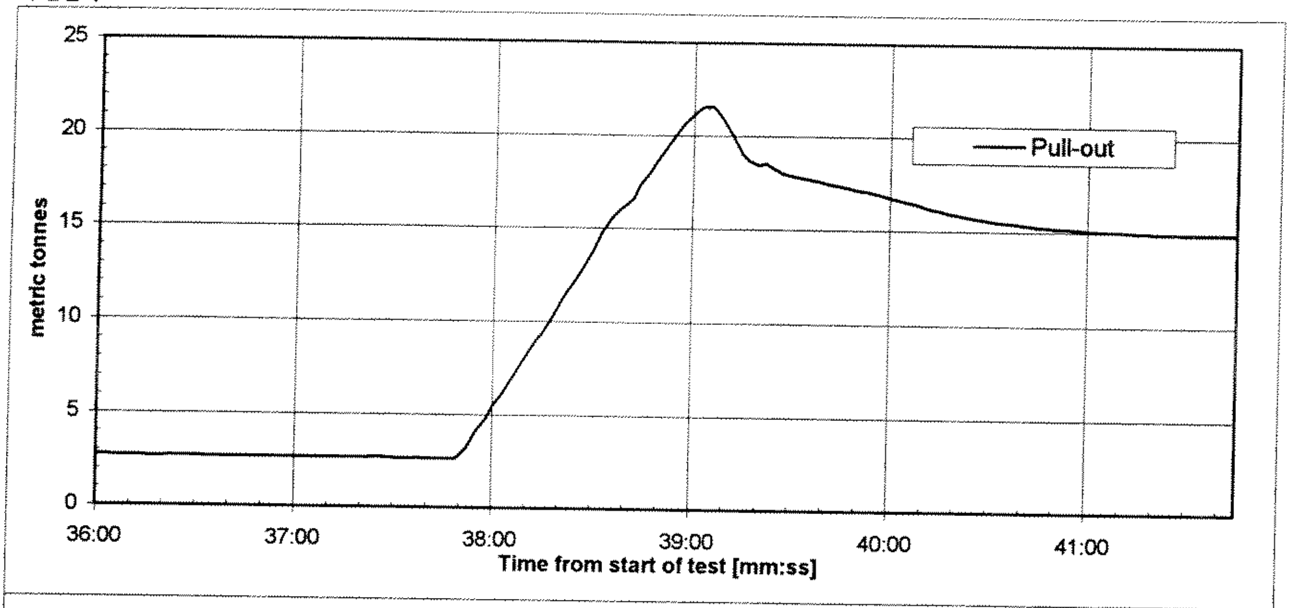


0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
metres/minute
Speed
Average speed
20:10
21:10
22:10
23:10
24:10
25:10
26:10
27:10
28:10
29:10
30:10
31:10
32:10
Time from start of test [mm:ss]

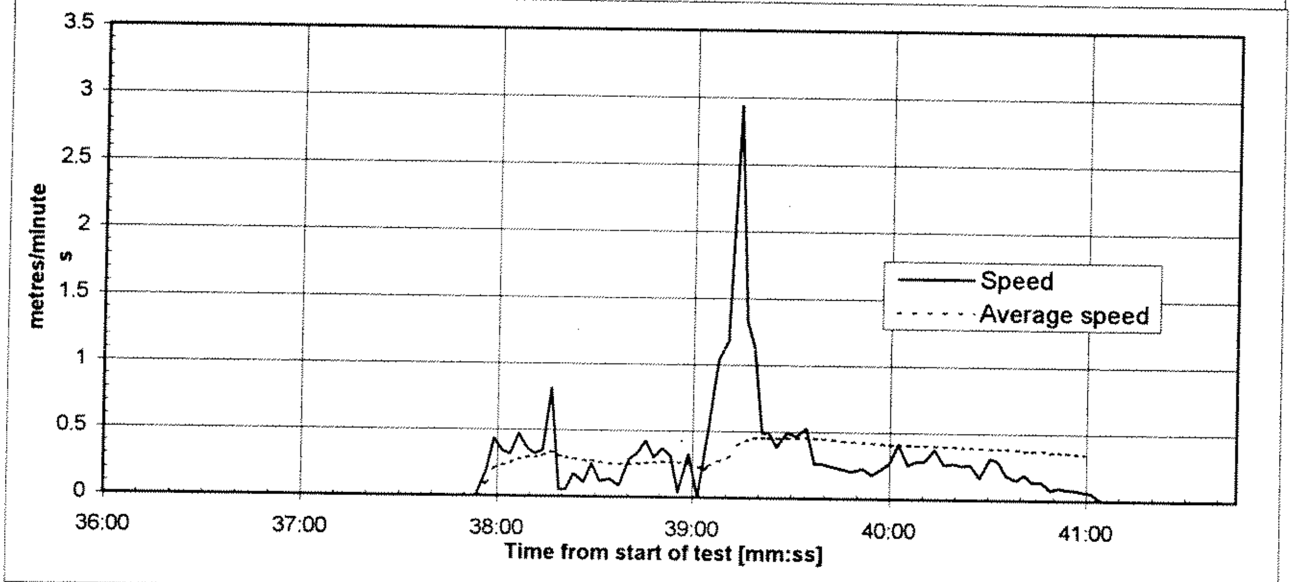


12
10
8
6
4
2
0
metres/minute
Mobilization
0
0.2
0.4
0.6
0.8
1
1.2
Displacements [m]

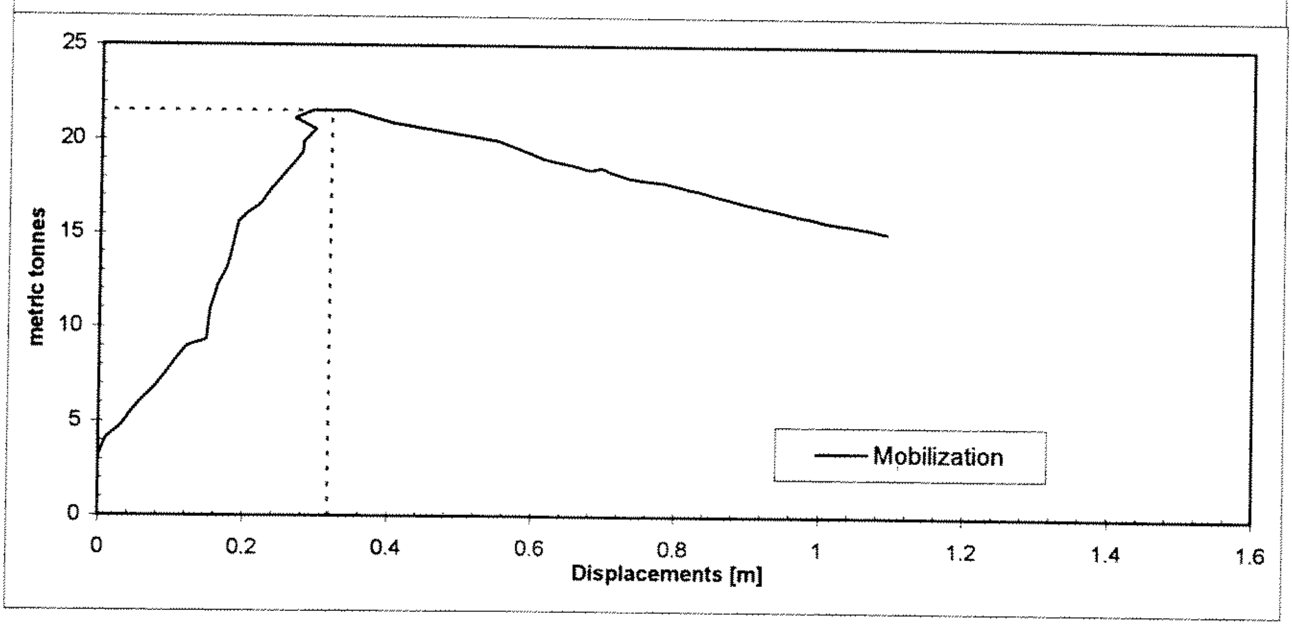
4-DL-1



25
20
15
10
5
0
metric tonnes
Pull-out
36:00
37:00
38:00
39:00
40:00
41:00
Time from start of test [mm:ss]

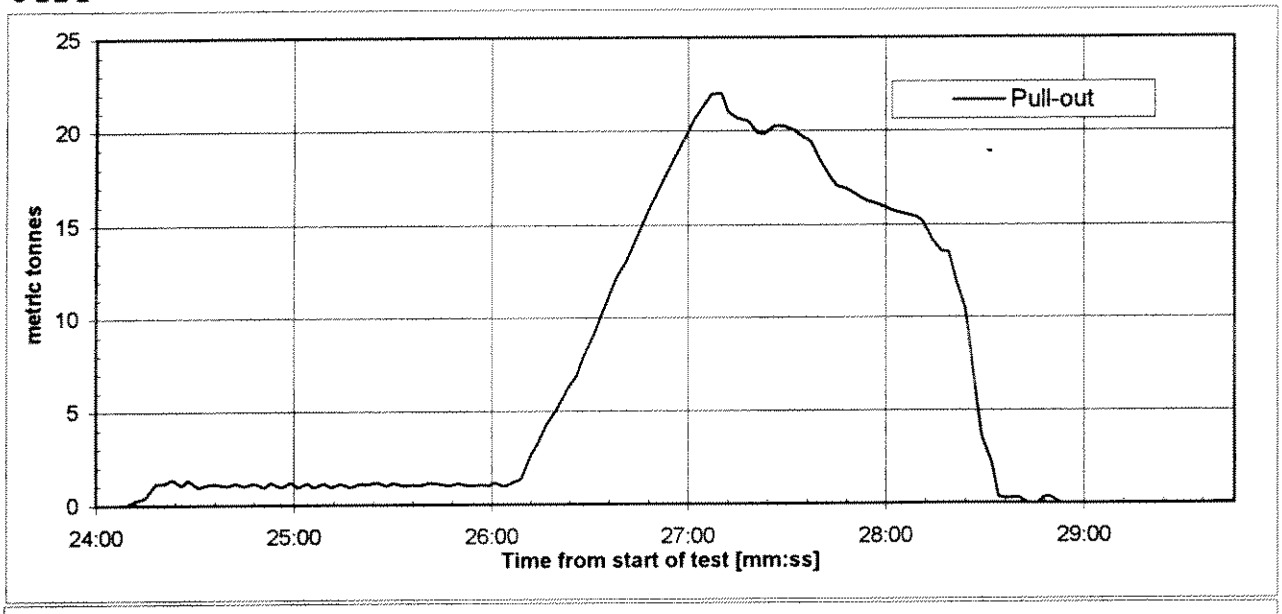


3.5
3
2.5
2
1.5
1
0.5
0
metres/minute s
Speed
Average speed
36:00
37:00
38:00
39:00
40:00
41:00
Time from start of test [mm:ss]

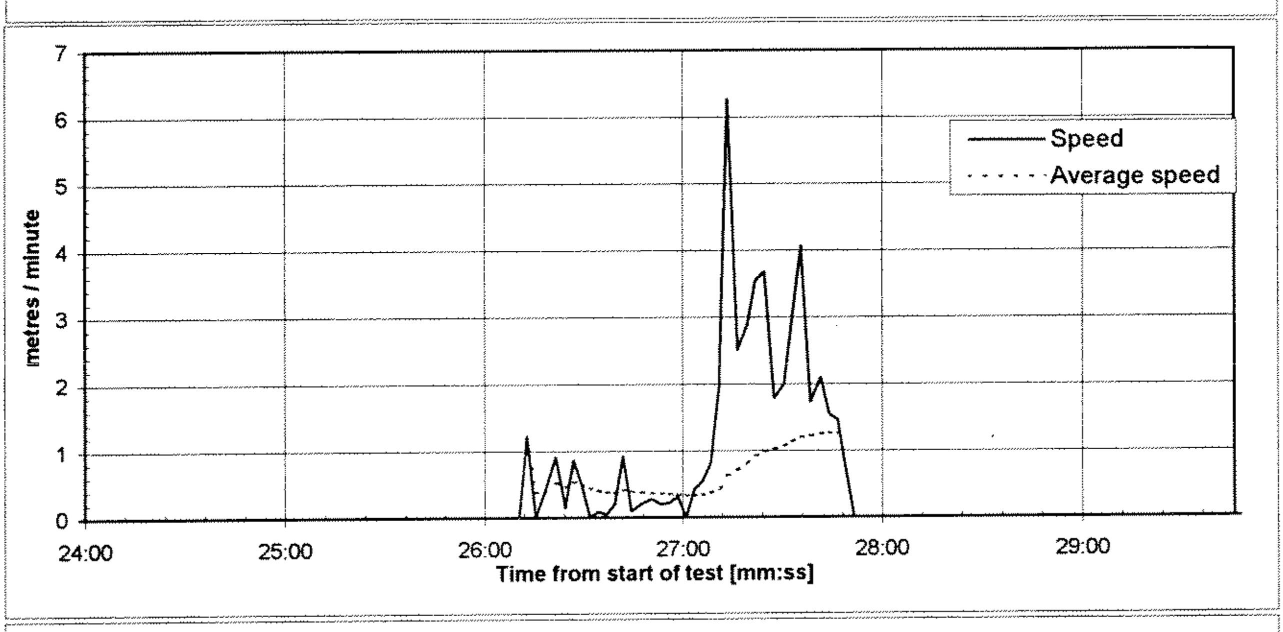


25
20
15
10
5
0
metric tonnes
Mobilization
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
Displacements [m]

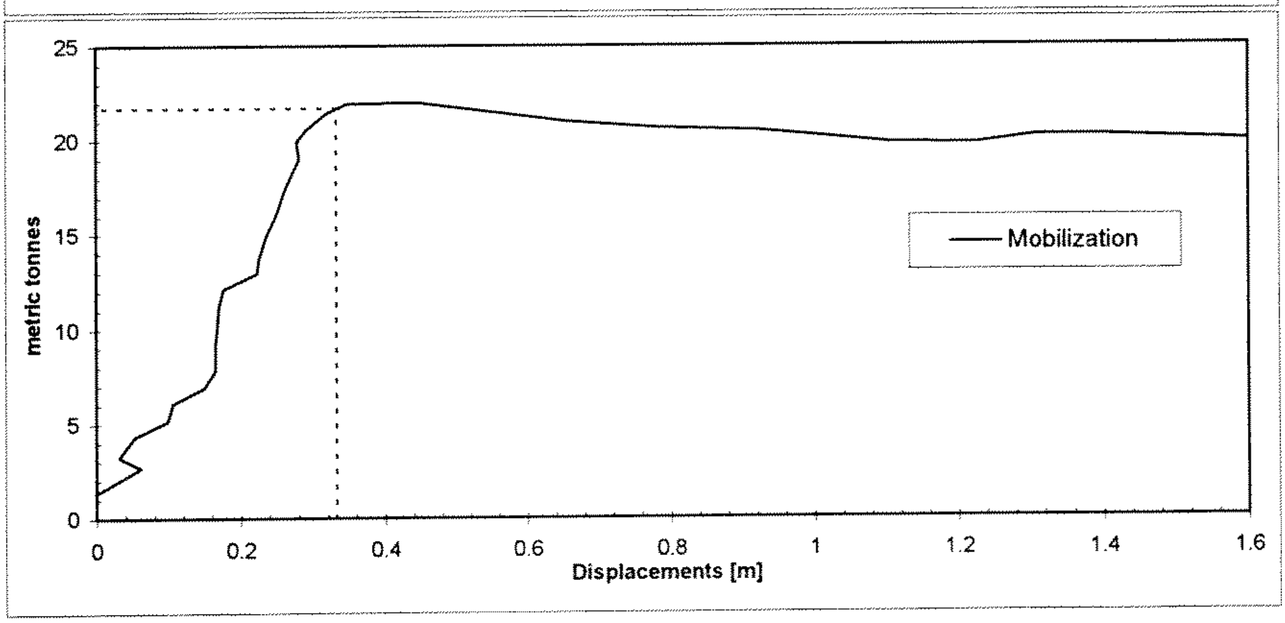
5-DL-2



25
20
15
10
5
0
metric tonnes
24:00
25:00
26:00
27:00
28:00
29:00
Time from start of test [mm:ss]
Pull-out

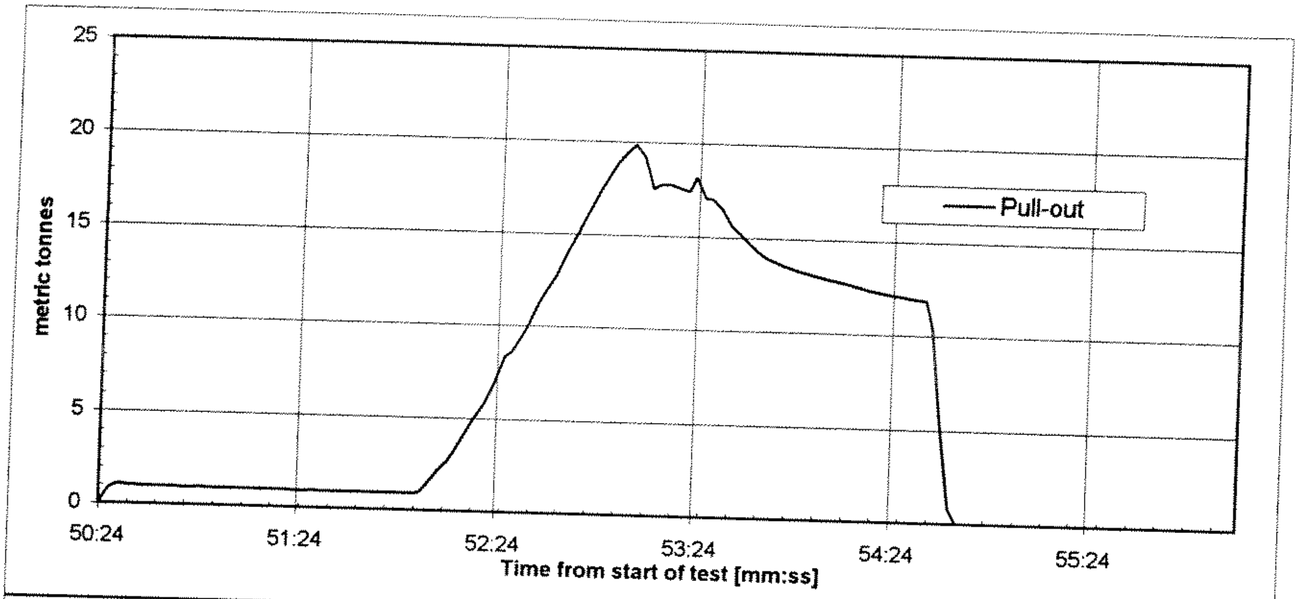


7
6
5
4
3
2
1
0
metres / minute
24:00
25:00
26:00
27:00
28:00
29:00
Time from start of test [mm:ss]
Speed
Average speed

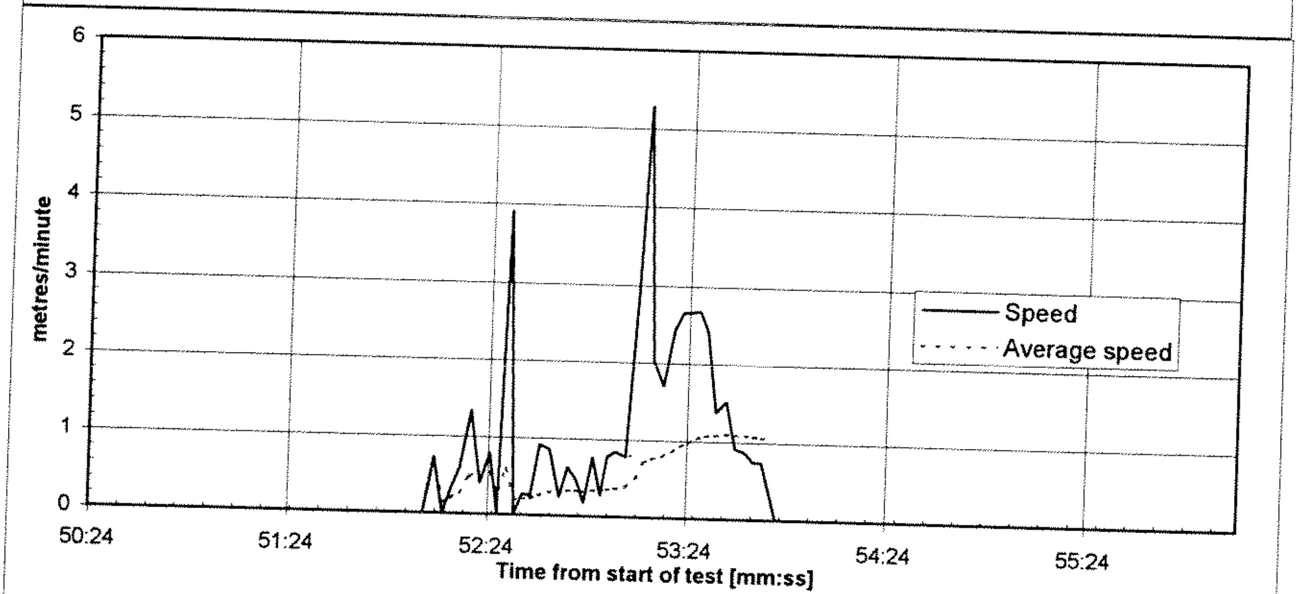


25
20
15
10
5
0
metric tonnes
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
Displacements [m]
Mobilization

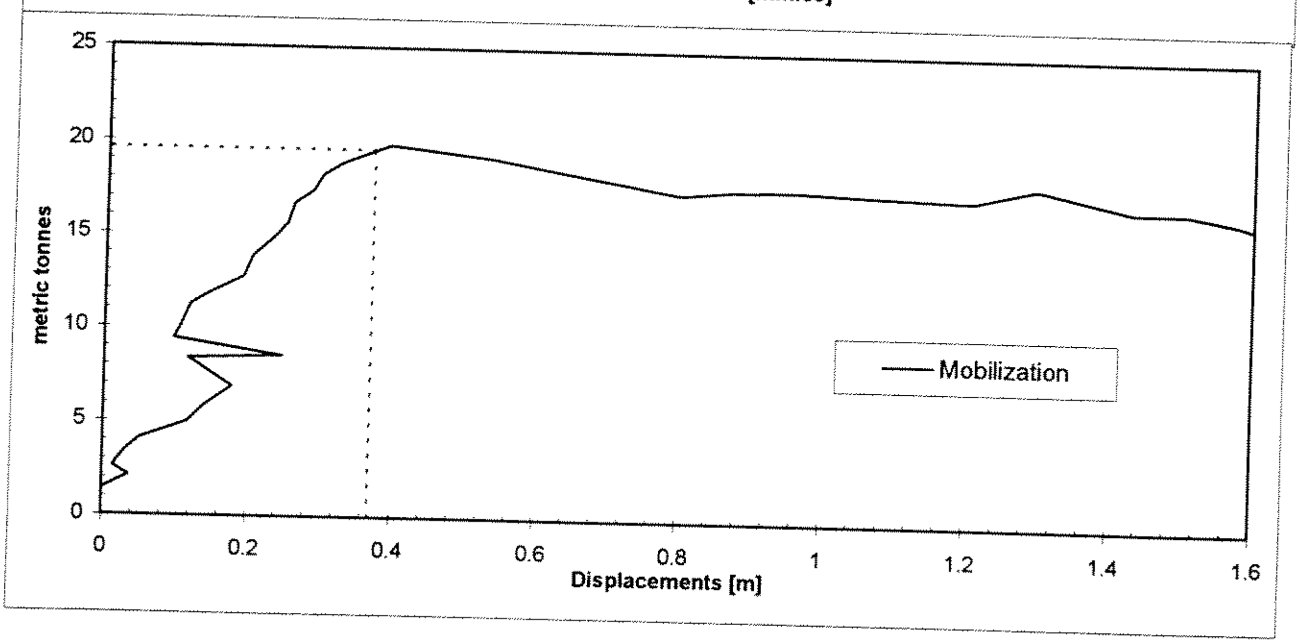
9-DL-3



25
20
15
10
5
0
metric tonnes
Pull-out
50:24
51:24
52:24
53:24
54:24
55:24
Time from start of test [mm:ss]

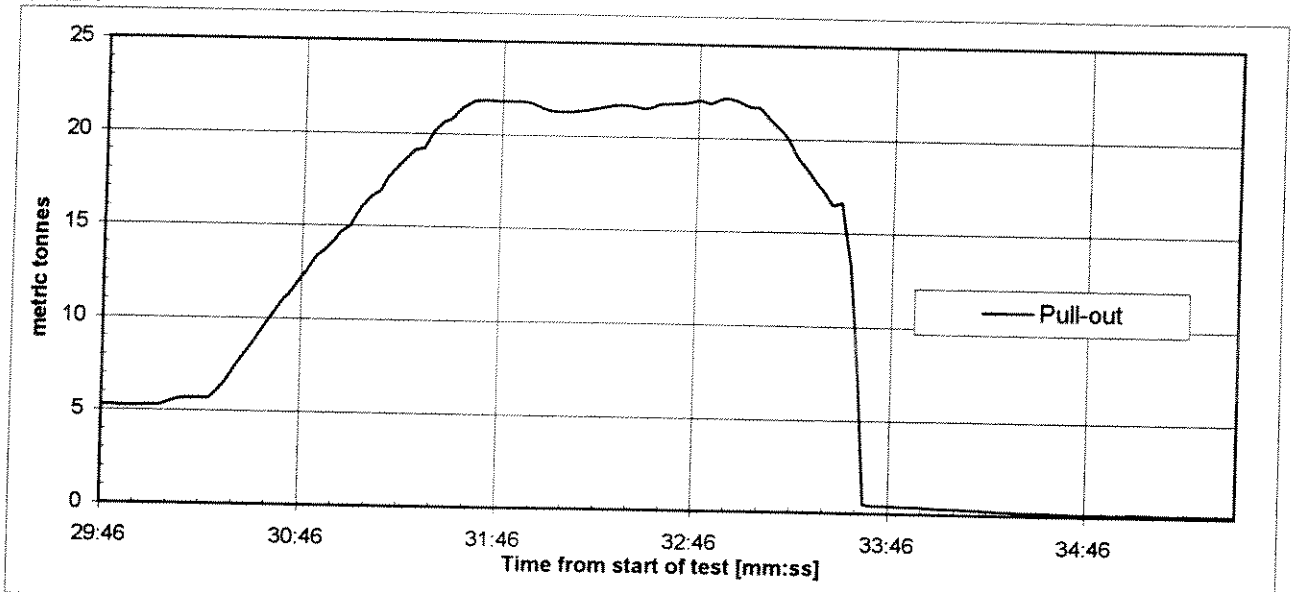


6
5
4
3
2
1
0
metres/minute
Speed
Average speed
50:24
51:24
52:24
53:24
54:24
55:24
Time from start of test [mm:ss]

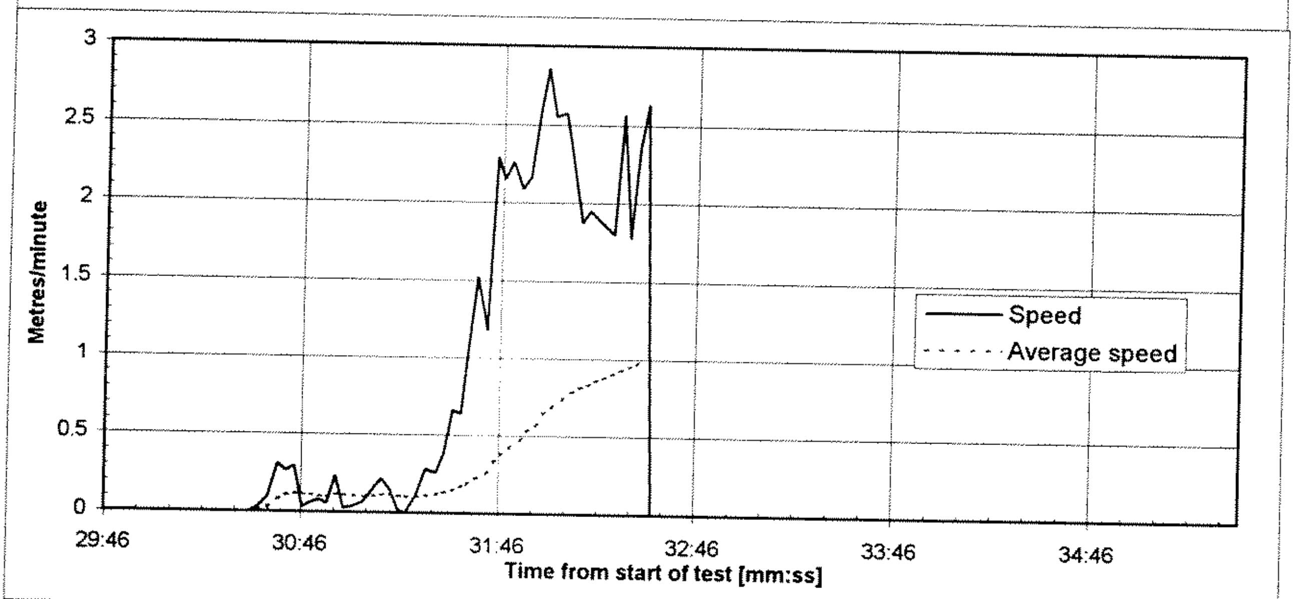


25
20
15
10
5
0
metric tonnes
Mobilization
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
Displacements [m]

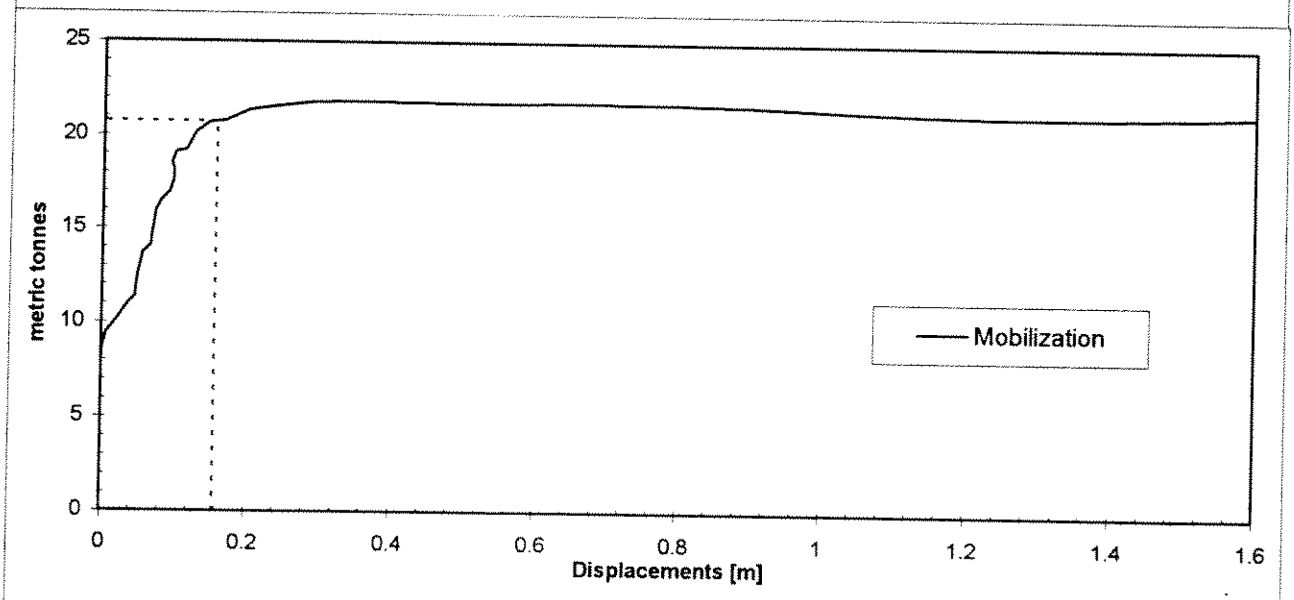
7-SL-1



metric tonnes
25
20
15
10
5
0
29:46
30:46
31:46
32:46
33:46
34:46
Time from start of test [mm:ss]
Pull-out

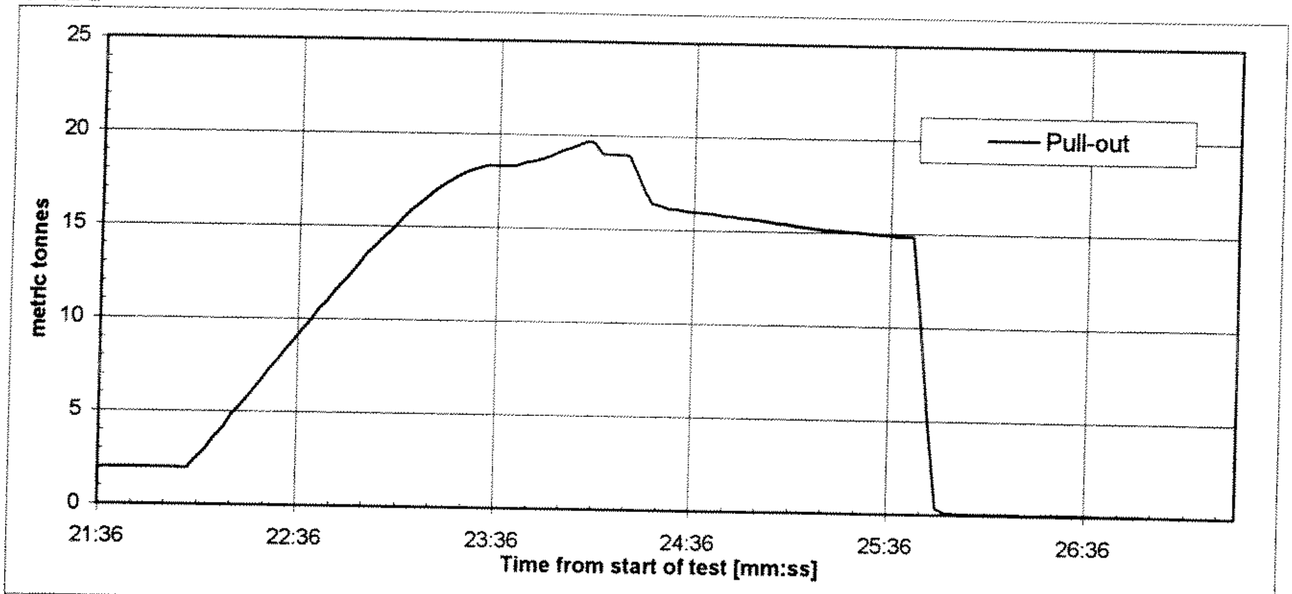


Metres/minute
3
2.5
2
1.5
1
0.5
0
29:46
30:46
31:46
32:46
33:46
34:46
Time from start of test [mm:ss]
Speed
Average speed

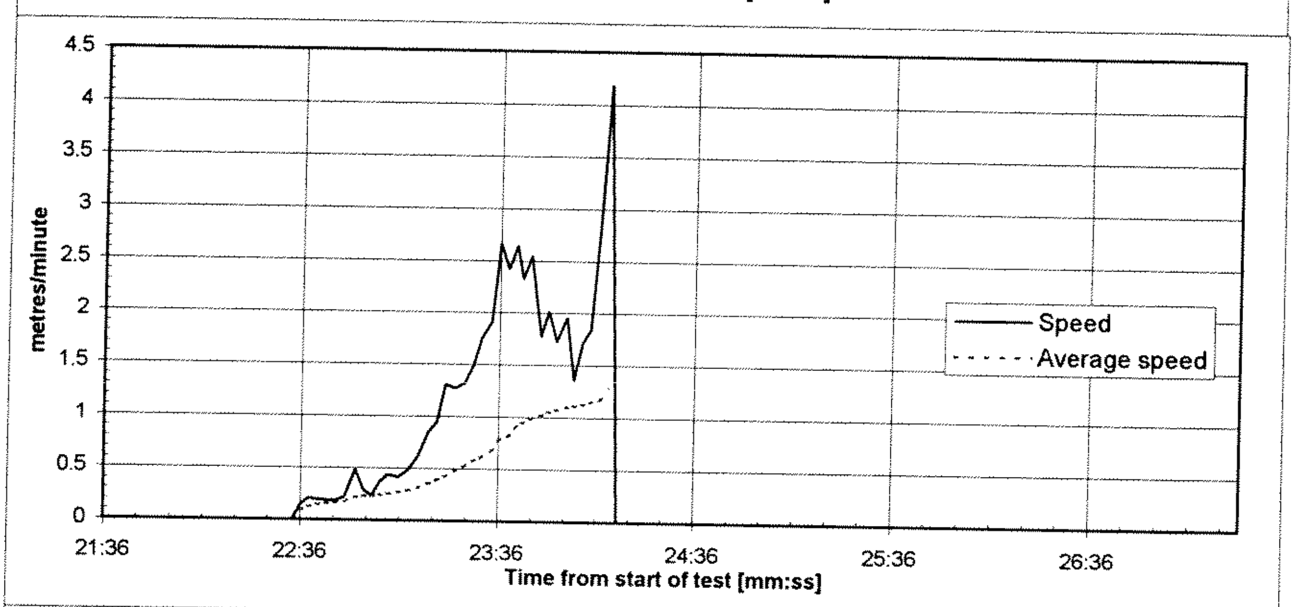


metric tonnes
25
20
15
10
5
0
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
Displacements [m]
Mobilization

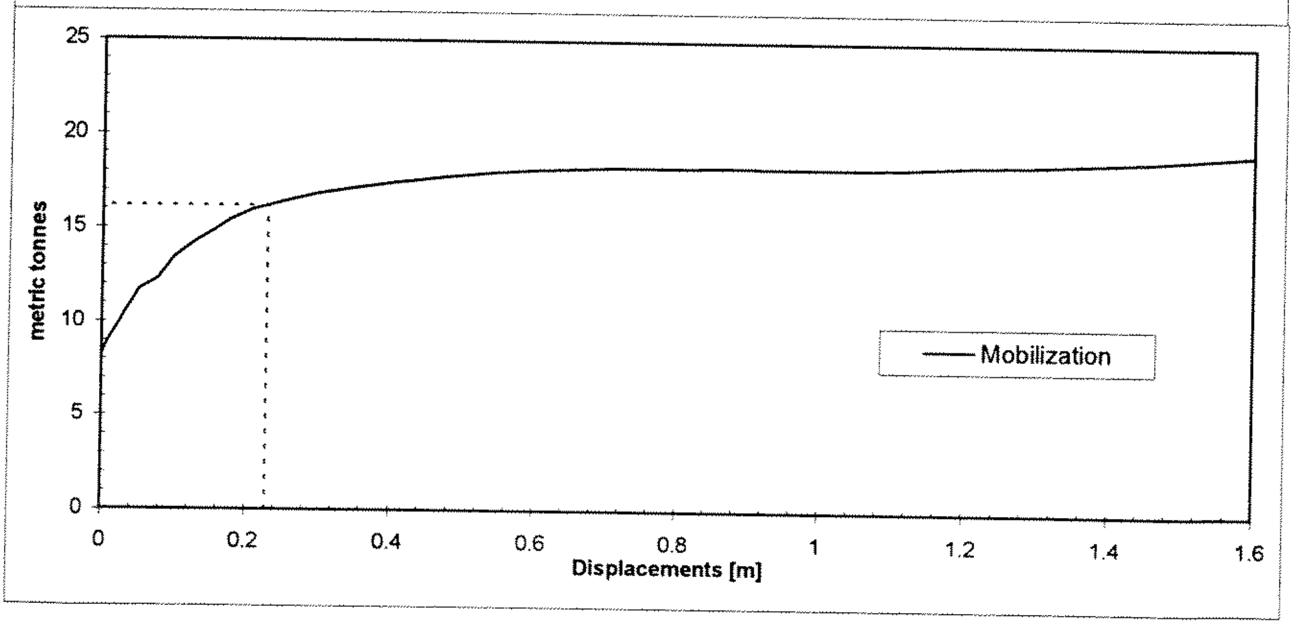
7-SL-2



25
20
15
10
5
0
metric tonnes
Pull-out
21:36
22:36
23:36
24:36
25:36
26:36
Time from start of test [mm:ss]



4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
metres/minute
Speed
Average speed
21:36
22:36
23:36
24:36
25:36
26:36
Time from start of test [mm:ss]



25
20
15
10
5
0
metric tonnes
Mobilization
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
Displacements [m]

Track	&	Test	Depth of trench	Penetration of shackle	Dh (Fluke to shackle)	Failure displacement	Time to failure	failure strain 5% , 360mm	Depth of anchor	Shear strength	Nc-value	Static tests 3% β-factor	η-factor
			[m]	[m]	[m]	[m]	[min]	[% / hour]	[m]	[kN/m]	[kN/m]	β-factor	η-factor
1	-	D-1	0.95	4.05	1.2	0.34	1.26	226	6.23	12.63	11.3	1.229	0.682
1	-	D-2	0.90	4.58	1.2	0.42	1.12	313	6.73	13.11	13.0	1.246	0.772
11	-	D-3	1.10	4.60	1.2	0.43	1.91	186	6.95	13.31	8.9	1.219	0.538
11	-	D-4	1.10	4.30	1.2	0.15	1.04	116	6.65	13.03	9.0	1.194	0.557
9	-	D-5	1.00	5.00	1.2	0.37	0.95	328	7.25	13.60	9.3	1.249	0.553
2	-	S-1	1.20	5.00	1.0	0.17	1.73	82	7.24	13.59	10.7	1.175	0.659
2	-	S-2	0.95	5.45	1.1	0.63	1.29	411	7.47	13.81	10.7	1.261	0.613
12	-	S-3	1.10	5.80	1.0	0.52	1.60	271	7.95	14.27	9.06	1.239	0.530
12	-	S-4	1.00	2.45	1.0	0.36	6.67	45	4.49	10.96	9.91	1.143	0.628
4	-	DL-1	1.20	5.30	1.8	0.32	1.34	198	8.29	14.59	10.3	1.222	0.627
5	-	DL-2	1.00	5.80	1.8	0.33	0.97	285	8.59	14.88	10.2	1.241	0.610
9	-	DL-3	1.25	5.20	1.8	0.37	1.02	304	8.23	14.53	9.4	1.245	0.561
7	-	SL-1	1.10	4.80	1.4	0.16	1.22	108	7.29	13.64	10.7	1.190	0.649
7	-	SL-2	1.10	3.30	1.4	0.23	0.74	259	5.84	12.26	9.3	1.236	0.543
											10.11884		0.609

Weight data:

W = 2.00 kN

COG X = .10
Z = -.03

Anchor groups: 2

No.	Definition
1	Fluke
2	Shanck

Anchor members: 19

No.	Group	Nodes	Cross section shape Side	Front	F.Area	X	Y	Z
1	1	11	2	1	.011	.00	.28	.00
						.41	.39	.00
						.59	.32	.00
						.67	.27	.00
						.47	.07	.00
						.44	.00	.00
						.47	-.07	.00
						.67	-.27	.00
						.59	-.32	.00
						.41	-.39	.00
						.00	-.28	.00
2	1	3	1	1	.004	.00	-.28	.00
						.41	-.39	.00
						.00	-.58	-.06
3	1	3	1	1	.004	.00	.58	-.06
						.41	.39	.00
						.00	.28	.00
4	1	3	1	1	.000	.00	-.58	-.06
						.00	-.28	-.06
						-.25	-.31	-.08
	Note:	Coordinate direction changed compared to input						
5	1	3	1	1	.000	.00	.28	-.06
						.00	.58	-.06
						-.25	.31	-.08
	Note:	Coordinate direction changed compared to input						
6	1	6	1	1	.000	.00	-.31	.00
						-.23	-.28	-.08
						-.14	-.16	-.05
						-.14	.16	-.05
						-.23	.28	-.08
						.00	.31	.00
7	1	4	1	1	.000	.00	.28	-.06
						.00	.28	-.14
						-.28	.34	-.22
						-.07	.31	-.07
8	1	4	1	1	.000	-.07	-.31	-.07
						.00	-.28	-.06
						.00	-.28	-.14
						-.28	-.34	-.22
	Note:	Coordinate direction changed compared to input						
9	1	5	1	1	.007	.00	.28	-.06
						.00	.28	-.14
						.73	.28	-.05
						.67	.28	.00

						.41	.28	.00
10	1	5	1	1	.007	.41	-.28	.00
						.67	-.28	.00
						.73	-.28	-.05
						.00	-.28	-.14
						.00	-.28	-.06
11	1	5	1	1	.008	-.05	-.31	.00
						-.28	-.31	-.10
						-.28	-.31	-.07
						-.13	-.28	.03
						-.07	-.31	.03
12	1	5	1	1	.008	-.05	.31	.00
						-.07	.31	.03
						-.13	.28	.03
						-.28	.31	-.07
						-.28	.31	-.10
		Note:	Coordinate direction changed compared to input					
13	1	6	1	1	.000	-.08	.32	-.08
						-.24	.34	-.09
						-.35	.37	-.13
						-.38	.37	-.18
						-.36	.35	-.23
						-.28	.34	-.23
		Note:	Coordinate direction changed compared to input					
14	1	6	1	1	.000	-.08	-.32	-.08
						-.28	-.34	-.23
						-.36	-.35	-.23
						-.38	-.37	-.18
						-.35	-.37	-.13
						-.24	-.34	-.09
15	2	5	1	1	.008	.40	.00	.81
						.69	.00	.98
						.68	.00	.86
						.57	.00	.84
						.50	.00	.76
16	2	4	1	1	.011	-.12	.30	-.03
						-.10	.30	-.03
						.49	.00	.79
						.47	.00	.79
17	2	4	1	1	.013	.52	.30	-.03
						.53	.30	-.03
						.65	.00	.87
						.64	.00	.87
18	2	4	1	1	.011	-.12	-.30	-.03
						.47	.00	.79
						.49	.00	.79
						-.10	-.30	-.03
19	2	4	1	1	.013	.52	-.30	-.03
						.64	.00	.87
						.65	.00	.87
						.53	-.30	-.03

Interaction parameters:

```
Line      Nc    = Default
          Fmud  = 0.7/0.2
          Femb  =     .30
Anchor    Nc    = Default
          F     =    1.00
```

Scaling:

```
    Dimension  Sw    =   1.800
               Sl    =   1.414

    Rotation   Group =   2
               Angle =    .000 deg
               X     =    .203 m
               Z     =    .000 m
```

Anchor after scaling :

```
    Fluke/Shank angle after scaling :   54.24  (Connection/Back/Tip)

    Line connection:

         X =      .95
         Z =     1.32
         Grp :    2

    Anchor tip:

         X =     1.01
         Z =      .00
         Grp :    1

    Anchor back:

         X =      .00
         Z =      .00
         Grp :    1

    Weight data:

         W =     3.60 kN

         COG   X =      .14
               Z =     -.04

    Anchor groups:   2
```

No.	Definition
1	Fluke
2	Shanck

Anchor members: 19

No.	Group	Nodes	Cross section shape Side	Front	F.Area	X	Y	Z
1	1	11	2	1	.022	.00	.40	.00
						.58	.55	.00
						.83	.45	.00
						.94	.38	.00
						.66	.10	.00
						.62	.00	.00
						.66	-.10	.00
						.94	-.38	.00
						.83	-.45	.00
						.58	-.55	.00
						.00	-.40	.00
2	1	3	1	1	.008	.00	-.40	.00
						.58	-.55	.00
						.00	-.83	-.09
3	1	3	1	1	.008	.00	.83	-.09
						.58	.55	.00
						.00	.40	.00

4	1	3	1	1	.000	.00	-.83	-.09
						.00	-.40	-.09
						-.35	-.44	-.11
5	1	3	1	1	.000	.00	.40	-.09
						.00	.83	-.09
						-.35	.44	-.11
6	1	6	1	1	.000	.00	-.44	.00
						-.32	-.40	-.11
						-.19	-.22	-.07
						-.19	.22	-.07
						-.32	.40	-.11
						.00	.44	.00
7	1	4	1	1	.000	.00	.40	-.09
						.00	.40	-.20
						-.40	.48	-.32
						-.10	.43	-.10
8	1	4	1	1	.000	-.10	-.43	-.10
						.00	-.40	-.09
						.00	-.40	-.20
						-.40	-.48	-.32
9	1	5	1	1	.014	.00	.40	-.09
						.00	.40	-.20
						1.03	.40	-.07
						.94	.40	.00
						.58	.40	.00
10	1	5	1	1	.014	.58	-.40	.00
						.94	-.40	.00
						1.03	-.40	-.07
						.00	-.40	-.20
						.00	-.40	-.09
11	1	5	1	1	.016	-.07	-.43	.00
						-.40	-.44	-.15
						-.40	-.43	-.10
						-.19	-.39	.04
						-.10	-.43	.04
12	1	5	1	1	.016	-.07	.43	.00
						-.10	.43	.04
						-.19	.39	.04
						-.40	.43	-.10
						-.40	.44	-.15
13	1	6	1	1	.000	-.11	.45	-.11
						-.34	.48	-.12
						-.49	.52	-.18
						-.54	.52	-.25
						-.50	.49	-.33
						-.40	.48	-.32
14	1	6	1	1	.000	-.11	-.45	-.11
						-.40	-.48	-.32
						-.50	-.49	-.33
						-.54	-.52	-.25
						-.49	-.52	-.18
						-.34	-.48	-.12
15	2	5	1	1	.016	.57	.00	1.14
						.98	.00	1.39
						.96	.00	1.21
						.80	.00	1.19
						.70	.00	1.08
16	2	4	1	1	.022	-.17	.42	-.04
						-.15	.42	-.04

						.69	.00	1.12
						.67	.00	1.12
17	2	4	1	1	.026	.74	.42	-.04
						.75	.42	-.04
						.92	.00	1.23
						.91	.00	1.23
18	2	4	1	1	.022	-.17	-.42	-.04
						.67	.00	1.12
						.69	.00	1.12
						-.15	-.42	-.04
19	2	4	1	1	.026	.74	-.42	-.04
						.91	.00	1.23
						.92	.00	1.23
						.75	-.42	-.04

Triggering of anchor :

Anchor triggering at depth : 11.01
Anchor group to be rotated : 2

SUMMARY OF CALCULATIONS :

Dep	Tension								Penetr.		Lengths				Distances			
	Fairlead		Seabed				Anchor		Dir.	Orien.	Susp	Seab	Embd	Pull	Susp	Seab	Embd	Pen.
	TF	AngF	TTD	AngTD	TDD	AngDD	TA	AngA	AngD	AngO	LS	LM	LE	LP	DS	DM	DE	DP
.1	38	4.7	38	2.9	38	2.9	38	7.1	147.0	147.0	41	0	1	79	41	0	1	.1
.5	60	4.6	60	3.5	60	3.5	59	13.6	124.0	124.0	38	0	3	79	38	0	3	.6
1.0	67	4.8	67	3.9	67	3.9	65	17.9	121.0	121.0	35	0	5	80	35	0	5	1.3
1.5	65	5.1	65	4.2	65	4.2	63	22.7	114.0	114.0	33	0	6	81	33	0	6	2.3
2.0	66	5.4	66	4.6	66	4.6	64	25.5	111.0	111.0	31	0	7	82	31	0	7	3.5
2.5	70	5.7	70	5.0	70	5.0	68	28.1	109.0	109.0	29	0	9	83	28	0	8	4.9
3.0	75	6.2	75	5.6	75	5.6	72	29.7	108.0	108.0	26	0	10	85	26	0	9	6.4
3.5	79	6.8	79	6.3	79	6.3	76	31.6	106.0	106.0	24	0	11	86	24	0	10	8.0
4.0	84	7.5	84	7.1	84	7.1	81	33.3	105.0	105.0	21	0	12	88	21	0	11	9.8
4.5	89	8.5	89	8.1	89	8.1	85	34.8	104.0	104.0	19	0	12	90	18	0	11	11.7
5.0	92	9.7	92	9.4	92	9.4	89	36.4	102.0	102.0	16	0	13	92	16	0	12	13.9
5.5	96	11.7	96	11.4	96	11.4	92	38.2	100.0	100.0	13	0	13	94	13	0	12	16.5
6.0	101	14.2	101	14.0	101	14.0	97	39.9	99.0	99.0	11	0	13	96	11	0	12	19.5