TUGAS AKHIR – MO141326

ANALISIS *BUCKLING* SELAMA PROSES *ABANDONMENT AND RECOVERY* PADA *PIPELINE* 20” DI SANGATTA, KALIMANTAN TIMUR

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JURUSAN TEKNIK KELAUTAN
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BUCKLING ANALYSIS DURING ABANDONMENT AND RECOVERY PROCESS OF 20" PIPELINE IN SANGATTA, EAST KALIMANTAN

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TUGAS AKHIR

Diajukan untuk memenuhi salah satu syarat memperoleh gelar Sarjana Teknik (S.T)
pada Program Studi S-1 Jurusan Teknik Kelautan Fakultas Teknologi Kelautan
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SURABAYA, JULI 2016

ANALISIS *BUCKLING* SELAMA PROSES *ABANDONMENT AND RECOVERY* PADA *PIPELINE* 20" DI SANGATTA, KALIMANTAN TIMUR

Nama : Moch. Ardiansyah

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Abstrak

Dalam pelaksanaannya, proses instalasi sebuah *subsea pipeline* tidak sepenuhnya akan berjalan sesuai yang direncanakan. Ada beberapa hal yang bisa membuat proses instalasi tersebut harus dihentikan sementara, misalnya cuaca buruk, peralatan instalasi mengalami kerusakan, dan terjadi *buckling* pada *pipeline* saat proses instalasi. Jika salah satu peristiwa di atas terjadi, maka langkah mitigasi yang bisa dilakukan adalah *abandonment and recovery*. Secara garis besar, *abandonment and recovery* ini adalah langkah mitigasi yang dilakukan dengan menurunkan *pipeline* ke dasar laut hingga proses instalasi bisa berjalan kembali. Setelah segala sesuatunya siap dan proses instalasi akan dilanjutkan, maka *pipeline* dinaikkan kembali ke atas *pipe lay barge*. Proses *abandonment and recovery* ini dilakukan dengan bantuan A&R *winch.* Pada penelitian ini dilakukan analisis *abandonment and recovery* dengan variasi jarak ujung *stinger* terhadap permukaan laut. Ada 3 variasi yang dilakukan, yakni 3m, 4m, dan 5m. Dari hasil analisis yang dilakukan, diketahui bahwa pada jarak ujung *stinger* terhadap permukaan laut yang bernilai 3m dan 5m, *pipeline* mengalami kegagalan karena tegangan ekuivalen yang terjadi melebih batas aman (87% SMYS) yakni 398.49 Mpa (110.69% SMYS) dan 394.15 Mpa (109.49% SMYS). Selain itu, nilai *unity check* untuk *local buckling* juga melebihi 1 yakni 1.414 dan 1.382. Sedangkan untuk jarak ujung *stinger* terhadap permukaan laut yang bernilai 4m, *pipeline* tidak mengalami kegagalan karena tegangan ekuivalen yang terjadi sebesar 306.29 Mpa (85.08% SMYS) dan nilai *unity check* bernilai 0.821 pada *overbend* dan 0.789 pada *sagbend*.

Kata Kunci: *abandonment and recovery*, tegangan ekuivalen, *local buckling*, *unity check*

BUCKLING ANALYSIS DURING ABANDONMENT AND RECOVERY PROCESS OF 20" PIPELINE IN SANGATTA, EAST KALIMANTAN

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Abstract

In practice, the installation of a subsea pipeline was not fully be progressing as planned. There are several things that can make the installation has to be stopped temporarily, for example, bad weather, equipment installation was damaged, and the buckling occurs in the pipeline during the installation process. If any of the above events occurs, then the mitigation measures that can be done is the abandonment and recovery. Abandonment and recovery are mitigation measures undertaken by lowering the pipeline into the seabed until the installation is able to walk again. Once everything was ready and the installation process will continue, then the pipeline is raised back up the pipe lay barge. Abandonment and recovery process is done with the help of A & R winch. In this research, analysis of abandonment and recovery with variation of stinger stern depth. There are 3 variations, namely 3m, 4m and 5m. From the analysis, it is known that the stinger stern depth that is worth 3m and 5m, pipeline failure occurred because the equivalent stress exceeds safe limits (87% SMYS) ie 398.49 Mpa (110.69% SMYS) and 394.15 Mpa (109.49% SMYS). In addition, the value of unity check for local buckling also exceeds 1, ie, 1.235 and 1.207. As for the stinger stern depth that is worth 4m, not pipeline failure occurred because the equivalent stress of 306.29 Mpa (85.08% SMYS) and the value of unity in overbend check worth 0.717 and 0.689 on sagbend.

Keywords : abandonment and recovery, equivalent stress, local buckling, unity check

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PENUTUP

V.1 Kesimpulan

Berdasarkan analisis dan pembahasan yang telah dilakukan pada bab yang sebelumnya, maka dapat ditarik beberapa kesimpulan mengenai topik dalam tugas akhir ini, yaitu :

1. Karakteristik gerak *pipe lay barge* pada gelombang reguler untuk gerakan *surge,* nilai terbesar terjadi karena gelombang datang arah 0°&180° yaitu bernilai 0.91 m/m. Untuk gerakan *sway*, nilai terbesarnya adalah 0.97 m/m. Lalu untuk gerakan *heave*, nilai terbesarnya adalah 1.22 m/m. Sedangkan untuk gerakan *roll*, nilai terbesarnya adalah 11.72 deg/m. Pada gerakan *sway*,*heave,* dan *roll*, nilai terbesar terjadi karena gelombang datang arah 90°. Kemudian untuk grakan *pitch* dan *yaw*, nilai terbesarnya berturut-turut yaitu 5.10 deg/m dan 1.81 deg/m.
2. Selama proses *abandonment and* recovery, *pipeline* mengalami tegangan yang berlebih (*overstress*) pada saat jarak ujung *stinger* terhadap permukaan laut bernilai 3m dan 5m. Pada saat jarak ujung *stinger* terhadap permukaan laut bernilai 3m, tegangan ekuivalen terbesar yang terjadi sebesar 398.49 Mpa (110.69% SMYS) dan pada saat bernilai 5m, tegangan ekuivalen terbesar yang terjadi sebesar 394.15 Mpa (109.49% SMYS). Sedangkan pada saat jarak ujung *stinger* terhadap permukaan laut bernilai 4m, *pipeline* tidak mengalami tegangan yang berlebih (*overstress*) karena tegangan ekuivalen terbesar yang terjadi sebesar 306.29 Mpa (85.08% SMYS).
3. *Local buckling* terjadi pada saat jarak ujung *stinger* terhadap permukaan laut bernilai 3m dan 5m, karena nilai *unity check* pada saat 3m adalah 1.414 dan pada 5m bernilai 1.382. Sedangkan pada jarak ujung *stinger* yang bernilai 4m, tidak terjadi *local buckling,* karena nilai *unity check* untuk perhitungan *local buckling* adalah 0.821 pada *overbend* dan 0.789 pada *sagbend*.

V.2 Saran

Saran yang bisa diberikan untuk penelitian selanjutnya mengenai tugas akhir ini adalah sebagai berikut :

1. Perlu ditambahkan mengenai pengaruh pasang surut air laut selama proses *abandonment and recovery*.
2. Pemodelan lebih mendetail mengenai *pulling head* (sambungan *cable* dengan *pipeline*)
3. Perlu ditambahkan *mooring analysis* selama proses *abandonment and recovery*.

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BIODATA PENULIS

Moch. Ardiansyah lahir di Surabaya pada tanggal 30 Januari 1994. Penulis merupakan anak pertama dari dua bersaudara. Penulis mempunyai orang tua yang bernama Moch. Nuh Effendi dan Aris Hidayati. Selain itu, penulis mempunyai adik yang bernama Figo Arfiansyah. Selama ini penulis bertempat tinggal di jl. Kedung Sroko 16 A Surabaya. Pada waktu jenjang taman kanak-kanak, penulis bersekolah di TK Diponegoro Surabaya. Kemudian penulis melanjutkan pendidikan jenjang sekolah dasar di SDN Pacarkeling VI Surabaya. Setelah itu, penulis melanjutkan pendidikan jenjang menengah pertama dan menengah atas di SMPN 3 Surabaya dan SMAN 6 Surabaya. Selama di SMAN 6 Surabaya, penulis aktif dalam kegiatan ekstrakurikuler futsal. Selama 3 tahun, penulis aktif dalam ektrakurikuler futsal tersebut. Penulis juga beberapa mengikuti lomba futsal di tingkat regional dan kota untuk mewaakili SMAN 6 Surabaya. Setelah lulus, penulis diterima di Jurusan Teknik Kelautan Institut Teknologi Sepuluh Nopember Surabaya. Penulis diterima melalui jalur Seleksi Nasional Masuk Perguruan Tinggi Negeri (SNMPTN) tahun 2012. Selama mahasiswa, penulis aktif dalam berbagai kepanitian dan organisasi mahasiswa. Salah satunya, penulis pernah mengikuti kepanitian ITS EXPO tahun 2012. Pada tahun kedua, penulis terdaftar sebagai staff BEM ITS dan staff di Himpunan Mahasiswa Teknik Kelautan FTK ITS. Pada saat di BEM ITS, penulis pernah menjadi *Steering Committe* (SC) untuk kegiatan *Surabaya Education Great Event*. Pada tahun ketiga, penulis menjadi ketua Himpunan Mahasiswa Teknik Kelautan FTK ITS periode 2014-2015. Selain aktif dalam berbagai kegiatan kemahasiswaan penulis juga aktif dalam tim kepemanduan FTK ITS pada tahun 2014 dan 2015. Penulis juga pernah mengikuti Latihan Keterampilan Manajemen Mahasiswa Tingkat Pra-Dasar (LKMM Pra TD) dan Tingkat Dasar (LKMM TD). Penulis juga pernah menjalani kerja praktek kurang lebih selama 2 bulan di PT. Dwisatu Mustika Bumi pada tahun 2015. Pada tahun keempat, penulis mengambil tugas akhir dalam bidang perencanaan dan perancangan pipa bawah laut. Judul tugas akhir penulis adalah Analisis *Buckling* selama Proses *Abandonment and Recovery* pada *Pipeline* 20" di Sangatta, Kalimantan Timur. Selama pengerjaan tugas akhir tersebut, penulis dibimbing oleh Bapak Ir. Imam Rochani, M.Sc. dan Bapak Ir. Handayanu, M.Sc., Ph.D.

BAB I

PENDAHULUAN

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I.1 Latar Belakang Masalah

Pendistribusian hasil pengeboran berupa minyak mentah atau gas alam pada umumnya dilakukan dengan dua cara, yaitu dengan pipa bawah laut (*subsea pipeline*) dan secara curah (misal : tanker, kapal kargo). Pendistribusian dengan *subsea pipeline* relatif aman dibandingkan dengan pendistribusian secara curah (Soegiono, 2007). Dengan tingkat keamanan yang baik saat instalasi akan memberikan investasi jangka panjang yang menguntungkan sesuai umur operasi yang telah direncanakan.

Dalam merancang sebuah *subsea pipeline*, harus mempertimbangkan beberapa moda kegagalan yang akan terjadi pada *subsea pipeline*, diantaranya *buckling, fatigue,* maupun *overstress*. Salah satu tahap yang yang harus direncanakan dan dilakukan analisis agar tidak terjadi kegagalan pada *subsea pipeline* adalah tahap instalasi. Perencanaan dan analisis tersebut perlu dilakukan untuk memastikan tegangan yang bekerja pada *subsea pipeline* pada saat proses instalasi tidak melebihi tegangan yang diizinkan dan memastikan *subsea pipeline* tidak mengalami *buckling*. *Bending stress* maksimum pada *pipeline* terjadi akibat gerakan *surge, heave, pitch* (Brewer and Dixon, 1969). Hal yang biasa dilakukan agar tidak terjadi kegagalan (tegangan yang berlebihan dan *buckling*) pada *subsea pipeline* saat instalasi adalah mengatur kurvatur *stinger* pada *pipe lay barge* sebagai tumpuan pada saat proses instalasi (Guo, 2014).

Dalam pelaksanaannya, proses instalasi sebuah *subsea pipeline* tidak sepenuhnya akan berjalan sesuai yang direncanakan. Hal-hal yang bisa menyebabkan terganggunya atau bahkan menyebabkan terhentinya proses instalasi sebuah *subsea pipeline* juga harus dipertimbangkan, misalnya cuaca buruk, peralatan instalasi mengalami kerusakan, dan terjadi *buckling* pada *pipeline* saat proses instalasi. Ketiga peristiwa tersebut tentunya tidak diharapkan terjadi saat proses instalasi sebuah *subsea pipeline*.

Sebagai seorang insinyur, kita juga harus bisa mengantisipasi jika salah satu peristiwa di atas, terjadi saat instalasi sebuah *subsea pipeline*. Jika salah satu peristiwa di atas terjadi, maka hal yang harus dilakukan adalah *abandonment and recovery*. *Abandonment and recovery* adalah dua proses yang sangat berbeda dan berkebalikan (Satrio, 2016). *Abandonment* artinya menurunkan pipa di dasar laut kemudian ditinggalkan untuk sementara dan akan dilanjutkan proses instalasinya jika keadaan memungkinkan. Sedangkan *recovery*

adalah proses kebalikan dari *abandonment*, yakni proses mengangkat dan menaikkan pipa kembali ke atas *pipe lay barge* (Soegiono, 2007).

Namun, akhir-akhir ini *abandonment and recovery* tidak hanya dilakukan sebagai langkah mitigasi saja, melainkan *abandonment and recovery* ini juga dilakukan dalam rangka proses instalasi pipa bawah laut yang menggunakan lebih dari satu *pipe lay barge*. Sehingga saat akan dilakukan pergantian *pipe lay barge*, maka *abandonment and recovery* ini harus dilakukan.

Selama proses *abandonment and recovery* ini, pipa sangat rentan mengalami tegangan yang berlebihan (*overstress*) akibat beban-beban yang bekerja pada pipa tersebut. Selain itu, pipa juga rentan mengalami *local buckling* selama proses tersebut. Sehingga perlu dilakukan penelitian lebih lanjut mengenai proses *abandonment and recovery* pada pipa bawah laut.

I.2 Perumusan Masalah

Permasalahan yang di bahas pada penelitian tugas akhir ini adalah

1. Bagaimana karakteristik gerak *pipe lay barge* pada gelombang reguler ?
2. Bagaimana tegangan dan gaya-gaya yang terjadi pada *pipeline* saat proses *abandonment and recovery* ?
3. Bagaimana *local buckling* yang terjadi pada *pipeline* saat proses *abandonment and recovery* ?

I.3 Tujuan

Adapun tujuan yang dicapai dalam penelitian tugas akhir ini adalah

1. Mengetahui serta menganalisis karakteristik gerak *pipe lay barge* pada gelombang reguler.
2. Mengetahui serta menganalisis tegangan dan gaya-gaya yang terjadi pada *pipeline* selama proses *abandonment and recovery*.
3. Menganalisis *local buckling* yang terjadi selama proses *abandonment and recovery.*

I.4 Manfaat

Hasil penelitian dalam tugas akhir ini diharapkan mampu memberikan referensi kepada pembaca dalam melakukan analisis instalasi *subsea pipeline*, khususnya untuk analisis *abandonment and recovery*. Selain itu, hasil penelitian ini juga bisa dijadikan rujukan untuk merencakan proses *abandonment and recovery*.

I.5 Batasan Masalah

Untuk memfokuskan ruang lingkup dari permasalahan yang telah dijabarkan di atas, maka permasalahan akan dibatasi pada hal-hal berikut:

1. Data yang digunakan adalah data *pipeline* 20” OD milik PT Kaltim Prima *Coal* (KPC) yang ada di Sangatta, Kalimantan Timur.
2. Metode instalasi *subsea pipeline* yang digunakan adalah *S-lay method*.
3. Pelaksanaan *abandonment and recovery* menggunakan *reverse lay barge method* dengan bantuan A&R *winch*.
4. Jarak ujung *stinger* terhadap permukaan laut yang digunakan dalam analisis ini adalah 3m, 4m, dan 5m.
5. Perhitungan tegangan yang terjadi pada *subsea pipeline* menggunakan *software* OFFPIPE.
6. Arah datang gelombang adalah 0°, 45°, 90°, 135°, 180° terhadap *pipe lay barge*.
7. Sistem penambatan (*mooring*) tidak dimodelkan
8. Bangunan atas dari *pipe lay barge* tidak dimodelkan
9. *Seabed* dianggap datar.
10. Massa kabel A&R *winch* diabaikan.
11. Panjang *stinger* konstan.
12. *Radius of curvature* konstan.

(Halaman ini sengaja dikosongkan)

BAB II

TINJAUAN PUSTAKA DAN DASAR TEORI

BAB II
TINJAUAN PUSTAKA DAN DASAR TEORI

II.1 Tinjauan Pustaka

Pipa bawah laut merupakan suatu alat transportasi hidrokarbon dari satu tempat ke tempat lain. Umumnya, pipa bawah laut ini digunakan untuk memindahkan hidrokarbon dari *wellhead atau reservoir* menuju *production facility* (FPSO atau platform). Pipa bawah laut ini merupakan alternatif lain untuk transportasi hidrokarbon (fluida) yang biasanya menggunakan kapal tanker. Investasi awal dari pipa bawah laut ini sangat tinggi tetapi struktur ini memiliki biaya operasi rendah dibandingkan dengan kapal tanker. Dalam hal operabilitas saat cuaca buruk, pipa bawah laut juga lebih unggul dibandingkan dengan kapal tanker yang memiliki keterbatasan operasi. Sebelum beroperasi, sebuah pipa bawah laut akan melalui tahap instalasi.

Ada banyak permasalahan yang bisa terjadi saat proses instalasi pipa, namun ada sebuah kondisi dimana proses instalasi pipa tersebut harus dihentikan dan dilakukan *abandonment and recovery*. Secara garis besar, *abandonment and recovery* ini adalah langkah mitigasi yang dilakukan dengan menurunkan pipa ke dasar laut hingga proses instalasi bisa berjalan kembali. Setelah segala sesuatunya siap dan proses instalasi akan dilanjutkan, maka pipa dinaikkan kembali ke atas *pipe lay barge*. *Abandonment and recovery* adalah langkah mitigasi yang dilakukan saat terjadi cuaca buruk saat instalasi, peralatan instalasi mengalami kerusakan yang parah sehingga instalasi harus dihentikan untuk sementara waktu, pipa mengalami *buckling* saat proses instalasi. Selain itu, *abandonment and recovery* juga bisa dilakukan saat proses instalasi pipa yang menggunakan 2 *pipe lay barge* yang berbeda.

Datta (1982) telah melakukan penelitian mengenai pengaruh kecepatan arus terhadap tegangan pada pipa dalam proses *abandonment and recovery*. Dalam penelitian ini, beban yang dianalisis adalah beban statis selama proses *abandonment and recovery*.

Satrio (2016) telah melakukan penelitian terkait tegangan yang dialami pipa saat proses *abandonment and recovery*. Namun perlu adanya penelitian mengenai kemungkinan terjadinya *local buckling* saat proses *abandonment and recovery*.

Penelitian mengenai terjadinya *local buckling* pada saat proses *abandonment and recovery* sangat penting, karena bisa mengakibatkan perubahan penampang pada pipa. Ayu (2014) pernah melakukan penelitian tentang optimasi konfigurasi sudut *stinger* dan kedalaman laut dengan *local buckling check*. Namun penelitian tersebut dilakukan pada saat

proses instalasi pipa bawah laut. Rosyidi (2015) juga pernah melakukan penelitian mengenai *local buckling*, namun variasi dilakukan terhadap *radius curvature* saat proses instalasi.

Berdasarkan penelitian-penelitian yang telah dilakukan sebelumnya, maka penulis mengajukan penelitian mengenai *local buckling* yang terjadi selama proses *abandonment and recovery*. Dalam penelitian ini, penulis melakukan analisis *local buckling* dengan variasi jarak ujung *stinger* terhadap permukaan air laut (*stinger stern depth*).

II.2 Dasar Teori

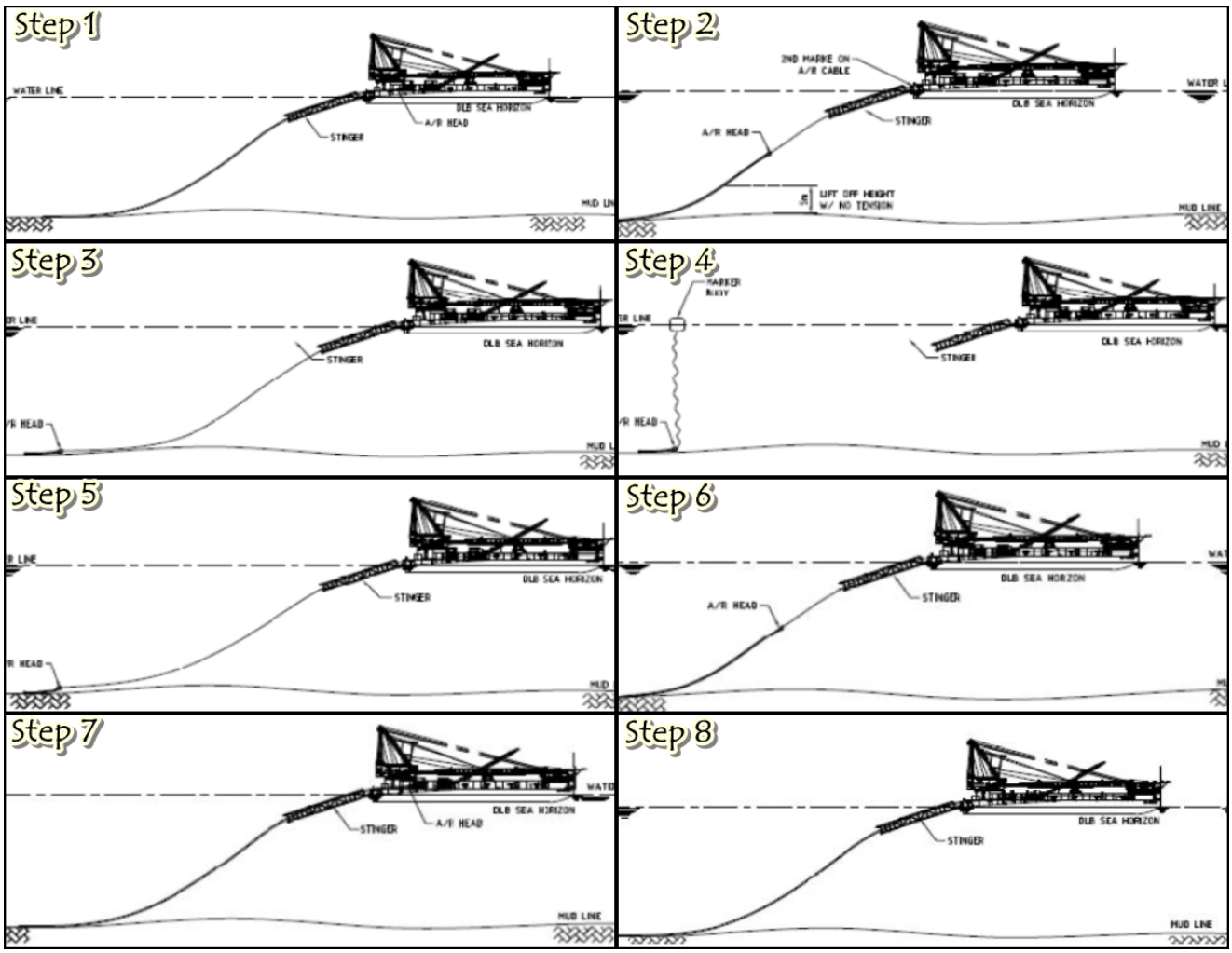
II.2.1 *Abandonment and Recovery*

Abandonment and recovery adalah sebuah langkah mitigasi yang biasanya dilakukan saat proses instalasi pipa bawah laut yang tengah berlangsung, mengalami gangguan dan menyebabkan proses instalasi tersebut harus dihentikan sementara waktu. Ada 3 hal yang bisa menyebabkan proses instalasi pipa bawah laut akan terganggu atau bahkan bisa berhenti, yaitu:

a. Terjadi cuaca buruk
b. Peralatan instalasi mengalami kerusakan
c. Pipa mengalami *buckling* saat instalasi

Menurut Satrio (2016), *abandonment and recovery* adalah dua proses yang berbeda, dimana *abandonment* adalah proses yang dilakukan untuk menurunkan pipa ke dasar laut dengan bantuan A&R *winch* dan *barge movement*. A&R *winch cable* diikatkan pada *cap* (ujung pipa yang telah ditutup) untuk mencegah pipa agar tidak kemasukan air. Setelah pipa terletak di dasar laut, maka pipa tersebut ditinggalkan oleh barge hingga proses instalasi bisa dilanjutkan kembali. Biasanya ujung pipa tersebut, diikatkan ke *buoy* yang ada di permukaan air laut untuk memudahkan pencarian pipa saat proses instalasi akan dilanjutkan. Sedangkan *recovery* adalah kebalikan dari *abandonment*, proses pengangkatan pipa dari dasar laut ke atas *pipe lay barge*. Proses *recovery* ini juga dibantu dengan A&R *winch* dan *reverse barge movement* (Brown, 1997).

Selain untuk mitigasi, *abandonment and recovery* juga bisa dilakukan saat instalasi sebuah pipa bawah laut yang dirancang untuk menggunakan lebih dari satu *pipe lay barge*. Sehingga pada saat akan terjadi pergantian *pipe lay barge*, maka *abandonment and recovery* ini akan dilakukan. Proses *abandonment and recovery* ini bisa dilihat pada Gambar 2.1 di bawah ini



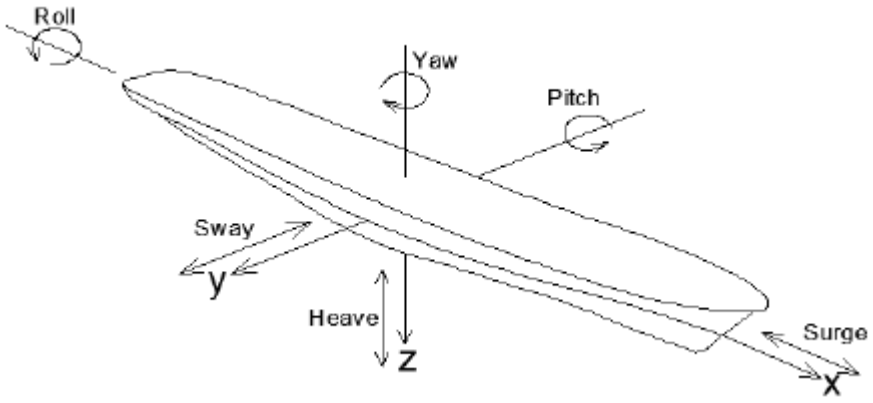
Gambar 2.1 Proses *Abandonment and Recovery* Pipa Bawah Laut dengan Metode *Reverse Laybarge* (*Training* OFFPIPE)

II.2.2 Teori Dasar Gerakan Bangunan Apung

Bangunan apung (dalam hal ini *pipe lay barge*) memiliki enam mode gerakan bebas (*Six Degree of Freedom)* yang terbagi menjadi dua kelompok, yaitu 3 mode gerakan translasional dan 3 mode gerakan rotasional dalam 3 arah sumbu (Bhattacharyya, 1978).

Seperti yang ditunjukkan pada Gambar 2.2, berikut adalah penjelasan keenam mode gerakan tersebut :

1. Mode Gerak Translasional
   a. *Surge*, gerakan transversal arah sumbu x
   b. *Sway*, gerakan transversal arah sumbu y
   c. *Heave*, gerakan transversal arah sumbu z
2. Mode Gerak Rotasional
   a. *Roll*, gerakan rotasional arah sumbu x
   b. *Pitch*, gerakan rotasional arah sumbu y
   c. *Yaw*, gerakan rotasional arah sumbu z



Gambar 2.2 Enam Derajat Kebebasan Gerakan Struktur Terapung (Hasanudin,2015)

Dari Gambar 2.2 di atas dapat kita ketahui bahwa hanya 3 macam gerakan yang merupakan gerakan osilasi murni yaitu *heaving, rolling dan pitching*, karena gerakan ini bekerja dibawah gaya atau momen pengembali ketika struktur itu terganggu dari posisi kesetimbangannya. Untuk gerakan *surging, swaying* dan *yawing* struktur tidak kembali menuju posisi kesetimbangannya semula kalau diganggu, kecuali ada gaya atau momen pengembali yang menyebabkannya bekerja dalam arah berlawanan.

II.2.3 *Response Amplitude Operator* (RAO)

Response Amplitude Operator (RAO) atau disebut juga dengan *transfer function* merupakan fungsi respon yang terjadi akibat gelombang dalam rentang frekuensi yang mengenai sruktur. RAO merupakan alat untuk mentransfer gaya gelombang menjadi respon gerakan dinamis struktur.

RAO memuat informasi tentang karakteristik gerakan bangunan laut yang disajikan dalam bentuk grafik, dimana absisnya adalah parameter frekuensi, sedangkan ordinatnya adalah rasio antara amplitudo gerakan pada mode tertentu, ζ_{k0}, dengan amplitudo gelombang, ζ_0. Menurut Chakrabarti (1987), RAO dapat dicari dengan Persamaan 2.1 di bawah ini:

$$RAO(\omega) = \frac{\zeta_{k0}(\omega)}{\zeta_0(\omega)} \quad \text{(m/m)} \tag{2.1}$$

dengan:

$\zeta_{k0}(\omega)$ = amplitudo struktur (m)

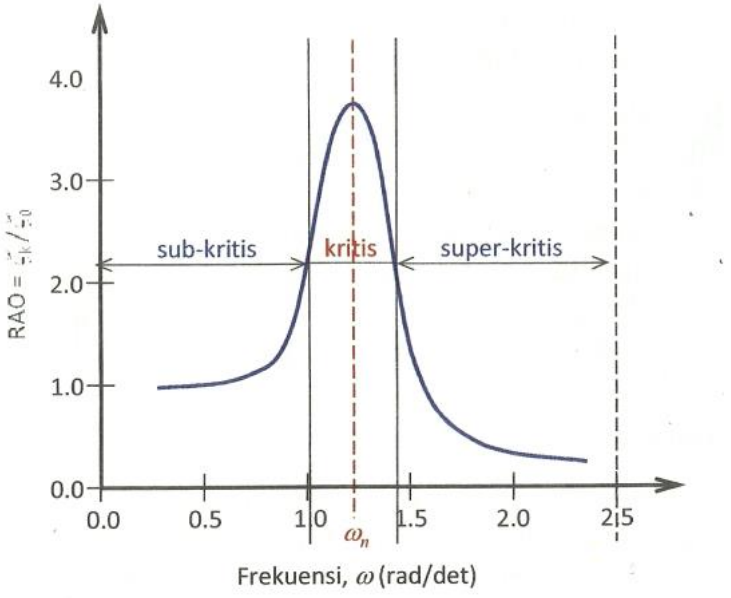
$\zeta_0(\omega)$ = amplitudo gelombang (m)

Respons gerakan RAO untuk gerakan translasi (*surge, sway, heave*) merupakan perbandingan langsung antara amplitudo gerakan dibanding dengan amplitudo gelombang

insiden (keduanya dalam satuan panjang) (Djatmiko, 2012). Persamaan RAO untuk gerakan translasi sama dengan Persamaan 2.1 di atas.

Sedangkan untuk respons gerakan RAO untuk gerakan rotasi (*roll*, *pitch*, *yaw*) merupakan perbandingan antara amplitudo gerakan rotasi (dalam radian) dengan kemiringan gelombang, yakni yang merupakan perkalian antara gelombang ($k_w=\omega^2/g$) dengan amplitudo gelombang insiden (Djtamiko, 2012):

$$RAO(\omega)=\frac{\zeta_{k0}(\omega)}{\zeta_0(\omega)}=\frac{\zeta_{k0}}{(\omega^2/g)\zeta_0}\ \text{(rad/rad)} \tag{2.2}$$



Gambar 2.3 Bentuk Umum Grafik Respons Gerakan Bangunan Apung (Djatmiko, 2012)

Berdasarkan Gambar 2.3 di atas, kurva respons gerakan bangunan apung pada dasarnya dapat dibagi menjadi tiga bagian:

- Pertama adalah bagian frekuensi rendah, atau gelombang (dengan periode) panjang, yang disebut daerah sub-kritis. Pada daerah ini bangunan laut akan bergerak mengikuti pola atau kontur elevasi gelombang yang panjang sehingga amplitudo gerakan kurang lebih akan ekuivalen dengan amplitudo gelombang, atau disebut sebagai *contouring*. Dalam korelasi persamaan hidrodinamis, di daerah frekuensi rendah, atau $\omega^2<k/(m+a)$, gerakan akan didominasi oleh faktor kekakuan.
- Kedua adalah daerah kritis, meliputi pertengahan lengan kurva di sisi frekuensi rendah sampai dengan puncak kurva dan diteruskan ke pertengahan lengan kurva

di sisi frekuensi tinggi. Puncak kurva berada pada frekuensi alami, yang merupakan daerah resonansi, sehingga respons gerakan mengalami magnifikasi, atau amplitudo gerakan akan beberapa kali lebih besar daripada amplitudo gelombang. Secara hidrodinamis di daerah frekuensi alami, yakni $k/(m+a)<\omega^2<k/a$, gerakan akan didominasi oleh faktor redaman.

- Ketiga adalah daerah super kritis, yaitu daerah frekuensi tinggi, atau gelombang-gelombag (dengan periode) pendek. Pada daerah ini respons gerakan akan mengecil. Semakin tinggi frekuensi, atau semakin rapat antara puncak-puncak gelombang yang berurutan, maka akan memberikan efek seperti bangunan laut bergerak di atas air yang relatif datar. Oleh karena itu gerakan bangunan laut diistilahkan sebagai *platforming*. Dalam hal korelasi hidrodinamis, gerakan di daerah frekuensi tinggi ini, dimana $\omega^2<k/a$, gerakan akan didominasi oleh faktor massa (Djatmiko, 2012).

II.2.4 Respons Bangunan Apung pada Gelombang Acak (Spektra Respons)

Respons bangunan apung pada khususnya kapal yang diakibatkan oleh eksitasi gelombang acak telah diperkenalkan pertama kali oleh St. Denis dan Pierson (1953). Gerakan bangunan apung dalam kondisi ideal dapat dihitung sebagai reaksi adanya eksitasi gelombang sinusoidal, dengan karakteristik tinggi atau amplitudo dan frekuensi tertentu. Perhitungan kemudian dilakukan dengan mengambil amplitudo gelombang yang konstan, namun harga frekuensinya divariasikan dengan interval kenaikan tertentu.

Gelombang acak merupakan superposisi dari komponen-komponen pembentuknya yang berupa gelombang sinusoidal dalam jumlah tidak terhingga. Tiap-tiap komponen gelombang mempunyai tingkat energi tertentu yang dikontribusikan, yang kemudian secara keseluruhan diakumulasikan dalam bentuk spektrum energi gelombang (Djatmiko, 2012).

Dalam analisis respons bangunan apung pada gelombang reguler dapat diketahui pengaruh interaksi hidrodinamik pada massa tambah, *potential damping* dan gaya eksternal. Analisis tersebut menghasilkan respon struktur pada gelombang reguler. Respon struktur pada gelombang acak dapat dilakukan dengan mentransformasikan spektrum gelombang menjadi spektrum respon. Spektrum respon didefinisikan sebagai respon kerapatan energi pada struktur akibat gelombang. Hal ini dapat dilakukan dengan mengalikan harga pangkat kuadrat dari *Response Amplitude Operator* (RAO) dengan spektrum gelombang pada daerah struktur bangunan apung tersebut beroperasi. Persamaan respons struktur secara matematis dapat dituliskan seperti Persamaan 2.3 di bawah ini :

$$S_R = [RAO(\omega)]^2 \; S(\omega) \tag{2.3}$$

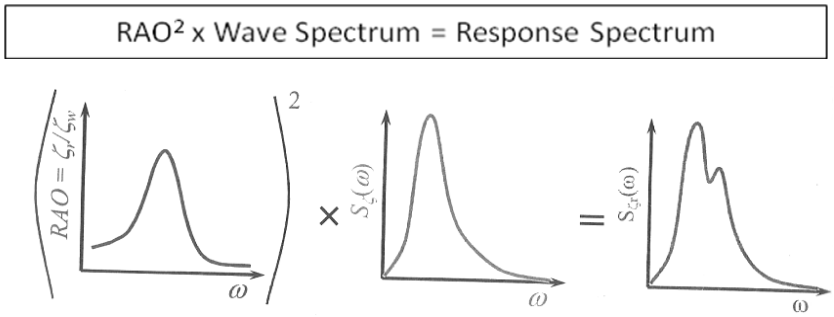
dengan :

S_R = Spektrum Respons (m^2-sec)

$S(\omega)$ = Spektrum Gelombang (m^2-sec)

$RAO(\omega)$ = *Transfer Function*

ω = Frekuensi Gelombang (rad/sec)



Gambar 2.4 Transformasi Spektra Gelombang menjadi Spektra Respons (Djatmiko, 2012)

II.2.5 Spektrum Gelombang

Pemilihan spektrum energi gelombang untuk memperoleh resposn spektra suatu struktur didasarkan pada kondisi aktual laut yang ditinjau. Bila tidak ada, maka dapat digunakan model spektrum yang dikeluarkan oleh berbagai institusi dengan mempertimbangkan kesamaan fisik lingkungan. Perubahan dari spektrum gelombang menjadi parameter-parameter gelombang, dapat dilihat pada tabel 2.1 berikut ini:

Tabel 2.1 Parameter Gelombang yang Didapat dari Spektrum Gelombang

Profil Gelombang	Amplitudo	Tinggi
Gelombang rata-rata	$1.25\sqrt{mo}$	$2.5\sqrt{mo}$
Gelombang signifikan	$2.00\sqrt{mo}$	$4.00\sqrt{mo}$
Rata-rata 1/10 gelombang tertinggi	$2.55\sqrt{mo}$	$5.00\sqrt{mo}$
Rata-rata 1/1000 gelombang tertinggi	$3.44\sqrt{mo}$	$6.67\sqrt{mo}$

dengan:

m_0 = Luasan dibawah kurva spektrum (zero moment) = $\int_0^{\omega} S_{(\omega)}\, d\omega$

Analisis spektrum gelombang dapat menggunakan beberapa teori spektrum gelombang yang telah ada, antara lain model spektrum JONSWAP, *Pierson-Moskowitz*, *Bretschneider*, ISSC ataupun ITTC. Model matematik spektrum secara umum didasarkan pada satu atau lebih parameter, misalnya tinggi gelombang signifikan, periode gelombang, faktor permukaan, dan lain-lain.

Salah satu model spektra adalah yang diajukan oleh *Pierson Morkowitz* pada 1964 dan masih secara luas digunakan. Aplikasi umum dari satu parameter spektrum gelombang *Pierson-Moskowitz* dibatasi oleh fakta jika kondisi laut adalah *fully developed*. Pengembangan dari laut juga dibatasi oleh *fetch*. Setelah itu, mulai dikembangkan suatu spektrum untuk perairan dengan batasan fetch tertentu. Dimana spektrum tersebut merupakan turunan dari spektra *Pierson-Moskowitz*, yakni dikehui sebagai *Joint North Sea Wave Project* (JONSWAP).

Pada Tugas Akhir ini, dalam analisisnya akan digunakan spektrum gelombang JONSWAP. JONSWAP merupakan proyek yang dilakukan pada perairan *North Sea*. Menurut DNV RP-C205 (2014), formulasi spektrum JONSWAP merupakan modifikasi dari spektrum *Pierson-Moskowitz*. Spektrum JONSWAP mendeskripsikan angin yang membangkitkan gelombang dengan kondisi *sea state* yang ekstrim. Kriteria yang ada di DNV RP-C205, bahwa spektrum JONSWAP dapat diaplikasikan untuk perairan dengan :

$$3.6 < T_p / (H_s)^{1/2} < 5 \tag{2.4}$$

Persamaan spektrum JONSWAP (DNV RP-F105) bisa dilihat pada Persamaan 2.5 di bawah ini :

$$S(\omega) = \alpha g^2 \omega^{-5} \exp\left(-\frac{5}{4}\left(\frac{\omega}{\omega_p}\right)^{-4}\right) \gamma^{\exp\left(-0.5\left(\frac{\omega-\omega_p}{\sigma\,\omega_p}\right)^2\right)} \tag{2.5}$$

dengan :

α = $\frac{5}{16}\frac{H_s^{\,2}\,\omega_p^{\,4}}{g^2}(1-0.287\ln\gamma)$

σ = *Spectral Width Parameter*

= 0,07 jika $\omega \leq \omega_p$

= 0,09 jika $\omega > \omega_p$

ω_p = *Angular Spectral Peak Frequency* (rad/s)

= 2π / Tp

ω = *Wave Frequency* (rad/s)

= 2π / T

Hs = Tinggi Gelombang Signifikan (m)

Tp = Periode Puncak (s)

T = Periode Gelombang (s)

Nilai *Peakedness Parameter* bisa dicari dengan menggunakan Persamaan 2.6 di bawah ini

$$\gamma = \begin{cases} 5 & \varphi \le 3.6 \\ \exp(5.75 - 1.15\varphi) & 3.6 < \varphi < 5 \\ 1 & \varphi \ge 5 \end{cases} \quad ; \quad \varphi = \frac{T_p}{\sqrt{H_S}} \tag{2.6}$$

Formulasi spektrum JONSWAP sering digunakan dalam perancangan dan analisis bangunan lepas pantai yang beroperasi di Indonesia. Hal ini dikarenakan perairan Indonesia adalah perairan kepulauan atau perairan tertutup. Namun, dari sejumlah kajian yang ada, dalam melakukan analisis bangunan lepas pantai yang dioperasikan di perairan Indonesia, maka nilai parammeter γ yang dipakai sekitar 2 – 2.5. Hal ini karena untuk mengurangi dominasi energi yang dikontribusikan oleh frekuensi gelombang tertentu saja.

II.2.6 *Hoop Stress*

Dalam pemilihan tebal pipa, pertimbangan tebal material untuk menahan perbedaan tekanan dari luar dan dari dalam yang disebut dengan *hoop stress* adalah sangat penting. Adapun formulasi untuk menghitung *hoop stress* berdasarkan DNV OS F101 adalah seperti Persamaan 2.7 berikut ini :

$$\sigma_h = (P_i - P_e)\frac{D-t}{2t} \tag{2.7}$$

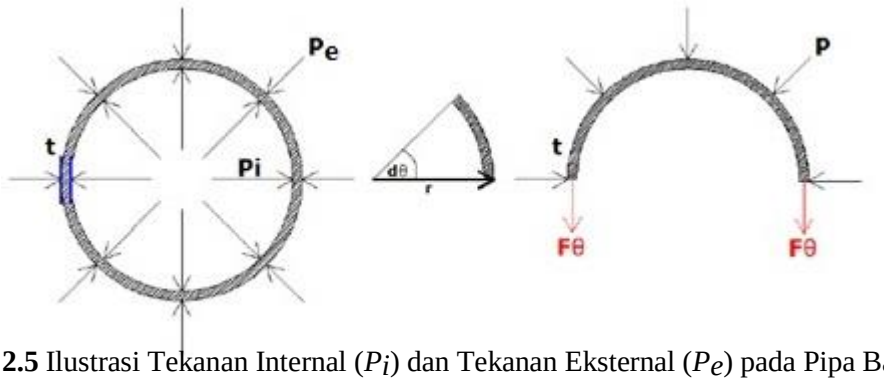
dimana

Pi = *Internal Pressure*, Mpa

Pe = *Eksternal Pressure*, Mpa

D = *Outside Diamenter of Linepipe*, m

t = *Nominal Wall Thickness*, m



Gambar 2.5 Ilustrasi Tekanan Internal (P_i) dan Tekanan Eksternal (P_e) pada Pipa Bawah Laut (Pratama, 2007)

II.2.7 Tegangan Longitudinal (*Longitudinal Stress*)

Tegangan longitunal adalah tegangan yang dipengaruhi oleh gaya yang diakibatkan oleh beban lingkungan. Adapun formulasi untuk menghitung *longitudinal stress* berdasarkan DNV OS F101 adalah seperti Persamaan 2.8 berikut ini :

$$\sigma_l = \frac{N}{\pi\,(D-t).t} + \frac{M}{\frac{\pi\,(D^4-(D-2t)^4)}{32\,D}} \tag{2.8}$$

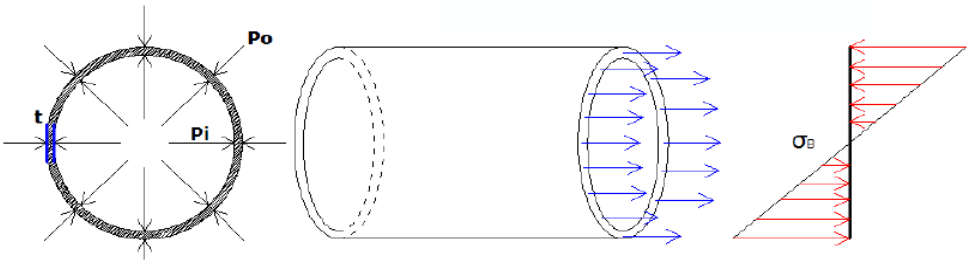
dimana

N = *Pipe Wall Force*, N

M = *Bending moment*, kNm

D = *Outside Diamenter of Linepipe*, m

t = *Nominal Wall Thickness*, m



Gambar 2.6 Ilustrasi Tegangan *Longitudinal* pada Pipa (Pratama, 2007)

II.2.8 Tegangan Ekuivalen (*Von Mises Stress*)

Setelah mendapatkan *hoop stress* dan *longitudinal stress* maka tegangan ekuivalen dapat dicari. Untuk mencari tegangan ekuivalen, kita menggunakan formulasi *Von Mises Stress* yang terdapat dalam DNV OS F101, sperti yang ditunjukkan pada Persamaan 2.9 berikut :

$$\sigma_e = \sqrt{\sigma_h^2 + \sigma_l^2 - \sigma_h\sigma_l + 3\tau_{hl}^2} \tag{2.9}$$

Dimana :

σ_e = *Equivalent Stress*, Mpa

σ_l = Tegangan Longitudinal (*longitudinal stress*), Mpa

σ_h = *Hoop Stress*, Mpa

τ_{hl} = *Tangential Shear Stress*, Mpa

II.2.9 Analisis Dinamis

Menurut Chakrabarti ada dua pendekatan dasar yang dipertimbangkan dalam menganalisa masalah struktur terapung, yaitu dengan metode *frekuensi domain* dan *time domain*. Frekuensi domain biasanya dilakukan untuk penyelesaian yang sederhana. Solusi pada metode ini diperoleh melalui pendekatan persamaan diferensial. Keterbatasan dari metode ini adalah semua persamaan *non-linier* harus dirubah dalam bentuk persamaan linier.

Sedangkan untuk metode *time domain* menggunakan pendekatan integrasi numeris dari persamaan gerak dari semua sistem *non-linier*. Beberapa contoh persamaan yang menggunakan analisis *non-linier* adalah gaya drag, gaya pada *mooring* dan viskositas *damping.*

Dalam *American Petroleum Institute* 1987 API RP 2T membagi analisis dinamis struktur lepas pantai kedalam 2 metode analisis domain, yaitu:

a. *Frequency domain analysis* adalah simulasi kejadian pada saat tertentu dengan interval frekuensi yang telah ditentukan sebelumnya. Frekuensi domain juga dapat digunakan untuk memperkirakan respon gelombang acak termasuk gerakan platform dan percepatan, gaya tendon dan sudut. Keuntungannya adalah lebih menghemat waktu perhitungan dan juga input atau output lebih sering digunakan oleb perancang. Namun kekurangannya metode ini adalah semua persamaan non-linier harus diubah dalam bentuk linear.

b. *Time domain analysis* adalah penyelesaian gerakan dinamis struktur berdasarkan fungsi waktu. Pendekatan yang dilakukan dalam metode ini menggunakan prosedur integrasi waktu dan akan menghasilkan respon *time history* berdasarkan waktu *x(t)*.

Metode *time domain solution* secara umum digunakan untuk tahap final detail desain dan untuk mengecek solusi *frequency domain*. Metode *time domain* biasanya digunakan untuk analisis kondisi ekstrim tetapi tidak digunakan untuk analisis *fatigue* atau analisis kondisi lebih moderat dimana analisis linierisasi bekerja lebih effisien. Sejak integrasi numerik langsung persamaan motion dilakukan, pengaruh-pengaruh fungsi-fungsi nonlinier gelombang relevan dan variabel-variabel motion diikutkan. Keuntungan dari metode *time*

domain dibanding metode *frequency domain* adalah semua tipe *non-linier* (matrik sistem dan beban-beban eksternal) dapat dimodelkan dengan lebih tepat. Ketidakuntungannya adalah memerlukan waktu menghitung yang lebih banyak, seperti periode simulasi memerlukan waktu panjang. Simulasi *time domain* dapat dikerjakan menurut beberapa skema integrasi. Untuk dapat mewakili kondisi sebenarnya simulasi minimal dilakukan selama 3 jam.

Dengan menyelesaikan persamaan tersebut menggunakan prosedur integrasi waktu, satu didapat solusi pada pola *response time history* (*t*). Pada umumnya semua matrik sistem (massa, *damping* dan kekakuan) dapat difungsikan sebagai response atau waktu, seperti pada kasus vektor beban (analisis *non-linier*). Matrik sistem konstan memberikan analisis *linier*. Output dari analisis *time domain* adalah respons *time series* dimana:

Simulasi gelombang reguler dapat digunakan untuk memprediksikan *transfer function* dengan mengambil rasio *respons amplitude* dengan input amplitudo gelombang.

Spektrum respons dapat dihitung dari *time series*, memberikan informasi yang sama dengan analisis *frekuensi domain*.

Respons ekstrim dapat diestimasi secara langsung dari puncak respons selama simulasi.

II.2.10 *Allowable Stress and Strain Criteria*

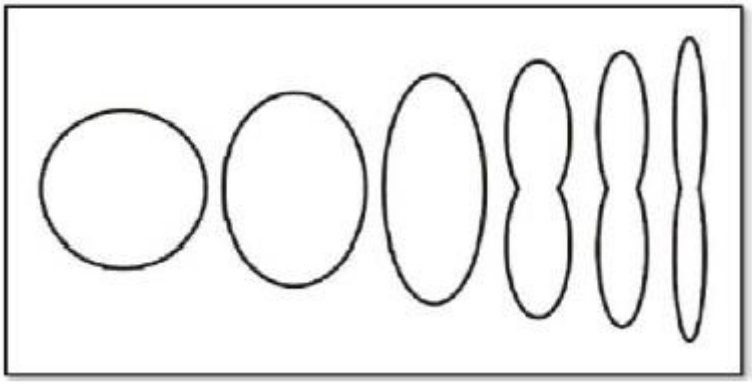
Pada saat proses *abandonment and recovery* berjalan, tegangan yang terjadi pada pipa tidak boleh melebihi tegangan yang diizinkan. Jenis material pipa yang digunakan dalam penelitian ini adalah *linepipe* API 5L X52. Berikut ini kriteria tegangan dan regangan yang diizinkan berdasarkan DNV OS F101 :

a. Regangan yang diizinkan pada wilayah *overbend*
   Analisis statis = 0.205 %
   Analisis dinamis = 0.260 %
b. Tegangan yang diizinkan pada wilayah *sagbend* dan *stinger tip*
   $\sigma_{eq} \leq$ 87 % SMYS

II.2.11 *Local Buckling*

Buckling merupakan keadaan dimana pipa sudah tidak bundar atau mengalami perubahan bentuk akibat tekanan hidrostatis yang besar pada kedalaman tertentu. Kemungkinan terjadinya *buckling* pada pipa harus dipertimbangkan dan harus diprediksi sejak awal agar menghindari terjadinya kegagalan pada pipa. Terjadinya *buckling* pada pipa, biasanya diawali dengan terjadinya *buckle initiation*. Jenis *buckling* yang terjadi pada pipa dapat dibagi menjadi 2, yaitu *local buckling* dan *global buckling*. *Local buckling* merupakan

suatu kondisi dimana terjadi deformasi bentuk pada penampang melintang suatu pipa. Proses perubahan bentuk penampang pipa, bisa dilihat pada Gambar 2.7 di bawah. Analisis *local buckling* perlu dihitung saat proses *abandonment and recovery* karena dalam prosesnya, pipa akan terkena beban hidrostatis yang bervariasi terhadap kedalaman laut. Selain itu, pipa juga akan terkena *eksternal pressure, axial force,* dan *bending moment* selama proses *abandonment and recovery*.



Gambar 2.7 Ilustrasi *Local Buckling* yang Terjadi pada Penampang Pipa (Halliwel, 1986)

Berdasarkan DNV OS F101, dalam melakukan analisis *local buckling* yang terjadi pada pipa, harus memenuhi beberapa kriteria, yaitu

1. Kriteria *system collapse*

   Semakin dalam suatu perairan, maka tekanan yang terjadi juga akan semakin besar. Hal ini yang harus dipertimbangkan oleh para perancang pipa bawah laut agar nanti ketika pipa beroperasi pada kedalaman tertentu, tekanan eksternal yang melebihi tekanan internal pipa tidak dapat mengakibatkan *collapse*. *Collapse* pada dinding pipa bergantung pada berbagai faktor, termasuk rasio antara diameter terhadap ketebalan pipa (*D/t*), karakteristik tegangan dan regangan material, beserta ovalisasi.

   Berdasarkan DNV OS F101, karakteristik tahanan untuk tekanan *collapse* (P_C) ditentukan dengan Persamaan 2.10 berikut :

$$\left(p_c\,(t) - p_{el}\,(t)\right).\left(p_c\,(t)^2 - p_{el}\,(t)^2\right) = p_c\,(t).p_{el}\,(t).p_p\,(t).f_0.\frac{D}{t} \quad (2.10)$$

   dengan :

$$p_{el}\,(t) = \frac{2.E.\left(\frac{t}{D}\right)^3}{1-v^2} \quad (2.11)$$

$$p_p\ (t) = f_y . \alpha_{fab} . \frac{2.t}{D} \tag{2.12}$$

$$f_0 = \frac{D_{max} - D_{min}}{D} \tag{2.13}$$

dengan :

P_C = Karakteristik tekanan *collapse*, Mpa

P_{el} = Tekanan *collapse* elastis, Mpa (Pers. 2.11)

P_p = Tekanan *collapse* plastis, Mpa (Pers. 2.12)

f_o = *Ovality*, ($0.5\ \% \leq f_o \leq 1.5\ \%$)

α_{fab} = Faktor fabrikasi (Tabel 2.2)

D_{max} = Diameter pipa terbesar yang diukur, m

D_{min} = Diameter pipa terkecil yang diukur, m

t = *Nominal Wall Thickness*, m

E = *Young Modulus*

v = *Poisson ratio*, 0.3

Faktor fabrikasi maksimum (α_{fab}) untuk pembuatan pipa diberikan pada Tabel 2.2 berikut ini :

Tabel 2.2 Faktor Fabrikasi Maksimum (DNV OS F101)

Pipe	*Seamless*	*UO & TRB & ERW*	*UOE*
α_{fab}	1.00	0.93	0.85

Dimana :

UO : Proses fabrikasi untuk *welded pipe*

TRB : *Three Rolling Bending*

ERW : *Electrical Resistance Welded pipe*

UOE : Proses fabrikasi untuk *welded pipe-expanded*

Persamaan 2.10, tekanan *collapse* (P_c) merupakan persamaan polinomial derajat tiga, untuk itu dilakukan pendekatan nilai P_c dengan Persamaan 2.14 - 2.21 :

$$P_c = y - \frac{1}{3}\ b \tag{2.14}$$

dengan :

$$b = -P_{el} \tag{2.15}$$

$$y = -2\sqrt{-u}\cos\left(\frac{\Phi}{3} + \frac{60\,\pi}{180}\right) \tag{2.16}$$

$$c = -\left(P_p + P_p\,P_{el}\,f_0\,\frac{D}{t}\right) \tag{2.17}$$

$$d = P_{el} + P_p^2 \tag{2.18}$$

$$u = \frac{1}{3}\left(-\frac{1}{3}\,b^2 + c\right) \tag{2.19}$$

$$v = \frac{1}{2}\left(\frac{2}{27}\,b^3 - \frac{1}{3}\,bc + d\right) \tag{2.20}$$

$$\Phi = \cos^{-1}\left(\frac{-v}{\sqrt{-u^3}}\right) \tag{2.21}$$

Sesuai dengan *codes* DNV OS F101, tekanan eksternal yang terjadi di sepanjang pipa harus memenuhi kriteria pada Persamaan 2.22 dibawah ini (pengecekan terhadap *system collapse*) :

$$P_e - P_{min} \leq \frac{P_c\,(t_1)}{\gamma_m\,\gamma_{SC}} \tag{2.22}$$

dengan :

P_{min} = Tekanan Internal Minimum (untuk kasus instalasi pipa bawah laut nilainya 0), Mpa

γ_m = *Material Resistance Factor* (Tabel 2.3)

γ_{SC} = *Safety Class Resistance Factor* (Tabel 2.4)

Tabel 2.3 *Material Resistance Factor* (DNV OS F101)

Limit state category[1)]	*SLS/ULS/ALS*	*FLS*
γ_m	1.15	1.00

Tabel 2.4 *Safety Class Resistance Factor* (DNV OS F101)

	γ_{SC}		
Safety class	*Low*	*Medium*	*High*
Pressure containment [1)]	1.046 [2),3)]	1.138	1.308 [4)]
Other	1.04	1.14	1.26

2. Kriteria *combined loading*

Kriteria ini menunjukkan syarat kekuatan dari pipa bawah laut terhadap semua gaya dan tekanan yang terjadi pada pipa. Gaya dan tekanan yang dimaksud yaitu kombinasi pembebanan terhadap *design bending moment*, *design effective axial force*, tekanan internal dan eksternal, tekanan pada *pressure containment*, tekanan *collapse*, dan karakteristik tahanan gaya aksial plastis. Berdasarkan *codes* DNV OS F101 : *Submarine Pipeline System* , kriteria ini akan diperiksa terhadap dua kondisi, yaitu :

a. Tekanan Internal Berlebih (*Internal Overpressure*)

Pada kondisi ini kekuatan pipa akan diperiksa terhadap tekanan internal yang terjadi. Tekanan ini dipengaruhi oleh tekanan fluida pengisi (*pressure containment*) serta tahanan aksial dari pipa. Berdasarkan pada standar DNV OS F101, kriteria ini harus memenuhi Persamaan 2.23 berikut ini :

$$\left\{\gamma_m \cdot \gamma_{SC} \cdot \frac{|M_{Sd}|}{\alpha_c \cdot M_p(t_2)} + \left\{\frac{\gamma_m \cdot \gamma_{SC} \cdot S_{Sd}(p_i)}{\alpha_c \cdot S_p(t_2)}\right\}^2\right\}^2 + \left(\alpha_p \cdot \frac{p_i - p_e}{\alpha_c \cdot p_b(t_2)}\right)^2 \leq 1 \qquad (2.23)$$

Digunakan untuk :

$$15 \leq {}^{D}/_{t_2} \leq 45\,,\; P_i \geq P_e\,,\; |S_{sd}|/S_p < 0.4$$

$$S_p(t) = f_y.\pi.(D-t).t \qquad (2.24)$$

$$M_p(t) = f_y.\pi.(D-t)^2.t \qquad (2.25)$$

$$\alpha_c = (1-\beta) + \beta\,\frac{f_u}{f_y} \qquad (2.26)$$

$$\alpha_p = \begin{cases} 1-\beta & \dfrac{p_i - p_e}{p_b} < \dfrac{2}{3} \\ 1 - 3\beta\left(1 - \dfrac{p_i - p_e}{p_b}\right) & \dfrac{p_i - p_e}{p_b} \geq \dfrac{2}{3} \end{cases} \qquad (2.27)$$

$$\beta = \frac{60 - {}^{D}/_{t_2}}{90} \qquad (2.28)$$

$$M_{sd} = M_F.\gamma_F.\gamma_C + M_E.\gamma_E + M_I.\gamma_F.\gamma_C + M_A.\gamma_A.\gamma_C \qquad (2.29)$$

$$S_{sd} = S_F \cdot \gamma_F \cdot \gamma_C + S_E \cdot \gamma_E + S_I \cdot \gamma_F \cdot \gamma_C + S_A \cdot \gamma_A \cdot \gamma_C \quad (2.30)$$

Untuk nilai faktor beban (γ_F,γ_E,γ_F,γ_A) dan faktor kondisi pembebanan (γ_C) bisa dilihat pada Tabel 2.5 dan Tabel 2.6 di bawah ini :

Tabel 2.5 *Load Effect Factor Combinations* (DNV OS F101)

Limit State / Load combination	*Load effect combination*		*Functional loads* [1)]	*Environmental load*	*Interference loads*	*Accidental loads*
			γ_F	γ_E	γ_F	γ_A
ULS	*a*	System check[2)]	1.2	0.7		
	b	Local check	1.1	1.3	1.1	
FLS	*c*		1.0	1.0	1.0	
ALS	*d*		1.0	1.0	1.0	1.0

Tabel 2.6 *Conditions Load Effect Factor* (DNV OS F101)

Condition	γ_c
Pipeline resting on uneven seabed	1.07
Reeling on and J-tube pull-in	0.82
System pressure test	0.93
Otherwise	1.00

b. Tekanan Eksternal Berlebih (*External Overpressure*)

Pada kondisi ini kekuatan pipa akan diperiksa berdasarkan tekanan eksternal yang terjadi. Tekanan ini sangat dipengaruhi oleh tekanan eksternal terhadap pipa. Tahanan dari kondisi tersebut di antaranya adalah tekanan *collapse*. Berdasarkan pada standar DNV OS F101, kriteria ini harus memenuhi Persamaan 2.31 berikut ini :

$$\left\{\gamma_m \cdot \gamma_{SC} \cdot \frac{|M_{Sd}|}{\alpha_c \cdot M_p(t_2)}\right\} + \left\{\frac{\gamma_m \cdot \gamma_{SC} \cdot S_{Sd}}{\alpha_c \cdot S_p(t_2)}\right\}^2 \Bigg\}^2 + \left(\gamma_m \cdot \gamma_{SC} \cdot \frac{p_e - p_{\min}}{p_c(t_2)}\right)^2 \leq 1 \quad (2.31)$$

Digunakan untuk :

$$15 \leq {}^{D}/_{t_2} \leq 45 \, , P_i < P_e \, , |S_{sd}|/S_p < 0.4$$

Dimana :

Mf = Momen Bending Desain, kNm (Pers. 2.29)

Sf = Gaya Aksial Efektif Desain, kN (Pers. 2.30)

Mp = Tahanan Momen Plastis, kNm (Pers. 2.25)

Sp = Tahanan Aksial Plastis, kN (Pers. 2.24)

Pc = *Collapse Pressure*, Mpa

P_{min} = Tekanan Internal Minimum, Mpa

Pe = *Eksternal Pressure*, Mpa

α_c = Parameter *Strain Hardening* (Pers. 2.26)

γ_m = *Material resistance factor* (Tabel 2.3)

γ_{SC} = *Safety class resistance factor* (Tabel 2.4)

t_2 = *Nominal Wall Thickness*, m

3. Kriteria *propagation buckling*

Propagation buckling adalah deformasi bentuk pada penampang melintang pipa yang kemudian berubah menjadi *buckle* yang memanjang dan merambat di sepanjang pipa. Penyebab utama dari *propagation buckling* ini adalah tekanan eksternal (hidrostatik) yang nilainya lebih besar dari tekanan yang diperlukan untuk mencegah terjadinya perambatan *buckle* tersebut. Terjadinya *propagation buckling* di dahului oleh adanya *local buckling* dan tidak bisa menjalar ke bagian lain jika tekanan eksternal masih di bawah tekanan propagasi (P_{pr}).

Berdasarkan DNV OS F101 : *Submarine Pipeline Systems,* nilai tekanan *propagation buckling* dapat ditentukan dengan menggunakan Persamaan 2.32 di bawah ini :

$$P_{pr} = 35.f_y.\alpha_{fab}\left(\frac{t_2}{D}\right)^{2.5} \tag{2.32}$$

dengan :

P_{pr} = *Propagation buckling*, N/m²

α_{fab} = Faktor fabrikasi (Tabel 2.2)

Berdasarkan DNV OS F101, Kriteria pengecekan terhadap *propagation buckling* dinyatakan dalam Persamaan 2.33 di bawah ini :

$$P_e - P_{min} \leq \frac{P_{pr}}{\gamma_m.\gamma_{SC}} \tag{2.33}$$

BAB III

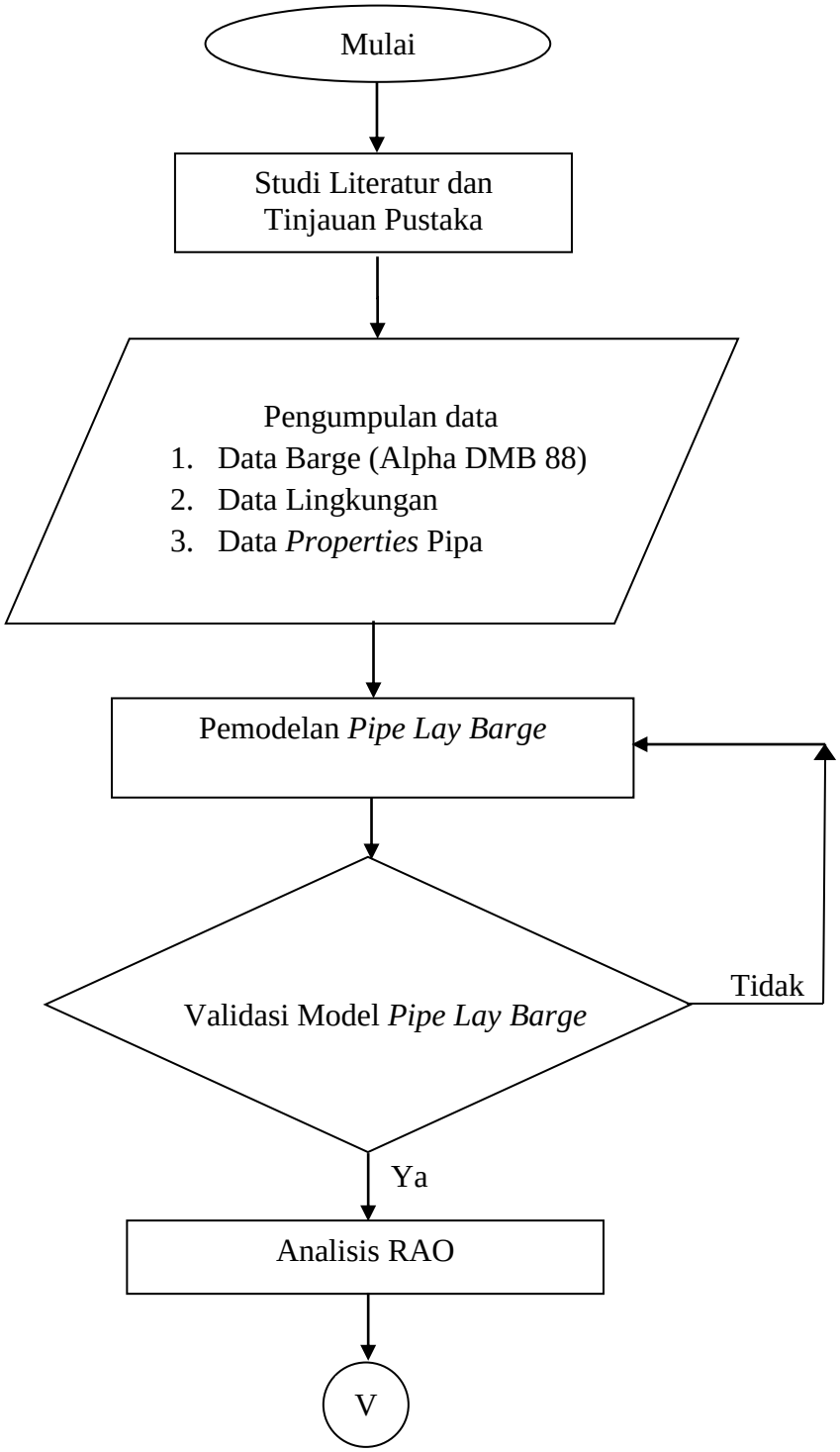
METODOLOGI PENELITIAN

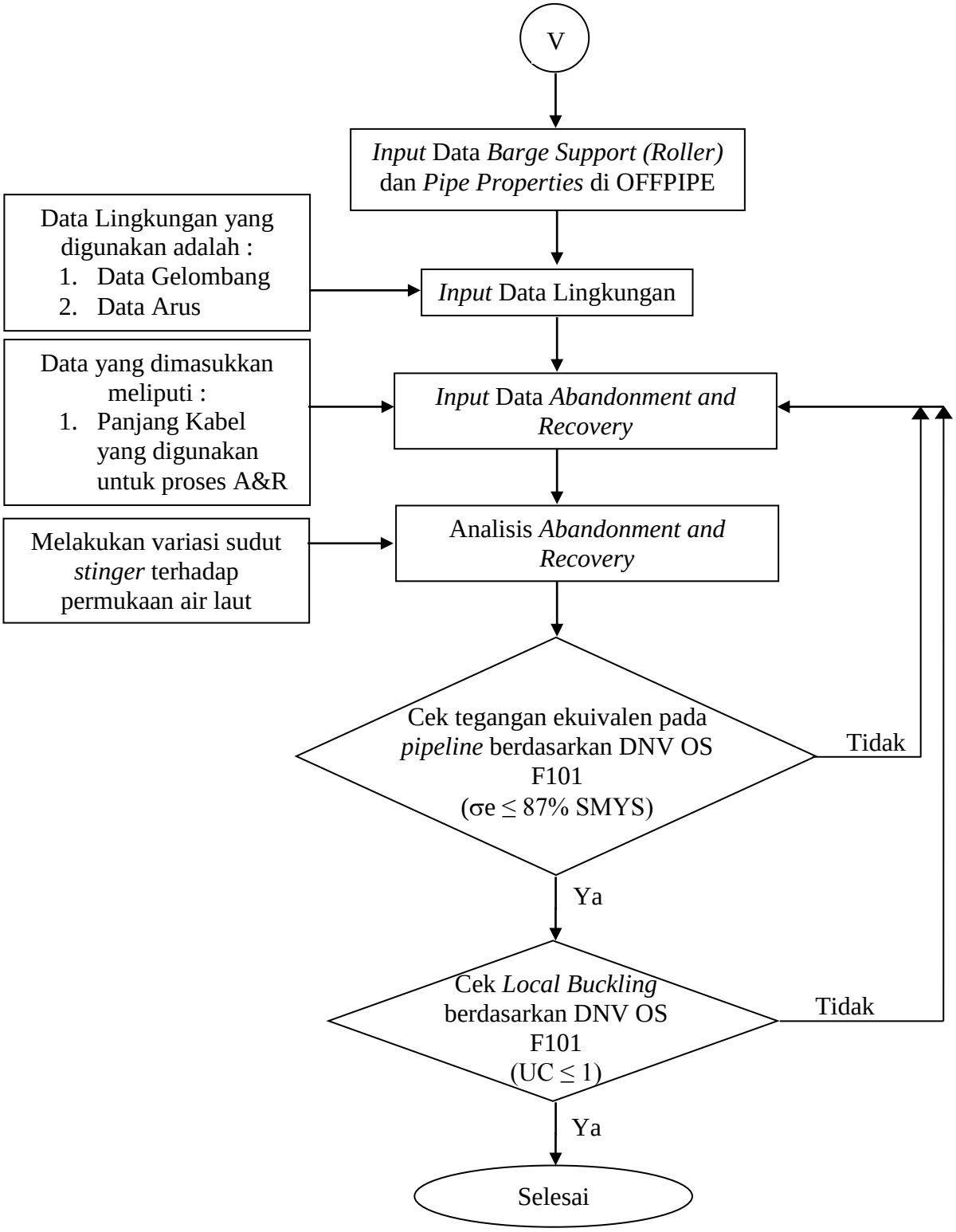
BAB III

METODOLOGI PENELITIAN

III.1 Metode Penelitian

Diagram alir secara umum





Gambar 3.1 Alur Pengerjaan Secara Umum

1. Studi Literatur dan Tinjauan Pustaka

   Mengumpulkan referensi (sumber pustaka) yang berupa buku, jurnal, penelitian, *codes*, maupun standard yang berhubungan dengan analisis *abandonment and recovery*. Salah satu penelitian yang dipelajari adalah milik Maryanto Satrio yang berjudul "Analisa *Abandonment and Recovery* sebagai Mitigasi Cuaca Buruk pada Proses Instalasi Pipa Bawah Laut".

2. Pengumpulan data

   Data yang digunakan pada penelitian ini adalah data proyek *EPCIC of Fixed Dolphin Mooring System and 3 km Subsea Onshore Pipeline* di Sangatta, Kutai Timur, Kalimantan Timur.

3. Pemodelan *Pipe Lay Barge*

   Membuat permodelan *barge* Alpha DMB 88 pada *software* MOESS berdasarkan data-data yang telah diperoleh. Permodelan ini adalah saat *barge* dalam kondisi *free floating*.

4. Validasi Model *Pipe Lay Barge*

   Validasi *barge* dilakukan dengan membandingkan hasil permodelan *barge* antara *software* MOSES dan data *barge* yang ada di lapangan. Apabila validasi tidak terpenuhi, maka harus dilakukan permodelan barge kembali dengan *software* MOSES hingga memenuhi syarat validasi. Berdasarkan IACS, kriteria validasi pada *displacement* bernilai 2%.

5. Analisis RAO

   RAO ini menggambarkan karakteristik gerakan *barge* pada gelombang reguler. Untuk memperoleh RAO, dilakukan *input center of gravity* (x,y,z) dan nilai jari-jari girasi (K_{xx},K_{yy},K_{zz}).

6. *Input* Data *Barge Support* (*Roller*) dan *stinger* di OFFPIPE

   Memasukkan koordinat lokasi *barge support* (*roller*) dan *stinger* di OFFPIPE.

7. *Input* Data Lingkungan

   Memasukkan data lingkungan untuk mengetahui efek kondisi lingkungan (gelombang dan arus) saat proses *abandonment and recovery*.

8. *Input* Data *Abandonment and Recovery*

   Memasukkan properti kabel yang akan digunakan dalam analisis *abandonment and recovery*.

9. Analisis *Abandonment and Recovery*

   Dalam analisis ini, dilakukan simulasi penurunan dan pengangkatan pipa dengan melakukan variasi jarak ujung *stinger* terhadap permukaan laut (*stinger stern depth*).

10. Cek Tegangan Ekuivalen pada *pipeline* berdasarkan DNV OS F101

    Menghitung gaya-gaya yang terjadi pada pipa selama proses *abandonment and recovery*. Tegangan yang dihitung adalah tegangan ekuivalen (Von Mises). Jika tegangan yang terjadi memenuhi kriteria yang diizinkan, maka dilanjutkan untuk perhitungan *local buckling*. Jika tidak memenuhi, maka harus dilakukan pemodelan ulang.

11. Cek *Local Buckling* berdasarkan DNV OS F101

    Analisis *local buckling* ini mengacu pada DNV OS F101. *Local buckling* ini berasal dari kombinasi kritis dari *bending moment* dan *axial force* yang kemudian dicari UC. Jika UC kurang dari 1, maka analisis *abandonment and recovery* bisa dinyatakan selesai. Namun jika UC lebih dari 1, maka harus dilakukan pemodelan ulang.

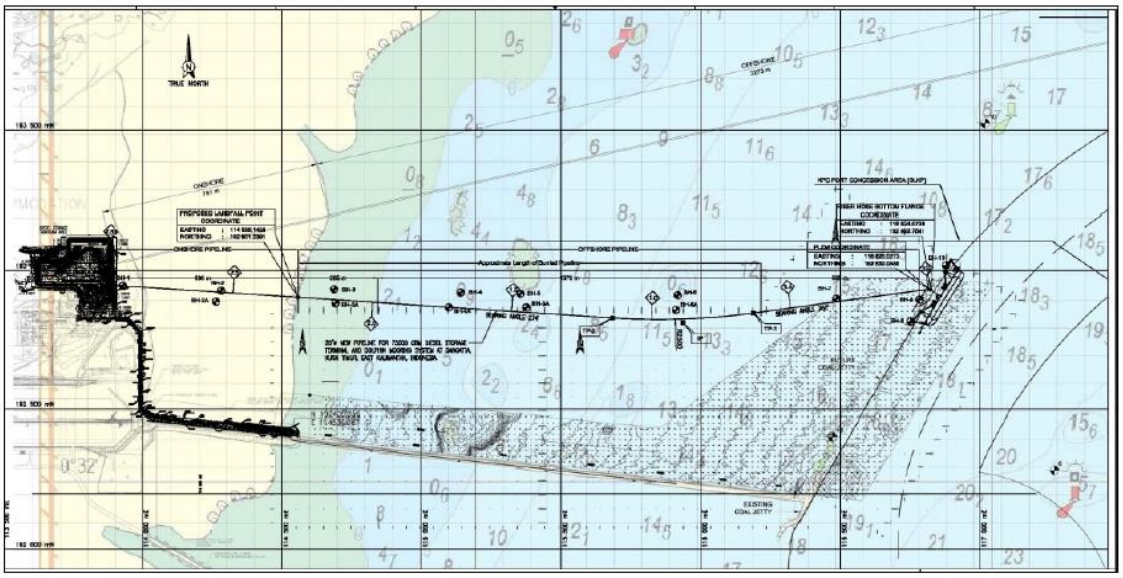
BAB IV

ANALISIS DAN PEMBAHASAN

BAB IV
ANALISIS DAN PEMBAHASAN

IV.1 Pengumpulan dan Identifikasi Data

Data yang digunakan dalam penelitian ini, merupakan data pada proyek *EPCIC of Fixed Dolphin Mooring System and 3 km Subsea Onshore Pipeline*. Lokasi proyek tersebut berada di Sangatta, Kutai Timur, Kalimantan Timur. Peta lokasi proyek tersebut ditunjukkan pada Gambar 4.1 di bawah ini :



Gambar 4.1 Peta Jalur *Nearshore Pipeline* pada Proyek *EPCIC of Fixed Dolphin Mooring System and 3 km Subsea Onshore Pipeline* (PT DMB, 2015)

Instalasi *pipeline* tersebut dilakukan dengan 2 metode, untuk KP 0+000 – 1+424 menggunakan metode *push pull*, sedangkan untuk KP 1+424 – 2+898 menggunakan metode *S-lay*. *Pipelay barge* yang digunakan adalah *Pipe Lay Barge* Alpha DMB 88 milik PT Dwisatu Mustika Bumi.

Ada beberapa data yang digunakan dalam penelitian ini, diantaranya : data properti pipa, data properti *barge* dan *stinger*, data lingkungan kondisi setempat, dan beberapa data yang menyangkut sistem perlindungan pipa (*external coating* dan *concrete*). Data yang digunakan pada penelitian ini, bisa dilihat pada tabel 4.1 - 4.7 di bawah ini :

IV.1.1 Data Properti Pipa

Tabel 4.1 *Pipeline Properties* (PT DMB, 2015)

Parameters	Units	Value
Design Life	Years	30
Outside Diameter	mm	508 (20")
Wall Thickness	mm	15.9 (0.625")
Seam Type	-	SAWL
SMYS	Mpa	360 (52.2 ksi)
SMTS	Mpa	460 (66.7 ksi)
Young Modulus	Mpa	207000 (30022.9 ksi)
Poison Ratio	-	0.3
Density	Kg/m³	7850
Coeff. Of Thermal Expansion	/°C	0.00011
Service	-	Diesel Oil
Fluid Density	Kg/m³	850
Ovality	-	ODmin-Odmax < 3% of OD
Internal Corrosion Allowance	mm	3
Total Length of Pipe Expose	Km	653
Total Length of Pipe Buried	Km	1617
Design Pressure	psig	285 (19.6 barg)
Operating Pressure	psig	145 (9.8 barg)
Hydrotest Pressure	psig	356.25 (24.5 barg)
Design Temperature	°C	50
Operating Temperature	°C	47

IV.1.2 Data *External Coating dan Concrete Coating*

Tabel 4.2 *External Coating Properties* (PT. DMB, 2015)

Parameters	Units	Value
Selected External Anti-Corrosion Coating	-	3-LPE
Thickness	mm	2.5
Density	Kg/m³	958.23
Coating Cutback	mm	150

Tabel 4.3 *Concrete Coating Properties* (PT DMB, 2015)

Parameters	Units	Value
Concrete Density	Kg/m³	3040
Thickness	mm	50

IV.1.3 Data *Pipe Lay Barge*

Tabel 4.4 *Pipe Lay Barge* Alpha DMB 88 *Properties* (PT DMB, 2015)

Parameters	Units	Value
Length Overall	m	62
Breadth	m	11
Depth	m	3
Operating Draft	m	2
A/R Winch	Ton	60
Tensioner	Ton	40
Length of Stinger	m	31,9
Number of Support on Barge (including tensioner)	-	8
Number of Support on Stinger	-	6
Hitch Coordinate		X = -0.399 ; Y = -0.744

Tabel 4.5 *Pipe Lay Barge Roller Configuration* (PT DMB, 2015)

Roller No.	X Coordinate	Y Coordinate
B1	38	1.516
B2	32.095	1.516
T	26.5	1.516
TR1	23	1.516
TR2	16.520	1.396
TR3	12	1.192
TR4	5.5	0.723
TR5	0	0.160

IV.1.4 Data *Stinger*

Tabel 4.6 *Stinger Roller Configuration* (PT DMB, 2015)

Roller No.	X Coordinate	Y Coordinate
S1	6.900	1.222
S2	14.130	1.371
S3	20.180	1.359
S4	24.930	1.261
S5	30.000	1.116
S6	31.792	1.116

IV.1.4 Data Lingkungan

Tabel 4.7 *Wave Data* (PT DMB, 2015)

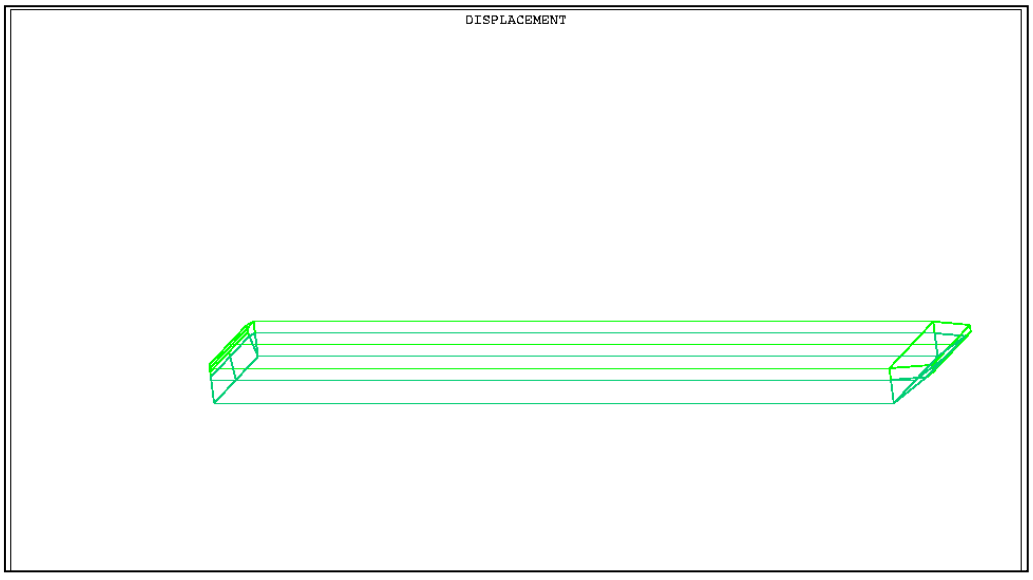
Return Period	Max. Significant Wave Height (m)	Wave Peak Period (sec)
1-year	2.11	7.2
100-year	3.19	8.8

Tabel 4.8 *Current Data* (PT DMB, 2015)

Return Period	Current Velocity (m/s)
1-year	0.2
100-year	0.25

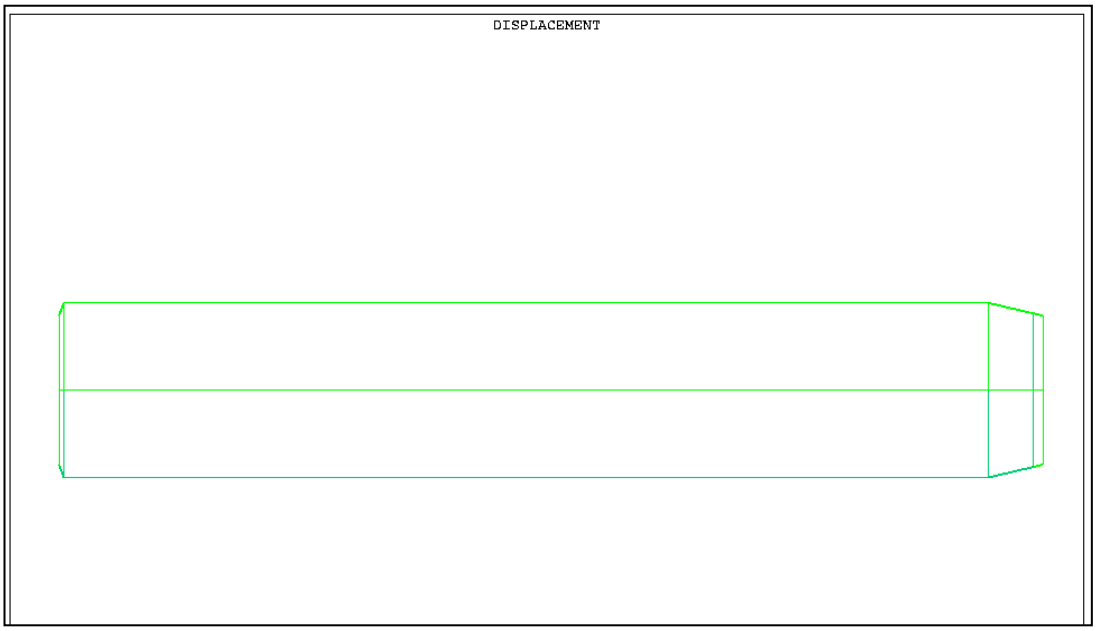
IV.2 Pemodelan *Pipe Lay Barge*

Struktur *pipe lay barge* dimodelkan sesuai data yang ada pada tabel 4.4 diatas. Pemodelan *pipe lay barge* dalam penelitian ini, dilakukan dengan bantuan *software* MOSES. Pembuatan model *pipe lay barge* ini, mengacu pada data *general arrangement* yang ada. Hasil pemodelan yang sudah dilakukan, bisa dilihat pada Gambar 4.2 – 4.5 di bawah ini :

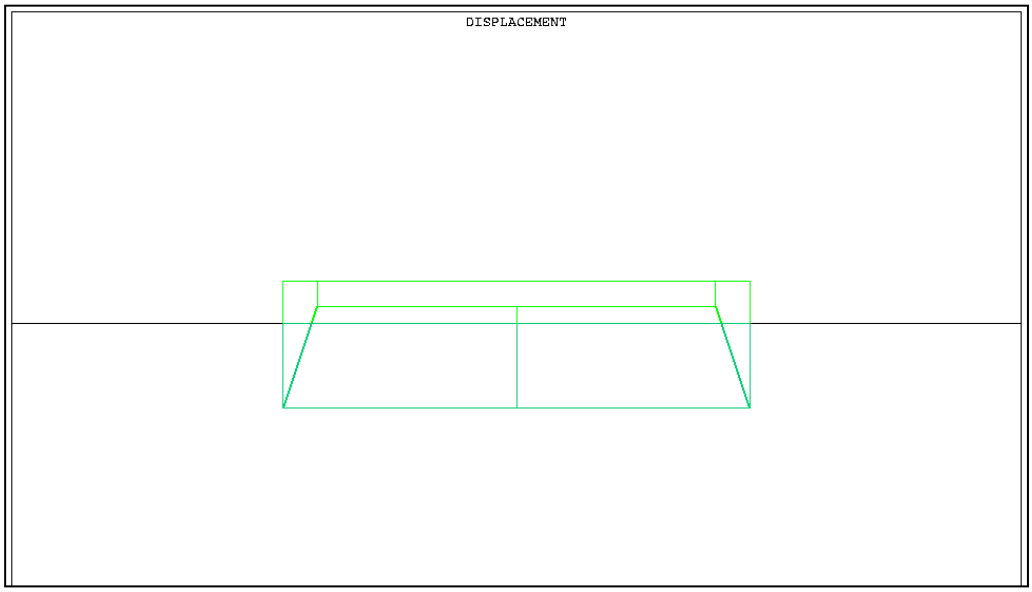


Gambar 4.2 Model *Pipe Lay Barge* Tampak Isometri

Gambar 4.3 Model *Pipe Lay Barge* Tampak Samping



Gambar 4.4 Model *Pipe Lay Barge* Tampak Atas



Gambar 4.5 Model *Pipe Lay Barge* Tampak Depan

IV.2.1 Validasi model *Pipe Lay Barge*

Sebelum melanjutkan ke tahap selanjutnya, model *pipe lay barge* yang telah dibuat dengan bantuan *software* MOSES harus dilakukan validasi terlebih dahulu, agar model yang telah dibuat tersebut bisa mewakili keadaan *pipe lay barge* yang sebenarnya. Validasi dilakukan dengan membandingkan parameter hasil pemodelan dengan *software* MOSES dengan data. Kriteria validasi yang digunakan mengacu pada IACS dimana kriteria validasi untuk *displacement* bernilai 2% dan untuk parameter yang lain, maksimal 1%. Hasil validasi yang telah dilakukan, bisa dilihat pada Tabel 4.9 di bawah ini :

Tabel 4.9 Validasi Model *Pipe Lay Barge*

Parameter	Model	Data	Error (%)
Loa (m)	62	62	0
Breadth (m)	11	11	0
Depth (m)	3	3	0
Draft (m)	2	2	0
Displacement (ton)	1348	1344,40	0,27
LCB (m)	30,07a	30,18a	0,37
VCB (m)	1,01	1	0,99

Berdasarkan hasil validasi pada Tabel 4.9 di atas, maka dapat disimpulkan bahwa model yang telah dibuat dengan bantuan *software* MOSES tersebut valid dan bisa digunakan untuk analisis pada tahapan selanjutnya.

IV.3 Analisis Karakteristik Gerak Struktur pada Gelombang Reguler

Setelah melakukan validasi struktur pada tahapan sebelumnya, kemudian dilanjutkan untuk analisis karakteristik gerak *pipe lay barge* pada gelombang reguler atau yang lebih dikenal dengan analisis *Response Amplitude Operator* (RAO).

Dalam penelitian ini, RAO *pipe lay barge* dihasilkan dengan bantuan *software* MOSES. Untuk memperoleh RAO pada *software* tersebut, harus terlebih dahulu melakukan *input center of gravity* untuk sumbu x, y, dan z serta input radius girasi (k_{xx},k_{yy},k_{zz}) dari *pipe lay barge*. Untuk *center of gravity*, dilakukan *input* sesuai dengan nilai yang ada pada *stability booklet* dari *pipe lay barge*. Sedangkan untuk nilai radius girasi, dilakukan perhitungan berdasarkan pendekatan dari Jakobsen (2008) seperti pada Persamaan 4.1 dan 4.2 berikut ini :

- Radius Girasi *Roll*

$$K_{xx} = 0.34 \; x \; B \tag{4.1}$$

- Radius Girasi *Pitch* = *Yaw*

$$K_{yy} = K_{zz} = 0.27 \; x \; L_{OA} \tag{4.2}$$

dengan :

B = *Breadth*, m

L_{OA} = *Length of overall*, m

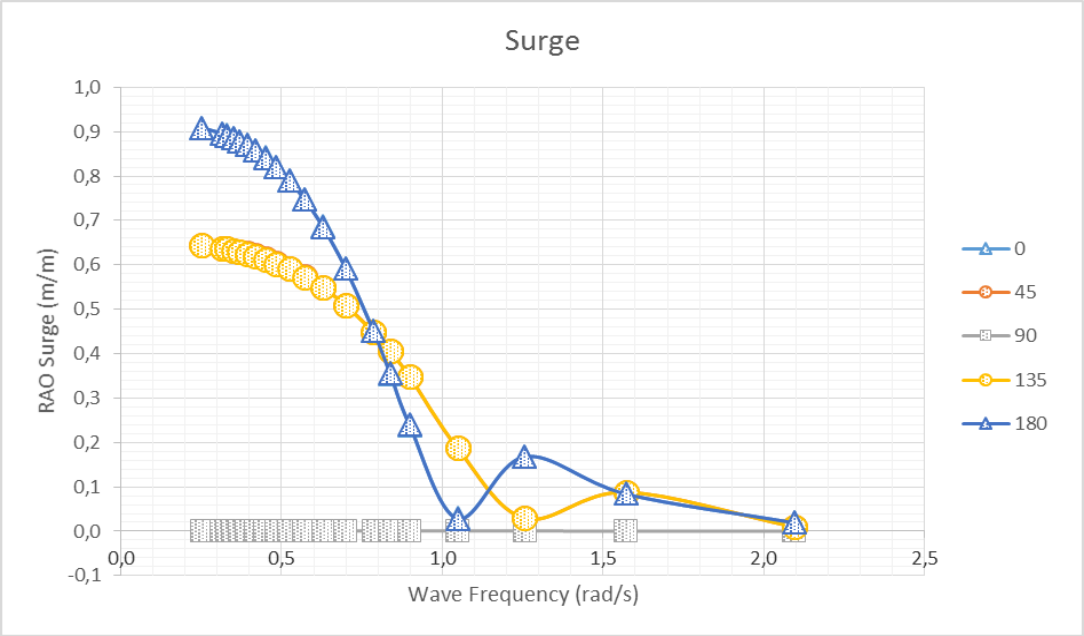
Nilai *center of gravity* yang diinputkan pada *software* MOSES untuk memperoleh RAO masing-masing untuk sumbu x,y,z adalah 31.93m, 0m , 3.94m. Sedangkan untuk nilai radius girasi masing-masing untuk sumbu x,y,z adalah 3.74m, 16.74m, 16.74m.

Dalam melakukan analisis RAO, ada 6 gerakan yang ditinjau yaitu, *surge*, *sway*, *heave*, *roll*, *pitch*, *yaw*. Selain itu ada beberapa arah datang gelombang (*heading*) yang digunakan dalam analisis RAO ini, yaitu 0°, 45°, 90°, 135°, dan 180°. Analisis RAO ini dilakukan pada *pipe lay barge* dalam keadaan tanpa tertambat (*free floating*).

IV.3.1 Gerakan *Surge*

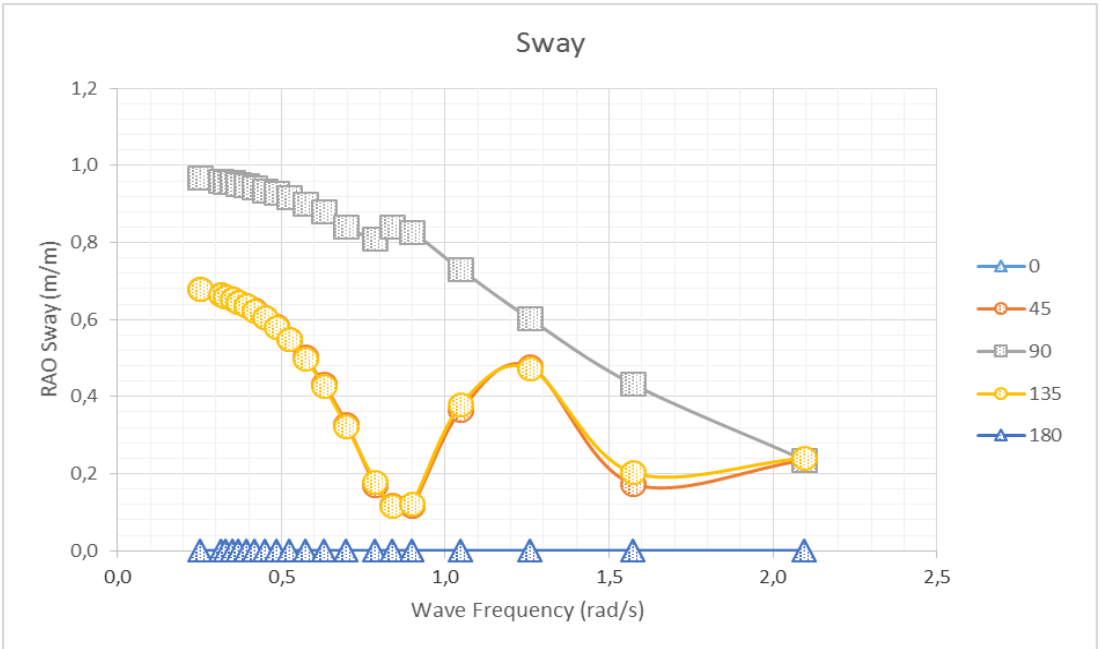
Berdasarkan gambar 4.6 di bawah, dapat diketahui bahwa nilai *surge* paling besar diakibatkan oleh gelombang arah 0° dan 180° yakni sekitar 0.91 m/m. Untuk arah datang gelombang 45° dan 135° mengakibatkan gerakan surge sebesar 0.64 m/m. Sedangkan untuk

arah datang gelombang 90°, bisa dikatakan tidak menyebabkan gerakan *surge* pada *pipe lay barge*.



Gambar 4.6 RAO untuk Gerakan *Surge*

IV.3.2 Gerakan *Sway*



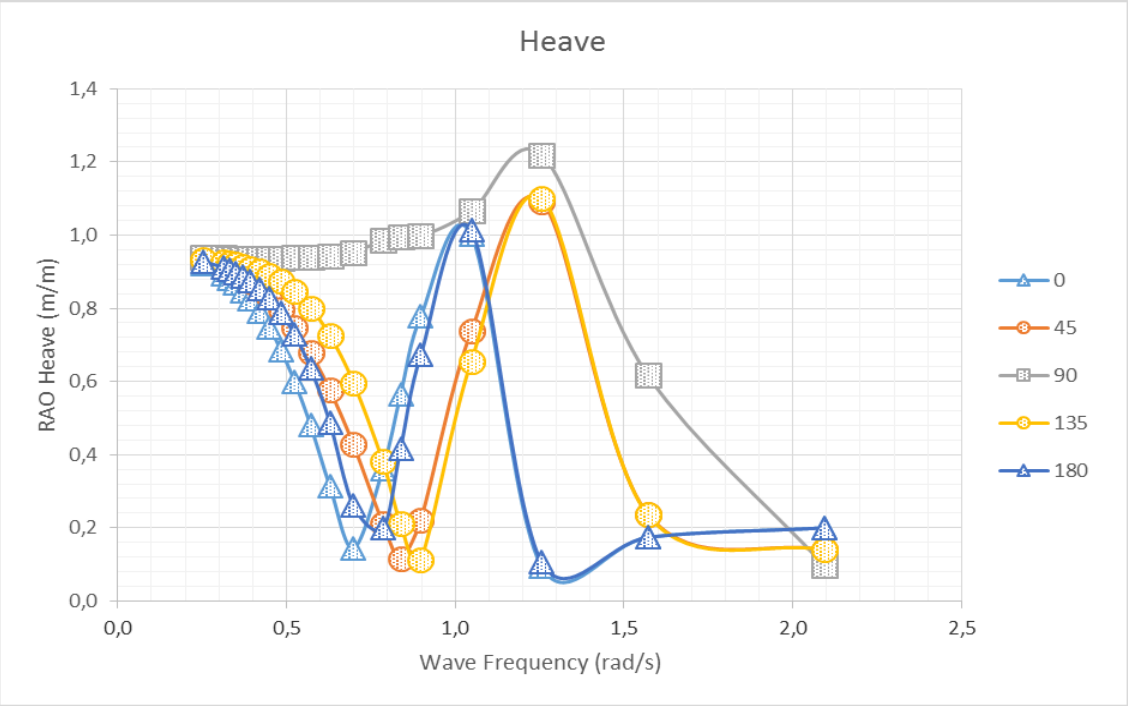
Gambar 4.7 RAO untuk Gerakan *Sway*

Berdasarkan gambar 4.7 di atas, *sway* yang paling besar bernilai sekitar 0.97 m/m dan terjadi saat frekuensi gelombang (ω) bernilai 0.25 rad/sec. Nilai sway yang paling besar diakibatkan oleh gelombang arah 90°. Untuk arah datang gelombang 90°, nilai *sway* relatif

turun akibat bertambahnya nilai frekuensi gelombang (ω). Untuk gelombang arah 45° dan 135°, nilai *sway* relatif bersifat fluktuatif namun nilai terbesar terjadi saat frekuensi gelombang (ω) bernilai 0.251 rad/sec.

IV.3.3 Gerakan *Heave*

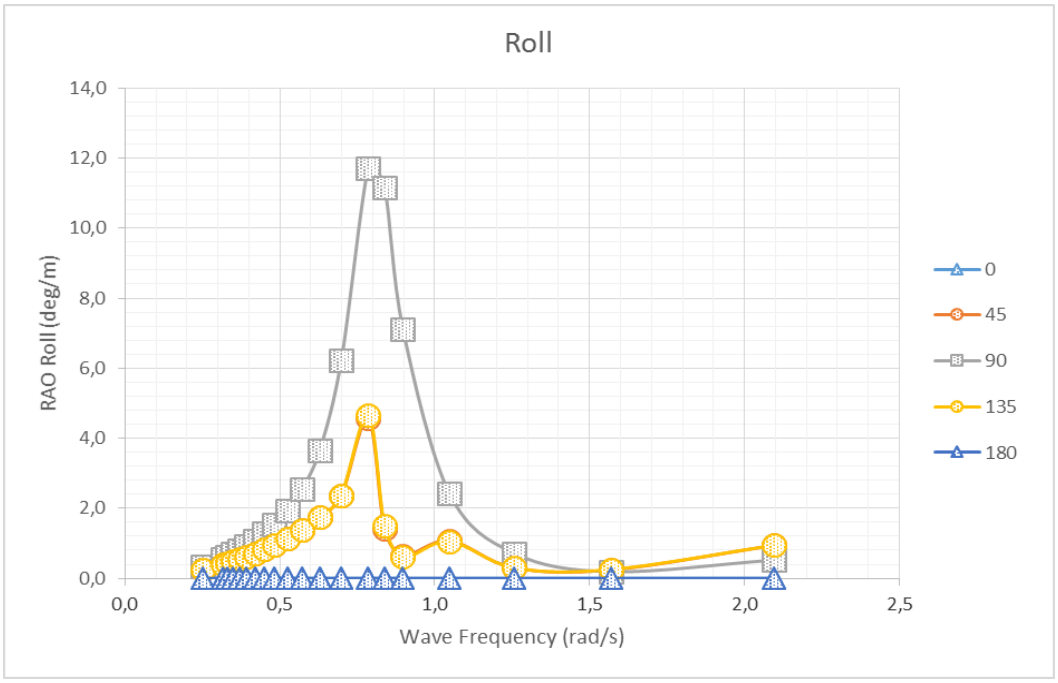
Berdasarkan gambar 4.8 di bawah, nilai *heave* paling besar diakibatkan oleh gelombang arah 90° yakni sekitar 1.22 m/m pada saat frekuensi gelombang (ω) bernilai sekitar 1.26 rad/sec. Untuk arah datang gelombang 90°, nilai *heave* yang terbesar berada dalam rentang nilai frekuensi gelombang (ω) antara 1 rad/sec – 1.30 rad/sec. Kemudian seiring bertambahnya nilai frekuensi gelombang (ω), nilai *heave* semakin menurun hingga mendekati 0.



Gambar 4.8 RAO untuk Gerakan *Heave*

IV.3.4 Gerakan *Roll*

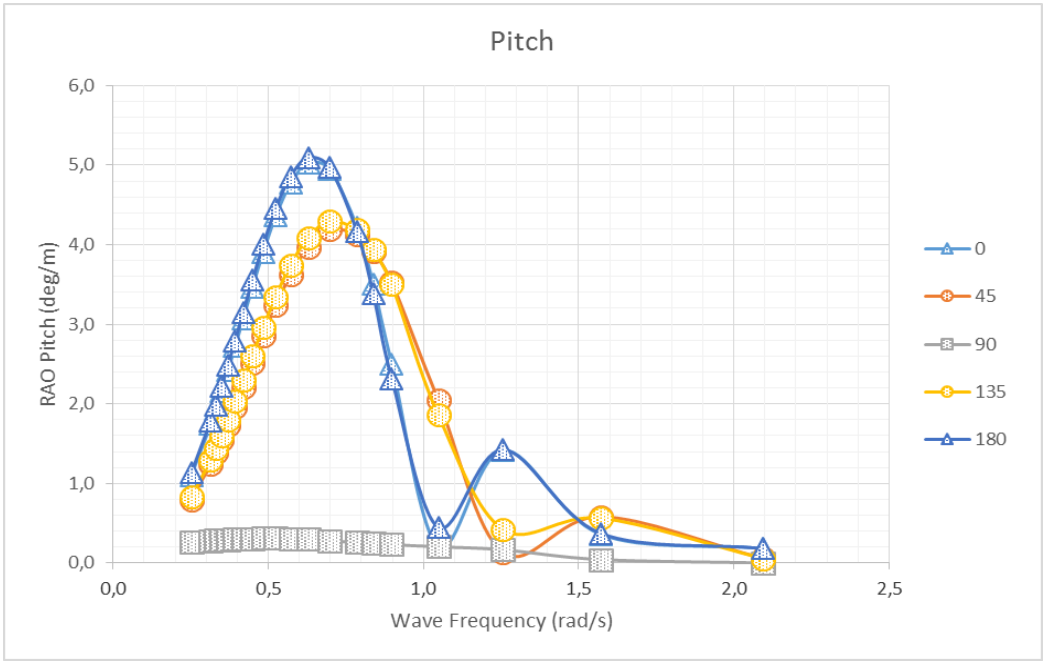
Berdasarkan gambar 4.9 di bawah, nilai *roll* paling besar sekitar 11.72 deg/m dan terjadi pada saat frekuensi gelombang (ω) bernilai 0.79 rad/sec. Gerakan *roll* paling besar diakibatkan oleh gelombang dengan arah 90°. Untuk gelombang dengan arah 45° dan 135°, nilai *roll* paling besar sekitar 4.60 deg/m dan 4.70 deg/m. Sedangkan untuk arah datang gelombang 0° dan 180°, bisa dikatakan tidak menyebabkan gerakan *roll* pada *pipe lay barge*.



Gambar 4.9 RAO untuk Gerakan *Roll*

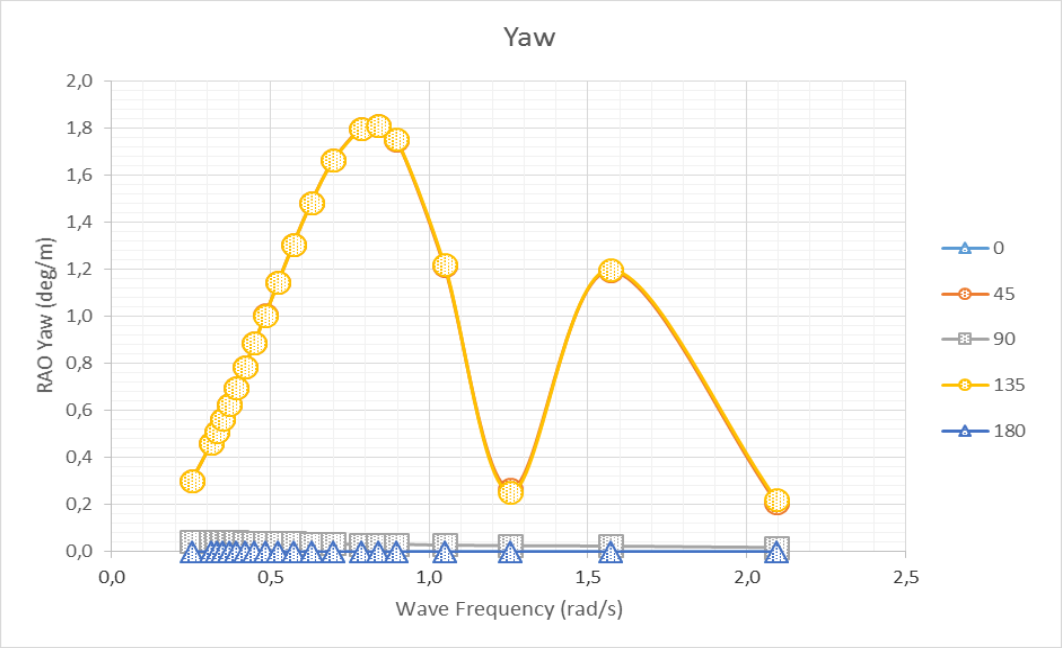
IV.3.5 Gerakan *Pitch*

Berdasarkan gambar 4.10 di bawah, nilai *pitch* paling besar diakibatkan oleh gelombang arah 0° dan 180° yakni sekitar 5.026 deg/m dan 5.10 deg/m. Nilai tersebut terdapat pada saat frekuensi gelombang (ω) bernilai sekitar 0.63 rad/sec. Gerakan *pitch* yang terbesar, diakibatkan oleh gelombang arah 0° dan 180°. Kemudian seiring bertambahnya nilai frekuensi gelombang (ω), nilai *pitch* semakin menurun hingga mendekati 0.



Gambar 4.10 RAO untuk Gerakan *Pitch*

IV.3.6 Gerakan *Yaw*



Gambar 4.11 RAO untuk Gerakan *Yaw*

Berdasarkan gambar 4.11 di atas, dapat diketahui bahwa nilai *yaw* paling besar diakibatkan oleh gelombang arah 45° dan 135° yakni sekitar 1.81 deg/m. Nilai terbesar untuk gerakan *yaw*, terjadi saat frekuensi gelombang (ω) bernilai 0.84 rad/sec. Untuk arah datang gelombang 90°, *yaw* terbesar bernilai 0.044 deg/m. Sedangkan untuk arah datang gelombang 0° dan 180°, bisa dikatakan tidak menyebabkan gerakan *yaw* pada *pipe lay barge*.

IV.4 Analisis Tegangan pada *Pipeline* Selama Proses *Abandonment and Recovery*

IV.4.1 Pemodelan *Abandonment and Recovery*

Dalam penelitian ini, proses *abandonment and recovery* pada *pipeline*, dimodelkan dengan bantuan *software* OFFPIPE. OFFPIPE adalah *software* khusus untuk analisis instalasi pipa yang berbasis *finite element*.

Untuk melakukan pemodelan proses abandonment and recovery pada OFFPIPE harus dilakukan input data yang dibutuhkan untuk pemodelan tersebut, diantaranya (lihat lampiran)

- Input data properti *pipeline* (*pipeline properties*)
- Input data *barge* beserta koordinat *roller* / tumpuan
- Input data *stinger* beserta koordinat *roller* / tumpuan
- Input data lingkungan
- Input data properti kabel A&R *winch*

- Input RAO hasil dari *software* MOSES
- Input data Spektrum Gelombang yang digunakan (Jonswap)

Dalam *software* OFFPIPE, proses *abandonment and recovery*, dimodelkan dengan melakukan variasi panjang kabel yang digunakan. Dengan menambah panjang kabel yang digunakan, berarti secara tidak langsung kita sedang melakukan pemodelan proses *abandonment* pada *pipeline* sedangkan jika mengurangi panjang kabel, berarti saat itu sedang dilakukan pemodelan proses *recovery* pada *pipeline*.

Pada penelitian ini, pemodelan *abandonment and recovery* dilakukan dengan melakukan variasi panjang kabel sebanyak 6 buah. Panjang kabel yang digunakan bisa dilihat pada Tabel 4.10 di bawah ini :

Tabel 4.10 Variasi Panjang Kabel yang Digunakan untuk Simulasi *Abandonment and Recovery*

Case No.	Panjang Kabel (m)	Keterangan
1	24	*Pipeline* berada di atas roller pertama
2	62	*Pipeline* berada di hitch (sambungan antara barge dengan stinger)
3	83	*Pipeline* berada di pertengahan stinger
4	94	*Pipeline* berada di ujung stinger
5	120	*Pipeline* berada di pertengahan kedalaman laut
6	147	*Pipeline* meletak di dasar laut

Panjang kabel yang digunakan dalam pemodelan ini berhubungan dengan tegangan yang akan diterima oleh *pipeline* selama proses *abandonment and recovery*. Jadi tegangan maksimal yang diterima oleh *pipeline*, harus bisa diidentifikasi letak dan nilainya.

IV.4.2 Skema Analisis yang Dilakukan

Setelah menentukan panjang kabel yang digunakan, selanjutnya adalah menentukan skema analisis yang dilakukan. Dalam penelitian ini, analisis *abandonment and recovery* dilakukan dengan 3 variasi jarak ujung *stinger* terhadap permukaan laut. Tujuannya adalah mengetahui pengaruh perubahan jarak ujung *stinger* terhadap permukaan laut dengan tegangan serta kemungkinan *local buckling* yang terjadi pada *pipeline* selama proses *abandonment and recovery*.

Variasi yang dilakukan, bisa dilihat pada Tabel 4.11 adalah berikut ini :

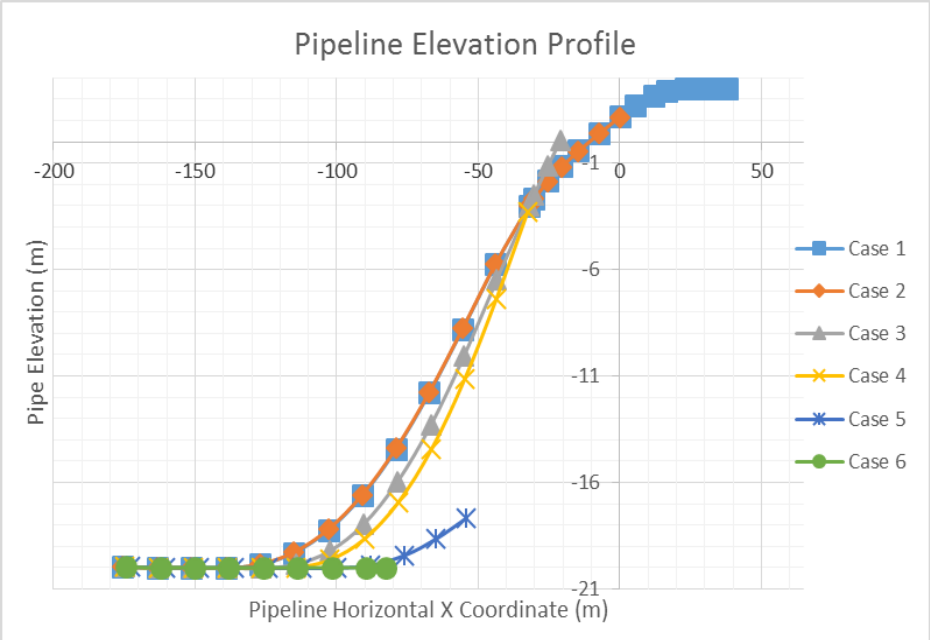
Tabel 4.11 Variasi Jarak Ujung *Stinger* terhadap Permukaan Air Laut

No	Jarak Ujung *Stinger* terhadap Permukaan Laut (m)
1	3
2	4
3	5

IV.4.3 Analisis Dinamis *Abandonment and Recovery*

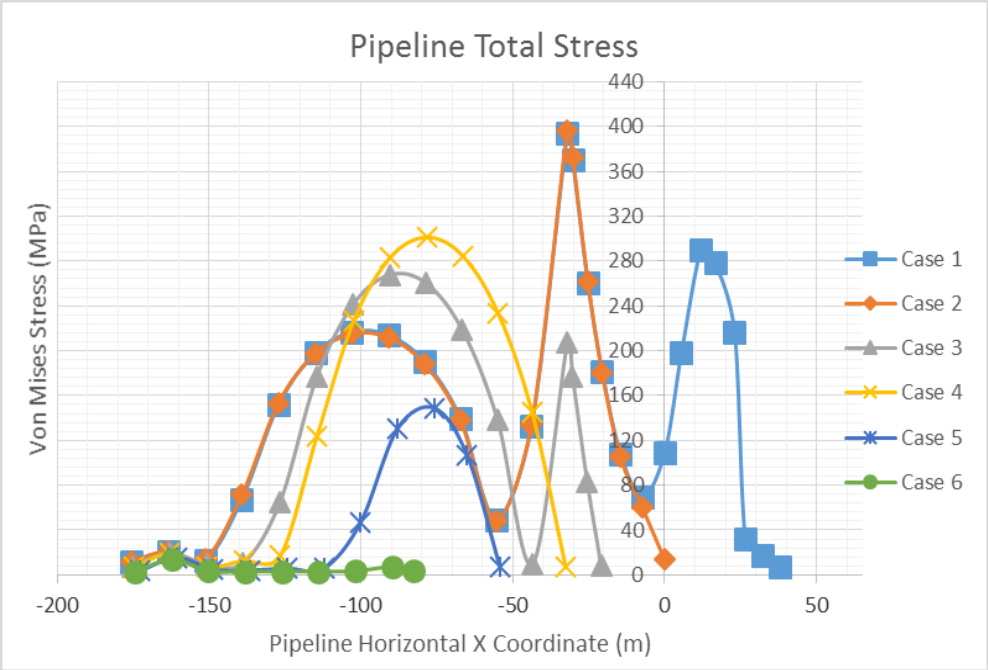
Analisis dinamis dilakukan untuk mengetahui interaksi antara *pipeline* dengan arus dan gelombang selama proses *abandonment and recovery*. Kombinasi arus dan gelombang yang mengenai *pipeline* bisa menyebabkan tegangan pada *pipeline* sehingga analisis dinamis perlu dilakukan.

a. Tegangan ekuivalen akibat pembebanan arah 0° (*stinger stern depth* = 3m)



Gambar 4.12 Profil *Pipelline* selama Proses *Abandonment and Recovery* (pembebanan arah 0° dan *stinger stern depth* = 3m)

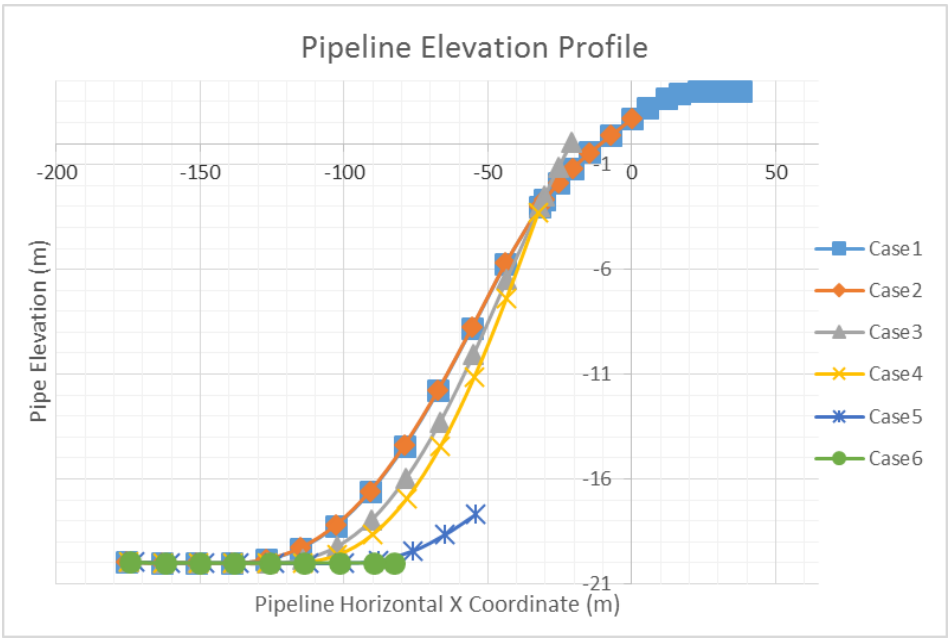
Gambar 4.12 di atas menunjukkan profil *pipeline* selama proses *abandonment and recovery* akibat pembebanan arah 0° dan jarak ujung *stinger* terhadap permukaan laut bernilai 3m.



Gambar 4.13 Tegangan Ekuivalen selama Proses *Abandonment and Recovery* (pembebanan arah 0° dan *stinger stern depth* = 3m)

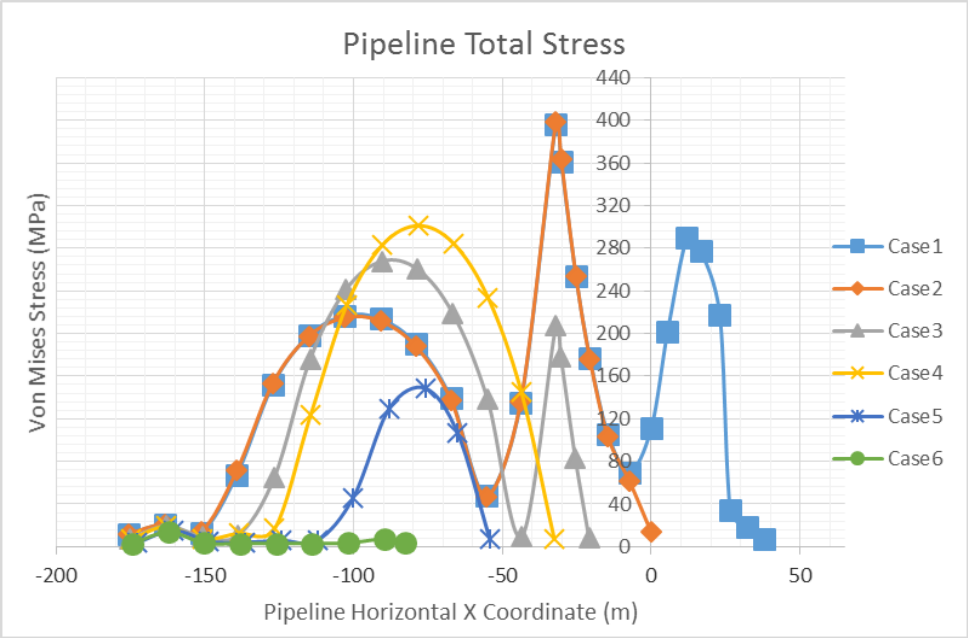
Berdasarkan Gambar 4.13 di atas, tegangan ekuivalen terbesar ada pada *node* ke-30 yang berada di ujung *stinger* dan mempunyai nilai 396.28 Mpa. Berdasarkan DNV OS F101, tegangan ekuivalen maksimal yang diizinkan (87% SMYS) adalah sebesar 313.2 Mpa. Jadi kesimpulannya pada kasus ini, *pipeline* akan mengalami kegagalan karena tegangan ekuivalen yang terjadi melebihi batas tegangan yang diizinkan.

b. Tegangan ekuivalen akibat pembebanan arah 45° (*stinger stern depth* = 3m)



Gambar 4.14 Profil *Pipelline* selama Proses *Abandonment and Recovery* (pembebanan arah 45° dan *stinger stern depth* = 3m)

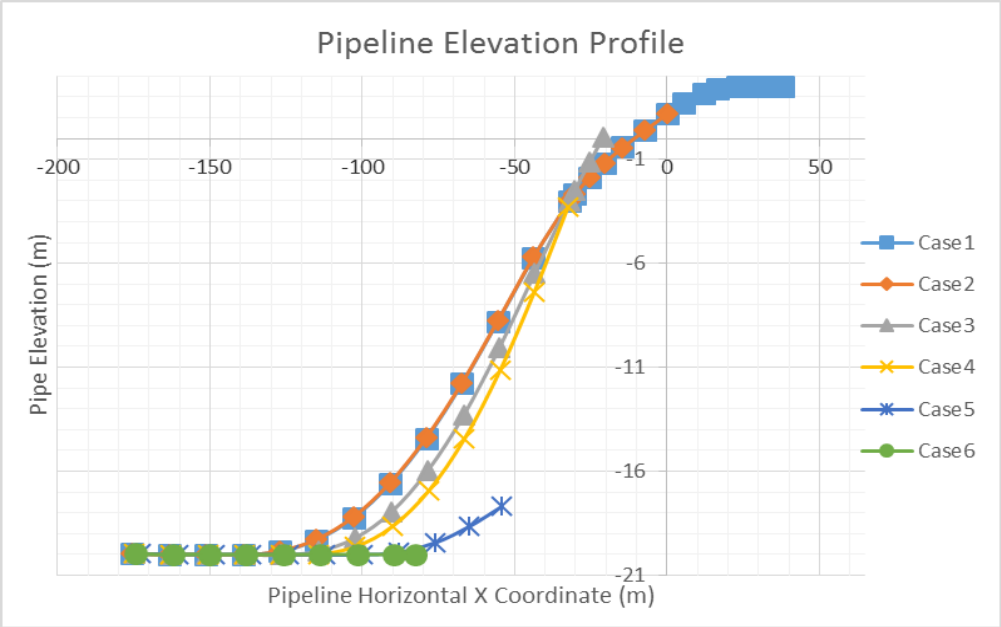
Gambar 4.14 di atas menunjukkan profil *pipeline* selama proses *abandonment and recovery* akibat pembebanan arah 45° dan jarak ujung *stinger* terhadap permukaan laut bernilai 3m.



Gambar 4.15 Tegangan Ekuivalen selama Proses *Abandonment and Recovery* (pembebanan arah 45° dan *stinger stern depth* = 3m)

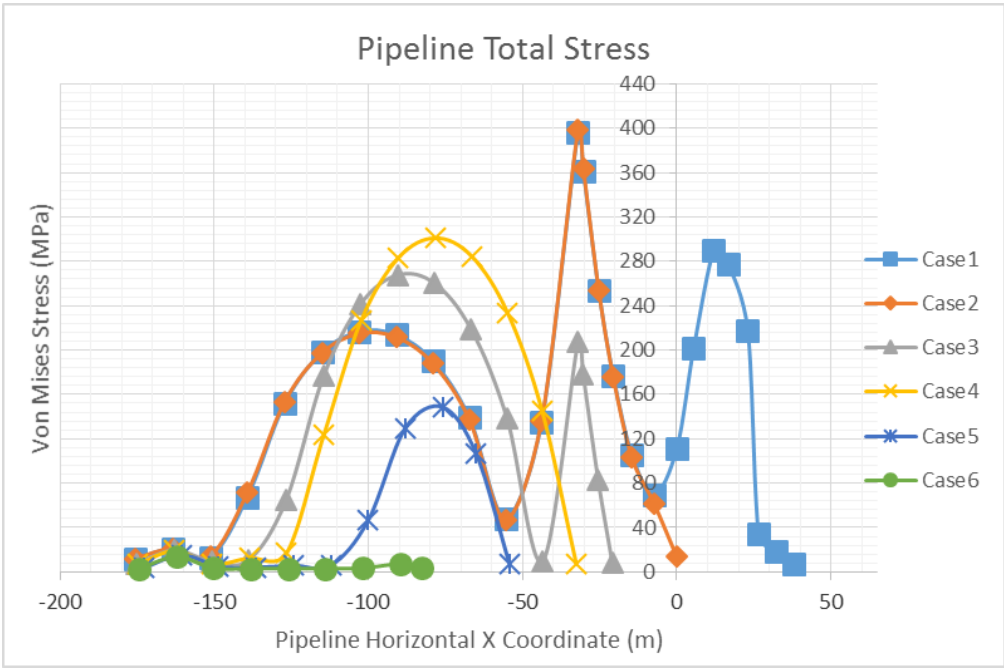
Berdasarkan Gambar 4.15 di atas, tegangan ekuivalen terbesar ada pada *node* ke-30 yang berada di ujung *stinger* dan mempunyai nilai 398.49 Mpa. Berdasarkan DNV OS F101, tegangan ekuivalen maksimal yang diizinkan (87% SMYS) adalah sebesar 313.2 Mpa. Jadi kesimpulannya pada kasus ini, *pipeline* akan mengalami kegagalan karena tegangan ekuivalen yang terjadi melebihi batas tegangan yang diizinkan.

c. Tegangan ekuivalen akibat pembebanan arah 90° (*stinger stern depth* = 3m)



Gambar 4.16 Profil *Pipelline* selama Proses *Abandonment and Recovery* (pembebanan arah 90° dan *stinger stern depth* = 3m)

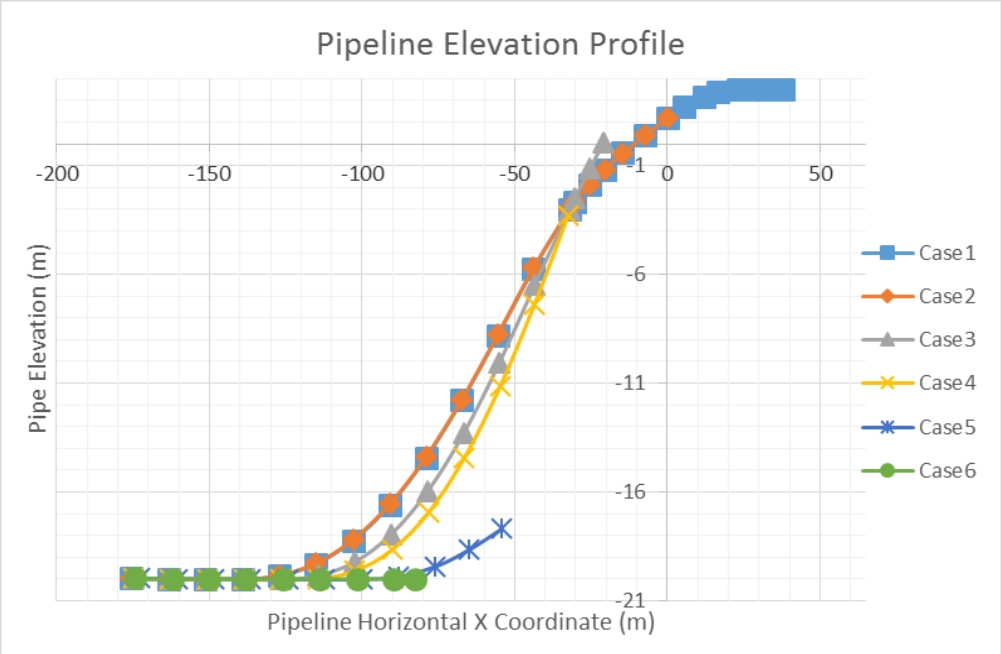
Gambar 4.16 di atas menunjukkan profil *pipeline* selama proses *abandonment and recovery* akibat pembebanan arah 90° dan jarak ujung *stinger* terhadap permukaan laut bernilai 3m.



Gambar 4.17 Tegangan Ekuivalen selama Proses *Abandonment and Recovery* (pembebanan arah 90° dan *stinger stern depth* = 3m)

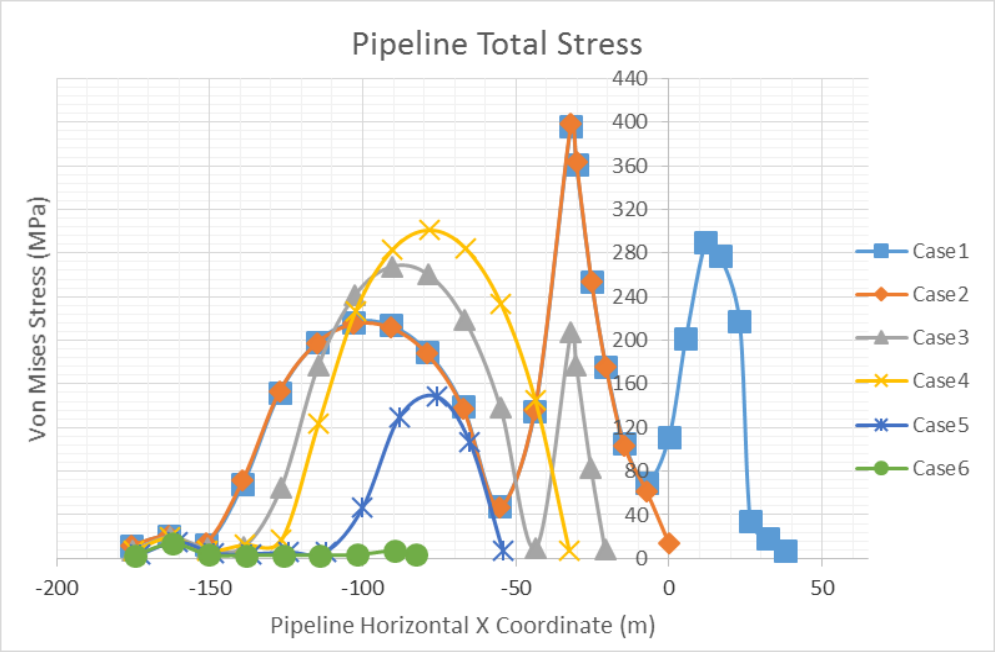
Berdasarkan Gambar 4.17 di atas, tegangan ekuivalen terbesar ada pada *node* ke-30 yang berada di ujung *stinger* dan mempunyai nilai 398.31 Mpa. Berdasarkan DNV OS F101, tegangan ekuivalen maksimal yang diizinkan (87% SMYS) adalah sebesar 313.2 Mpa. Jadi kesimpulannya pada kasus ini, *pipeline* akan mengalami kegagalan karena tegangan ekuivalen yang terjadi melebihi batas tegangan yang diizinkan.

d. Tegangan ekuivalen akibat pembebanan arah 135° (*stinger stern depth* = 3m)



Gambar 4.18 Profil *Pipelline* selama Proses *Abandonment and Recovery* (pembebanan arah 135° dan *stinger stern depth* = 3m)

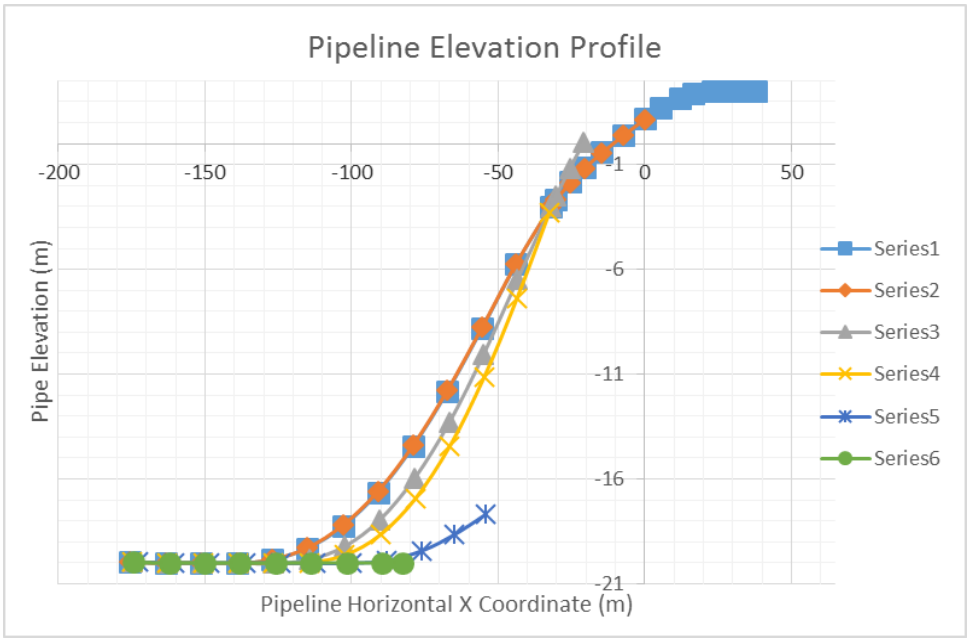
Gambar 4.18 di atas menunjukkan profil *pipeline* selama proses *abandonment and recovery* akibat pembebanan arah 135° dan jarak ujung *stinger* terhadap permukaan laut bernilai 3m.



Gambar 4.19 Tegangan Ekuivalen selama Proses *Abandonment and Recovery* (pembebanan arah 135° dan *stinger stern depth* = 3m)

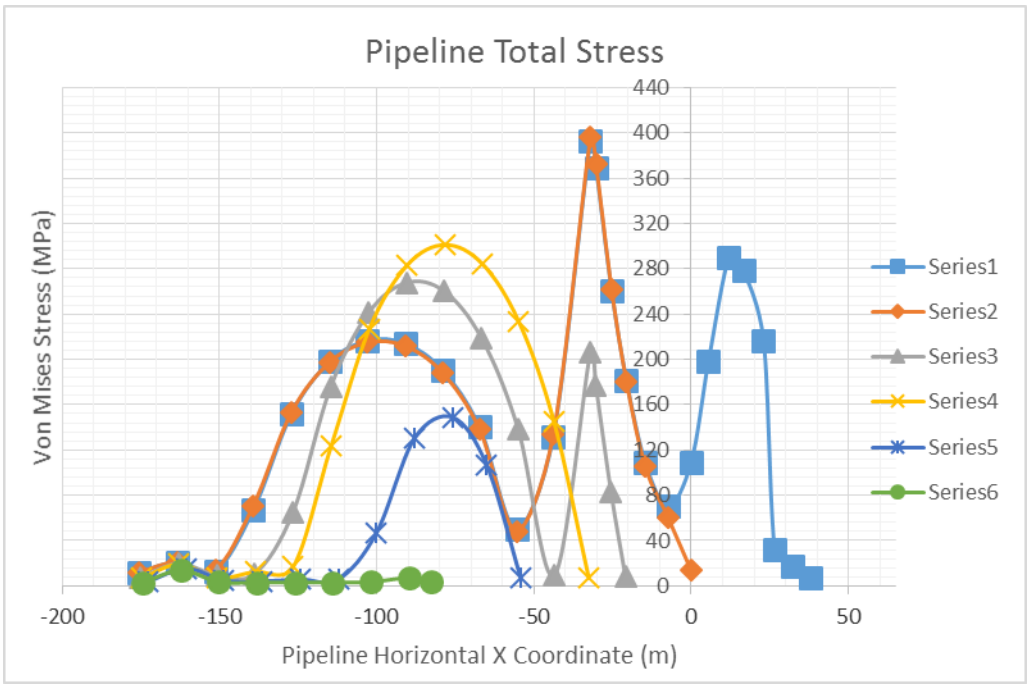
Berdasarkan Gambar 4.19 di atas, tegangan ekuivalen terbesar ada pada *node* ke-30 yang berada di ujung *stinger* dan mempunyai nilai 398.05 Mpa. Berdasarkan DNV OS F101, tegangan ekuivalen maksimal yang diizinkan (87% SMYS) adalah sebesar 313.2 Mpa. Jadi kesimpulannya pada kasus ini, *pipeline* akan mengalami kegagalan karena tegangan ekuivalen yang terjadi melebihi batas tegangan yang diizinkan.

e. Tegangan ekuivalen akibat pembebanan arah 180° (*stinger stern depth* = 3m)



Gambar 4.20 Profil *Pipelline* selama Proses *Abandonment and Recovery* (pembebanan arah 180° dan *stinger stern depth* = 3m)

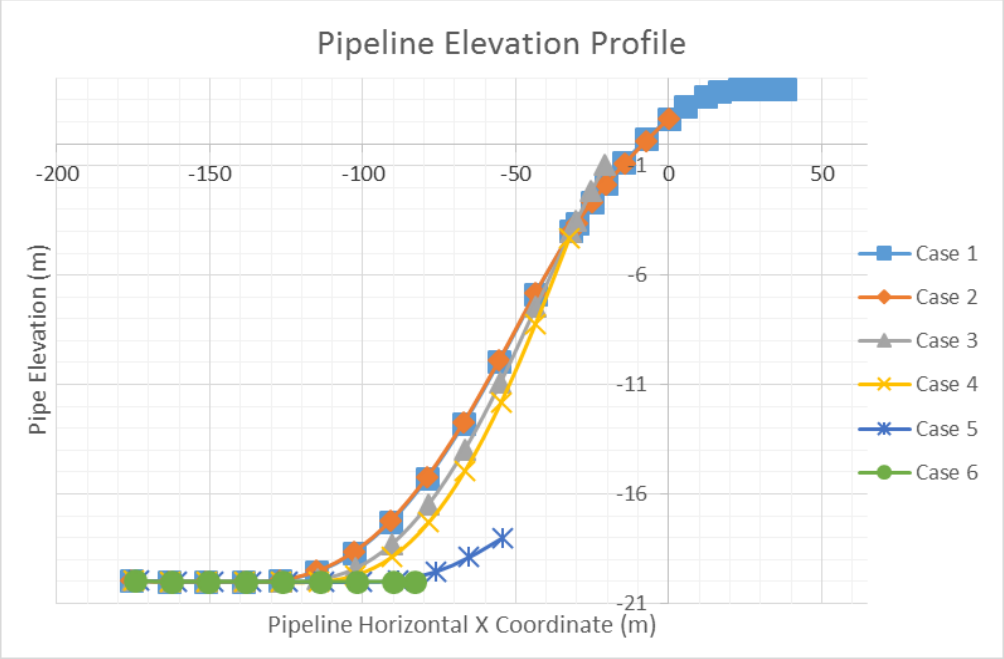
Gambar 4.20 di atas menunjukkan profil *pipeline* selama proses *abandonment and recovery* akibat pembebanan arah 180° dan jarak ujung *stinger* terhadap permukaan laut bernilai 3m.



Gambar 4.21 Tegangan Ekuivalen selama Proses *Abandonment and Recovery* (pembebanan arah 180° dan *stinger stern depth* = 3m)

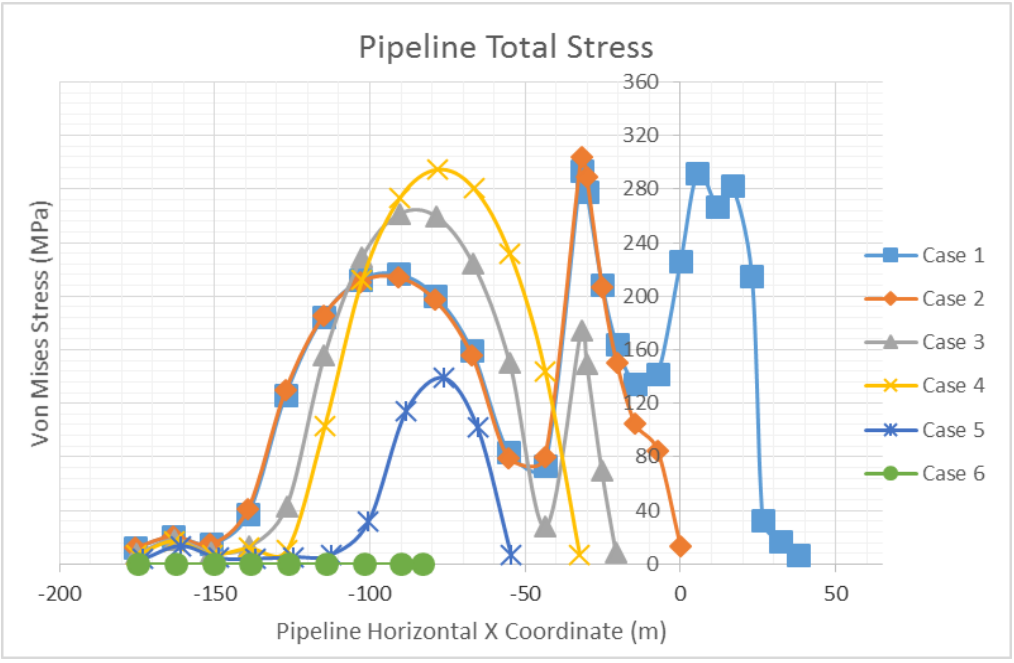
Berdasarkan Gambar 4.21 di atas, tegangan ekuivalen terbesar ada pada *node* ke-30 yang berada di ujung *stinger* dan mempunyai nilai 395.79 Mpa. Berdasarkan DNV OS F101, tegangan ekuivalen maksimal yang diizinkan (87% SMYS) adalah sebesar 313.2 Mpa. Jadi kesimpulannya pada kasus ini, *pipeline* akan mengalami kegagalan karena tegangan ekuivalen yang terjadi melebihi batas tegangan yang diizinkan.

f. Tegangan ekuivalen akibat pembebanan arah 0° (*stinger stern depth* = 4m)



Gambar 4.22 Profil *Pipelline* selama Proses *Abandonment and Recovery* (pembebanan arah 0° dan *stinger stern depth* = 4m)

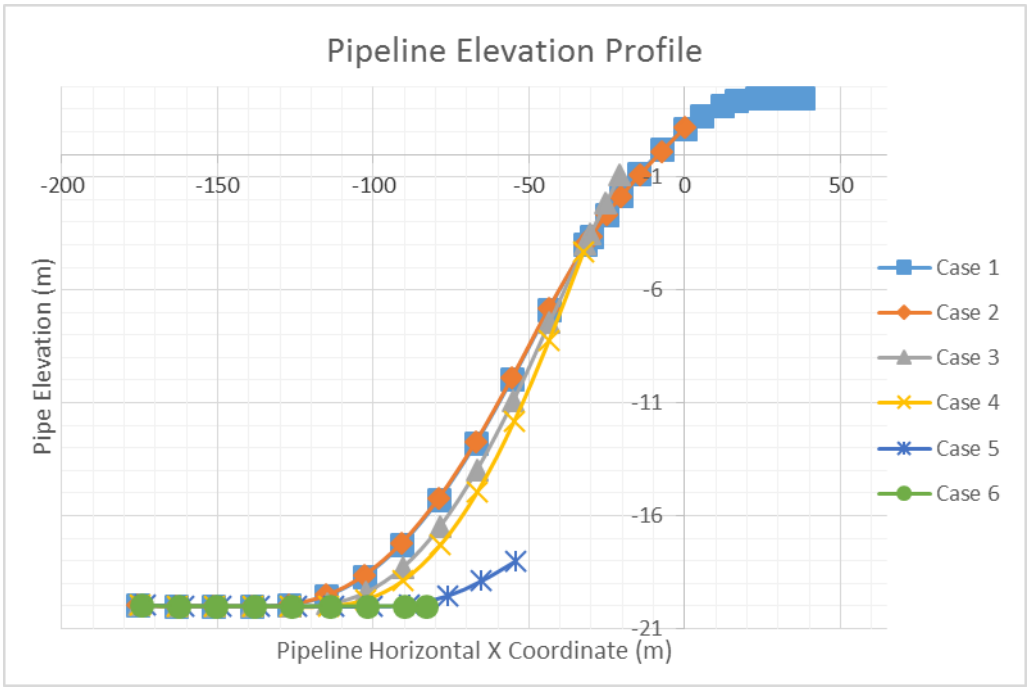
Gambar 4.22 di atas menunjukkan profil *pipeline* selama proses *abandonment and recovery* akibat pembebanan arah 0° dan jarak ujung *stinger* terhadap permukaan laut bernilai 4m.



Gambar 4.23 Tegangan Ekuivalen selama Proses *Abandonment and Recovery* (pembebanan arah 0° dan *stinger stern depth* = 4m)

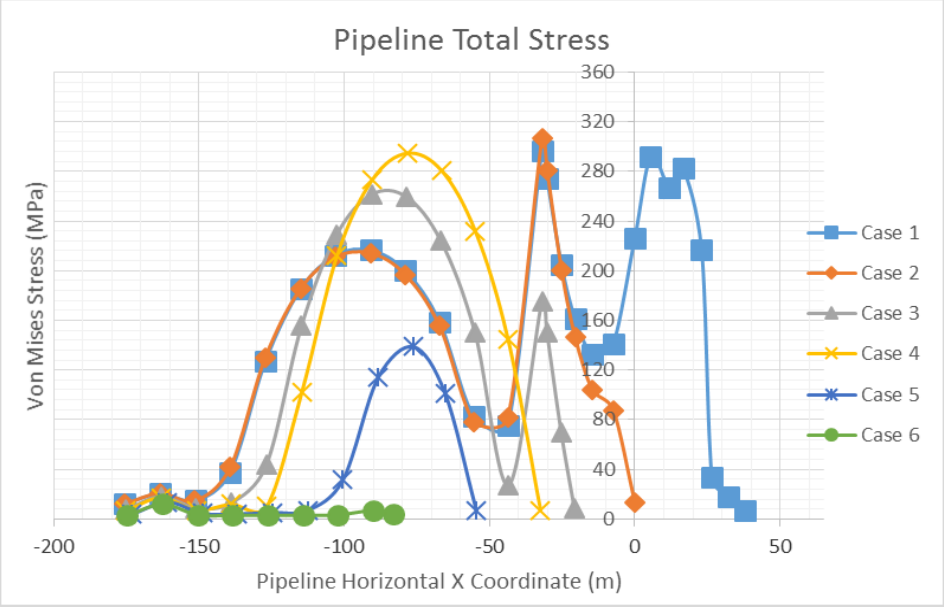
Berdasarkan Gambar 4.23 di atas, tegangan ekuivalen terbesar ada pada *node* ke-30 yang berada di ujung *stinger* dan mempunyai nilai 304.33 Mpa. Berdasarkan DNV OS F101, tegangan ekuivalen maksimal yang diizinkan (87% SMYS) adalah sebesar 313.2 Mpa. Jadi kesimpulannya pada kasus ini, *pipeline* tidak mengalami kegagalan karena tegangan ekuivalen yang terjadi lebih kecil dibandingkan dengan tegangan yang diizinkan.

g. Tegangan ekuivalen akibat pembebanan arah 45° (*stinger stern depth* = 4m)



Gambar 4.24 Profil *Pipelline* selama Proses *Abandonment and Recovery* (pembebanan arah 45° dan *stinger stern depth* = 4m)

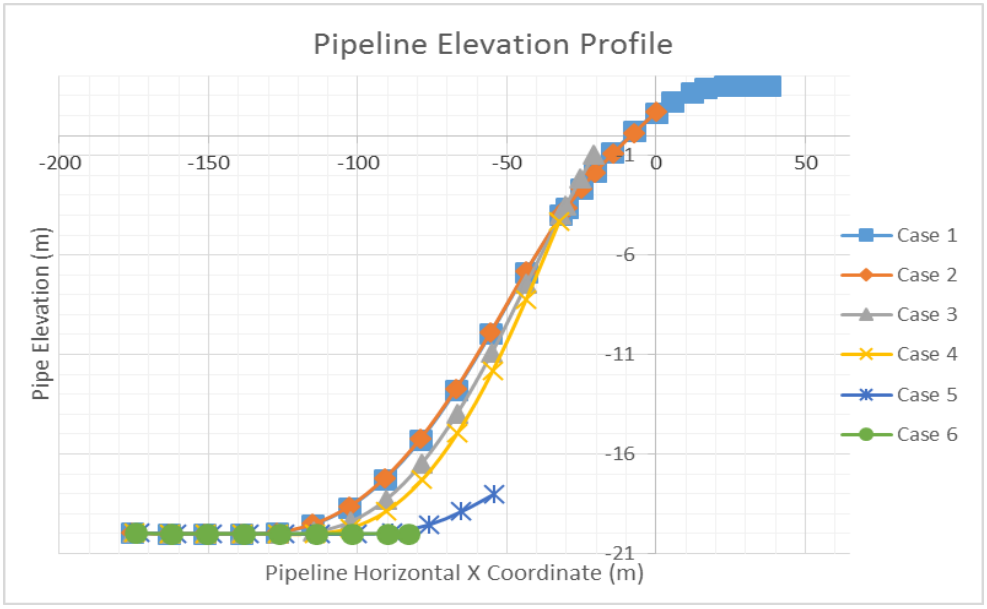
Gambar 4.24 di atas menunjukkan profil *pipeline* selama proses *abandonment and recovery* akibat pembebanan arah 45° dan jarak ujung *stinger* terhadap permukaan laut bernilai 4m.



Gambar 4.25 Tegangan Ekuivalen selama Proses *Abandonment and Recovery* (pembebanan arah 45° dan *stinger stern depth* = 4m)

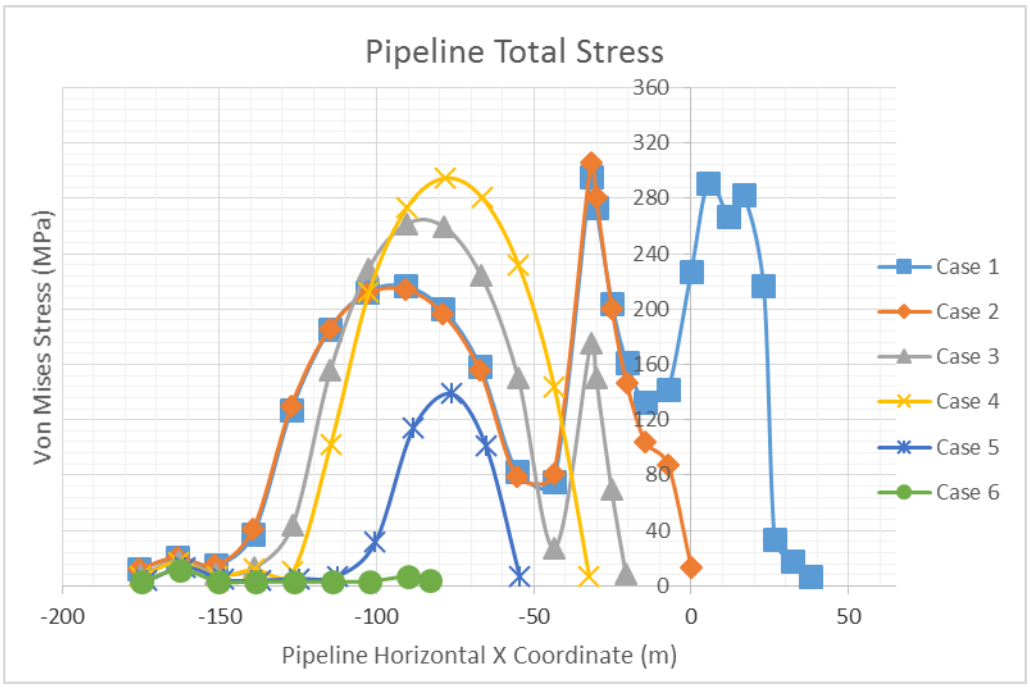
Berdasarkan Gambar 4.25 di atas, tegangan ekuivalen terbesar ada pada *node* ke-30 yang berada di ujung *stinger* dan mempunyai nilai 306.29 Mpa. Berdasarkan DNV OS F101, tegangan ekuivalen maksimal yang diizinkan (87% SMYS) adalah sebesar 313.2 Mpa. Jadi kesimpulannya pada kasus ini, *pipeline* tidak mengalami kegagalan karena tegangan ekuivalen yang terjadi lebih kecil dibandingkan dengan tegangan yang diizinkan.

h. Tegangan ekuivalen akibat pembebanan arah 90° (*stinger stern depth* = 4m)



Gambar 4.26 Profil *Pipelline* selama Proses *Abandonment and Recovery* (pembebanan arah 90° dan *stinger stern depth* = 4m)

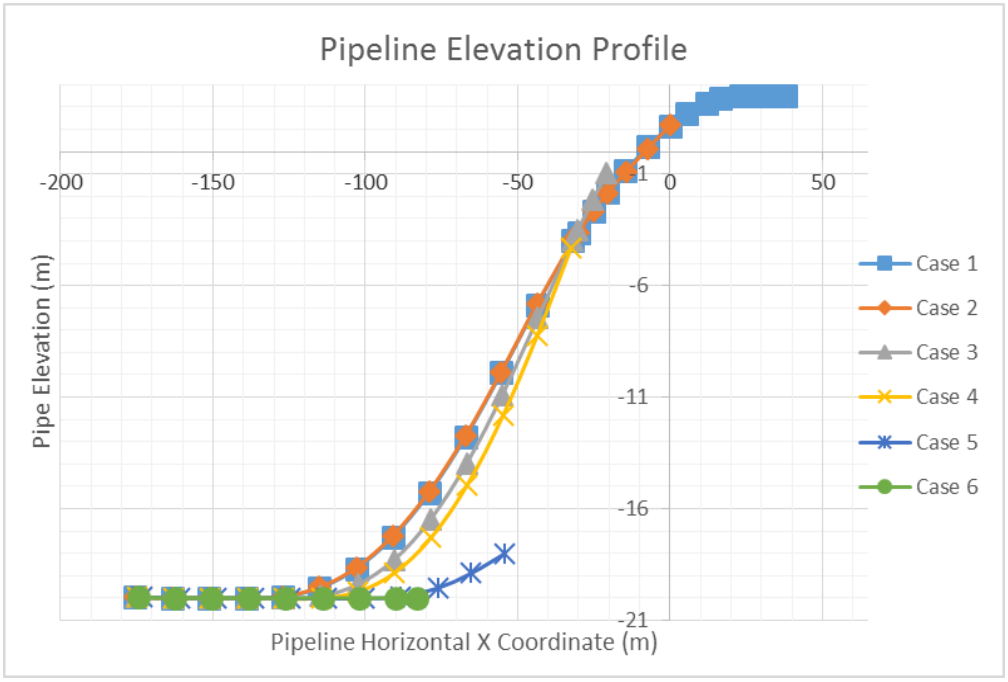
Gambar 4.26 di atas menunjukkan profil *pipeline* selama proses *abandonment and recovery* akibat pembebanan arah 90° dan jarak ujung *stinger* terhadap permukaan laut bernilai 4m.



Gambar 4.27 Tegangan Ekuivalen selama Proses *Abandonment and Recovery* (pembebanan arah 90° dan *stinger stern depth* = 4m)

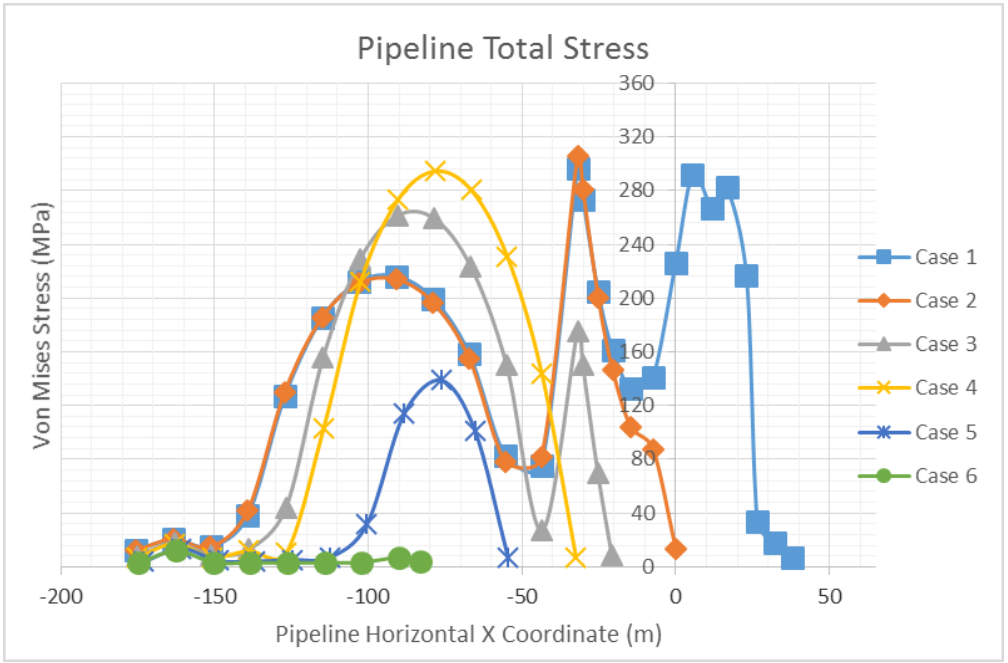
Berdasarkan Gambar 4.27 di atas, tegangan ekuivalen terbesar ada pada *node* ke-30 yang berada di ujung *stinger* dan mempunyai nilai 305.62 Mpa. Berdasarkan DNV OS F101, tegangan ekuivalen maksimal yang diizinkan (87% SMYS) adalah sebesar 313.2 Mpa. Jadi kesimpulannya pada kasus ini, *pipeline* tidak mengalami kegagalan karena tegangan ekuivalen yang terjadi lebih kecil dibandingkan dengan tegangan yang diizinkan.

i. Tegangan ekuivalen akibat pembebanan arah 135° (*stinger stern depth* = 4m)



Gambar 4.28 Profil *Pipelline* selama Proses *Abandonment and Recovery* (pembebanan arah 135° dan *stinger stern depth* = 4m)

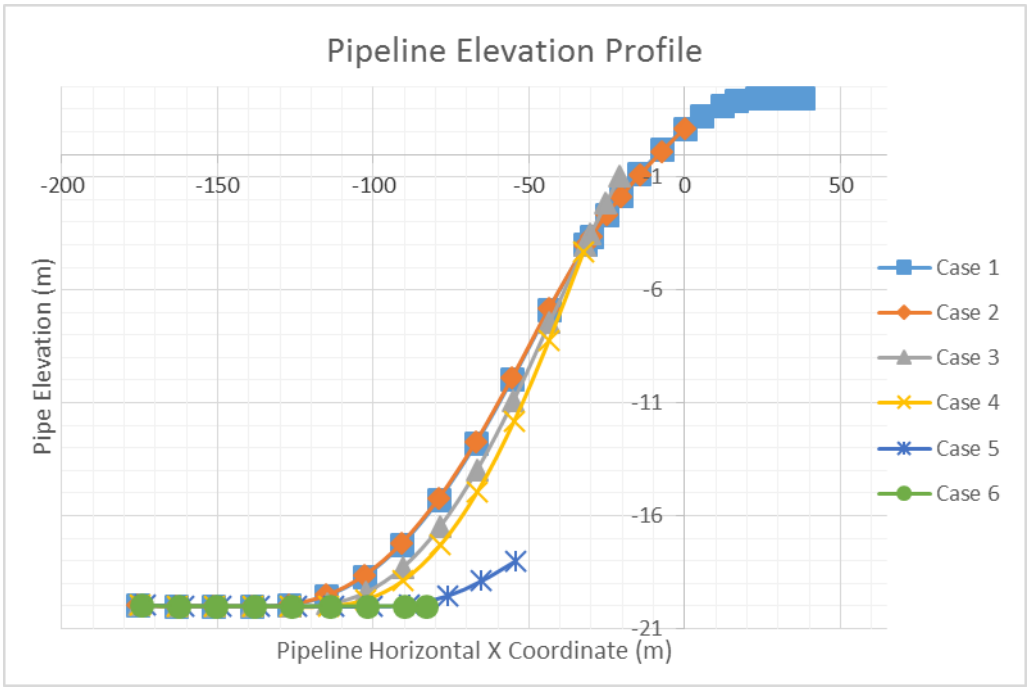
Gambar 4.28 di atas menunjukkan profil *pipeline* selama proses *abandonment and recovery* akibat pembebanan arah 135° dan jarak ujung *stinger* terhadap permukaan laut bernilai 4m.



Gambar 4.29 Tegangan Ekuivalen selama Proses *Abandonment and Recovery* (pembebanan arah 135° dan *stinger stern depth* = 4m)

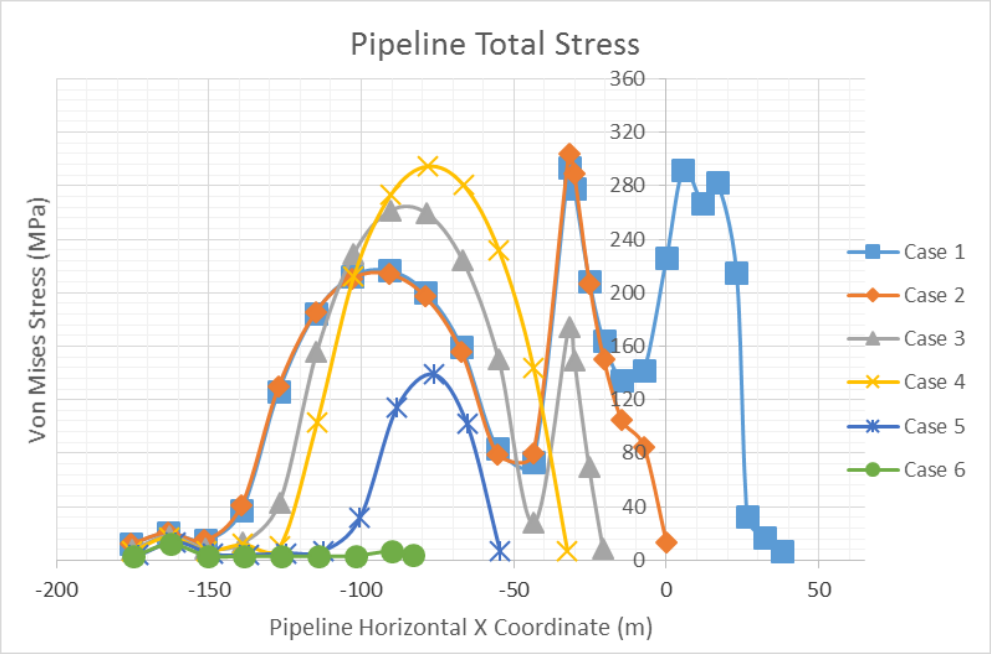
Berdasarkan Gambar 4.29 di atas, tegangan ekuivalen terbesar ada pada *node* ke-30 yang berada di ujung *stinger* dan mempunyai nilai 305.9 Mpa. Berdasarkan DNV OS F101, tegangan ekuivalen maksimal yang diizinkan (87% SMYS) adalah sebesar 313.2 Mpa. Jadi kesimpulannya pada kasus ini, *pipeline* tidak mengalami kegagalan karena tegangan ekuivalen yang terjadi lebih kecil dibandingkan dengan tegangan yang diizinkan.

j. Tegangan ekuivalen akibat pembebanan arah 180° (*stinger stern depth* = 4m)



Gambar 4.30 Profil *Pipelline* selama Proses *Abandonment and Recovery* (pembebanan arah 180° dan *stinger stern depth* = 4m)

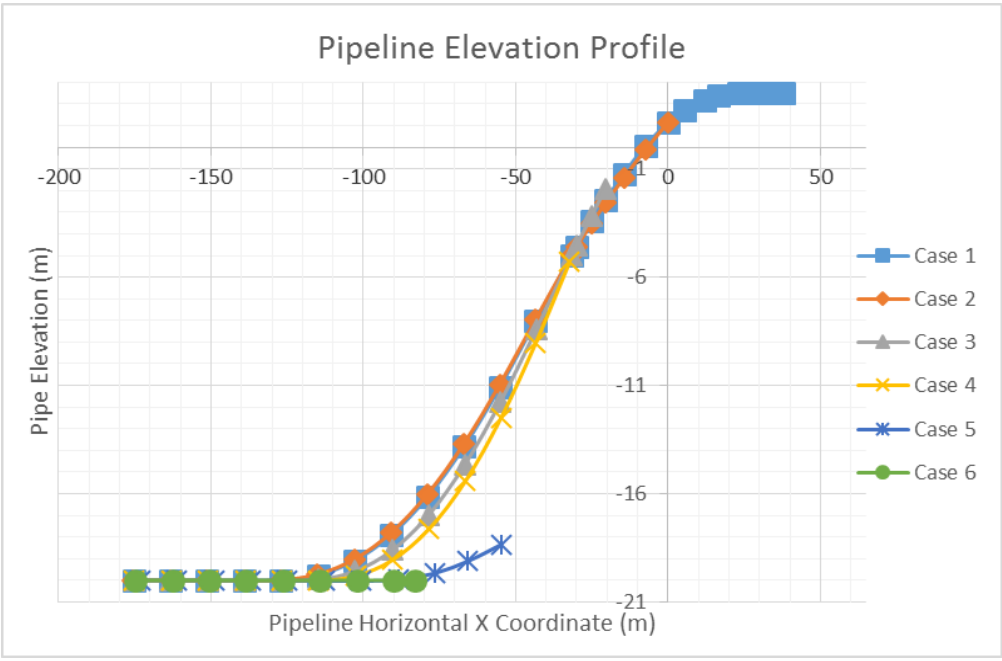
Gambar 4.30 di atas menunjukkan profil *pipeline* selama proses *abandonment and recovery* akibat pembebanan arah 180° dan jarak ujung *stinger* terhadap permukaan laut bernilai 4m.



Gambar 4.31 Tegangan Ekuivalen selama Proses *Abandonment and Recovery* (pembebanan arah 180° dan *stinger stern depth* = 4m)

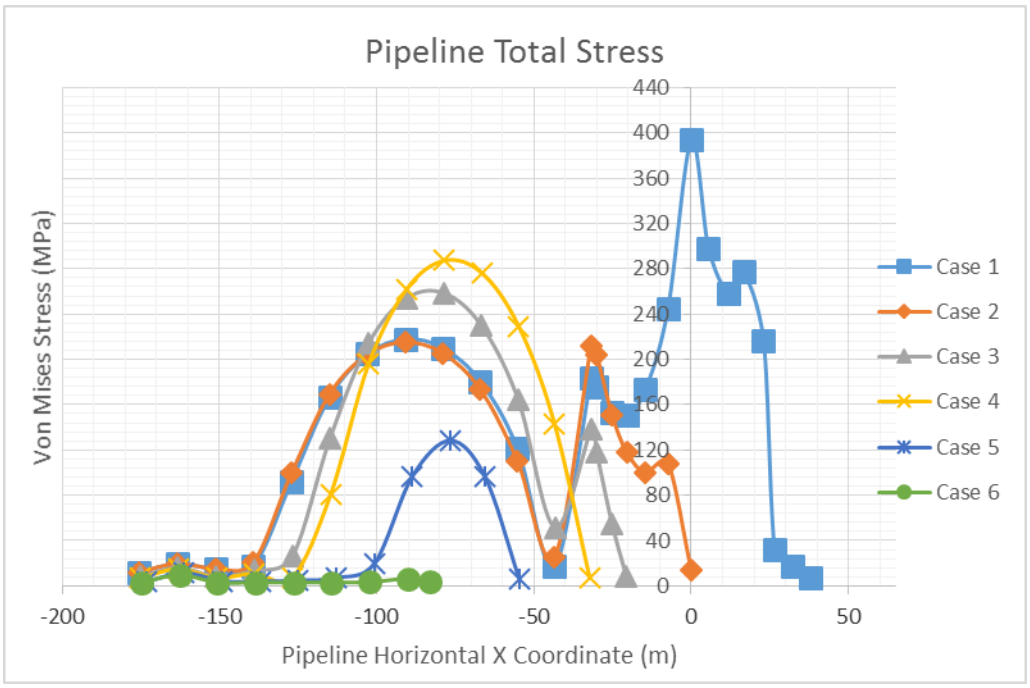
Berdasarkan Gambar 4.31 di atas, tegangan ekuivalen terbesar ada pada *node* ke-30 yang berada di ujung *stinger* dan mempunyai nilai 304.33 Mpa. Berdasarkan DNV OS F101, tegangan ekuivalen maksimal yang diizinkan (87% SMYS) adalah sebesar 313.2 Mpa. Jadi kesimpulannya pada kasus ini, *pipeline* tidak mengalami kegagalan karena tegangan ekuivalen yang terjadi lebih kecil dibandingkan dengan tegangan yang diizinkan.

k. Tegangan ekuivalen akibat pembebanan arah 0° (*stinger stern depth* = 5m)



Gambar 4.32 Profil *Pipelline* selama Proses *Abandonment and Recovery* (pembebanan arah 0° dan *stinger stern depth* = 5m)

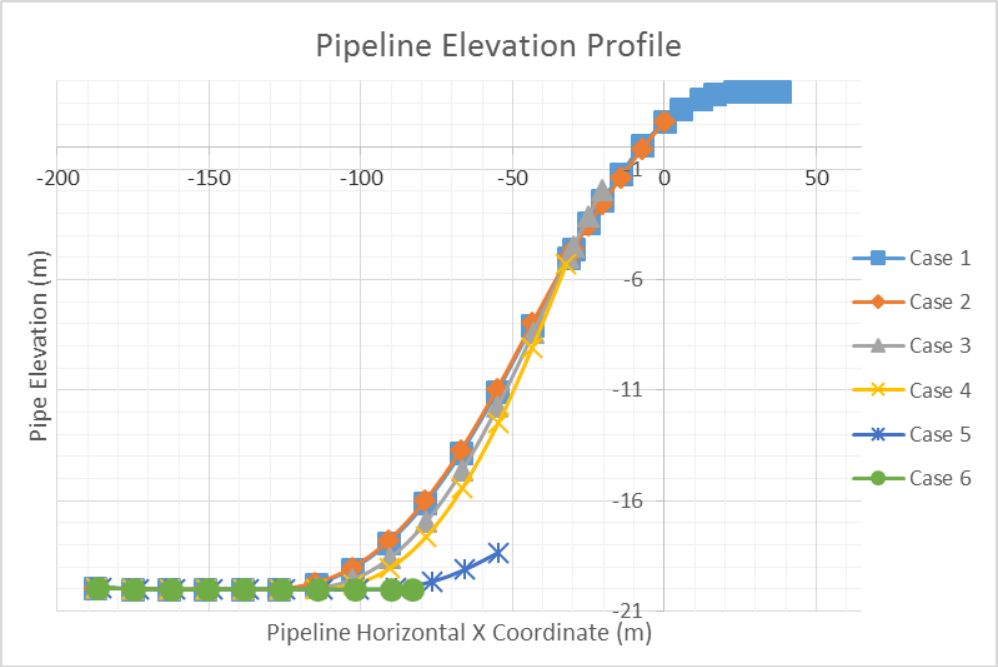
Gambar 4.32 di atas menunjukkan profil *pipeline* selama proses *abandonment and recovery* akibat pembebanan arah 0° dan jarak ujung *stinger* terhadap permukaan laut bernilai 5m.



Gambar 4.33 Tegangan Ekuivalen selama Proses *Abandonment and Recovery* (pembebanan arah 0° dan *stinger stern depth* = 5m)

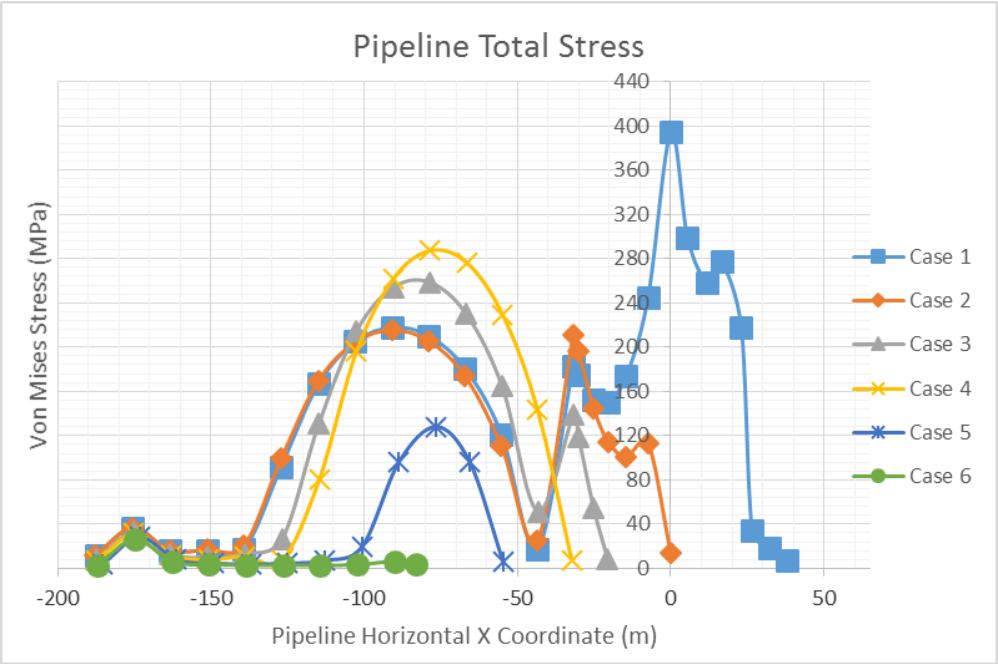
Berdasarkan Gambar 4.33 di atas, tegangan ekuivalen terbesar ada pada *node* ke-17 yang berada di sambungan antara *barge* dengan *stinger* (*hitch*) dan mempunyai nilai 393.53 Mpa. Berdasarkan DNV OS F101, tegangan ekuivalen maksimal yang diizinkan (87% SMYS) adalah sebesar 313.2 Mpa. Jadi kesimpulannya pada kasus ini, *pipeline* akan mengalami kegagalan karena tegangan ekuivalen yang terjadi melebihi batas tegangan yang diizinkan.

l. Tegangan ekuivalen akibat pembebanan arah 45° (*stinger stern depth* = 5m)



Gambar 4.34 Profil *Pipelline* selama Proses *Abandonment and Recovery* (pembebanan arah 45° dan *stinger stern depth* = 5m)

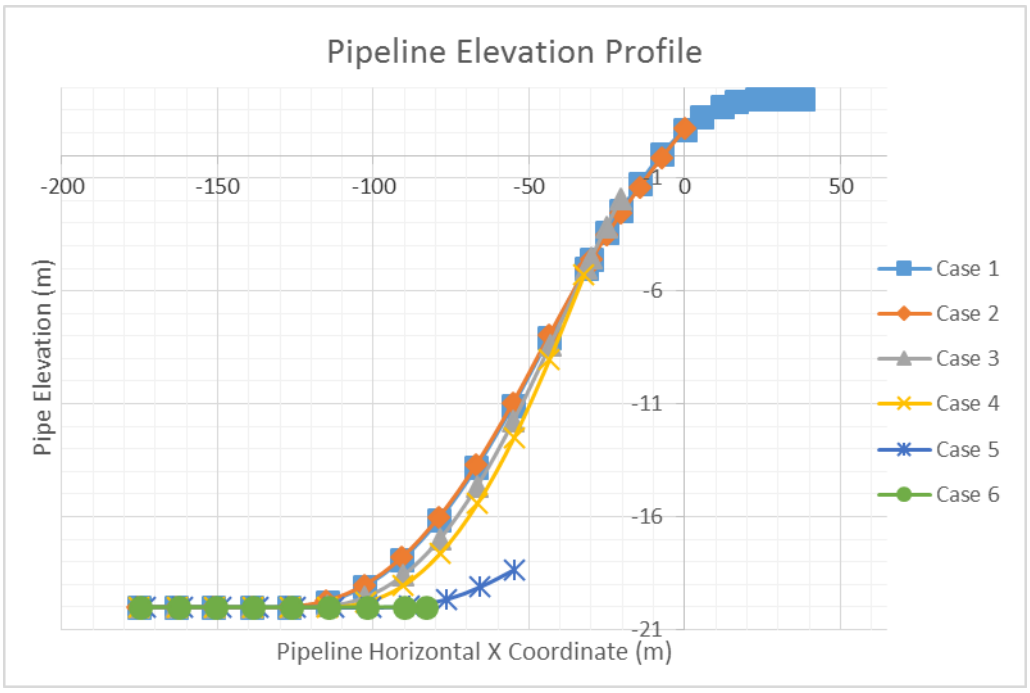
Gambar 4.34 di atas menunjukkan profil *pipeline* selama proses *abandonment and recovery* akibat pembebanan arah 45° dan jarak ujung *stinger* terhadap permukaan laut bernilai 5m.



Gambar 4.35 Tegangan Ekuivalen selama Proses *Abandonment and Recovery* (pembebanan arah 45° dan *stinger stern depth* = 5m)

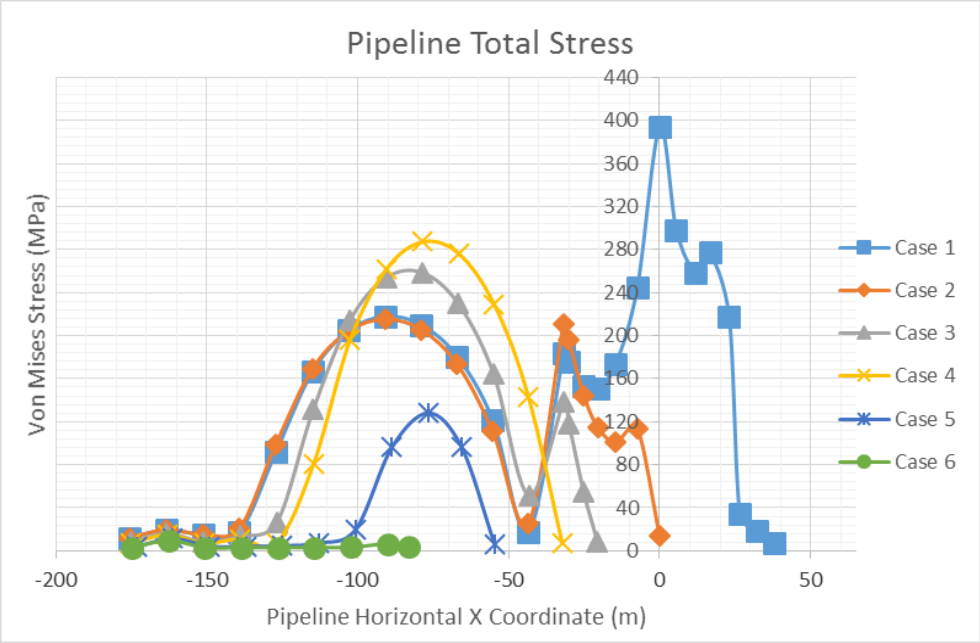
Berdasarkan Gambar 4.35 di atas, tegangan ekuivalen terbesar ada pada *node* ke-17 yang berada di sambungan antara *barge* dengan *stinger* (*hitch*) dan mempunyai nilai 394.15 Mpa. Berdasarkan DNV OS F101, tegangan ekuivalen maksimal yang diizinkan (87% SMYS) adalah sebesar 313.2 Mpa. Jadi kesimpulannya pada kasus ini, *pipeline* akan mengalami kegagalan karena tegangan ekuivalen yang terjadi melebihi batas tegangan yang diizinkan.

m. Tegangan ekuivalen akibat pembebanan arah 90° (*stinger stern depth* = 5m)



Gambar 4.36 Profil *Pipelline* selama Proses *Abandonment and Recovery* (pembebanan arah 90° dan *stinger stern depth* = 5m)

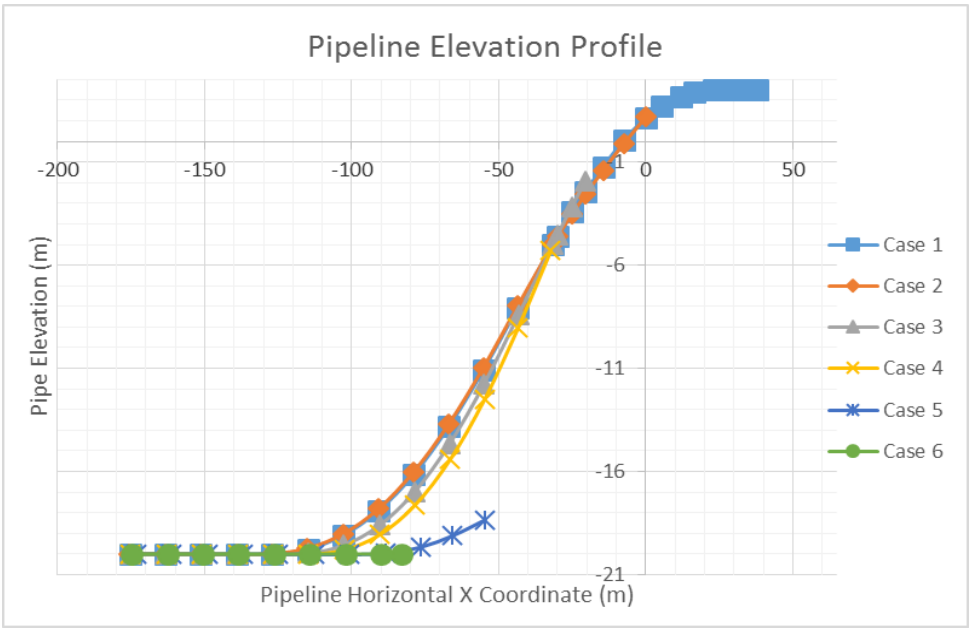
Gambar 4.36 di atas menunjukkan profil *pipeline* selama proses *abandonment and recovery* akibat pembebanan arah 90° dan jarak ujung *stinger* terhadap permukaan laut bernilai 5m.



Gambar 4.37 Tegangan Ekuivalen selama Proses *Abandonment and Recovery* (pembebanan arah 90° dan *stinger stern depth* = 5m)

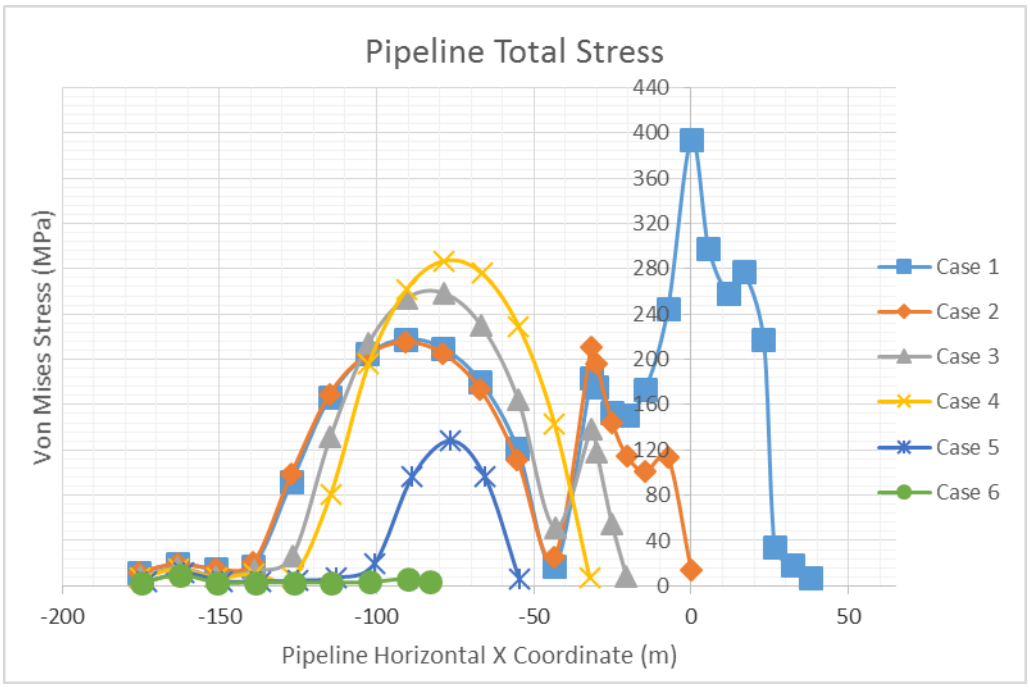
Berdasarkan Gambar 4.37 di atas, tegangan ekuivalen terbesar ada pada *node* ke-17 yang berada di sambungan antara *barge* dengan *stinger* (*hitch*) dan mempunyai nilai 394.13 Mpa. Berdasarkan DNV OS F101, tegangan ekuivalen maksimal yang diizinkan (87% SMYS) adalah sebesar 313.2 Mpa. Jadi kesimpulannya pada kasus ini, *pipeline* akan mengalami kegagalan karena tegangan ekuivalen yang terjadi melebihi batas tegangan yang diizinkan.

n. Tegangan ekuivalen akibat pembebanan arah 135° (*stinger stern depth* = 5m)



Gambar 4.38 Profil *Pipelline* selama Proses *Abandonment and Recovery* (pembebanan arah 135° dan *stinger stern depth* = 5m)

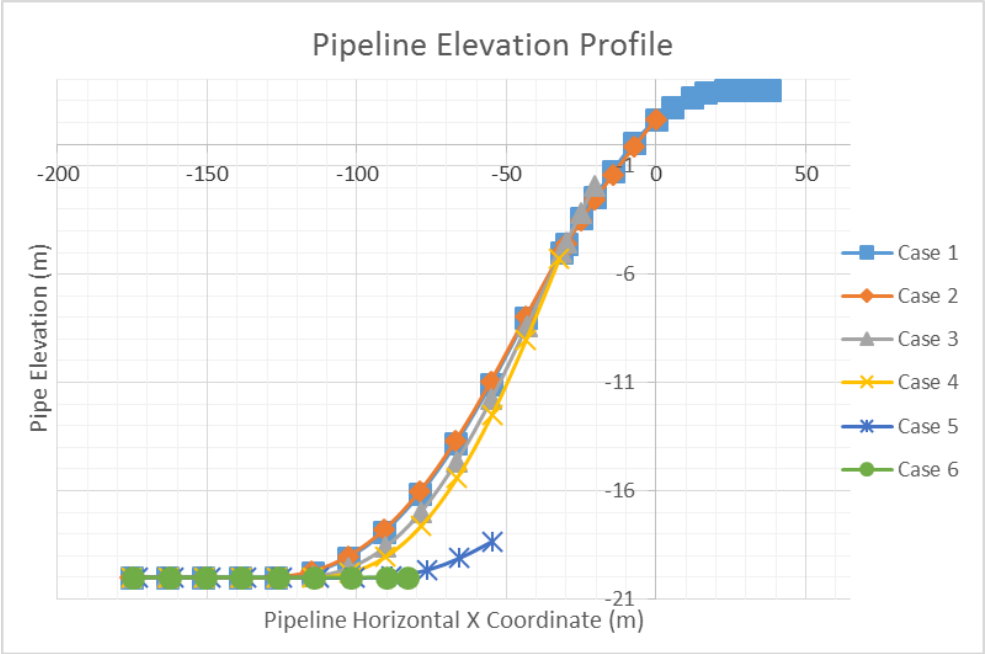
Gambar 4.38 di atas menunjukkan profil *pipeline* selama proses *abandonment and recovery* akibat pembebanan arah 135° dan jarak ujung *stinger* terhadap permukaan laut bernilai 5m.



Gambar 4.39 Tegangan Ekuivalen selama Proses *Abandonment and Recovery* (pembebanan arah 135° dan *stinger stern depth* = 5m)

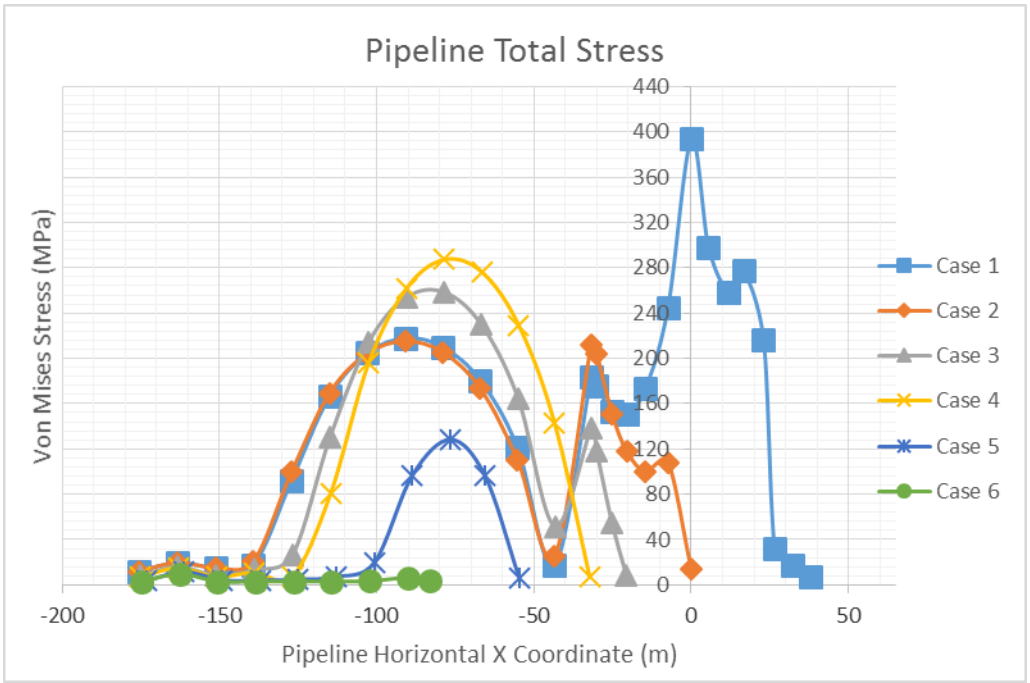
Berdasarkan Gambar 4.39 di atas, tegangan ekuivalen terbesar ada pada *node* ke-17 yang berada di sambungan antara *barge* dengan *stinger* (*hitch*) dan mempunyai nilai 394.16 Mpa. Berdasarkan DNV OS F101, tegangan ekuivalen maksimal yang diizinkan (87% SMYS) adalah sebesar 313.2 Mpa. Jadi kesimpulannya pada kasus ini, *pipeline* akan mengalami kegagalan karena tegangan ekuivalen yang terjadi melebihi batas tegangan yang diizinkan.

o. Tegangan ekuivalen akibat pembebanan arah 135° (*stinger stern depth* = 5m)



Gambar 4.40 Profil *Pipelline* selama Proses *Abandonment and Recovery* (pembebanan arah 180° dan *stinger stern depth* = 5m)

Gambar 4.40 di atas menunjukkan profil *pipeline* selama proses *abandonment and recovery* akibat pembebanan arah 180° dan jarak ujung *stinger* terhadap permukaan laut bernilai 5m.



Gambar 4.41 Tegangan Ekuivalen selama Proses *Abandonment and Recovery* (pembebanan arah 180° dan *stinger stern depth* = 5m)

Berdasarkan Gambar 4.41 di atas, tegangan ekuivalen terbesar ada pada *node* ke-17 yang berada di sambungan antara *barge* dengan *stinger* (*hitch*) dan mempunyai nilai 393.53 Mpa. Berdasarkan DNV OS F101, tegangan ekuivalen maksimal yang diizinkan (87% SMYS) adalah sebesar 313.2 Mpa. Jadi kesimpulannya pada kasus ini, *pipeline* akan mengalami kegagalan karena tegangan ekuivalen yang terjadi melebihi batas tegangan yang diizinkan.

IV.4.4 Hasil Perhitungan Tegangan Ekuivalen pada *Pipeline* Selama Proses *Abandonment and Recovery* dengan Variasi Jarak Ujung *Stinger* terhadap Permukaan Laut

Tabel 4.12 Hasil Perhitungan Tegangan Ekuivalen pada *Pipeline* Selama Proses *Abandonment and Recovery*

No	Stinger Stern Depth	Stinger Angle	Wave and Current Direction	Max. Stress at Overbend		Max. Stress at Stinger Tip		Max. Stress at Sagbend	
				Actual	Allowable	Actual	Allowable	Actual	Allowable
-	(m)	(deg)	(deg)	(% SMYS)		(% SMYS)		(% SMYS)	
1	3	8.77	0	103.62	87	110.08	87	83.67	87
2			45	100.99	87	110.69	87	83.67	87
3			90	100.92	87	110.64	87	83.63	87
4			135	100.88	87	110.57	87	83.6	87
5			180	103.5	87	109.94	87	83.66	87
6	4	10.7	0	80.18	87	84.54	87	81.81	87
7			45	78.08	87	85.08	87	81.83	87
8			90	77.88	87	84.9	87	81.79	87
9			135	77.98	87	84.97	87	81.77	87
10			180	80.18	87	84.54	87	81.81	87
11	5	12.57	0	109.31	87	58.97	87	79.8	87
12			45	109.49	87	58.64	87	79.81	87
13			90	109.48	87	59.8	87	79.78	87
14			135	109.49	87	58.54	87	79.75	87
15			180	109.31	87	58.97	87	79.8	87

Berdasarkan Tabel 4.12 di atas, dapat disimpulkan bahwa *pipeline* akan mengalami tegangan yang berlebih (*overstress*) jika jarak ujung *stinger* terhadap permukaan laut (*stinger stern depth*) bernilai 3m dan 5m. Hal ini terjadi karena tegangan ekuivalen yang terjadi melebihi tegangan yang diizinkan (87% SMYS). Sedangkan jika jarank ujung *stinger* terhadap permukaan laut (*stinger stern depth*) benilai 4m, *pipeline* dinyatakan aman karena tidak mengalami tegangan yang berlebih pada *overbend*, *sagbend*, maupun *stinger tip*.

IV.5 Analisis *Local Buckling* Selama Proses *Abandonment and Recovery*

Setelah melakukan analisis tegangan yang terjadi selama proses *abandonment and recovery*, kemudian setelah itu harus dilakukan analisis *local buckling* pada pipeline. Analisis *local buckling* ini dilakukan untuk menghindari terjadinya *local buckling* pada *pipeline* yang diakibatkan oleh *bending moment* dan *axial force* yang timbul selama proses *abandonment and recovery*. Nilai *maximum bending moment* dan *maximum axial force* didapat dari *output* pemodelan proses *abandonment and recovery* dengan menggunakan *software* OFFPIPE.

Perhitungan nilai *local buckling* dilakukan secara manual dengan menggunakan Persamaan 2.31. Berdasarkan DNV OS F101, persamaan ini digunakan untuk menghitung *local buckling* yang terjadi karena tekanan ekstenal yang berlebih (*external overpressure*). Hasil yang didapatkan dari perhitungan *local buckling* berupa *unity check*. Dalam DNV OS F101, *local buckling* terjadi jika nilai *unity check* melebihi 1 (UC > 1)

IV.5.1 Skema Analisis yang Dilakukan

Analisis *local buckling* selama proses *abandonment and recovery* dilakukan dengan 3 variasi jarak ujung *stinger* terhadap permukaan laut. Analisis *local buckling* ini dilakukan pada daerah *sagbend* dan *overbend*. Hal ini dilakukan karena, menurut DNV OS F101 dua daerah tersebut adalah daerah yang paling rentan bagi *pipeline* untuk mengalami kegagalan baik karena tegangan yang berlebih maupun *local buckling*. Nilai *maximum bending moment* dan *maximum axial force* yang digunakan untuk analisis *local buckling*, bisa dilihat pada Tabel 4.13 berikut ini :

Tabel 4.13 Nilai *Bending Moment* dan *Axial Force* yang digunakan untuk menghitung *Local Buckling*

No	Stinger Stern Depth	Max. Bending Moment		Max. Axial Force	
		Overbend	Sagbend	Overbend	Sagbend
-	(m)	(kNm)		(kN)	
1	3	1130.93	865.38	330.08	174.82
2	4	860.59	845.86	330.02	174.82
3	5	1117.75	824.3	329.18	174.83

IV.5.2 Hasil Perhitungan *Local Buckling*

Tabel 4.14 Rangkuman Hasil Perhitungan *Local Buckling* Selama Proses *Abandonment and Recovery*

No	Stinger Stern Depth	Unity Check		Status	
		Overbend	Sagbend	Overbend	Sagbend
-	(m)				
1	3	1.235	0.721	FAIL	OK
2	4	0.717	0.689	OK	OK
3	5	1.207	0.655	FAIL	OK

Berdasarkan Tabel 4.14 di atas, dapat disimpulkan bahwa *pipeline* akan mengalami *local buckling*, jika jarak ujung *stinger* terhadap permukaan laut *(stinger stern depth*) bernilai 3m dan 5m. Hal ini terjadi karena nilai *unity check* melebihi 1 (UC > 1) pada daerah *overbend*. Sedangkan jika jarak ujung *stinger* terhadap permukaan laut (*stinger stern depth*) bernilai 4m, nilai *unity check* pada daerah *overbend* dan *sagbend*, kurang dari 1 (UC < 1). Sehingga bisa dikatakan, *pipeline* tidak megalami *local buckling*.

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BAB V
PENUTUP

V.1 Kesimpulan

Berdasarkan analisis dan pembahasan yang telah dilakukan pada bab yang sebelumnya, maka dapat ditarik beberapa kesimpulan mengenai topik dalam tugas akhir ini, yaitu :

1. Karakteristik gerak *pipe lay barge* pada gelombang reguler untuk gerakan *surge,* nilai terbesar terjadi karena gelombang datang arah 0°&180° yaitu bernilai 0.91 m/m. Untuk gerakan *sway*, nilai terbesarnya adalah 0.97 m/m. Lalu untuk gerakan *heave*, nilai terbesarnya adalah 1.22 m/m. Sedangkan untuk gerakan *roll*, nilai terbesarnya adalah 11.72 deg/m. Pada gerakan *sway*,*heave,* dan *roll*, nilai terbesar terjadi karena gelombang datang arah 90°. Kemudian untuk grakan *pitch* dan *yaw*, nilai terbesarnya berturut-turut yaitu 5.10 deg/m dan 1.81 deg/m.
2. Selama proses *abandonment and* recovery, *pipeline* mengalami tegangan yang berlebih (*overstress*) pada saat jarak ujung *stinger* terhadap permukaan laut bernilai 3m dan 5m. Pada saat jarak ujung *stinger* terhadap permukaan laut bernilai 3m, tegangan ekuivalen terbesar yang terjadi sebesar 398.49 Mpa (110.69% SMYS) dan pada saat bernilai 5m, tegangan ekuivalen terbesar yang terjadi sebesar 394.15 Mpa (109.49% SMYS). Sedangkan pada saat jarak ujung *stinger* terhadap permukaan laut bernilai 4m, *pipeline* tidak mengalami tegangan yang berlebih (*overstress*) karena tegangan ekuivalen terbesar yang terjadi sebesar 306.29 Mpa (85.08% SMYS).
3. *Local buckling* terjadi pada saat jarak ujung *stinger* terhadap permukaan laut bernilai 3m dan 5m, karena nilai *unity check* pada saat 3m adalah 1.414 dan pada 5m bernilai 1.382. Sedangkan pada jarak ujung *stinger* yang bernilai 4m, tidak terjadi *local buckling,* karena nilai *unity check* untuk perhitungan *local buckling* adalah 0.821 pada *overbend* dan 0.789 pada *sagbend*.

V.2 Saran

Saran yang bisa diberikan untuk penelitian selanjutnya mengenai tugas akhir ini adalah sebagai berikut :

1. Perlu ditambahkan mengenai pengaruh pasang surut air laut selama proses *abandonment and recovery*.
2. Pemodelan lebih mendetail mengenai *pulling head* (sambungan *cable* dengan *pipeline*)
3. Perlu ditambahkan *mooring analysis* selama proses *abandonment and recovery*.

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LAMPIRAN A

HASIL *OUTPUT SOFTWARE* MOSES

(*DISPLACEMENT*)

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*************************************************************************************************************
*                                         ***  MOSES  ***                                                   *
*                                         ---------------                          9 May, 2016              *
*       DISPLACEMENT                                                                                        *
*                                                                                                           *
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+++ B U O Y A N C Y   A N D   W E I G H T   F O R   A D M B 8 8 +++

Process is DEFAULT: Units Are Degrees, Meters, and M-Tons Unless Specified

Results Are Reported In Body System

Draft = 2.00 Roll Angle = 0.00 Pitch Angle = 0.00

Wet Radii Of Gyration About CG

K-X = 0.00 K-Y = 0.01 K-Z = 0.01

GMT = 2.20 GML = 156.88

Name	Weight	/-- Center of Gravity ---/ ---X---	---Y---	---Z---	Sounding	% Full
Part ADMB88						
LOAD_GRO	1348.0	31.93	0.00	3.94		
Total	1348.0	31.93	0.00	3.94		
Buoyancy	1348.0	31.93	0.00	1.01		


```
*************************************************************************************************************
*                                         ***  MOSES  ***                                                   *
*                                         ---------------                          9 May, 2016              *
*       DISPLACEMENT                                                                                        *
*                                                                                                           *
*************************************************************************************************************
```

+++ H Y D R O S T A T I C   P R O P E R T I E S +++

For Body ADMB88

Process is DEFAULT: Units Are Degrees, Meters, and M-Tons Unless Specified

/--- Condition ---/ Draft	Trim	Roll	/- Displac-/	/-- Center Of Buoyancy --/ ---X---	---Y---	---Z---	/ W.P. / Area	/C. Flotation / ---X---	---Y---	/---- Metacentric Heights ----/ -KMT-	-KML-	-BMT-	-BML-
0.20	0.00	0.00	131.79	32.49	0.00	0.10	645.	32.42	0.00	50.65	1434.03	50.55	1433.93
0.40	0.00	0.00	264.28	32.42	0.00	0.20	648.	32.30	0.00	25.53	726.50	25.33	726.30
0.60	0.00	0.00	397.44	32.36	0.00	0.30	651.	32.17	0.00	17.23	490.69	16.93	490.39
0.80	0.00	0.00	531.28	32.30	0.00	0.40	654.	32.05	0.00	13.12	372.81	12.72	372.41
1.00	0.00	0.00	665.79	32.23	0.00	0.50	658.	31.93	0.00	10.70	302.10	10.20	301.60
1.20	0.00	0.00	800.95	32.17	0.00	0.60	661.	31.80	0.00	9.11	254.98	8.51	254.37
1.40	0.00	0.00	936.76	32.11	0.00	0.70	664.	31.68	0.00	8.01	221.33	7.31	220.63
1.60	0.00	0.00	1073.21	32.05	0.00	0.81	667.	31.57	0.00	7.21	196.11	6.40	195.30
1.80	0.00	0.00	1210.30	31.99	0.00	0.91	670.	31.45	0.00	6.60	176.50	5.70	175.59
2.00	0.00	0.00	1348.00	31.93	0.00	1.01	673.	31.33	0.00	6.14	160.82	5.13	159.81


```
*************************************************************************************************************
*                                         ***  MOSES  ***                                                   *
*                                         ---------------                          9 May, 2016              *
*       DISPLACEMENT                                                                                        *
*                                                                                                           *
*************************************************************************************************************
```

+++ H Y D R O S T A T I C   C O E F F I C I E N T S +++

For Body ADMB88

Process is DEFAULT: Units Are Degrees, Meters, and M-Tons Unless Specified

/--- Condition ---/ Draft	Trim	Roll	Displacement	Wetted Surface	Load To Change Draft 1 MM	/----- For 0 KG -----/ Moment To Change .01 Deg --- Heel ---	--- Trim ---
0.20	0.00	0.00	131.79	670.5	0.66	1.16	32.98
0.40	0.00	0.00	264.28	699.9	0.66	1.17	33.50
0.60	0.00	0.00	397.44	729.5	0.67	1.17	34.02
0.80	0.00	0.00	531.28	759.1	0.67	1.18	34.53
1.00	0.00	0.00	665.79	788.7	0.67	1.18	35.05
1.20	0.00	0.00	800.95	818.5	0.68	1.19	35.56
1.40	0.00	0.00	936.76	848.3	0.68	1.19	36.07
1.60	0.00	0.00	1073.21	878.2	0.68	1.20	36.58
1.80	0.00	0.00	1210.30	908.2	0.69	1.20	37.09
2.00	0.00	0.00	1348.00	938.2	0.69	1.21	37.60

LAMPIRAN B

HASIL *OUTPUT SOFTWARE* MOSES (*RAO*)

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*** MOSES ***

9 May, 2016

Response Amplitude Operator

Draft = 2.0 Meters | Trim Angle = 0.00 Deg. | GMT = 2.18 Meters
Roll Gy. Radius = 3.7 Meters | Pitch Gy. Radius = 16.7 Meters | Yaw Gy. Radius = 16.7 Meters
Heading = 0.00 Deg. | Forward Speed = 0.00 Knots | Linearization Based on 1/ 20

+++ M O T I O N R E S P O N S E O P E R A T O R S +++

Of Point On Body ADMB88 At X = 32.0 Y = 0.0 Z = 4.0

Process is DEFAULT: Units Are Degrees, Meters, and M-Tons Unless Specified

E N C O U N T E R		Surge /		Sway /		Heave /		Roll /		Pitch /		Yaw /	
		Wave Ampl.		Wave Ampl.		Wave Ampl.		Wave Ampl.		Wave Ampl.		Wave Ampl.	
Frequency -(Rad/Sec)-	Period -(Sec)-	Ampl.	Phase	Ampl.	Phase	Ampl.	Phase	Ampl.	Phase	Ampl.	Phase	Ampl.	Phase
0.2513	25.00	0.909	102	0.000	0	0.920	10	0.000	0	1.100	-98	0.000	0
0.3142	20.00	0.896	109	0.000	0	0.892	15	0.000	0	1.739	-91	0.000	0
0.3307	19.00	0.892	111	0.000	0	0.881	17	0.000	0	1.932	-90	0.000	0
0.3491	18.00	0.886	113	0.000	0	0.867	18	0.000	0	2.157	-88	0.000	0
0.3696	17.00	0.879	116	0.000	0	0.848	20	0.000	0	2.418	-86	0.000	0
0.3927	16.00	0.870	120	0.000	0	0.824	23	0.000	0	2.721	-85	0.000	0
0.4189	15.00	0.858	124	0.000	0	0.791	26	0.000	0	3.071	-82	0.000	0
0.4488	14.00	0.842	129	0.000	0	0.747	29	0.000	0	3.469	-80	0.000	0
0.4833	13.00	0.820	135	0.000	0	0.686	34	0.000	0	3.905	-77	0.000	0
0.5236	12.00	0.790	143	0.000	0	0.600	39	0.000	0	4.357	-74	0.000	0
0.5712	11.00	0.748	153	0.000	0	0.480	44	0.000	0	4.767	-69	0.000	0
0.6283	10.00	0.686	166	0.000	0	0.314	46	0.000	0	5.026	-61	0.000	0
0.6981	9.00	0.593	-175	0.000	0	0.144	9	0.000	0	4.944	-50	0.000	0
0.7854	8.00	0.451	-150	0.000	0	0.361	-45	0.000	0	4.223	-32	0.000	0
0.8378	7.50	0.354	-134	0.000	0	0.564	-39	0.000	0	3.506	-19	0.000	0
0.8976	7.00	0.239	-114	0.000	0	0.778	-25	0.000	0	2.503	-2	0.000	0
1.0472	6.00	0.029	120	0.000	0	1.001	17	0.000	0	0.207	177	0.000	0
1.2566	5.00	0.168	-147	0.000	0	0.093	0	0.000	0	1.419	-59	0.000	0
1.5708	4.00	0.084	-159	0.000	0	0.174	42	0.000	0	0.362	-46	0.000	0
2.0944	3.00	0.019	-155	0.000	0	0.200	106	0.000	0	0.185	21	0.000	0

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*** MOSES ***

9 May, 2016

Response Amplitude Operator

Draft = 2.0 Meters | Trim Angle = 0.00 Deg. | GMT = 2.18 Meters
Roll Gy. Radius = 3.7 Meters | Pitch Gy. Radius = 16.7 Meters | Yaw Gy. Radius = 16.7 Meters
Heading = 45.00 Deg. | Forward Speed = 0.00 Knots | Linearization Based on 1/ 20

+++ M O T I O N R E S P O N S E O P E R A T O R S +++

Of Point On Body ADMB88 At X = 32.0 Y = 0.0 Z = 4.0

Process is DEFAULT: Units Are Degrees, Meters, and M-Tons Unless Specified

E N C O U N T E R		Surge /		Sway /		Heave /		Roll /		Pitch /		Yaw /	
		Wave Ampl.		Wave Ampl.		Wave Ampl.		Wave Ampl.		Wave Ampl.		Wave Ampl.	
Frequency -(Rad/Sec)-	Period -(Sec)-	Ampl.	Phase	Ampl.	Phase	Ampl.	Phase	Ampl.	Phase	Ampl.	Phase	Ampl.	Phase
0.2513	25.00	0.645	99	0.679	97	0.929	7	0.242	98	0.797	-107	0.301	-176
0.3142	20.00	0.638	103	0.666	101	0.912	11	0.386	103	1.246	-100	0.461	-169
0.3307	19.00	0.636	105	0.661	102	0.906	12	0.430	105	1.383	-99	0.508	-167
0.3491	18.00	0.633	106	0.655	104	0.898	13	0.482	106	1.543	-98	0.562	-165
0.3696	17.00	0.630	108	0.647	105	0.888	15	0.544	108	1.732	-97	0.625	-163
0.3927	16.00	0.626	111	0.638	107	0.874	17	0.618	111	1.953	-96	0.698	-160
0.4189	15.00	0.621	114	0.625	110	0.856	19	0.709	113	2.213	-94	0.784	-157
0.4488	14.00	0.614	117	0.607	113	0.831	22	0.822	117	2.513	-93	0.886	-153
0.4833	13.00	0.604	122	0.583	116	0.797	25	0.965	121	2.856	-92	1.005	-148
0.5236	12.00	0.592	127	0.550	120	0.748	30	1.148	126	3.233	-90	1.144	-142
0.5712	11.00	0.574	134	0.503	126	0.678	35	1.392	133	3.620	-88	1.305	-135
0.6283	10.00	0.549	144	0.433	133	0.577	42	1.741	142	3.969	-84	1.484	-125
0.6981	9.00	0.510	156	0.330	140	0.427	50	2.359	153	4.189	-77	1.665	-111
0.7854	8.00	0.449	174	0.171	145	0.212	51	4.570	126	4.127	-66	1.798	-92
0.8378	7.50	0.405	-173	0.119	133	0.116	8	1.418	16	3.916	-58	1.810	-79
0.8976	7.00	0.349	-159	0.116	75	0.222	-44	0.650	-161	3.529	-47	1.750	-63
1.0472	6.00	0.187	-120	0.365	72	0.738	-31	1.076	-117	2.051	-13	1.214	-19
1.2566	5.00	0.029	122	0.479	129	1.092	9	0.296	-41	0.132	-154	0.266	-131
1.5708	4.00	0.088	-117	0.174	98	0.237	-74	0.243	70	0.585	-10	1.192	5
2.0944	3.00	0.010	-40	0.235	176	0.139	26	0.939	158	0.059	110	0.207	107

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*** MOSES ***

9 May, 2016

Response Amplitude Operator

Draft = 2.0 Meters | Trim Angle = 0.00 Deg. | GMT = 2.18 Meters
Roll Gy. Radius = 3.7 Meters | Pitch Gy. Radius = 16.7 Meters | Yaw Gy. Radius = 16.7 Meters
Heading = 90.00 Deg. | Forward Speed = 0.00 Knots | Linearization Based on 1/ 20

+++ M O T I O N R E S P O N S E O P E R A T O R S +++

Of Point On Body ADMB88 At X = 32.0 Y = 0.0 Z = 4.0

Process is DEFAULT: Units Are Degrees, Meters, and M-Tons Unless Specified

E N C O U N T E R		Surge /		Sway /		Heave /		Roll /		Pitch /		Yaw /	
Frequency	Period	Wave Ampl.		Wave Ampl.		Wave Ampl.		Wave Ampl.		Wave Ampl.		Wave Ampl.	
-(Rad/Sec)-	-(Sec)-	Ampl.	Phase	Ampl.	Phase	Ampl.	Phase	Ampl.	Phase	Ampl.	Phase	Ampl.	Phase
0.2513	25.00	0.001	175	0.968	90	0.939	0	0.346	90	0.264	169	0.044	90
0.3142	20.00	0.001	168	0.961	90	0.938	1	0.558	90	0.281	163	0.043	90
0.3307	19.00	0.001	166	0.958	90	0.937	1	0.624	90	0.286	161	0.043	90
0.3491	18.00	0.001	163	0.956	90	0.937	1	0.704	90	0.290	159	0.043	91
0.3696	17.00	0.001	161	0.952	90	0.937	1	0.802	90	0.295	156	0.042	91
0.3927	16.00	0.001	158	0.948	90	0.936	1	0.923	90	0.300	153	0.042	91
0.4189	15.00	0.001	154	0.943	90	0.936	1	1.076	90	0.304	150	0.041	91
0.4488	14.00	0.001	149	0.936	90	0.936	1	1.276	89	0.308	145	0.041	91
0.4833	13.00	0.001	144	0.928	90	0.937	1	1.548	89	0.311	140	0.040	92
0.5236	12.00	0.001	137	0.917	90	0.938	2	1.937	89	0.311	134	0.039	92
0.5712	11.00	0.001	129	0.902	90	0.940	2	2.546	88	0.307	127	0.037	93
0.6283	10.00	0.001	120	0.880	90	0.944	2	3.651	87	0.297	118	0.036	95
0.6981	9.00	0.001	109	0.842	91	0.953	3	6.210	74	0.281	108	0.033	98
0.7854	8.00	0.001	97	0.810	95	0.986	3	11.715	20	0.259	97	0.031	105
0.8378	7.50	0.001	89	0.841	96	0.994	1	11.158	-28	0.246	91	0.032	108
0.8976	7.00	0.001	82	0.828	94	0.997	1	7.107	-68	0.233	84	0.032	109
1.0472	6.00	0.001	62	0.730	95	1.065	0	2.430	-83	0.205	66	0.028	118
1.2566	5.00	0.001	24	0.603	101	1.219	-15	0.715	-78	0.168	29	0.026	133
1.5708	4.00	0.000	0	0.433	117	0.616	-59	0.189	117	0.045	-38	0.024	156
2.0944	3.00	0.000	0	0.236	165	0.096	-30	0.520	165	0.002	-25	0.018	-157

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*** MOSES ***

9 May, 2016

Response Amplitude Operator

Draft = 2.0 Meters | Trim Angle = 0.00 Deg. | GMT = 2.18 Meters
Roll Gy. Radius = 3.7 Meters | Pitch Gy. Radius = 16.7 Meters | Yaw Gy. Radius = 16.7 Meters
Heading = 135.00 Deg. | Forward Speed = 0.00 Knots | Linearization Based on 1/ 20

+++ M O T I O N R E S P O N S E O P E R A T O R S +++

Of Point On Body ADMB88 At X = 32.0 Y = 0.0 Z = 4.0

Process is DEFAULT: Units Are Degrees, Meters, and M-Tons Unless Specified

E N C O U N T E R		Surge /		Sway /		Heave /		Roll /		Pitch /		Yaw /	
Frequency	Period	Wave Ampl.		Wave Ampl.		Wave Ampl.		Wave Ampl.		Wave Ampl.		Wave Ampl.	
-(Rad/Sec)-	-(Sec)-	Ampl.	Phase	Ampl.	Phase	Ampl.	Phase	Ampl.	Phase	Ampl.	Phase	Ampl.	Phase
0.2513	25.00	0.645	-98	0.679	83	0.934	-5	0.242	81	0.828	93	0.301	-2
0.3142	20.00	0.638	-102	0.666	79	0.927	-9	0.386	77	1.295	77	0.461	-8
0.3307	19.00	0.636	-104	0.661	78	0.924	-10	0.430	75	1.438	73	0.508	-10
0.3491	18.00	0.633	-105	0.655	76	0.920	-11	0.482	73	1.605	69	0.562	-12
0.3696	17.00	0.629	-107	0.647	75	0.916	-13	0.544	71	1.801	64	0.624	-14
0.3927	16.00	0.625	-110	0.637	73	0.910	-15	0.618	69	2.031	58	0.698	-17
0.4189	15.00	0.620	-113	0.624	70	0.902	-17	0.710	66	2.299	52	0.784	-20
0.4488	14.00	0.613	-116	0.607	67	0.890	-20	0.823	62	2.611	44	0.885	-24
0.4833	13.00	0.603	-120	0.582	64	0.873	-23	0.965	58	2.964	35	1.004	-28
0.5236	12.00	0.591	-126	0.549	60	0.846	-28	1.149	52	3.350	24	1.143	-34
0.5712	11.00	0.573	-132	0.500	54	0.801	-34	1.394	45	3.744	11	1.304	-41
0.6283	10.00	0.548	-141	0.429	48	0.726	-41	1.745	35	4.092	-4	1.483	-49
0.6981	9.00	0.509	-154	0.323	41	0.597	-52	2.373	21	4.296	-24	1.663	-61
0.7854	8.00	0.448	-171	0.180	47	0.381	-63	4.675	-41	4.189	-50	1.795	-77
0.8378	7.50	0.405	177	0.117	56	0.212	-63	1.517	-179	3.939	-66	1.809	-87
0.8976	7.00	0.349	163	0.123	114	0.114	2	0.606	-10	3.498	-84	1.751	-100
1.0472	6.00	0.188	124	0.379	117	0.655	21	1.058	-50	1.863	-134	1.222	-135
1.2566	5.00	0.029	-119	0.474	67	1.101	-52	0.298	-106	0.422	-17	0.252	-6
1.5708	4.00	0.088	118	0.203	117	0.235	-42	0.254	120	0.566	-130	1.199	-118
2.0944	3.00	0.010	39	0.241	72	0.139	-75	0.939	59	0.058	-161	0.219	178

```
*********************************************************************************************************
*                                          ***  MOSES   ***                                             *
*                                          ----------------                                             *
*                                                                                 9 May, 2016           *
*          Response Amplitude Operator                                                                  *
*                                                                                                       *
*   Draft =   2.0 Meters                 Trim Angle =   0.00 Deg.          GMT =   2.18 Meters          *
*   Roll Gy. Radius =   3.7 Meters       Pitch Gy. Radius =  16.7 Meters   Yaw Gy. Radius =  16.7 Meters  *
*   Heading = 180.00 Deg.                Forward Speed =  0.00 Knots       Linearization Based on 1/ 20   *
*                                                                                                       *
*********************************************************************************************************
```

+++ M O T I O N R E S P O N S E O P E R A T O R S +++

Of Point On Body ADMB88 At X = 32.0 Y = 0.0 Z = 4.0

Process is DEFAULT: Units Are Degrees, Meters, and M-Tons Unless Specified

E N C O U N T E R		Surge /		Sway /		Heave /		Roll /		Pitch /		Yaw /	
Frequency -(Rad/Sec)-	Period -(Sec)-	Wave Ampl. Ampl.	Phase	Wave Ampl. Ampl.	Phase	Wave Ampl. Ampl.	Phase	Wave Ampl. Ampl.	Phase	Wave Ampl. Ampl.	Phase	Wave Ampl. Ampl.	Phase
0.2513	25.00	0.909	-101	0.000	0	0.928	-8	0.000	0	1.131	84	0.000	0
0.3142	20.00	0.896	-108	0.000	0	0.912	-13	0.000	0	1.788	68	0.000	0
0.3307	19.00	0.891	-110	0.000	0	0.905	-15	0.000	0	1.986	64	0.000	0
0.3491	18.00	0.885	-112	0.000	0	0.897	-17	0.000	0	2.217	59	0.000	0
0.3696	17.00	0.878	-115	0.000	0	0.887	-19	0.000	0	2.484	53	0.000	0
0.3927	16.00	0.869	-118	0.000	0	0.873	-22	0.000	0	2.795	47	0.000	0
0.4189	15.00	0.857	-122	0.000	0	0.854	-25	0.000	0	3.153	39	0.000	0
0.4488	14.00	0.841	-127	0.000	0	0.827	-29	0.000	0	3.557	31	0.000	0
0.4833	13.00	0.819	-133	0.000	0	0.788	-33	0.000	0	4.000	20	0.000	0
0.5236	12.00	0.789	-140	0.000	0	0.728	-40	0.000	0	4.454	7	0.000	0
0.5712	11.00	0.747	-150	0.000	0	0.636	-47	0.000	0	4.858	-9	0.000	0
0.6283	10.00	0.685	-163	0.000	0	0.488	-56	0.000	0	5.097	-29	0.000	0
0.6981	9.00	0.593	179	0.000	0	0.261	-59	0.000	0	4.969	-54	0.000	0
0.7854	8.00	0.451	154	0.000	0	0.199	24	0.000	0	4.164	-88	0.000	0
0.8378	7.50	0.355	138	0.000	0	0.416	30	0.000	0	3.389	-109	0.000	0
0.8976	7.00	0.240	119	0.000	0	0.672	16	0.000	0	2.319	-135	0.000	0
1.0472	6.00	0.028	-114	0.000	0	1.013	-37	0.000	0	0.451	0	0.000	0
1.2566	5.00	0.168	152	0.000	0	0.105	-87	0.000	0	1.426	-119	0.000	0
1.5708	4.00	0.084	162	0.000	0	0.174	-153	0.000	0	0.375	-87	0.000	0
2.0944	3.00	0.019	157	0.000	0	0.200	-113	0.000	0	0.185	-28	0.000	0

LAMPIRAN C-1

HASIL *OUTPUT SOFTWARE* OFFPIPE

(*STINGER STERN DEPTH* = 3m)

```
*******************************************************************************
*                                                                             *
*                  O F F P I P E  --  OFFSHORE PIPELINE ANALYSIS SYSTEM       *
*                                                                             *
*          COPYRIGHT (C) 1993, ROBERT C. MALAHY.  ALL RIGHTS RESERVED WORLDWIDE.
*                                                                             *
*                        VERSION NO. - 2.05 AC                                *
*                        RELEASED ON - 10/24/1993                             *
*                        LICENSED TO - RICKY TAWEKAL                          *
*                                                                             *
*******************************************************************************
*                                                                             *
*    OFFPIPE IS A NONLINEAR,  3-DIMENSIONAL FINITE ELEMENT METHOD BASED PROGRAM FOR THE    *
*    STATIC AND DYNAMIC ANALYSIS OF PROBLEMS ARISING IN THE DESIGN OF MARINE PIPELINES.    *
*    THIS VERSION  OF OFFPIPE MAY BE USED FOR THE ANALYSIS OF OFFSHORE PIPELAYING OPER-    *
*    ATIONS AND DAVIT LIFTS.                                                  *
*                                                                             *
*    OFFPIPE AND ITS ASSOCIATED DOCUMENTATION ARE THE PROPERTY OF ROBERT C. MALAHY, JR.    *
*    AND ARE MADE AVAILABLE  UNDER LICENSE TO CLIENT COMPANIES WORLDWIDE.  THIS PROGRAM    *
*    AND ITS DOCUMENTATION  CANNOT BE USED  OR COPIED WITHOUT THE EXPRESS  WRITTEN PER-    *
*    MISSION OF ROBERT C. MALAHY, JR.                                         *
*                                                                             *
*    WHILE EVERY EFFORT HAS BEEN MADE TO ENSURE THAT THIS PROGRAM AND ITS DOCUMENTATION    *
*    ARE CORRECT AND ACCURATE, NO WARRANTY,  EXPRESS OR IMPLIED IS GIVEN.  NO LIABILITY    *
*    WILL BE  ACCEPTED BY  ROBERT C. MALAHY, JR. FOR ANY  LOSSES OR  DAMAGES  WHICH MAY    *
*    RESULT FROM THE USE OF THESE MATERIALS.                                  *
*                                                                             *
*    OFFPIPE IS AVAILABLE FOR USE WORLDWIDE.  FOR INFORMATION REGARDING THE USE OR LIC-    *
*    ENSING OF OFFPIPE, PLEASE CONTACT:                                       *
*                                                                             *
*                  ROBERT C. MALAHY, JR.           TELEPHONE: (713) 664-8635  *
*                  8007 MULLINS                    FACSIMILE: (713) 664-0962  *
*                  HOUSTON, TEXAS 77081                                       *
*                  U.S.A.                                                     *
*                                                                             *
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PRINTED OUTPUT SELECTED
=======================
   PRINT PIPE STRAINS IN OUTPUT ......NO
   USE DNV STRESS FORMULA ............NO
   STATIC PIPE FORCES AND STRESSES ...YES
   STATIC SOLUTION SUMMARY ...........YES
   OVERBEND PIPE SUPPORT GEOMETRY ....NO
   STINGER BALLAST SCHEDULE DATA .....NO
   DYNAMIC PIPE FORCES AND STRESSES ..YES
   DYNAMIC RANGE OF PIPE DATA ........NO
   DYNAMIC TRACKING OF PIPE DATA .....NO
   PLOT DATA FILE SUMMARY TABLES .....NO

PROFILE PLOT TABLE ENTRIES
==========================
   PLOT TABLE INDEX ..................         1
   PLOT NUMBER .......................         1
   PLOT TYPE OPTION NUMBER ...........         4
   DYNAMIC PROFILE TIME POINT ........      .000
   DYNAMIC PROFILE TIME INCREMENT ....      .000
   ORDINATE PARAMETER CODE NUMBER ....         2
   AXIS LABEL FOR ORDINATE ........... "Pipe Elevation or Y Coordinate  "
   ABSCISSA PARAMETER CODE NUMBER ....         1
   AXIS LABEL FOR ABSCISSA ........... "Pipe Horizontal X Coordinate    "

   PLOT TITLE ........................ "Pipeline Elevation Profile                              "
   MINIMUM HORIZONTAL AXIS RANGE .....      .000
   MAXIMUM HORIZONTAL AXIS RANGE .....      .000
   MINIMUM VERTICAL AXIS RANGE .......      .000
   MAXIMUM VERTICAL AXIS RANGE .......      .000

PROFILE PLOT TABLE ENTRIES
==========================
   PLOT TABLE INDEX ..................         2
   PLOT NUMBER .......................         2
   PLOT TYPE OPTION NUMBER ...........         4
   DYNAMIC PROFILE TIME POINT ........      .000
   DYNAMIC PROFILE TIME INCREMENT ....      .000
   ORDINATE PARAMETER CODE NUMBER ....        14
   AXIS LABEL FOR ORDINATE ........... "Total Von Mises Pipe Stress     "
   ABSCISSA PARAMETER CODE NUMBER ....         1
   AXIS LABEL FOR ABSCISSA ........... "Pipe Horizontal X Coordinate    "

   PLOT TITLE ........................ "Pipeline Total Pipe Stress                              "
   MINIMUM HORIZONTAL AXIS RANGE .....      .000
   MAXIMUM HORIZONTAL AXIS RANGE .....      .000
   MINIMUM VERTICAL AXIS RANGE .......      .000
   MAXIMUM VERTICAL AXIS RANGE .......      .000

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OFFPIPE - OFFSHORE PIPELINE ANALYSIS SYSTEM - VERSION 2.05 AC          PAGE   4
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PIPE PROPERTIES
===============
   PIPE PROPERTY TABLE ROW ...........         2
   PIPE SECTION LENGTH ...............      .000 M
   STEEL MODULUS OF ELASTICITY .......   207000. MPA
   AREA OF STEEL CROSS SECTION .......   250.000 CM**2
   COATED PIPE AVG MOMENT OF INERTIA .  74490.00 CM**4
   WEIGHT PER-UNIT-LENGTH IN AIR .....   4568.00 N/M
   WEIGHT PER-UNIT-LENGTH SUBMERGED ..   1556.66 N/M
   MAXIMUM ALLOWABLE PIPE STRAIN .....   .205000 PCT

   STEEL OUTSIDE DIAMETER ............   50.8000 CM
   STEEL WALL THICKNESS ..............    1.5900 CM
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   YIELD STRESS ......................    360.00 MPA
   STRESS/STRAIN INTENSE FACTOR ......      .0000
   HYDRODYNAMIC OUTSIDE DIAMETER .....       .000 CM
   DRAG COEFFICIENT ..................      .0000
   HYDRODYNAMIC TOTAL AREA ...........       .000 CM**2
   ADDED MASS COEFFICIENT ............      .0000
   POISSON'S RATIO ...................      .3000
   COEFFICIENT OF THERMAL EXPANSION .. .00000000 1/DEG C

PIPE COATING PROPERTIES
=======================
   PIPE PROPERTY TABLE INDEX .........         2
   CORROSION COATING THICKNESS .......      .250 CM
   CONCRETE COATING THICKNESS ........     5.000 CM
   STEEL WEIGHT DENSITY ..............    77009. N/M**3
   CORROSION COATING WEIGHT DENSITY ..     9398. N/M**3
   CONCRETE COATING WEIGHT DENSITY ...    29822. N/M**3
   DESIRED PIPE SPECIFIC GRAVITY .....      .0000

   AVERAGE PIPE JOINT LENGTH .........    12.100 M
   FIELD JOINT LENGTH ................      .600 M
   JOINT FILL WEIGHT DENSITY .........    10055. N/M**3
   DENSITY OF PIPE CONTENTS ..........        0. N/M**3

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OFFPIPE - OFFSHORE PIPELINE ANALYSIS SYSTEM - VERSION 2.05 AC          PAGE   5
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SUPPORT ELEMENT PROPERTIES
==========================
   SUPPORT PROPERTY TABLE INDEX ......           7
   SUPPORT ELEMENT TYPE ..............           2 TENSIONER
   TENSIONER AXIAL STIFFNESS (F/L) ...   0.000E+00 KN/M
   VERTICAL STIFFNESS (F/L) ..........   0.000E+00 KN/M
   STATIC VERTICAL DEFLECTION ........       .0000 CM
   LATERAL STIFFNESS (F/L) ...........   0.000E+00 KN/M
   BOTTOM ROLLER ANGLE TO HORIZONTAL .      30.000 DEG

   SIDE ROLLER ANGLE TO VERTICAL .....        .000 DEG
   SIDE ROLLER OFFSET FROM C.L. ......        .000 M
   BED ROLLER LENGTH .................      2.000 M
   HEIGHT OF TOP ROLLER ABOVE BED ....        .000 M
   TENSIONER X-AXIS ROTATIONAL STIF. .        .000 KN/DEG
   TENSIONER Y-AXIS ROTATIONAL STIF. .        .000 KN/DEG
   TENSIONER Y-AXIS ROTATIONAL STIF. .        .000 KN/DEG

SUPPORT ELEMENT PROPERTIES
==========================
   SUPPORT PROPERTY TABLE INDEX ......           8
   SUPPORT ELEMENT TYPE ..............           1 SIMPLE SUPPORT
   TENSIONER AXIAL STIFFNESS (F/L) ...   0.000E+00 KN/M
   VERTICAL STIFFNESS (F/L) ..........   0.000E+00 KN/M
   STATIC VERTICAL DEFLECTION ........       .0000 CM
   LATERAL STIFFNESS (F/L) ...........   0.000E+00 KN/M
   BOTTOM ROLLER ANGLE TO HORIZONTAL .      30.000 DEG

   SIDE ROLLER ANGLE TO VERTICAL .....      60.000 DEG
   SIDE ROLLER OFFSET FROM C.L. ......       1.000 M
   BED ROLLER LENGTH .................       1.500 M
   HEIGHT OF TOP ROLLER ABOVE BED ....        .000 M
   TENSIONER X-AXIS ROTATIONAL STIF. .        .000 KN/DEG
   TENSIONER Y-AXIS ROTATIONAL STIF. .        .000 KN/DEG
   TENSIONER Y-AXIS ROTATIONAL STIF. .        .000 KN/DEG

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OFFPIPE - OFFSHORE PIPELINE ANALYSIS SYSTEM - VERSION 2.05 AC          PAGE   6
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SUPPORT ELEMENT PROPERTIES
==========================
   SUPPORT PROPERTY TABLE INDEX ......           9
   SUPPORT ELEMENT TYPE ..............           1 SIMPLE SUPPORT
   TENSIONER AXIAL STIFFNESS (F/L) ...   0.000E+00 KN/M
   VERTICAL STIFFNESS (F/L) ..........   0.000E+00 KN/M
   STATIC VERTICAL DEFLECTION ........       .0350 CM
   LATERAL STIFFNESS (F/L) ...........   0.000E+00 KN/M
   BOTTOM ROLLER ANGLE TO HORIZONTAL .      30.000 DEG

   SIDE ROLLER ANGLE TO VERTICAL .....      60.000 DEG
   SIDE ROLLER OFFSET FROM C.L. ......       1.000 M
   BED ROLLER LENGTH .................       1.500 M
   HEIGHT OF TOP ROLLER ABOVE BED ....        .000 M
   TENSIONER X-AXIS ROTATIONAL STIF. .        .000 KN/DEG
   TENSIONER Y-AXIS ROTATIONAL STIF. .        .000 KN/DEG
   TENSIONER Y-AXIS ROTATIONAL STIF. .        .000 KN/DEG

LAYBARGE DESCRIPTION
====================
   NUMBER OF PIPE NODES ..............         9
   BARGE GEOMETRY SPECIFIED BY .......         1 X-Y COORDINATES
   OVERBEND PIPE SUPPORT RADIUS ......      .000 M
   TANGENT POINT X-COORDINATE ........      .000 M
   TANGENT POINT Y-COORDINATE ........      .000 M
   PIPE ANGLE RELATIVE TO DECK .......     .0000 DEG
   HEIGHT OF DECK ABOVE WATER ........     1.000 M
   LAYBARGE FORWARD (X) OFFSET .......      .000 M
   BARGE TRIM ANGLE ..................     .0000 DEG

   STERN SHOE X COORDINATE ...........      .000 M
   STERN SHOE Y COORDINATE ...........      .000 M
   ROTATION CENTER X COORDINATE ......    31.930 M
   ROTATION CENTER Y COORDINATE ......     3.940 M
   ROTATION CENTER Z COORDINATE ......      .000 M
   BARGE HEADING .....................     .0000 DEG
   BARGE OFFSET FROM RIGHT-OF-WAY ....      .000 M
   PIPE RAMP PIVOT X COORDINATE ......      .000 M
   PIPE RAMP PIVOT Y COORDINATE ......      .000 M
   PIPE RAMP PIVOT ROTATION ANGLE ....      .000 DEG

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OFFPIPE - OFFSHORE PIPELINE ANALYSIS SYSTEM - VERSION 2.05 AC          PAGE   7
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     NODE X     NODE Y           SUPPORT           DAVIT
      COORD      COORD             TYPE           SPACING
     (M   )     (M   )                             (M   )
    ========   ========   ======================   =======
      61.000      1.516     2  PIPE TENSIONER         .000
      38.000      1.516     8  USER DEFINED           .000
      32.095      1.516     8  USER DEFINED           .000
```

26.500	1.516	7	USER DEFINED	.000	
23.000	1.516	8	USER DEFINED	.000	
16.520	1.396	8	USER DEFINED	.000	
12.000	1.192	8	USER DEFINED	.000	
5.500	.723	8	USER DEFINED	.000	
.000	.160	8	USER DEFINED	.000	

STINGER DESCRIPTION
==========

NUMBER OF PIPE/STINGER NODES	6
STINGER GEOMETRY SPECIFIED BY	1 X-Y COORD AND TANGENT PT
STINGER TYPE	2 STRAIGHT CONVENTIONAL
OVERBEND PIPE SUPPORT RADIUS	.00 M
HITCH X-COORDINATE	-.399 M
HITCH Y-COORDINATE	-.744 M
X COORDINATE OF LOCAL ORIGIN	-.399 M
Y COORDINATE OF LOCAL ORIGIN	-.744 M
ROTATION ABOUT STINGER HITCH	8.770 DEG
TANGENT POINT X-COORDINATE	.000 M
TANGENT POINT Y-COORDINATE	.000 M
TANGENT POINT ANGLE	.000 DEG

NODE X COORD (M)	NODE Y COORD (M)	SUPPORT TYPE		ELEMENT TYPE		ELEMENT LENGTH (M)
-6.900	1.222	9	USER DEFINED	1	FIXED END	.000
-14.130	1.371	9	USER DEFINED	1	FIXED END	.000
-20.180	1.359	9	USER DEFINED	1	FIXED END	.000
-24.930	1.261	9	USER DEFINED	1	FIXED END	.000
-30.000	1.116	9	USER DEFINED	1	FIXED END	.000
-31.792	1.116	9	USER DEFINED	1	FIXED END	.000

I N P U T D A T A E C H O

CURRENT VELOCITIES
==========

WATER DEPTH (M)	CURRENT SPEED (M/S)	DIRECTION OF TRAVEL (DEG)
.000	.250	.000
1.900	.246	.000
3.800	.243	.000
5.700	.238	.000
7.600	.233	.000
9.500	.228	.000
11.400	.222	.000
13.300	.214	.000
15.200	.204	.000
17.100	.190	.000
19.000	.114	.000
20.000	.000	.000

BARGE MOTION RAO TABLE (OFFPIPE) SIGN CONVENTION
==========

WAVE FREQUENCY (RAD/S)	SURGE AMPLITUDE (M/M)	SURGE PHASE (DEG)	SWAY AMPLITUDE (M/M)	SWAY PHASE (DEG)	HEAVE AMPLITUDE (M/M)	HEAVE PHASE (DEG)
.2510	.9090	102.00	.0000	.00	.9200	10.00
.3140	.8960	109.00	.0000	.00	.8920	15.00
.3310	.8920	111.00	.0000	.00	.8810	17.00
.3490	.8860	113.00	.0000	.00	.8670	18.00
.3700	.8790	116.00	.0000	.00	.8480	20.00
.3930	.8700	120.00	.0000	.00	.8240	23.00
.4190	.8580	124.00	.0000	.00	.7910	26.00
.4490	.8420	129.00	.0000	.00	.7470	29.00
.4830	.8200	135.00	.0000	.00	.6860	34.00
.5240	.7900	143.00	.0000	.00	.6000	39.00
.5710	.7480	153.00	.0000	.00	.4800	44.00
.6280	.6860	166.00	.0000	.00	.3140	46.00
.6980	.5930	-175.00	.0000	.00	.1440	9.00
.7850	.4510	-150.00	.0000	.00	.3610	-45.00
.8380	.3540	-134.00	.0000	.00	.5640	-39.00
.8980	.2390	-114.00	.0000	.00	.7780	-25.00
1.0470	.0290	120.00	.0000	.00	.0010	17.00
1.2570	.1680	-147.00	.0000	.00	.0930	0.00
1.5710	.0840	-159.00	.0000	.00	.1740	42.00
2.0940	.0190	-155.00	.0000	.00	.2000	106.00

I N P U T D A T A E C H O

WAVE FREQUENCY (RAD/S)	ROLL AMPLITUDE (DEG/M)	ROLL PHASE (DEG)	PITCH AMPLITUDE (DEG/M)	PITCH PHASE (DEG)	YAW AMPLITUDE (DEG/M)	YAW PHASE (DEG)
.2510	.0000	.00	1.1000	-98.00	.0000	.00
.3140	.0000	.00	1.7390	-91.00	.0000	.00
.3310	.0000	.00	1.9320	-90.00	.0000	.00
.3490	.0000	.00	2.1570	-88.00	.0000	.00
.3700	.0000	.00	2.4180	-86.00	.0000	.00
.3930	.0000	.00	2.7210	-85.00	.0000	.00
.4190	.0000	.00	3.0710	-82.00	.0000	.00
.4490	.0000	.00	3.4690	-80.00	.0000	.00
.4830	.0000	.00	3.9050	-77.00	.0000	.00
.5240	.0000	.00	4.3570	-74.00	.0000	.00
.5710	.0000	.00	4.7670	-69.00	.0000	.00
.6280	.0000	.00	5.0260	-61.00	.0000	.00
.6980	.0000	.00	4.9440	-50.00	.0000	.00
.7850	.0000	.00	4.2230	-32.00	.0000	.00
.8380	.0000	.00	3.5060	-19.00	.0000	.00
.8980	.0000	.00	2.5030	-2.00	.0000	.00
1.0470	.0000	.00	0.2070	177.00	.0000	.00
1.2570	.0000	.00	1.4190	-59.00	.0000	.00
1.5710	.0000	.00	0.3620	-46.00	.0000	.00
2.0940	.0000	.00	0.1850	21.00	.0000	.00

TIME INTEGRATION PARAMETERS
==========

TIME STEP LENGTH	.4000 SEC
SOLUTION STARTS AT TIME	60.000 SEC
MAXIMUM TIME OF INTEGRATION	10860.000 SEC
SOLUTION SAMPLING TIME STEP.....	.800 SEC
DAMPING RATIO	.0000

CONTROL SWITCHES
==========

MAXIMUM STATIC ITERATIONS	400
MAX DYNAMIC ITERATIONS PER STEP ...	400
PROBLEM TYPE (0=STATIC,1=DYNAMIC) .	1

```
   PINNED PIPE END ON SEABED .........   1
   DAVIT LIFT ANALYSIS (1=YES,0=NO) ..   0
   STOP INTEGRATION AT TIME STEP .....   0
   NUMBER OF DIMENSIONS (2 OR 3) .....   2
   INITIATION BY BOWLINE (1=YES,0=NO)    0
   SUPPORT RELEASE LOGIC PARAMETER ...   0

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WAVE SPECTRUM COEFFICIENTS
==========================
   NUMBER OF WAVES IN SPECTRUM .......        20
   1ST SPECTRUM COEFFICIENT .........     .6130 M2/S4
   2ND SPECTRUM COEFFICIENT .........     .7230 1/S**4
   MINIMUM FREQUENCY IN SPECTRUM .....    .2513 RAD/S
   MAXIMUM FREQUENCY IN SPECTRUM .....   2.0944 RAD/S
   DIRECTION OF WAVE TRAVEL .........      .000 DEG

WAVE PARAMETERS
===============
   WAVE HEIGHT (PEAK TO TROUGH) ......    2.110 M
   WAVE PERIOD .......................    7.200 SEC
   WAVE DIRECTION OF TRAVEL .........      .000 DEG
   WATER DEPTH FOR WAVE CALCULATIONS .    20.00 M

SAGBEND GEOMETRY
================
   SAGBEND PIPE ELEMENT LENGTH .......   12.100 M
   WATER DEPTH .......................    20.00 M
   ESTIMATED SAGBEND X LENGTH ........   140.00 M
   ESTIMATED PIPE LENGTH ON SEABED ...      .00 M
   X-COORD OF PIPE FREE END ON SEABED       .00 M
   ESTIMATED SPAN DEPTH FOR BOW LINE .      .00 M
   PIPE VERTICAL ANGLE AT SEABED .....     .000 DEG
   X-COORDINATE OF SPECIFIED DEPTH ...      .00 M
   MAXIMUM SLOPE (ANGLE) OF SEABED ...     .000 DEG
   DIRECTION OF MAXIMUM SLOPE ........     .000 DEG

CABLE PROPERTIES
================
   PIPE PROPERTY TABLE INDEX .........         1
   CABLE SECTION LENGTH ..............   24.000 M
   AXIAL STIFFNESS (EA) ..............      .00 KN
   BENDING STIFFNESS (EI) ............    .0000 KN-M**2
   WEIGHT PER-UNIT-LENGTH IN AIR .....      .0 N/M
   WEIGHT PER-UNIT-LENGTH SUBMERGED ..      .0 N/M

   CABLE DIAMETER ....................    3.200 CM
   DRAG COEFFICIENT ..................     .000
   CABLE CROSS SECTIONAL AREA ........     .000 KN
   ADDED MASS COEFFICIENT ............     .000

PIPE TENSION
============
   STATIC PIPE TENSION ON LAYBARGE ...  330.000 KN
   MINIMUM DYNAMIC PIPE TENSION ......     .000 KN
   MAXIMUM DYNAMIC PIPE TENSION ......     .000 KN

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OFFPIPE - OFFSHORE PIPELINE ANALYSIS SYSTEM - VERSION 2.05 AC          PAGE  11
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                                              E R R O R   M E S S A G E

             ***** WARNING / INFORMATIVE MESSAGE NO. -   1 *****

    The total stinger weight (




================================================================================
OFFPIPE - OFFSHORE PIPELINE ANALYSIS SYSTEM - VERSION 2.05 AC          PAGE  12
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CABLE PROPERTIES
================
   PIPE PROPERTY TABLE INDEX .........         1
   CABLE SECTION LENGTH ..............   62.000 M
   AXIAL STIFFNESS (EA) ..............      .00 KN
   BENDING STIFFNESS (EI) ............    .0000 KN-M**2
   WEIGHT PER-UNIT-LENGTH IN AIR .....      .0 N/M
   WEIGHT PER-UNIT-LENGTH SUBMERGED ..      .0 N/M

   CABLE DIAMETER ....................    3.200 CM
   DRAG COEFFICIENT ..................     .000
   CABLE CROSS SECTIONAL AREA ........     .000 KN
   ADDED MASS COEFFICIENT ............     .000

PIPE TENSION
============
   STATIC PIPE TENSION ON LAYBARGE ...  330.000 KN
   MINIMUM DYNAMIC PIPE TENSION ......     .000 KN
   MAXIMUM DYNAMIC PIPE TENSION ......     .000 KN

             ***** WARNING / INFORMATIVE MESSAGE NO. -   1 *****

    The total stinger weight (




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OFFPIPE - OFFSHORE PIPELINE ANALYSIS SYSTEM - VERSION 2.05 AC          PAGE  13
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CABLE PROPERTIES
================
   PIPE PROPERTY TABLE INDEX .........         1
   CABLE SECTION LENGTH ..............   83.000 M
```

```
   AXIAL STIFFNESS (EA) ..............       .00 KN
   BENDING STIFFNESS (EI) ............     .0000 KN-M**2
   WEIGHT PER-UNIT-LENGTH IN AIR .....        .0 N/M
   WEIGHT PER-UNIT-LENGTH SUBMERGED ..        .0 N/M

   CABLE DIAMETER .....................     3.200 CM
   DRAG COEFFICIENT ...................      .000
   CABLE CROSS SECTIONAL AREA .........      .000 KN
   ADDED MASS COEFFICIENT .............      .000

PIPE TENSION
============
   STATIC PIPE TENSION ON LAYBARGE ...   210.000 KN
   MINIMUM DYNAMIC PIPE TENSION ......      .000 KN
   MAXIMUM DYNAMIC PIPE TENSION ......      .000 KN

             ***** WARNING / INFORMATIVE MESSAGE NO. -   1 *****

    The total stinger weight (
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OFFPIPE - OFFSHORE PIPELINE ANALYSIS SYSTEM - VERSION 2.05 AC          PAGE  14
Abandonment and Recovery Analysis in Sangatta
JOB NO. - 1                    LICENSED TO: RICKY TAWEKAL
USER ID - Moch. Ardiansyah     DATE -  7/ 1/2016   TIME -  5:24:43   CASE   4
================================================================================

                       I N P U T   D A T A   E C H O


CABLE PROPERTIES
================
   PIPE PROPERTY TABLE INDEX .........        1
   CABLE SECTION LENGTH ..............    94.000 M
   AXIAL STIFFNESS (EA) ..............       .00 KN
   BENDING STIFFNESS (EI) ............     .0000 KN-M**2
   WEIGHT PER-UNIT-LENGTH IN AIR .....        .0 N/M
   WEIGHT PER-UNIT-LENGTH SUBMERGED ..        .0 N/M

   CABLE DIAMETER .....................     3.200 CM
   DRAG COEFFICIENT ...................      .000
   CABLE CROSS SECTIONAL AREA .........      .000 KN
   ADDED MASS COEFFICIENT .............      .000

PIPE TENSION
============
   STATIC PIPE TENSION ON LAYBARGE ...   180.000 KN
   MINIMUM DYNAMIC PIPE TENSION ......      .000 KN
   MAXIMUM DYNAMIC PIPE TENSION ......      .000 KN

             ***** WARNING / INFORMATIVE MESSAGE NO. -   1 *****

    The total stinger weight (
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OFFPIPE - OFFSHORE PIPELINE ANALYSIS SYSTEM - VERSION 2.05 AC          PAGE  15
Abandonment and Recovery Analysis in Sangatta
JOB NO. - 1                    LICENSED TO: RICKY TAWEKAL
USER ID - Moch. Ardiansyah     DATE -  7/ 1/2016   TIME -  5:24:43   CASE   5
================================================================================

                       I N P U T   D A T A   E C H O


CABLE PROPERTIES
================
   PIPE PROPERTY TABLE INDEX .........        1
   CABLE SECTION LENGTH ..............   120.000 M
   AXIAL STIFFNESS (EA) ..............       .00 KN
   BENDING STIFFNESS (EI) ............     .0000 KN-M**2
   WEIGHT PER-UNIT-LENGTH IN AIR .....        .0 N/M
   WEIGHT PER-UNIT-LENGTH SUBMERGED ..        .0 N/M

   CABLE DIAMETER .....................     3.200 CM
   DRAG COEFFICIENT ...................      .000
   CABLE CROSS SECTIONAL AREA .........      .000 KN
   ADDED MASS COEFFICIENT .............      .000

PIPE TENSION
============
   STATIC PIPE TENSION ON LAYBARGE ...    75.000 KN
   MINIMUM DYNAMIC PIPE TENSION ......      .000 KN
   MAXIMUM DYNAMIC PIPE TENSION ......      .000 KN

             ***** WARNING / INFORMATIVE MESSAGE NO. -   1 *****

    The total stinger weight (
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OFFPIPE - OFFSHORE PIPELINE ANALYSIS SYSTEM - VERSION 2.05 AC          PAGE  16
Abandonment and Recovery Analysis in Sangatta
JOB NO. - 1                    LICENSED TO: RICKY TAWEKAL
USER ID - Moch. Ardiansyah     DATE -  7/ 1/2016   TIME -  5:24:43   CASE   6
================================================================================

                       I N P U T   D A T A   E C H O


CABLE PROPERTIES
================
   PIPE PROPERTY TABLE INDEX .........        1
   CABLE SECTION LENGTH ..............   147.000 M
   AXIAL STIFFNESS (EA) ..............       .00 KN
   BENDING STIFFNESS (EI) ............     .0000 KN-M**2
   WEIGHT PER-UNIT-LENGTH IN AIR .....        .0 N/M
   WEIGHT PER-UNIT-LENGTH SUBMERGED ..        .0 N/M

   CABLE DIAMETER .....................     3.200 CM
   DRAG COEFFICIENT ...................      .000
   CABLE CROSS SECTIONAL AREA .........      .000 KN
   ADDED MASS COEFFICIENT .............      .000

PIPE TENSION
============
   STATIC PIPE TENSION ON LAYBARGE ...    20.000 KN
   MINIMUM DYNAMIC PIPE TENSION ......      .000 KN
   MAXIMUM DYNAMIC PIPE TENSION ......      .000 KN

             ***** WARNING / INFORMATIVE MESSAGE NO. -   1 *****

    The total stinger weight (

END OF INPUT DATA
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OFFPIPE - OFFSHORE PIPELINE ANALYSIS SYSTEM - VERSION 2.05 AC DATE - 7/ 1/2016 TIME - 5:24:43 PAGE 17
PROJECT - Abandonment and Recovery Analysis in Sangatta JOB NO. - 1
USER ID - Moch. Ardiansyah LICENSED TO: RICKY TAWEKAL CASE 1

S T A T I C P I P E C O O R D I N A T E S, F O R C E S A N D S T R E S S E S

NODE NO.	PIPE SECTION	X COORD (M)	Y COORD (M)	VERT ANGLE (DEG)	PIPE LENGTH (M)	SUPPORT REACTION (KN)	SEPARA -TION (M)	AXIAL TENSION (KN)	BENDING MOMENT (KN-M)	TENSILE STRESS (MPA)	BENDING STRESS (MPA)	TOTAL STRESS (MPA)	PERCNT YIELD (PCT)
1	TENSIONR	61.00	2.52	.00	.00	.498	.000	165.04	.000	.00	.00	.00	.00
3	LAYBARGE	38.00	2.52	.00	23.00	6.745	.000	165.04	1.265	6.71	.43	7.15	1.98
5	LAYBARGE	32.09	2.52	.02	28.90	60.901	.000	165.04	-31.342	6.71	-10.69	17.40	4.83
7	TENSIONR	26.50	2.52	-.08	34.50	-219.851	.000	330.01	55.616	13.43	18.97	32.39	9.00
9	LAYBARGE	23.00	2.52	.26	38.00	219.183	.000	328.73	-595.583	13.37	-203.10	216.47	60.13
11	LAYBARGE	16.52	2.40	1.92	44.48	47.559	.000	327.49	-777.714	13.32	-265.21	278.53	77.37
13	LAYBARGE	12.00	2.19	3.26	49.01	86.323	.000	326.33	-813.097	13.28	-277.27	290.55	80.71
15	LAYBARGE	5.50	1.72	4.88	55.52	39.954	.000	325.44	-541.942	13.24	-184.81	198.05	55.01
17	LAYBARGE	-.01	1.21	5.70	61.05	.000	.049	323.82	-280.745	13.17	-95.74	108.91	30.25
20	STINGER	-7.41	.43	6.26	68.49	.000	.018	320.42	-166.628	13.04	-56.82	69.86	19.40
22	STINGER	-14.59	-.39	6.82	75.73	.000	.155	317.69	-279.855	12.89	-95.43	108.36	30.10
24	STINGER	-20.59	-1.15	7.67	81.78	.000	.196	315.97	-494.155	12.76	-168.51	181.36	50.38
26	STINGER	-25.30	-1.82	8.74	86.53	.000	.149	314.00	-727.365	12.62	-248.04	260.81	72.45
28	STINGER	-30.30	-2.66	10.40	91.60	24.930	.000	310.82	-1047.462	12.42	-357.19	369.83	102.73
30	STINGER	-32.06	-3.00	11.13	93.39	139.426	.000	309.64	-1117.596	12.35	-381.11	393.70	109.36
32	SAGBEND	-43.85	-5.73	14.33	105.49	.000	.000	309.24	-351.376	12.11	-119.82	132.39	36.77
33	SAGBEND	-55.55	-8.80	14.79	117.59	.000	.000	304.81	108.674	11.67	37.06	49.45	13.74
34	SAGBEND	-67.27	-11.79	13.64	129.69	.000	.000	299.74	374.834	11.22	127.82	139.99	38.89
35	SAGBEND	-79.08	-14.45	11.59	141.79	.000	.000	295.17	523.272	10.81	178.44	190.42	52.89
36	SAGBEND	-90.98	-16.62	9.05	153.89	.000	.000	291.54	593.289	10.48	202.32	214.15	59.48
37	SAGBEND	-102.97	-18.24	6.35	165.99	.000	.000	288.98	601.138	10.24	204.99	216.72	60.20
38	SAGBEND	-115.02	-19.30	3.74	178.09	.000	.000	287.54	546.131	10.10	186.23	197.90	54.97
39	SAGBEND	-127.11	-19.85	1.55	190.19	.140	.000	287.10	411.128	10.03	140.20	151.85	42.18
40	SEABED	-139.21	-20.02	.22	202.29	22.581	.000	287.33	162.418	10.03	55.39	67.08	18.63
41	SEABED	-151.31	-20.02	-.05	214.39	33.903	.000	287.42	3.161	10.03	1.08	13.02	3.62
42	SEABED	-163.41	-20.01	-.09	226.49	13.962	.000	287.41	27.347	10.03	9.33	21.15	5.87
43	SEABED	-175.51	-19.98	-.23	238.59	.000	.000	287.46	.000	10.04	.00	11.97	3.32

OFFPIPE - OFFSHORE PIPELINE ANALYSIS SYSTEM - VERSION 2.05 AC PAGE 18
Abandonment and Recovery Analysis in Sangatta
JOB NO. - 1 LICENSED TO: RICKY TAWEKAL
USER ID - Moch. Ardiansyah DATE - 7/ 1/2016 TIME - 5:24:43 CASE 1

S T A T I C S O L U T I O N S U M M A R Y

PIPE PROPERTIES (2)

PIPE SECTION LENGTH ..	.00 M	ELASTIC MODULUS	207000. MPA
OUTSIDE DIAMETER	50.800 CM	CROSS SECTIONAL AREA .	250.00 CM2
WALL THICKNESS	1.590 CM	MOMENT OF INERTIA	74490.00 CM4
WEIGHT/LENGTH IN AIR .	4567.997 N/M	YIELD STRESS	360.00 MPA
SUBMERGED WGHT/LENG ..	1556.660 N/M	STRESS INTENS FACTOR .	1.000
SPECIFIC GRAVITY	1.517	STEEL DENSITY	77008.5 N/M3
WRAP COAT THICKNESS ..	.250 CM	WRAP COAT DENSITY	9397.6 N/M3
CONCRETE THICKNESS ...	5.000 CM	CONCRETE DENSITY	29822.4 N/M3

BARGE DATA

TOTAL PIPE TENSION ...	330.04 KN	RADIUS OF CURVATURE ..	.00 M
NUMBER OF TENSIONERS .	2	BARGE TRIM ANGLE	.000 DEG
NO. OF PIPE SUPPORTS .	7	PIPE ANGLE AT STERN ..	5.704 DEG

STINGER DATA

NO. OF PIPE SUPPORTS .	6	STINGER STERN DEPTH ..	-3.00 M
NO. STINGER SECTIONS .	6	PIPE ANGLE AT STERN ..	11.134 DEG
RADIUS OF CURVATURE ..	.00 M	STINGER LENGTH	31.90 M

SAGBEND DATA

WATER DEPTH	20.00 M	HORIZ PIPE TENSION ...	287.46 KN
TOUCHDOWN X-COORD. ...	-135.99 M	BOTTOM SLOPE ANGLE ...	.000 DEG

SOLUTION SUMMARY

NODE NO.	PIPE SECTION	X COORD	Y COORD	VERT ANGLE	REACT -ION	BENDING MOMENT	BENDING STRESS	TOTAL STRESS	PCT YLD
1	TENSIONR	61.0	2.5	.0	.5	.0	.0	.0	0.
3	LAYBARGE	38.0	2.5	.0	6.7	1.3	.4	7.1	2.
5	LAYBARGE	32.1	2.5	.0	60.9	-31.3	-10.7	17.4	5.
7	TENSIONR	26.5	2.5	-.1	-219.9	55.6	19.0	32.4	9.
9	LAYBARGE	23.0	2.5	.3	219.2	-595.6	-203.1	216.5	60.
11	LAYBARGE	16.5	2.4	1.9	47.6	-777.7	-265.2	278.5	77.
13	LAYBARGE	12.0	2.2	3.3	86.3	-813.1	-277.3	290.5	81.
15	LAYBARGE	5.5	1.7	4.9	40.0	-541.9	-184.8	198.0	55.
17	LAYBARGE	.0	1.2	5.7	.0	-280.7	-95.7	108.9	30.
20	STINGER	-7.4	.4	6.3	.0	-166.6	-56.8	69.9	19.
22	STINGER	-14.6	-.4	6.8	.0	-279.9	-95.4	108.4	30.
24	STINGER	-20.6	-1.1	7.7	.0	-494.2	-168.5	181.4	50.
26	STINGER	-25.3	-1.8	8.7	.0	-727.4	-248.0	260.8	72.
28	STINGER	-30.3	-2.7	10.4	24.9	-1047.5	-357.2	369.8	103.
30	STINGER	-32.1	-3.0	11.1	139.4	-1117.6	-381.1	393.7	109.
37	SAGBEND	-103.0	-18.2	6.3	.0	601.1	205.0	216.7	60.
40	SEABED	-139.2	-20.0	.2	22.6	162.4	55.4	67.1	19.

OFFPIPE - OFFSHORE PIPELINE ANALYSIS SYSTEM - VERSION 2.05 AC DATE - 7/ 1/2016 TIME - 5:24:43 PAGE 19
PROJECT - Abandonment and Recovery Analysis in Sangatta JOB NO. - 1
USER ID - Moch. Ardiansyah LICENSED TO: RICKY TAWEKAL CASE 2

S T A T I C P I P E C O O R D I N A T E S, F O R C E S A N D S T R E S S E S

NODE NO.	PIPE SECTION	X COORD (M)	Y COORD (M)	VERT ANGLE (DEG)	PIPE LENGTH (M)	SUPPORT REACTION (KN)	SEPARA -TION (M)	AXIAL TENSION (KN)	BENDING MOMENT (KN-M)	TENSILE STRESS (MPA)	BENDING STRESS (MPA)	TOTAL STRESS (MPA)	PERCNT YIELD (PCT)
1	TENSIONR	61.00	2.52	.00	.00	.498	.000	165.12	.000	.00	.00	.00	.00
3	LAYBARGE	38.00	2.52	.00	23.00	.626	.000	165.12	.117	.00	.00	.00	.00
5	LAYBARGE	32.09	2.52	.00	28.90	.249	.000	165.12	.047	.00	.00	.00	.00
7	TENSIONR	26.50	2.52	.00	34.50	.198	.000	330.12	.049	.00	.00	.00	.00
9	LAYBARGE	23.00	2.52	.53	38.00	6.328	.000	330.10	1.186	.00	.00	.00	.00
11	LAYBARGE	16.52	2.40	1.82	44.48	9.014	.000	330.08	1.690	.00	.00	.00	.00
13	LAYBARGE	12.00	2.19	3.36	49.01	9.127	.000	330.07	1.711	.00	.00	.00	.00
15	LAYBARGE	5.50	1.72	4.91	55.52	9.282	.000	330.05	1.740	.00	.00	.00	.00
17	LAYBARGE	.00	1.17	6.06	61.05	.000	.015	330.05	.000	13.43	.00	13.43	3.73
20	STINGER	-7.40	.38	6.20	68.49	31.466	.000	326.37	-138.002	13.28	-47.06	60.34	16.76
22	STINGER	-14.59	-.43	6.71	75.73	.000	.120	323.79	-269.693	13.14	-91.97	105.14	29.21
24	STINGER	-20.59	-1.17	7.55	81.78	.000	.173	322.08	-490.826	13.01	-167.38	180.48	50.13
26	STINGER	-25.30	-1.84	8.62	86.53	.000	.136	320.10	-729.698	12.87	-248.83	261.85	72.74
28	STINGER	-30.30	-2.67	10.29	91.60	27.918	.000	316.88	-1056.152	12.67	-360.16	373.04	103.62
30	STINGER	-32.06	-3.00	11.03	93.39	138.547	.000	315.73	-1124.432	12.60	-383.44	396.28	110.08
32	SAGBEND	-43.85	-5.71	14.25	105.49	.000	.000	315.39	-355.192	12.36	-121.12	133.94	37.21
33	SAGBEND	-55.56	-8.77	14.72	117.59	.000	.000	311.00	104.202	11.93	35.53	48.18	13.38
34	SAGBEND	-67.29	-11.75	13.60	129.69	.000	.000	305.96	368.851	11.47	125.78	138.21	38.39
35	SAGBEND	-79.09	-14.40	11.58	141.79	.000	.000	301.41	516.171	11.07	176.02	188.25	52.29
36	SAGBEND	-90.99	-16.57	9.08	153.89	.000	.000	297.78	586.114	10.74	199.87	211.95	58.88
37	SAGBEND	-102.98	-18.20	6.40	165.99	.000	.000	295.20	595.392	10.50	203.03	215.01	59.72
38	SAGBEND	-115.03	-19.27	3.81	178.09	.000	.000	293.73	543.788	10.35	185.44	197.35	54.82
39	SAGBEND	-127.12	-19.84	1.62	190.19	.070	.000	293.25	414.783	10.29	141.44	153.35	42.60
40	SEABED	-139.22	-20.02	.25	202.29	20.813	.000	293.45	173.609	10.28	59.20	71.14	19.76
41	SEABED	-151.32	-20.02	-.05	214.39	34.341	.000	293.55	5.823	10.28	1.99	14.15	3.93
42	SEABED	-163.42	-20.01	-.09	226.49	14.238	.000	293.54	26.930	10.28	9.18	21.26	5.90
43	SEABED	-175.52	-19.98	-.23	238.59	.000	.000	293.59	.000	10.29	.00	12.21	3.39

OFFPIPE - OFFSHORE PIPELINE ANALYSIS SYSTEM - VERSION 2.05 AC PAGE 20
Abandonment and Recovery Analysis in Sangatta
JOB NO. - 1 LICENSED TO: RICKY TAWEKAL
USER ID - Moch. Ardiansyah DATE - 7/ 1/2016 TIME - 5:24:43 CASE 2

S T A T I C S O L U T I O N S U M M A R Y

PIPE PROPERTIES (2)

PIPE SECTION LENGTH ..	.00 M	ELASTIC MODULUS	207000. MPA
OUTSIDE DIAMETER	50.800 CM	CROSS SECTIONAL AREA .	250.00 CM2
WALL THICKNESS	1.590 CM	MOMENT OF INERTIA	74490.00 CM4
WEIGHT/LENGTH IN AIR .	4567.997 N/M	YIELD STRESS	360.00 MPA
SUBMERGED WGHT/LENG ..	1556.660 N/M	STRESS INTENS FACTOR .	1.000
SPECIFIC GRAVITY	1.517	STEEL DENSITY	77008.5 N/M3
WRAP COAT THICKNESS ..	.250 CM	WRAP COAT DENSITY	9397.6 N/M3
CONCRETE THICKNESS ...	5.000 CM	CONCRETE DENSITY	29822.4 N/M3

BARGE DATA

TOTAL PIPE TENSION ...	330.12 KN	RADIUS OF CURVATURE ..	.00 M
NUMBER OF TENSIONERS .	2	BARGE TRIM ANGLE	.000 DEG
NO. OF PIPE SUPPORTS .	7	PIPE ANGLE AT STERN ..	6.058 DEG

STINGER DATA

NO. OF PIPE SUPPORTS .	6	STINGER STERN DEPTH ..	-3.00 M
NO. STINGER SECTIONS .	6	PIPE ANGLE AT STERN ..	11.030 DEG
RADIUS OF CURVATURE ..	.00 M	STINGER LENGTH	31.90 M

SAGBEND DATA

WATER DEPTH	20.00 M	HORIZ PIPE TENSION ...	293.59 KN
TOUCHDOWN X-COORD. ...	-136.54 M	BOTTOM SLOPE ANGLE ...	.000 DEG

SOLUTION SUMMARY

NODE NO.	PIPE SECTION	X COORD	Y COORD	VERT ANGLE	REACT -ION	BENDING MOMENT	BENDING STRESS	TOTAL STRESS	PCT YLD
1	TENSIONR	61.0	2.5	.0	.5	.0	.0	.0	0.
3	LAYBARGE	38.0	2.5	.0	.6	.1	.0	.0	0.
5	LAYBARGE	32.1	2.5	.0	.2	.0	.0	.0	0.
7	TENSIONR	26.5	2.5	.0	.2	.0	.0	.0	0.
9	LAYBARGE	23.0	2.5	.5	6.3	1.2	.0	.0	0.
11	LAYBARGE	16.5	2.4	1.8	9.0	1.7	.0	.0	0.
13	LAYBARGE	12.0	2.2	3.4	9.1	1.7	.0	.0	0.
15	LAYBARGE	5.5	1.7	4.9	9.3	1.7	.0	.0	0.
17	LAYBARGE	.0	1.2	6.1	.0	.0	.0	13.4	4.
20	STINGER	-7.4	.4	6.2	31.5	-138.0	-47.1	60.3	17.
22	STINGER	-14.6	-.4	6.7	.0	-269.7	-92.0	105.1	29.
24	STINGER	-20.6	-1.2	7.6	.0	-490.8	-167.4	180.5	50.
26	STINGER	-25.3	-1.8	8.6	.0	-729.7	-248.8	261.8	73.
28	STINGER	-30.3	-2.7	10.3	27.9	-1056.2	-360.2	373.0	104.
30	STINGER	-32.1	-3.0	11.0	138.5	-1124.4	-383.4	396.3	110.
37	SAGBEND	-103.0	-18.2	6.4	.0	595.4	203.0	215.0	60.
40	SEABED	-139.2	-20.0	.3	20.8	173.6	59.2	71.1	20.

OFFPIPE - OFFSHORE PIPELINE ANALYSIS SYSTEM - VERSION 2.05 AC DATE - 7/ 1/2016 TIME - 5:24:43 PAGE 21
PROJECT - Abandonment and Recovery Analysis in Sangatta JOB NO. - 1
USER ID - Moch. Ardiansyah LICENSED TO: RICKY TAWEKAL CASE 3

S T A T I C P I P E C O O R D I N A T E S, F O R C E S A N D S T R E S S E S

NODE NO.	PIPE SECTION	X COORD (M)	Y COORD (M)	VERT ANGLE (DEG)	PIPE LENGTH (M)	SUPPORT REACTION (KN)	SEPARA -TION (M)	AXIAL TENSION (KN)	BENDING MOMENT (KN-M)	TENSILE STRESS (MPA)	BENDING STRESS (MPA)	TOTAL STRESS (MPA)	PERCNT YIELD (PCT)
1	TENSIONR	61.00	2.52	.00	.00	.498	.000	105.16	.000	.00	.00	.00	.00
3	LAYBARGE	38.00	2.52	.00	23.00	.626	.000	105.16	.117	.00	.00	.00	.00
5	LAYBARGE	32.09	2.52	.00	28.90	.249	.000	105.16	.047	.00	.00	.00	.00
7	TENSIONR	26.50	2.52	.00	34.50	.197	.000	210.16	.049	.00	.00	.00	.00
9	LAYBARGE	23.00	2.52	.53	38.00	4.107	.000	210.15	.770	.00	.00	.00	.00
11	LAYBARGE	16.52	2.40	1.82	44.48	5.825	.000	210.13	1.092	.00	.00	.00	.00
13	LAYBARGE	12.00	2.19	3.21	49.01	4.818	.000	210.13	.903	.00	.00	.00	.00
15	LAYBARGE	5.50	1.76	3.80	55.52	.000	.033	210.13	.000	.00	.00	.00	.00
17	LAYBARGE	-.02	1.39	3.72	61.05	.000	.234	210.11	.000	.00	.00	.00	.00
20	STINGER	-7.45	.92	3.64	68.49	.000	.505	210.09	.000	.00	.00	.00	.00
22	STINGER	-14.63	.46	3.56	75.69	.000	1.009	210.07	.000	.00	.00	.00	.00
24	STINGER	-20.94	.08	15.01	82.03	.000	1.467	205.82	-.005	8.37	.00	8.37	2.33
26	STINGER	-25.49	-1.15	15.19	86.75	.000	.849	203.53	-217.637	8.18	-74.22	82.49	22.91
28	STINGER	-30.34	-2.49	15.85	91.78	.000	.153	200.80	-496.091	7.96	-169.17	177.33	49.26
30	STINGER	-32.05	-2.98	16.21	93.55	126.550	.000	199.64	-582.968	7.87	-198.80	206.91	57.48
32	SAGBEND	-43.48	-6.49	17.47	105.51	.000	.000	195.37	-4.858	7.41	-1.66	9.63	2.68
33	SAGBEND	-55.04	-10.06	16.55	117.61	.000	.000	189.34	383.636	6.87	130.82	138.51	38.47
34	SAGBEND	-66.70	-13.29	14.25	129.71	.000	.000	183.54	619.996	6.37	211.42	218.86	60.80
35	SAGBEND	-78.50	-15.96	11.15	141.81	.000	.000	178.84	741.759	5.95	252.95	260.19	72.27
36	SAGBEND	-90.43	-17.95	7.73	153.91	.000	.000	175.64	764.594	5.66	260.73	267.84	74.40
37	SAGBEND	-102.46	-19.22	4.42	166.01	.000	.000	174.02	687.929	5.49	234.59	241.63	67.12
38	SAGBEND	-114.55	-19.85	1.71	178.11	.486	.000	173.77	496.313	5.42	169.25	176.29	48.97
39	SEABED	-126.64	-20.03	.17	190.21	29.252	.000	174.25	169.175	5.43	57.69	64.79	18.00
40	SEABED	-138.74	-20.02	-.07	202.31	33.908	.000	174.34	-9.881	5.43	-3.37	10.78	2.99
41	SEABED	-150.84	-20.01	-.01	214.41	21.986	.000	174.33	-5.906	5.43	-2.01	9.47	2.63
42	SEABED	-162.95	-20.01	-.07	226.51	11.954	.000	174.33	36.784	5.43	12.54	19.78	5.49
43	SEABED	-175.05	-19.98	-.23	238.61	.000	.000	174.38	.000	5.44	.00	7.57	2.10

OFFPIPE - OFFSHORE PIPELINE ANALYSIS SYSTEM - VERSION 2.05 AC PAGE 22
Abandonment and Recovery Analysis in Sangatta
JOB NO. - 1 LICENSED TO: RICKY TAWEKAL
USER ID - Moch. Ardiansyah DATE - 7/ 1/2016 TIME - 5:24:43 CASE 3

S T A T I C S O L U T I O N S U M M A R Y

PIPE PROPERTIES (2)

PIPE SECTION LENGTH ..	.00 M	ELASTIC MODULUS	207000. MPA
OUTSIDE DIAMETER	50.800 CM	CROSS SECTIONAL AREA .	250.00 CM2
WALL THICKNESS	1.590 CM	MOMENT OF INERTIA	74490.00 CM4
WEIGHT/LENGTH IN AIR .	4567.997 N/M	YIELD STRESS	360.00 MPA
SUBMERGED WGHT/LENG ..	1556.660 N/M	STRESS INTENS FACTOR .	1.000
SPECIFIC GRAVITY	1.517	STEEL DENSITY	77008.5 N/M3
WRAP COAT THICKNESS ..	.250 CM	WRAP COAT DENSITY	9397.6 N/M3
CONCRETE THICKNESS ...	5.000 CM	CONCRETE DENSITY	29822.4 N/M3

BARGE DATA

TOTAL PIPE TENSION ...	210.16 KN	RADIUS OF CURVATURE ..	.00 M
NUMBER OF TENSIONERS .	2	BARGE TRIM ANGLE	.000 DEG
NO. OF PIPE SUPPORTS .	7	PIPE ANGLE AT STERN ..	3.723 DEG

STINGER DATA

NO. OF PIPE SUPPORTS .	6	STINGER STERN DEPTH ..	-2.98 M
NO. STINGER SECTIONS .	6	PIPE ANGLE AT STERN ..	16.213 DEG
RADIUS OF CURVATURE ..	.00 M	STINGER LENGTH	31.90 M

SAGBEND DATA

WATER DEPTH	20.00 M	HORIZ PIPE TENSION ...	174.38 KN
TOUCHDOWN X-COORD. ...	-122.34 M	BOTTOM SLOPE ANGLE ...	.000 DEG

SOLUTION SUMMARY

NODE NO.	PIPE SECTION	X COORD	Y COORD	VERT ANGLE	REACT -ION	BENDING MOMENT	BENDING STRESS	TOTAL STRESS	PCT YLD
1	TENSIONR	61.0	2.5	.0	.5	.0	.0	.0	0.
3	LAYBARGE	38.0	2.5	.0	.6	.1	.0	.0	0.
5	LAYBARGE	32.1	2.5	.0	.2	.0	.0	.0	0.
7	TENSIONR	26.5	2.5	.0	.2	.0	.0	.0	0.
9	LAYBARGE	23.0	2.5	.5	4.1	.8	.0	.0	0.
11	LAYBARGE	16.5	2.4	1.8	5.8	1.1	.0	.0	0.
13	LAYBARGE	12.0	2.2	3.2	4.8	.9	.0	.0	0.
15	LAYBARGE	5.5	1.8	3.8	.0	.0	.0	.0	0.
17	LAYBARGE	.0	1.4	3.7	.0	.0	.0	.0	0.
20	STINGER	-7.4	.9	3.6	.0	.0	.0	.0	0.
22	STINGER	-14.6	.5	3.6	.0	.0	.0	.0	0.
24	STINGER	-20.9	.1	15.0	.0	.0	.0	8.4	2.
26	STINGER	-25.5	-1.2	15.2	.0	-217.6	-74.2	82.5	23.
28	STINGER	-30.3	-2.5	15.9	.0	-496.1	-169.2	177.3	49.
30	STINGER	-32.0	-3.0	16.2	126.5	-583.0	-198.8	206.9	57.
36	SAGBEND	-90.4	-17.9	7.7	.0	764.6	260.7	267.8	74.
39	SEABED	-126.6	-20.0	.2	29.3	169.2	57.7	64.8	18.

OFFPIPE - OFFSHORE PIPELINE ANALYSIS SYSTEM - VERSION 2.05 AC DATE - 7/ 1/2016 TIME - 5:24:43 PAGE 23
PROJECT - Abandonment and Recovery Analysis in Sangatta JOB NO. - 1
USER ID - Moch. Ardiansyah LICENSED TO: RICKY TAWEKAL CASE 4

S T A T I C P I P E C O O R D I N A T E S, F O R C E S A N D S T R E S S E S

NODE NO.	PIPE SECTION	X COORD (M)	Y COORD (M)	VERT ANGLE (DEG)	PIPE LENGTH (M)	SUPPORT REACTION (KN)	SEPARA -TION (M)	AXIAL TENSION (KN)	BENDING MOMENT (KN-M)	TENSILE STRESS (MPA)	BENDING STRESS (MPA)	TOTAL STRESS (MPA)	PERCNT YIELD (PCT)
1	TENSIONR	61.00	2.52	.00	.00	.498	.000	90.01	.000	.00	.00	.00	.00
3	LAYBARGE	38.00	2.52	.00	23.00	.626	.000	90.01	.117	.00	.00	.00	.00
5	LAYBARGE	32.09	2.52	.00	28.90	.249	.000	90.01	.047	.00	.00	.00	.00
7	TENSIONR	26.50	2.52	.00	34.50	.197	.000	180.01	.049	.00	.00	.00	.00
9	LAYBARGE	23.00	2.52	.53	38.00	3.549	.000	180.00	.665	.00	.00	.00	.00
11	LAYBARGE	16.52	2.40	1.82	44.48	5.024	.000	179.99	.942	.00	.00	.00	.00
13	LAYBARGE	12.00	2.19	3.36	49.01	5.085	.000	179.98	.953	.00	.00	.00	.00
15	LAYBARGE	5.50	1.72	4.99	55.52	5.655	.000	179.95	1.060	.00	.00	.00	.00
17	LAYBARGE	.00	1.16	5.83	61.05	.171	.000	179.95	.032	.00	.00	.00	.00
20	STINGER	-7.40	.41	6.68	68.49	5.783	.000	179.90	1.084	.00	.00	.00	.00
22	STINGER	-14.57	-.54	7.57	75.73	.372	.000	179.88	.070	.00	.00	.00	.00
24	STINGER	-20.57	-1.34	7.59	81.78	.213	.000	179.85	.040	.00	.00	.00	.00
26	STINGER	-25.28	-1.97	7.62	86.53	.360	.000	179.83	.067	.00	.00	.00	.00
28	STINGER	-30.31	-2.65	8.62	91.60	6.230	.000	179.77	1.168	.00	.00	.00	.00
30	STINGER	-32.07	-2.95	21.87	93.40	76.493	.000	175.74	14.338	.00	.00	.00	.00
32	SAGBEND	-32.58	-3.29	20.65	94.01	.000	.000	174.81	.005	6.84	.00	7.12	1.98
33	SAGBEND	-43.64	-7.38	19.70	105.80	.000	.000	167.90	404.974	6.22	138.10	144.91	40.25
34	SAGBEND	-54.82	-11.15	17.31	117.60	.000	.000	161.14	665.122	5.63	226.81	233.34	64.82
35	SAGBEND	-66.46	-14.42	13.94	129.70	.000	.000	155.33	816.236	5.12	278.34	284.63	79.06
36	SAGBEND	-78.30	-16.94	10.12	141.80	.000	.000	151.13	865.377	4.74	295.10	301.21	83.67
37	SAGBEND	-90.27	-18.66	6.31	153.90	.000	.000	148.73	813.368	4.50	277.36	283.38	78.72
38	SAGBEND	-102.33	-19.63	2.97	166.00	.000	.000	148.01	648.621	4.39	221.18	227.17	63.10
39	SAGBEND	-114.42	-19.99	.68	178.10	13.159	.000	148.42	345.962	4.38	117.98	123.99	34.44
40	SEABED	-126.52	-20.03	-.07	190.20	41.131	.000	148.80	31.720	4.39	10.82	17.05	4.74
41	SEABED	-138.62	-20.02	-.04	202.30	24.418	.000	148.79	-18.624	4.39	-6.35	12.66	3.52
42	SEABED	-150.72	-20.01	.01	214.40	20.293	.000	148.79	.953	4.39	.33	6.91	1.92
43	SEABED	-162.83	-20.01	-.07	226.50	12.413	.000	148.78	37.944	4.39	12.94	19.14	5.32
44	SEABED	-174.93	-19.98	-.23	238.60	.000	.000	148.84	.000	4.40	.00	6.61	1.84

S T A T I C S O L U T I O N S U M M A R Y

PIPE PROPERTIES (2)

PIPE SECTION LENGTH ..	.00 M	ELASTIC MODULUS	207000. MPA
OUTSIDE DIAMETER	50.800 CM	CROSS SECTIONAL AREA .	250.00 CM2
WALL THICKNESS	1.590 CM	MOMENT OF INERTIA	74490.00 CM4
WEIGHT/LENGTH IN AIR .	4567.997 N/M	YIELD STRESS	360.00 MPA
SUBMERGED WGHT/LENG ..	1556.660 N/M	STRESS INTENS FACTOR .	1.000
SPECIFIC GRAVITY	1.517	STEEL DENSITY	77008.5 N/M3
WRAP COAT THICKNESS ..	.250 CM	WRAP COAT DENSITY	9397.6 N/M3
CONCRETE THICKNESS ...	5.000 CM	CONCRETE DENSITY	29822.4 N/M3

BARGE DATA

TOTAL PIPE TENSION ...	180.01 KN	RADIUS OF CURVATURE ..	.00 M
NUMBER OF TENSIONERS .	2	BARGE TRIM ANGLE	.000 DEG
NO. OF PIPE SUPPORTS .	7	PIPE ANGLE AT STERN ..	5.827 DEG

STINGER DATA

NO. OF PIPE SUPPORTS .	6	STINGER STERN DEPTH ..	-2.95 M
NO. STINGER SECTIONS .	6	PIPE ANGLE AT STERN ..	21.869 DEG
RADIUS OF CURVATURE ..	.00 M	STINGER LENGTH	31.90 M

SAGBEND DATA

WATER DEPTH	20.00 M	HORIZ PIPE TENSION ...	148.84 KN
TOUCHDOWN X-COORD. ...	-115.18 M	BOTTOM SLOPE ANGLE ...	.000 DEG

SOLUTION SUMMARY

NODE NO.	PIPE SECTION	X COORD	Y COORD	VERT ANGLE	REACT -ION	BENDING MOMENT	BENDING STRESS	TOTAL STRESS	PCT YLD
1	TENSIONR	61.0	2.5	.0	.5	.0	.0	.0	0.
3	LAYBARGE	38.0	2.5	.0	.6	.1	.0	.0	0.
5	LAYBARGE	32.1	2.5	.0	.2	.0	.0	.0	0.
7	TENSIONR	26.5	2.5	.0	.2	.0	.0	.0	0.
9	LAYBARGE	23.0	2.5	.5	3.5	.7	.0	.0	0.
11	LAYBARGE	16.5	2.4	1.8	5.0	.9	.0	.0	0.
13	LAYBARGE	12.0	2.2	3.4	5.1	1.0	.0	.0	0.
15	LAYBARGE	5.5	1.7	5.0	5.7	1.1	.0	.0	0.
17	LAYBARGE	.0	1.2	5.8	.2	.0	.0	.0	0.
20	STINGER	-7.4	.4	6.7	5.8	1.1	.0	.0	0.
22	STINGER	-14.6	-.5	7.6	.4	.1	.0	.0	0.
24	STINGER	-20.6	-1.3	7.6	.2	.0	.0	.0	0.
26	STINGER	-25.3	-2.0	7.6	.4	.1	.0	.0	0.
28	STINGER	-30.3	-2.6	8.6	6.2	1.2	.0	.0	0.
30	STINGER	-32.1	-2.9	21.9	76.5	14.3	.0	.0	0.
36	SAGBEND	-78.3	-16.9	10.1	.0	865.4	295.1	301.2	84.
40	SEABED	-126.5	-20.0	-.1	41.1	31.7	10.8	17.0	5.

OFFPIPE - OFFSHORE PIPELINE ANALYSIS SYSTEM - VERSION 2.05 AC DATE - 7/ 1/2016 TIME - 5:24:43 PAGE 25
PROJECT - Abandonment and Recovery Analysis in Sangatta JOB NO. - 1
USER ID - Moch. Ardiansyah LICENSED TO: RICKY TAWEKAL CASE 5

S T A T I C P I P E C O O R D I N A T E S, F O R C E S A N D S T R E S S E S

NODE NO.	PIPE SECTION	X COORD (M)	Y COORD (M)	VERT ANGLE (DEG)	PIPE LENGTH (M)	SUPPORT REACTION (KN)	SEPARA -TION (M)	AXIAL TENSION (KN)	BENDING MOMENT (KN-M)	TENSILE STRESS (MPA)	BENDING STRESS (MPA)	TOTAL STRESS (MPA)	PERCNT YIELD (PCT)
1	TENSIONR	61.00	2.52	.00	.00	.498	.000	37.48	.000	.00	.00	.00	.00
3	LAYBARGE	38.00	2.52	.00	23.00	.626	.000	37.48	.117	.00	.00	.00	.00
5	LAYBARGE	32.09	2.52	.00	28.90	.249	.000	37.48	.047	.00	.00	.00	.00
7	TENSIONR	26.50	2.52	.00	34.50	.197	.000	74.98	.049	.00	.00	.00	.00
9	LAYBARGE	23.00	2.52	.53	38.00	1.605	.000	74.97	.301	.00	.00	.00	.00
11	LAYBARGE	16.52	2.40	1.82	44.48	2.231	.000	74.96	.418	.00	.00	.00	.00
13	LAYBARGE	12.00	2.19	3.36	49.01	2.257	.000	74.95	.423	.00	.00	.00	.00
15	LAYBARGE	5.50	1.72	4.99	55.52	2.507	.000	74.93	.470	.00	.00	.00	.00
17	LAYBARGE	.00	1.16	5.82	61.05	.206	.000	74.92	.039	.00	.00	.00	.00
20	STINGER	-7.40	.41	6.68	68.49	2.638	.000	74.87	.494	.00	.00	.00	.00
22	STINGER	-14.57	-.54	7.58	75.73	.278	.000	74.85	.052	.00	.00	.00	.00
24	STINGER	-20.57	-1.34	7.59	81.78	.203	.000	74.82	.038	.00	.00	.00	.00
26	STINGER	-25.28	-1.97	7.60	86.53	.198	.000	74.79	.037	.00	.00	.00	.00
28	STINGER	-30.31	-2.64	8.06	91.60	1.308	.000	74.76	.245	.00	.00	.00	.00
30	STINGER	-32.08	-2.91	21.37	93.40	33.522	.000	72.90	6.280	.00	.00	.00	.00
32	SAGBEND	-42.08	-9.72	33.54	105.54	.000	.000	74.53	.000	.00	.00	.00	.00
33	SAGBEND	-52.14	-16.44	32.15	117.64	.000	.000	74.25	2.891	.00	.00	.00	.00
34	SAGBEND	-54.17	-17.67	5.44	120.05	.000	.000	65.35	10.574	1.19	3.61	6.69	1.86
35	SAGBEND	-65.02	-18.66	4.74	130.94	.000	.000	63.52	305.165	1.04	104.06	106.63	29.62
36	SAGBEND	-75.89	-19.42	3.20	141.84	.000	.000	62.04	429.788	.91	146.56	149.06	41.41
37	SAGBEND	-87.98	-19.89	1.31	153.94	.716	.000	61.44	375.265	.85	127.97	130.45	36.23
38	SEABED	-100.08	-20.02	.12	166.04	27.838	.000	61.68	129.919	.85	44.30	46.84	13.01
39	SEABED	-112.18	-20.02	-.06	178.14	30.171	.000	61.73	-7.728	.85	-2.64	5.81	1.61
40	SEABED	-124.28	-20.01	-.01	190.24	19.222	.000	61.72	-8.066	.85	-2.75	5.91	1.64
41	SEABED	-136.38	-20.01	.01	202.34	18.792	.000	61.72	-1.912	.85	-.65	4.17	1.16
42	SEABED	-148.48	-20.01	.01	214.44	21.203	.000	61.72	4.156	.85	1.42	4.77	1.33
43	SEABED	-160.58	-20.01	-.08	226.54	12.966	.000	61.72	37.551	.85	12.81	15.52	4.31
44	SEABED	-172.68	-19.98	-.23	238.64	.000	.000	61.77	.000	.86	.00	3.71	1.03

OFFPIPE - OFFSHORE PIPELINE ANALYSIS SYSTEM - VERSION 2.05 AC PAGE 26
Abandonment and Recovery Analysis in Sangatta
JOB NO. - 1 LICENSED TO: RICKY TAWEKAL
USER ID - Moch. Ardiansyah DATE - 7/ 1/2016 TIME - 5:24:43 CASE 5

S T A T I C S O L U T I O N S U M M A R Y

PIPE PROPERTIES (2)

PIPE SECTION LENGTH ..	.00 M	ELASTIC MODULUS	207000. MPA
OUTSIDE DIAMETER	50.800 CM	CROSS SECTIONAL AREA .	250.00 CM2
WALL THICKNESS	1.590 CM	MOMENT OF INERTIA	74490.00 CM4
WEIGHT/LENGTH IN AIR .	4567.997 N/M	YIELD STRESS	360.00 MPA
SUBMERGED WGHT/LENG ..	1556.660 N/M	STRESS INTENS FACTOR .	1.000
SPECIFIC GRAVITY	1.517	STEEL DENSITY	77008.5 N/M3
WRAP COAT THICKNESS ..	.250 CM	WRAP COAT DENSITY	9397.6 N/M3
CONCRETE THICKNESS ...	5.000 CM	CONCRETE DENSITY	29822.4 N/M3

BARGE DATA

TOTAL PIPE TENSION ...	74.98 KN	RADIUS OF CURVATURE ..	.00 M
NUMBER OF TENSIONERS .	2	BARGE TRIM ANGLE	.000 DEG
NO. OF PIPE SUPPORTS .	7	PIPE ANGLE AT STERN ..	5.817 DEG

STINGER DATA

NO. OF PIPE SUPPORTS .	6	STINGER STERN DEPTH ..	-2.91 M
NO. STINGER SECTIONS .	6	PIPE ANGLE AT STERN ..	21.374 DEG
RADIUS OF CURVATURE ..	.00 M	STINGER LENGTH	31.90 M

SAGBEND DATA

WATER DEPTH	20.00 M	HORIZ PIPE TENSION ...	61.77 KN
TOUCHDOWN X-COORD. ...	-95.10 M	BOTTOM SLOPE ANGLE ...	.000 DEG

SOLUTION SUMMARY

NODE NO.	PIPE SECTION	X COORD	Y COORD	VERT ANGLE	REACT -ION	BENDING MOMENT	BENDING STRESS	TOTAL STRESS	PCT YLD
1	TENSIONR	61.0	2.5	.0	.5	.0	.0	.0	0.
3	LAYBARGE	38.0	2.5	.0	.6	.1	.0	.0	0.
5	LAYBARGE	32.1	2.5	.0	.2	.0	.0	.0	0.
7	TENSIONR	26.5	2.5	.0	.2	.0	.0	.0	0.
9	LAYBARGE	23.0	2.5	.5	1.6	.3	.0	.0	0.
11	LAYBARGE	16.5	2.4	1.8	2.2	.4	.0	.0	0.
13	LAYBARGE	12.0	2.2	3.4	2.3	.4	.0	.0	0.
15	LAYBARGE	5.5	1.7	5.0	2.5	.5	.0	.0	0.
17	LAYBARGE	.0	1.2	5.8	.2	.0	.0	.0	0.
20	STINGER	-7.4	.4	6.7	2.6	.5	.0	.0	0.
22	STINGER	-14.6	-.5	7.6	.3	.1	.0	.0	0.
24	STINGER	-20.6	-1.3	7.6	.2	.0	.0	.0	0.
26	STINGER	-25.3	-2.0	7.6	.2	.0	.0	.0	0.
28	STINGER	-30.3	-2.6	8.1	1.3	.2	.0	.0	0.
30	STINGER	-32.1	-2.9	21.4	33.5	6.3	.0	.0	0.
36	SAGBEND	-75.9	-19.4	3.2	.0	429.8	146.6	149.1	41.
38	SEABED	-100.1	-20.0	.1	27.8	129.9	44.3	46.8	13.

OFFPIPE - OFFSHORE PIPELINE ANALYSIS SYSTEM - VERSION 2.05 AC DATE - 7/ 1/2016 TIME - 5:24:43 PAGE 27
PROJECT - Abandonment and Recovery Analysis in Sangatta JOB NO. - 1
USER ID - Moch. Ardiansyah LICENSED TO: RICKY TAWEKAL CASE 6

S T A T I C P I P E C O O R D I N A T E S, F O R C E S A N D S T R E S S E S

NODE NO.	PIPE SECTION	X COORD (M)	Y COORD (M)	VERT ANGLE (DEG)	PIPE LENGTH (M)	SUPPORT REACTION (KN)	SEPARA -TION (M)	AXIAL TENSION (KN)	BENDING MOMENT (KN-M)	TENSILE STRESS (MPA)	BENDING STRESS (MPA)	TOTAL STRESS (MPA)	PERCNT YIELD (PCT)
1	TENSIONR	61.00	2.52	.00	.00	.498	.000	10.00	.000	.00	.00	.00	.00
3	LAYBARGE	38.00	2.52	.00	23.00	.626	.000	10.00	.117	.00	.00	.00	.00
5	LAYBARGE	32.09	2.52	.00	28.90	.249	.000	10.00	.047	.00	.00	.00	.00
7	TENSIONR	26.50	2.52	.00	34.50	.197	.000	20.00	.049	.00	.00	.00	.00
9	LAYBARGE	23.00	2.52	.53	38.00	.587	.000	20.00	.110	.00	.00	.00	.00
11	LAYBARGE	16.52	2.40	1.82	44.48	.770	.000	19.99	.144	.00	.00	.00	.00
13	LAYBARGE	12.00	2.19	3.36	49.01	.777	.000	19.98	.145	.00	.00	.00	.00
15	LAYBARGE	5.50	1.72	4.99	55.52	.859	.000	19.96	.161	.00	.00	.00	.00
17	LAYBARGE	.00	1.16	5.81	61.05	.256	.000	19.94	.048	.00	.00	.00	.00
20	STINGER	-7.40	.41	6.68	68.49	.933	.000	19.91	.174	.00	.00	.00	.00
22	STINGER	-14.57	-.54	7.59	75.73	.258	.000	19.87	.048	.00	.00	.00	.00
24	STINGER	-20.57	-1.34	7.59	81.78	.202	.000	19.84	.038	.00	.00	.00	.00
26	STINGER	-25.28	-1.97	7.59	86.53	.184	.000	19.82	.034	.00	.00	.00	.00
28	STINGER	-30.31	-2.64	7.66	91.60	.172	.000	19.79	.032	.00	.00	.00	.00
30	STINGER	-32.08	-2.88	14.42	93.39	4.865	.000	19.65	.909	.00	.00	.00	.00
32	SAGBEND	-43.37	-7.24	20.47	105.50	.000	.000	19.64	.000	.00	.00	.00	.00
33	SAGBEND	-54.75	-11.35	19.17	117.60	.000	.000	19.49	.031	.00	.00	.00	.00
34	SAGBEND	-66.22	-15.20	17.58	129.70	.000	.000	19.34	.186	.00	.00	.00	.00
35	SAGBEND	-74.48	-17.77	14.35	138.36	.000	.000	19.22	.935	.00	.00	.00	.00
36	SEABED	-82.81	-20.00	.09	147.01	1.750	.000	18.41	5.435	-.91	1.85	3.77	1.05
37	SEABED	-89.70	-20.01	.05	153.90	11.839	.000	18.40	17.820	-.91	6.08	7.32	2.03
38	SEABED	-101.80	-20.01	.00	166.00	19.723	.000	18.40	3.807	-.91	1.30	3.42	.95
39	SEABED	-113.90	-20.01	.00	178.10	19.205	.000	18.40	-.679	-.91	-.23	2.93	.81
40	SEABED	-126.00	-20.01	.00	190.20	18.708	.000	18.40	-.585	-.91	-.20	2.92	.81
41	SEABED	-138.10	-20.01	.00	202.30	19.367	.000	18.40	-1.859	-.91	-.63	3.08	.86
42	SEABED	-150.20	-20.01	.01	214.40	21.307	.000	18.40	3.701	-.91	1.26	3.40	.95
43	SEABED	-162.30	-20.01	-.08	226.50	13.021	.000	18.39	37.677	-.91	12.85	13.83	3.84
44	SEABED	-174.40	-19.98	-.23	238.61	.000	.000	18.45	.000	-.90	.00	2.86	.80

OFFPIPE - OFFSHORE PIPELINE ANALYSIS SYSTEM - VERSION 2.05 AC PAGE 28
Abandonment and Recovery Analysis in Sangatta
JOB NO. - 1 LICENSED TO: RICKY TAWEKAL
USER ID - Moch. Ardiansyah DATE - 7/ 1/2016 TIME - 5:24:43 CASE 6

S T A T I C S O L U T I O N S U M M A R Y

PIPE PROPERTIES (2)

PIPE SECTION LENGTH ..	.00 M	ELASTIC MODULUS	207000. MPA
OUTSIDE DIAMETER	50.800 CM	CROSS SECTIONAL AREA .	250.00 CM2
WALL THICKNESS	1.590 CM	MOMENT OF INERTIA	74490.00 CM4
WEIGHT/LENGTH IN AIR .	4567.997 N/M	YIELD STRESS	360.00 MPA
SUBMERGED WGHT/LENG ..	1556.660 N/M	STRESS INTENS FACTOR .	1.000
SPECIFIC GRAVITY	1.517	STEEL DENSITY	77008.5 N/M3
WRAP COAT THICKNESS ..	.250 CM	WRAP COAT DENSITY	9397.6 N/M3
CONCRETE THICKNESS ...	5.000 CM	CONCRETE DENSITY	29822.4 N/M3

BARGE DATA

TOTAL PIPE TENSION ...	20.00 KN	RADIUS OF CURVATURE ..	.00 M
NUMBER OF TENSIONERS .	2	BARGE TRIM ANGLE	.000 DEG
NO. OF PIPE SUPPORTS .	7	PIPE ANGLE AT STERN ..	5.811 DEG

STINGER DATA

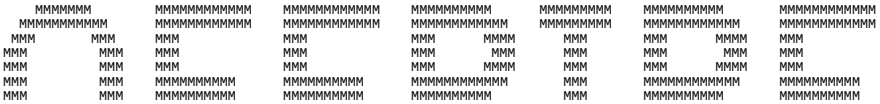
NO. OF PIPE SUPPORTS .	6	STINGER STERN DEPTH ..	-2.88 M
NO. STINGER SECTIONS .	6	PIPE ANGLE AT STERN ..	14.419 DEG
RADIUS OF CURVATURE ..	.00 M	STINGER LENGTH	31.90 M

SAGBEND DATA

WATER DEPTH	20.00 M	HORIZ PIPE TENSION ...	18.45 KN
TOUCHDOWN X-COORD. ...	-82.73 M	BOTTOM SLOPE ANGLE ...	.000 DEG

SOLUTION SUMMARY

NODE NO.	PIPE SECTION	X COORD	Y COORD	VERT ANGLE	REACT -ION	BENDING MOMENT	BENDING STRESS	TOTAL STRESS	PCT YLD
1	TENSIONR	61.0	2.5	.0	.5	.0	.0	.0	0.
3	LAYBARGE	38.0	2.5	.0	.6	.1	.0	.0	0.
5	LAYBARGE	32.1	2.5	.0	.2	.0	.0	.0	0.
7	TENSIONR	26.5	2.5	.0	.2	.0	.0	.0	0.
9	LAYBARGE	23.0	2.5	.5	.6	.1	.0	.0	0.
11	LAYBARGE	16.5	2.4	1.8	.8	.1	.0	.0	0.
13	LAYBARGE	12.0	2.2	3.4	.8	.1	.0	.0	0.
15	LAYBARGE	5.5	1.7	5.0	.9	.2	.0	.0	0.
17	LAYBARGE	.0	1.2	5.8	.3	.0	.0	.0	0.
20	STINGER	-7.4	.4	6.7	.9	.2	.0	.0	0.
22	STINGER	-14.6	-.5	7.6	.3	.0	.0	.0	0.
24	STINGER	-20.6	-1.3	7.6	.2	.0	.0	.0	0.
26	STINGER	-25.3	-2.0	7.6	.2	.0	.0	.0	0.
28	STINGER	-30.3	-2.6	7.7	.2	.0	.0	.0	0.
30	STINGER	-32.1	-2.9	14.4	4.9	.9	.0	.0	0.
36	SEABED	-82.8	-20.0	.1	1.8	5.4	1.9	3.8	1.
43	SEABED	-162.3	-20.0	-.1	13.0	37.7	12.8	13.8	4.



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*******************************************************************************
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*                                                                             *
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*                                                                             *
*                        VERSION NO. - 2.05 AC                                *
*                        RELEASED ON - 10/24/1993                             *
*                        LICENSED TO - RICKY TAWEKAL                          *
*                                                                             *
*******************************************************************************
*                                                                             *
*    OFFPIPE IS A NONLINEAR,  3-DIMENSIONAL FINITE ELEMENT METHOD BASED PROGRAM FOR THE
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*                                                                             *
*                  ROBERT C. MALAHY, JR.           TELEPHONE: (713) 664-8635  *
*                  8007 MULLINS                    FACSIMILE: (713) 664-0962  *
*                  HOUSTON, TEXAS 77081                                       *
*                  U.S.A.                                                     *
*                                                                             *
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I N P U T D A T A E C H O

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PRINTED OUTPUT SELECTED
=======================
   PRINT PIPE STRAINS IN OUTPUT ......NO
   USE DNV STRESS FORMULA ............NO
   STATIC PIPE FORCES AND STRESSES ...YES
   STATIC SOLUTION SUMMARY ...........YES
   OVERBEND PIPE SUPPORT GEOMETRY ....NO
   STINGER BALLAST SCHEDULE DATA .....NO
   DYNAMIC PIPE FORCES AND STRESSES ..YES
   DYNAMIC RANGE OF PIPE DATA ........NO
   DYNAMIC TRACKING OF PIPE DATA .....NO
   PLOT DATA FILE SUMMARY TABLES .....NO

PROFILE PLOT TABLE ENTRIES
==========================
   PLOT TABLE INDEX ..................         1
   PLOT NUMBER .......................         1
   PLOT TYPE OPTION NUMBER ...........         4
   DYNAMIC PROFILE TIME POINT ........      .000
   DYNAMIC PROFILE TIME INCREMENT ....      .000
   ORDINATE PARAMETER CODE NUMBER ....         2
   AXIS LABEL FOR ORDINATE ........... "Pipe Elevation or Y Coordinate  "
   ABSCISSA PARAMETER CODE NUMBER ....         1
   AXIS LABEL FOR ABSCISSA ........... "Pipe Horizontal X Coordinate    "

   PLOT TITLE ........................ "Pipeline Elevation Profile                              "
   MINIMUM HORIZONTAL AXIS RANGE .....      .000
   MAXIMUM HORIZONTAL AXIS RANGE .....      .000
   MINIMUM VERTICAL AXIS RANGE .......      .000
   MAXIMUM VERTICAL AXIS RANGE .......      .000

PROFILE PLOT TABLE ENTRIES
==========================
   PLOT TABLE INDEX ..................         2
   PLOT NUMBER .......................         2
   PLOT TYPE OPTION NUMBER ...........         4
   DYNAMIC PROFILE TIME POINT ........      .000
   DYNAMIC PROFILE TIME INCREMENT ....      .000
   ORDINATE PARAMETER CODE NUMBER ....        14
   AXIS LABEL FOR ORDINATE ........... "Total Von Mises Pipe Stress     "
   ABSCISSA PARAMETER CODE NUMBER ....         1
   AXIS LABEL FOR ABSCISSA ........... "Pipe Horizontal X Coordinate    "

   PLOT TITLE ........................ "Pipeline Total Pipe Stress                              "
   MINIMUM HORIZONTAL AXIS RANGE .....      .000
   MAXIMUM HORIZONTAL AXIS RANGE .....      .000
   MINIMUM VERTICAL AXIS RANGE .......      .000
   MAXIMUM VERTICAL AXIS RANGE .......      .000
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OFFPIPE - OFFSHORE PIPELINE ANALYSIS SYSTEM - VERSION 2.05 AC          PAGE   4
Abandonment and Recovery Analysis in Sangatta
JOB NO. - 1                    LICENSED TO: RICKY TAWEKAL
USER ID - Moch. Ardiansyah     DATE -  7/ 1/2016   TIME -  5:25:59   CASE   1
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I N P U T D A T A E C H O

```
PIPE PROPERTIES
===============
   PIPE PROPERTY TABLE ROW ...........         2
   PIPE SECTION LENGTH ...............      .000 M
   STEEL MODULUS OF ELASTICITY .......   207000. MPA
   AREA OF STEEL CROSS SECTION .......   250.000 CM**2
   COATED PIPE AVG MOMENT OF INERTIA .  74490.00 CM**4
   WEIGHT PER-UNIT-LENGTH IN AIR .....   4568.00 N/M
   WEIGHT PER-UNIT-LENGTH SUBMERGED ..   1556.66 N/M
   MAXIMUM ALLOWABLE PIPE STRAIN .....   .205000 PCT

   STEEL OUTSIDE DIAMETER ............   50.8000 CM
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   STEEL WALL THICKNESS ..............    1.5900 CM
   YIELD STRESS ......................    360.00 MPA
   STRESS/STRAIN INTENSE FACTOR ......     .0000
   HYDRODYNAMIC OUTSIDE DIAMETER .....      .000 CM
   DRAG COEFFICIENT ..................     .0000
   HYDRODYNAMIC TOTAL AREA ...........      .000 CM**2
   ADDED MASS COEFFICIENT ............     .0000
   POISSON'S RATIO ...................     .3000
   COEFFICIENT OF THERMAL EXPANSION .. .00000000 1/DEG C

PIPE COATING PROPERTIES
=======================
   PIPE PROPERTY TABLE INDEX .........         2
   CORROSION COATING THICKNESS .......      .250 CM
   CONCRETE COATING THICKNESS ........     5.000 CM
   STEEL WEIGHT DENSITY ..............    77009. N/M**3
   CORROSION COATING WEIGHT DENSITY ..     9398. N/M**3
   CONCRETE COATING WEIGHT DENSITY ...    29822. N/M**3
   DESIRED PIPE SPECIFIC GRAVITY .....     .0000

   AVERAGE PIPE JOINT LENGTH .........    12.100 M
   FIELD JOINT LENGTH ................      .600 M
   JOINT FILL WEIGHT DENSITY .........    10055. N/M**3
   DENSITY OF PIPE CONTENTS ..........        0. N/M**3

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OFFPIPE - OFFSHORE PIPELINE ANALYSIS SYSTEM - VERSION 2.05 AC          PAGE   5
Abandonment and Recovery Analysis in Sangatta
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USER ID - Moch. Ardiansyah     DATE -  7/ 1/2016   TIME -  5:25:59   CASE   1
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                        I N P U T   D A T A   E C H O


SUPPORT ELEMENT PROPERTIES
==========================
   SUPPORT PROPERTY TABLE INDEX ......          7
   SUPPORT ELEMENT TYPE ..............          2 TENSIONER
   TENSIONER AXIAL STIFFNESS (F/L) ...  0.000E+00 KN/M
   VERTICAL STIFFNESS (F/L) ..........  0.000E+00 KN/M
   STATIC VERTICAL DEFLECTION ........      .0000 CM
   LATERAL STIFFNESS (F/L) ...........  0.000E+00 KN/M
   BOTTOM ROLLER ANGLE TO HORIZONTAL .     30.000 DEG

   SIDE ROLLER ANGLE TO VERTICAL .....        .000 DEG
   SIDE ROLLER OFFSET FROM C.L. ......        .000 M
   BED ROLLER LENGTH .................      2.000 M
   HEIGHT OF TOP ROLLER ABOVE BED ....        .000 M
   TENSIONER X-AXIS ROTATIONAL STIF. .        .000 KN/DEG
   TENSIONER Y-AXIS ROTATIONAL STIF. .        .000 KN/DEG
   TENSIONER Y-AXIS ROTATIONAL STIF. .        .000 KN/DEG

SUPPORT ELEMENT PROPERTIES
==========================
   SUPPORT PROPERTY TABLE INDEX ......          8
   SUPPORT ELEMENT TYPE ..............          1 SIMPLE SUPPORT
   TENSIONER AXIAL STIFFNESS (F/L) ...  0.000E+00 KN/M
   VERTICAL STIFFNESS (F/L) ..........  0.000E+00 KN/M
   STATIC VERTICAL DEFLECTION ........      .0000 CM
   LATERAL STIFFNESS (F/L) ...........  0.000E+00 KN/M
   BOTTOM ROLLER ANGLE TO HORIZONTAL .     30.000 DEG

   SIDE ROLLER ANGLE TO VERTICAL .....     60.000 DEG
   SIDE ROLLER OFFSET FROM C.L. ......      1.000 M
   BED ROLLER LENGTH .................      1.500 M
   HEIGHT OF TOP ROLLER ABOVE BED ....        .000 M
   TENSIONER X-AXIS ROTATIONAL STIF. .        .000 KN/DEG
   TENSIONER Y-AXIS ROTATIONAL STIF. .        .000 KN/DEG
   TENSIONER Y-AXIS ROTATIONAL STIF. .        .000 KN/DEG

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OFFPIPE - OFFSHORE PIPELINE ANALYSIS SYSTEM - VERSION 2.05 AC          PAGE   6
Abandonment and Recovery Analysis in Sangatta
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USER ID - Moch. Ardiansyah     DATE -  7/ 1/2016   TIME -  5:25:59   CASE   1
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                        I N P U T   D A T A   E C H O


SUPPORT ELEMENT PROPERTIES
==========================
   SUPPORT PROPERTY TABLE INDEX ......          9
   SUPPORT ELEMENT TYPE ..............          1 SIMPLE SUPPORT
   TENSIONER AXIAL STIFFNESS (F/L) ...  0.000E+00 KN/M
   VERTICAL STIFFNESS (F/L) ..........  0.000E+00 KN/M
   STATIC VERTICAL DEFLECTION ........      .0350 CM
   LATERAL STIFFNESS (F/L) ...........  0.000E+00 KN/M
   BOTTOM ROLLER ANGLE TO HORIZONTAL .     30.000 DEG

   SIDE ROLLER ANGLE TO VERTICAL .....     60.000 DEG
   SIDE ROLLER OFFSET FROM C.L. ......      1.000 M
   BED ROLLER LENGTH .................      1.500 M
   HEIGHT OF TOP ROLLER ABOVE BED ....        .000 M
   TENSIONER X-AXIS ROTATIONAL STIF. .        .000 KN/DEG
   TENSIONER Y-AXIS ROTATIONAL STIF. .        .000 KN/DEG
   TENSIONER Y-AXIS ROTATIONAL STIF. .        .000 KN/DEG

LAYBARGE DESCRIPTION
====================
   NUMBER OF PIPE NODES ..............         9
   BARGE GEOMETRY SPECIFIED BY .......         1 X-Y COORDINATES
   OVERBEND PIPE SUPPORT RADIUS ......      .000 M
   TANGENT POINT X-COORDINATE ........      .000 M
   TANGENT POINT Y-COORDINATE ........      .000 M
   PIPE ANGLE RELATIVE TO DECK .......     .0000 DEG
   HEIGHT OF DECK ABOVE WATER ........     1.000 M
   LAYBARGE FORWARD (X) OFFSET .......      .000 M
   BARGE TRIM ANGLE ..................     .0000 DEG

   STERN SHOE X COORDINATE ..........       .000 M
   STERN SHOE Y COORDINATE ...........      .000 M
   ROTATION CENTER X COORDINATE ......    31.930 M
   ROTATION CENTER Y COORDINATE ......     3.940 M
   ROTATION CENTER Z COORDINATE ......      .000 M
   BARGE HEADING .....................     .0000 DEG
   BARGE OFFSET FROM RIGHT-OF-WAY ....      .000 M
   PIPE RAMP PIVOT X COORDINATE ......      .000 M
   PIPE RAMP PIVOT Y COORDINATE ......      .000 M
   PIPE RAMP PIVOT ROTATION ANGLE ....      .000 DEG

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OFFPIPE - OFFSHORE PIPELINE ANALYSIS SYSTEM - VERSION 2.05 AC          PAGE   7
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                        I N P U T   D A T A   E C H O
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NODE X COORD (M)	NODE Y COORD (M)	SUPPORT TYPE	DAVIT SPACING (M)
61.000	1.516	2 PIPE TENSIONER	.000
38.000	1.516	8 USER DEFINED	.000

32.095	1.516	8	USER DEFINED	.000	
26.500	1.516	7	USER DEFINED	.000	
23.000	1.516	8	USER DEFINED	.000	
16.520	1.396	8	USER DEFINED	.000	
12.000	1.192	8	USER DEFINED	.000	
5.500	.723	8	USER DEFINED	.000	
.000	.160	8	USER DEFINED	.000	

STINGER DESCRIPTION
==========

NUMBER OF PIPE/STINGER NODES	6	
STINGER GEOMETRY SPECIFIED BY	1	X-Y COORD AND TANGENT PT
STINGER TYPE	2	STRAIGHT CONVENTIONAL
OVERBEND PIPE SUPPORT RADIUS	.00	M
HITCH X-COORDINATE	-.399	M
HITCH Y-COORDINATE	-.744	M
X COORDINATE OF LOCAL ORIGIN	-.399	M
Y COORDINATE OF LOCAL ORIGIN	-.744	M
ROTATION ABOUT STINGER HITCH	8.870	DEG
TANGENT POINT X-COORDINATE	.000	M
TANGENT POINT Y-COORDINATE	.000	M
TANGENT POINT ANGLE	.000	DEG

NODE X COORD (M)	NODE Y COORD (M)	SUPPORT TYPE		ELEMENT TYPE		ELEMENT LENGTH (M)
-6.900	1.222	9	USER DEFINED	1	FIXED END	.000
-14.130	1.371	9	USER DEFINED	1	FIXED END	.000
-20.180	1.359	9	USER DEFINED	1	FIXED END	.000
-24.930	1.261	9	USER DEFINED	1	FIXED END	.000
-30.000	1.116	9	USER DEFINED	1	FIXED END	.000
-31.792	1.116	9	USER DEFINED	1	FIXED END	.000

I N P U T D A T A E C H O

CURRENT VELOCITIES
==========

WATER DEPTH (M)	CURRENT SPEED (M/S)	DIRECTION OF TRAVEL (DEG)
.000	.250	45.000
1.900	.246	45.000
3.800	.243	45.000
5.700	.238	45.000
7.600	.233	45.000
9.500	.228	45.000
11.400	.222	45.000
13.300	.214	45.000
15.200	.204	45.000
17.100	.190	45.000
19.000	.114	45.000
20.000	.000	45.000

BARGE MOTION RAO TABLE (OFFPIPE) SIGN CONVENTION
==========

WAVE FREQUENCY (RAD/S)	SURGE AMPLITUDE (M/M)	SURGE PHASE (DEG)	SWAY AMPLITUDE (M/M)	SWAY PHASE (DEG)	HEAVE AMPLITUDE (M/M)	HEAVE PHASE (DEG)
.2510	.6450	99.00	.6790	97.00	.9290	7.00
.3140	.6380	103.00	.6660	101.00	.9120	11.00
.3310	.6360	105.00	.6610	102.00	.9060	12.00
.3490	.6330	106.00	.6550	104.00	.8980	13.00
.3700	.6300	108.00	.6470	105.00	.8880	15.00
.3930	.6260	111.00	.6380	107.00	.8740	17.00
.4190	.6210	114.00	.6250	110.00	.8560	19.00
.4490	.6140	117.00	.6070	113.00	.8310	22.00
.4830	.6040	122.00	.5830	116.00	.7970	25.00
.5240	.5920	127.00	.5500	120.00	.7480	30.00
.5710	.5740	134.00	.5030	126.00	.6780	35.00
.6280	.5490	144.00	.4330	133.00	.5770	42.00
.6980	.5100	156.00	.3300	140.00	.4270	50.00
.7850	.4490	174.00	.1710	145.00	.2120	51.00
.8380	.4050	-173.00	.1190	133.00	.1160	8.00
.8980	.3490	-159.00	.1160	75.00	.2220	-44.00
1.0470	.1870	-120.00	.3650	72.00	.7380	-31.00
1.2570	.0290	122.00	.4790	129.00	1.0920	9.00
1.5710	.0880	-117.00	.1740	98.00	.2370	-74.00
2.0940	.0100	-40.00	.2350	176.00	.1390	26.00

I N P U T D A T A E C H O

WAVE FREQUENCY (RAD/S)	ROLL AMPLITUDE (DEG/M)	ROLL PHASE (DEG)	PITCH AMPLITUDE (DEG/M)	PITCH PHASE (DEG)	YAW AMPLITUDE (DEG/M)	YAW PHASE (DEG)
.2510	.2420	98.00	.7970	-107.00	.3010	-176.00
.3140	.3860	103.00	1.2460	-100.00	.4610	-169.00
.3310	.4300	105.00	1.3830	-99.00	.5080	-167.00
.3490	.4820	106.00	1.5430	-98.00	.5620	-165.00
.3700	.5440	108.00	1.7320	-97.00	.6250	-163.00
.3930	.6180	111.00	1.9530	-96.00	.6980	-160.00
.4190	.7090	113.00	2.2130	-94.00	.7840	-157.00
.4490	.8220	117.00	2.5130	-93.00	.8860	-153.00
.4830	.9650	121.00	2.8560	-92.00	1.0050	-148.00
.5240	1.1480	126.00	3.2330	-90.00	1.1440	-142.00
.5710	1.3920	133.00	3.6200	-88.00	1.3050	-135.00
.6280	1.7410	142.00	3.9690	-84.00	1.4840	-125.00
.6980	2.3590	153.00	4.1890	-77.00	1.6650	-111.00
.7850	4.5700	126.00	4.1270	-66.00	1.7980	-92.00
.8380	1.4180	16.00	3.9160	-58.00	1.8100	-79.00
.8980	.6500	-161.00	3.5290	-47.00	1.7500	-63.00
1.0470	1.0760	-117.00	2.0510	-13.00	1.2140	-19.00
1.2570	.2960	-41.00	.1320	-154.00	.2660	-131.00
1.5710	.2430	70.00	.5850	-10.00	1.1920	5.00
2.0940	.9390	158.00	.0590	110.00	.2070	107.00

TIME INTEGRATION PARAMETERS
==========

TIME STEP LENGTH	.4000	SEC
SOLUTION STARTS AT TIME	60.000	SEC
MAXIMUM TIME OF INTEGRATION	10860.000	SEC
SOLUTION SAMPLING TIME STEP.....	.800	SEC
DAMPING RATIO	.0000	

CONTROL SWITCHES
==========

MAXIMUM STATIC ITERATIONS	400
MAX DYNAMIC ITERATIONS PER STEP ...	400

```
   PROBLEM TYPE (0=STATIC,1=DYNAMIC) .   1
   PINNED PIPE END ON SEABED .........   1
   DAVIT LIFT ANALYSIS (1=YES,0=NO) ..   0
   STOP INTEGRATION AT TIME STEP .....   0
   NUMBER OF DIMENSIONS (2 OR 3) .....   2
   INITIATION BY BOWLINE (1=YES,0=NO)    0
   SUPPORT RELEASE LOGIC PARAMETER ...   0
```


I N P U T D A T A E C H O

WAVE SPECTRUM COEFFICIENTS

NUMBER OF WAVES IN SPECTRUM	20	
1ST SPECTRUM COEFFICIENT	.6130	M2/S4
2ND SPECTRUM COEFFICIENT	.7230	1/S**4
MINIMUM FREQUENCY IN SPECTRUM	.2513	RAD/S
MAXIMUM FREQUENCY IN SPECTRUM	2.0944	RAD/S
DIRECTION OF WAVE TRAVEL	45.000	DEG

WAVE PARAMETERS

WAVE HEIGHT (PEAK TO TROUGH)	2.110	M
WAVE PERIOD	7.200	SEC
WAVE DIRECTION OF TRAVEL	45.000	DEG
WATER DEPTH FOR WAVE CALCULATIONS .	20.00	M

SAGBEND GEOMETRY

SAGBEND PIPE ELEMENT LENGTH	12.100	M
WATER DEPTH	20.00	M
ESTIMATED SAGBEND X LENGTH	140.00	M
ESTIMATED PIPE LENGTH ON SEABED ...	.00	M
X-COORD OF PIPE FREE END ON SEABED	.00	M
ESTIMATED SPAN DEPTH FOR BOW LINE .	.00	M
PIPE VERTICAL ANGLE AT SEABED	.000	DEG
X-COORDINATE OF SPECIFIED DEPTH ...	.00	M
MAXIMUM SLOPE (ANGLE) OF SEABED ...	.000	DEG
DIRECTION OF MAXIMUM SLOPE	.000	DEG

CABLE PROPERTIES

PIPE PROPERTY TABLE INDEX	1	
CABLE SECTION LENGTH	24.000	M
AXIAL STIFFNESS (EA)	.00	KN
BENDING STIFFNESS (EI)	.0000	KN-M**2
WEIGHT PER-UNIT-LENGTH IN AIR	.0	N/M
WEIGHT PER-UNIT-LENGTH SUBMERGED ..	.0	N/M
CABLE DIAMETER	3.200	CM
DRAG COEFFICIENT	.000	
CABLE CROSS SECTIONAL AREA	.000	KN
ADDED MASS COEFFICIENT	.000	

PIPE TENSION

STATIC PIPE TENSION ON LAYBARGE ...	330.000	KN
MINIMUM DYNAMIC PIPE TENSION	.000	KN
MAXIMUM DYNAMIC PIPE TENSION	.000	KN

E R R O R M E S S A G E

***** WARNING / INFORMATIVE MESSAGE NO. - 1 *****

The total stinger weight (

I N P U T D A T A E C H O

CABLE PROPERTIES

PIPE PROPERTY TABLE INDEX	1	
CABLE SECTION LENGTH	62.000	M
AXIAL STIFFNESS (EA)	.00	KN
BENDING STIFFNESS (EI)	.0000	KN-M**2
WEIGHT PER-UNIT-LENGTH IN AIR	.0	N/M
WEIGHT PER-UNIT-LENGTH SUBMERGED ..	.0	N/M
CABLE DIAMETER	3.200	CM
DRAG COEFFICIENT	.000	
CABLE CROSS SECTIONAL AREA	.000	KN
ADDED MASS COEFFICIENT	.000	

PIPE TENSION

STATIC PIPE TENSION ON LAYBARGE ...	330.000	KN
MINIMUM DYNAMIC PIPE TENSION	.000	KN
MAXIMUM DYNAMIC PIPE TENSION	.000	KN

***** WARNING / INFORMATIVE MESSAGE NO. - 1 *****

The total stinger weight (

I N P U T D A T A E C H O

CABLE PROPERTIES

PIPE PROPERTY TABLE INDEX	1	

```
   CABLE SECTION LENGTH ..............    83.000 M
   AXIAL STIFFNESS (EA) ..............       .00 KN
   BENDING STIFFNESS (EI) ............     .0000 KN-M**2
   WEIGHT PER-UNIT-LENGTH IN AIR .....        .0 N/M
   WEIGHT PER-UNIT-LENGTH SUBMERGED ..        .0 N/M

   CABLE DIAMETER .....................     3.200 CM
   DRAG COEFFICIENT ...................      .000
   CABLE CROSS SECTIONAL AREA ........      .000 KN
   ADDED MASS COEFFICIENT ............      .000

PIPE TENSION
============
   STATIC PIPE TENSION ON LAYBARGE ...   210.000 KN
   MINIMUM DYNAMIC PIPE TENSION ......      .000 KN
   MAXIMUM DYNAMIC PIPE TENSION ......      .000 KN

             ***** WARNING / INFORMATIVE MESSAGE NO. -   1 *****

    The total stinger weight (
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                        I N P U T   D A T A   E C H O


CABLE PROPERTIES
================
   PIPE PROPERTY TABLE INDEX .........         1
   CABLE SECTION LENGTH ..............    94.000 M
   AXIAL STIFFNESS (EA) ..............       .00 KN
   BENDING STIFFNESS (EI) ............     .0000 KN-M**2
   WEIGHT PER-UNIT-LENGTH IN AIR .....        .0 N/M
   WEIGHT PER-UNIT-LENGTH SUBMERGED ..        .0 N/M

   CABLE DIAMETER .....................     3.200 CM
   DRAG COEFFICIENT ...................      .000
   CABLE CROSS SECTIONAL AREA ........      .000 KN
   ADDED MASS COEFFICIENT ............      .000

PIPE TENSION
============
   STATIC PIPE TENSION ON LAYBARGE ...   180.000 KN
   MINIMUM DYNAMIC PIPE TENSION ......      .000 KN
   MAXIMUM DYNAMIC PIPE TENSION ......      .000 KN

             ***** WARNING / INFORMATIVE MESSAGE NO. -   1 *****

    The total stinger weight (
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                        I N P U T   D A T A   E C H O


CABLE PROPERTIES
================
   PIPE PROPERTY TABLE INDEX .........         1
   CABLE SECTION LENGTH ..............   120.000 M
   AXIAL STIFFNESS (EA) ..............       .00 KN
   BENDING STIFFNESS (EI) ............     .0000 KN-M**2
   WEIGHT PER-UNIT-LENGTH IN AIR .....        .0 N/M
   WEIGHT PER-UNIT-LENGTH SUBMERGED ..        .0 N/M

   CABLE DIAMETER .....................     3.200 CM
   DRAG COEFFICIENT ...................      .000
   CABLE CROSS SECTIONAL AREA ........      .000 KN
   ADDED MASS COEFFICIENT ............      .000

PIPE TENSION
============
   STATIC PIPE TENSION ON LAYBARGE ...    75.000 KN
   MINIMUM DYNAMIC PIPE TENSION ......      .000 KN
   MAXIMUM DYNAMIC PIPE TENSION ......      .000 KN

             ***** WARNING / INFORMATIVE MESSAGE NO. -   1 *****

    The total stinger weight (
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                        I N P U T   D A T A   E C H O


CABLE PROPERTIES
================
   PIPE PROPERTY TABLE INDEX .........         1
   CABLE SECTION LENGTH ..............   147.000 M
   AXIAL STIFFNESS (EA) ..............       .00 KN
   BENDING STIFFNESS (EI) ............     .0000 KN-M**2
   WEIGHT PER-UNIT-LENGTH IN AIR .....        .0 N/M
   WEIGHT PER-UNIT-LENGTH SUBMERGED ..        .0 N/M

   CABLE DIAMETER .....................     3.200 CM
   DRAG COEFFICIENT ...................      .000
   CABLE CROSS SECTIONAL AREA ........      .000 KN
   ADDED MASS COEFFICIENT ............      .000

PIPE TENSION
============
   STATIC PIPE TENSION ON LAYBARGE ...    20.000 KN
   MINIMUM DYNAMIC PIPE TENSION ......      .000 KN
   MAXIMUM DYNAMIC PIPE TENSION ......      .000 KN

             ***** WARNING / INFORMATIVE MESSAGE NO. -   1 *****

    The total stinger weight (

END OF INPUT DATA
```

OFFPIPE - OFFSHORE PIPELINE ANALYSIS SYSTEM - VERSION 2.05 AC DATE - 7/ 1/2016 TIME - 5:25:59 PAGE 17
PROJECT - Abandonment and Recovery Analysis in Sangatta JOB NO. - 1
USER ID - Moch. Ardiansyah LICENSED TO: RICKY TAWEKAL CASE 1

S T A T I C P I P E C O O R D I N A T E S, F O R C E S A N D S T R E S S E S

NODE NO.	PIPE SECTION	X COORD (M)	Y COORD (M)	Z COORD (M)	HORIZ ANGLE (DEG)	VERT ANGLE (DEG)	PIPE LENGTH (M)	TENSILE STRESS (MPA)	HOOP STRESS (MPA)	BENDING STRESSES VERT (MPA)	BENDING STRESSES HORIZ (MPA)	TOTAL STRESS (MPA)	PERCNT YIELD (PCT)
1	TENSIONR	61.00	2.52	.00	.000	.000	.000	.00	.00	.00	.00	.00	.00
3	LAYBARGE	38.00	2.52	.00	.000	-.002	23.000	6.71	.00	.40	-.01	7.12	1.98
5	LAYBARGE	32.09	2.52	.00	.000	.019	28.905	6.71	.00	-11.46	-.22	18.17	5.05
7	TENSIONR	26.50	2.52	.00	.001	-.080	34.500	13.42	.00	20.67	.52	34.11	9.47
9	LAYBARGE	23.00	2.52	.00	.001	.255	38.000	13.37	.00	-204.67	-.71	218.05	60.57
11	LAYBARGE	16.52	2.40	.00	.000	1.922	44.481	13.32	.00	-264.59	.59	277.91	77.20
13	LAYBARGE	12.00	2.19	.00	-.002	3.259	49.006	13.28	.00	-276.52	-1.52	289.80	80.50
15	LAYBARGE	5.50	1.72	.00	.012	4.888	55.523	13.24	.00	-188.74	5.52	202.05	56.13
17	LAYBARGE	.00	1.21	.00	.041	5.732	61.052	13.17	.00	-98.04	4.05	111.29	30.91
20	STINGER	-7.41	.42	-.01	.066	6.297	68.496	13.03	.00	-56.85	2.07	69.92	19.42
22	STINGER	-14.59	-.40	-.02	.075	6.846	75.728	12.89	-.06	-92.99	.34	105.91	29.42
24	STINGER	-20.59	-1.16	-.03	.073	7.676	81.778	12.76	-.19	-163.57	-1.15	176.43	49.01
26	STINGER	-25.30	-1.84	-.03	.064	8.714	86.529	12.62	-.29	-240.90	-2.45	253.68	70.47
28	STINGER	-30.30	-2.67	-.04	.046	10.330	91.601	12.43	-.43	-348.95	-4.04	361.62	100.45
30	STINGER	-32.06	-3.00	-.04	.037	11.055	93.393	12.34	-.48	-383.94	-4.58	396.55	110.15
32	SAGBEND	-43.85	-5.72	-.04	-.009	14.299	105.493	12.11	-.92	-122.24	-2.30	134.83	37.45
33	SAGBEND	-55.55	-8.79	-.04	-.030	14.775	117.593	11.67	-1.41	35.75	-.92	48.15	13.38
34	SAGBEND	-67.28	-11.78	-.03	-.037	13.645	129.693	11.22	-1.89	127.13	-.16	139.31	38.70
35	SAGBEND	-79.08	-14.44	-.02	-.036	11.598	141.793	10.81	-2.32	178.10	.24	190.09	52.80
36	SAGBEND	-90.98	-16.61	-.02	-.031	9.065	153.893	10.48	-2.67	202.18	.42	214.02	59.45
37	SAGBEND	-102.97	-18.24	-.01	-.025	6.358	165.993	10.25	-2.93	205.00	.48	216.72	60.20
38	SAGBEND	-115.03	-19.30	.00	-.018	3.753	178.094	10.10	-3.10	186.36	.53	198.03	55.01
39	SAGBEND	-127.11	-19.85	.00	-.011	1.562	190.194	10.03	-3.19	140.48	.67	152.13	42.26
40	SEABED	-139.21	-20.02	.00	-.003	.222	202.294	10.03	-3.21	55.82	.47	67.52	18.75
41	SEABED	-151.31	-20.02	.00	.000	-.055	214.394	10.03	-3.21	1.14	.06	13.09	3.63
42	SEABED	-163.41	-20.01	.00	.000	-.090	226.495	10.03	-3.21	9.22	-.02	21.04	5.84
43	SEABED	-175.51	-19.98	.00	.000	-.224	238.595	10.04	-3.21	.00	.00	11.97	3.32

OFFPIPE - OFFSHORE PIPELINE ANALYSIS SYSTEM - VERSION 2.05 AC DATE - 7/ 1/2016 TIME - 5:25:59 PAGE 18
PROJECT - Abandonment and Recovery Analysis in Sangatta JOB NO. - 1
USER ID - Moch. Ardiansyah LICENSED TO: RICKY TAWEKAL CASE 1

S T A T I C P I P E C O O R D I N A T E S, F O R C E S A N D S T R E S S E S

NODE NO.	PIPE SECTION	X COORD (M)	Y COORD (M)	Z COORD (M)	SUPPORT REACTION VERT (KN)	SUPPORT REACTION HORIZ (KN)	SUPT SEPARATIONS VERT (M)	SUPT SEPARATIONS HORIZ (M)	PIPE TENSION (KN)	BENDING MOMENTS VERT (KN-M)	BENDING MOMENTS HORIZ (KN-M)	BENDING MOMENTS TOTAL (KN-M)
1	TENSIONR	61.00	2.52	.00	.50	.00	.00	.00	165.04	.00	.00	.00
3	LAYBARGE	38.00	2.52	.00	6.30	.13	.00	.00	165.04	1.18	-.02	1.18
5	LAYBARGE	32.09	2.52	.00	62.94	-.62	.00	.00	165.04	-33.60	-.64	33.61
7	TENSIONR	26.50	2.52	.00	-224.81	1.83	.00	.00	330.00	60.63	1.54	60.65
9	LAYBARGE	23.00	2.52	.00	223.71	-2.00	.00	.00	328.71	-600.21	-2.09	600.21
11	LAYBARGE	16.52	2.40	.00	46.54	2.40	.00	.00	327.50	-775.90	1.74	775.90
13	LAYBARGE	12.00	2.19	.00	83.91	-5.12	.00	.00	326.35	-810.89	-4.45	810.90
15	LAYBARGE	5.50	1.72	.00	43.31	4.53	.00	.00	325.40	-553.47	16.19	553.70
17	LAYBARGE	.00	1.21	.00	.00	.00	.05	.00	323.79	-287.49	11.88	287.73
20	STINGER	-7.41	.42	-.01	.00	.00	.02	-.01	320.39	-166.71	6.07	166.82
22	STINGER	-14.59	-.40	-.02	.00	.00	.17	-.02	317.68	-272.68	1.01	272.68
24	STINGER	-20.59	-1.16	-.03	.00	.00	.22	-.03	316.00	-479.67	-3.36	479.68
26	STINGER	-25.30	-1.84	-.03	.00	.00	.18	-.03	314.07	-706.44	-7.18	706.47
28	STINGER	-30.30	-2.67	-.04	.00	.00	.02	-.04	311.00	-1023.29	-11.83	1023.36
30	STINGER	-32.06	-3.00	-.04	163.25	-1.80	.00	-.04	309.54	-1125.89	-13.44	1125.97
32	SAGBEND	-43.85	-5.72	-.04	.00	.00	.00	.00	309.23	-358.47	-6.75	358.53
33	SAGBEND	-55.55	-8.79	-.04	.00	.00	.00	.00	304.83	104.82	-2.70	104.86
34	SAGBEND	-67.28	-11.78	-.03	.00	.00	.00	.00	299.76	372.82	-.46	372.82
35	SAGBEND	-79.08	-14.44	-.02	.00	.00	.00	.00	295.19	522.29	.70	522.29
36	SAGBEND	-90.98	-16.61	-.02	.00	.00	.00	.00	291.55	592.90	1.22	592.91
37	SAGBEND	-102.97	-18.24	-.01	.00	.00	.00	.00	288.99	601.15	1.41	601.15
38	SAGBEND	-115.03	-19.30	.00	.00	.00	.00	.00	287.54	546.50	1.55	546.50
39	SAGBEND	-127.11	-19.85	.00	.13	.11	.00	.00	287.10	411.95	1.97	411.95
40	SEABED	-139.21	-20.02	.00	22.41	.09	.00	.00	287.32	163.70	1.38	163.70
41	SEABED	-151.31	-20.02	.00	33.95	-.08	.00	.00	287.42	3.35	.16	3.36
42	SEABED	-163.41	-20.01	.00	14.04	-.02	.00	.00	287.41	27.03	-.06	27.03
43	SEABED	-175.51	-19.98	.00	.00	.00	.00	.00	287.46	.00	.00	.00

OFFPIPE - OFFSHORE PIPELINE ANALYSIS SYSTEM - VERSION 2.05 AC PAGE 19
Abandonment and Recovery Analysis in Sangatta
JOB NO. - 1 LICENSED TO: RICKY TAWEKAL
USER ID - Moch. Ardiansyah DATE - 7/ 1/2016 TIME - 5:25:59 CASE 1

S T A T I C S O L U T I O N S U M M A R Y

PIPE PROPERTIES (2)

PIPE SECTION LENGTH ..	.00 M	ELASTIC MODULUS	207000. MPA
OUTSIDE DIAMETER	50.800 CM	CROSS SECTIONAL AREA .	250.00 CM2
WALL THICKNESS	1.590 CM	MOMENT OF INERTIA	74490.00 CM4
WEIGHT/LENGTH IN AIR .	4567.997 N/M	YIELD STRESS	360.00 MPA
SUBMERGED WGHT/LENG ..	1556.660 N/M	STRESS INTENS FACTOR .	1.000
SPECIFIC GRAVITY	1.517	STEEL DENSITY	77008.5 N/M3
WRAP COAT THICKNESS ..	.250 CM	WRAP COAT DENSITY	9397.6 N/M3
CONCRETE THICKNESS ...	5.000 CM	CONCRETE DENSITY	29822.4 N/M3

BARGE DATA

TOTAL PIPE TENSION ...	330.04 KN	RADIUS OF CURVATURE ..	.00 M
NUMBER OF TENSIONERS .	2	BARGE TRIM ANGLE	.000 DEG
NO. OF PIPE SUPPORTS .	7	PIPE ANGLE AT STERN ..	5.732 DEG
BARGE HEADING	.000 DEG	OFFSET FROM R.O.W. ...	.00 M

STINGER DATA

NO. OF PIPE SUPPORTS .	6	STINGER STERN DEPTH ..	-3.00 M
NO. STINGER SECTIONS .	6	PIPE ANGLE AT STERN ..	11.055 DEG
RADIUS OF CURVATURE ..	.00 M	STINGER LENGTH	31.90 M

SAGBEND DATA

WATER DEPTH	20.00 M	HORIZ PIPE TENSION ...	287.46 KN
TOUCHDOWN X-COORD. ...	-136.05 M	BOTTOM SLOPE ANGLE ...	.000 DEG

SOLUTION SUMMARY

NODE NO.	PIPE SECTION	X COORD	Y COORD	Z COORD	SUPPORT REACT VERT	SUPPORT REACT HORIZ	TOTAL MOMENT	TOTAL STRESS	PCT YLD
1	TENSIONR	61.0	2.5	.0	.5	.0	.0	.0	0.
3	LAYBARGE	38.0	2.5	.0	6.3	.1	1.2	7.1	2.
5	LAYBARGE	32.1	2.5	.0	62.9	-.6	33.6	18.2	5.
7	TENSIONR	26.5	2.5	.0	-224.8	1.8	60.6	34.1	9.
9	LAYBARGE	23.0	2.5	.0	223.7	-2.0	600.2	218.0	61.
11	LAYBARGE	16.5	2.4	.0	46.5	2.4	775.9	277.9	77.
13	LAYBARGE	12.0	2.2	.0	83.9	-5.1	810.9	289.8	80.

15	LAYBARGE	5.5	1.7	.0	43.3	4.5	553.7	202.1	56.
17	LAYBARGE	.0	1.2	.0	.0	.0	287.7	111.3	31.
20	STINGER	-7.4	.4	.0	.0	.0	166.8	69.9	19.
22	STINGER	-14.6	-.4	.0	.0	.0	272.7	105.9	29.
24	STINGER	-20.6	-1.2	.0	.0	.0	479.7	176.4	49.
26	STINGER	-25.3	-1.8	.0	.0	.0	706.5	253.7	70.
28	STINGER	-30.3	-2.7	.0	.0	.0	1023.4	361.6	100.
30	STINGER	-32.1	-3.0	.0	163.3	-1.8	1126.0	396.5	110.
37	SAGBEND	-103.0	-18.2	.0	.0	.0	601.2	216.7	60.

S T A T I C S O L U T I O N S U M M A R Y

40	SEABED	-139.2	-20.0	.0	22.4	.1	163.7	67.5	19.

OFFPIPE - OFFSHORE PIPELINE ANALYSIS SYSTEM - VERSION 2.05 AC DATE - 7/ 1/2016 TIME - 5:25:59 PAGE 21
PROJECT - Abandonment and Recovery Analysis in Sangatta JOB NO. - 1
USER ID - Moch. Ardiansyah LICENSED TO: RICKY TAWEKAL CASE 2

S T A T I C P I P E C O O R D I N A T E S, F O R C E S A N D S T R E S S E S

NODE NO.	PIPE SECTION	X COORD (M)	Y COORD (M)	Z COORD (M)	HORIZ ANGLE (DEG)	VERT ANGLE (DEG)	PIPE LENGTH (M)	TENSILE STRESS (MPA)	HOOP STRESS (MPA)	BENDING STRESSES VERT (MPA)	BENDING STRESSES HORIZ (MPA)	TOTAL STRESS (MPA)	PERCNT YIELD (PCT)
1	TENSIONR	61.00	2.52	.00	.000	.000	.000	.00	.00	.00	.00	.00	.00
3	LAYBARGE	38.00	2.52	.00	.000	.000	23.000	.00	.00	.00	.00	.00	.00
5	LAYBARGE	32.09	2.52	.00	.000	.000	28.905	.00	.00	.00	.00	.00	.00
7	TENSIONR	26.50	2.52	.00	.000	.000	34.500	.00	.00	.00	.00	.00	.00
9	LAYBARGE	23.00	2.52	.00	.000	.531	38.000	.00	.00	.00	.00	.00	.00
11	LAYBARGE	16.52	2.40	.00	.000	1.823	44.481	.00	.00	.00	.00	.00	.00
13	LAYBARGE	12.00	2.19	.00	.000	3.356	49.006	.00	.00	.00	.00	.00	.00
15	LAYBARGE	5.50	1.72	.00	.002	4.878	55.523	.00	.00	.00	.00	.00	.00
17	LAYBARGE	.00	1.18	.00	.069	6.101	61.052	13.43	.00	.00	.00	13.43	3.73
20	STINGER	-7.40	.38	-.01	.072	6.247	68.496	13.28	.00	-48.53	.89	61.82	17.17
22	STINGER	-14.59	-.43	-.02	.075	6.762	75.728	13.14	-.07	-90.03	-.25	103.20	28.67
24	STINGER	-20.59	-1.18	-.03	.070	7.577	81.778	13.01	-.19	-162.26	-1.35	175.36	48.71
26	STINGER	-25.30	-1.85	-.03	.060	8.612	86.529	12.87	-.30	-240.96	-2.36	253.99	70.55
28	STINGER	-30.30	-2.67	-.04	.044	10.234	91.601	12.68	-.43	-350.65	-3.68	363.57	100.99
30	STINGER	-32.06	-3.00	-.04	.036	10.962	93.393	12.59	-.48	-385.63	-4.48	398.49	110.69
32	SAGBEND	-43.86	-5.70	-.04	-.009	14.221	105.493	12.36	-.92	-123.21	-2.25	136.05	37.79
33	SAGBEND	-55.56	-8.76	-.04	-.030	14.711	117.593	11.93	-1.41	34.42	-.89	47.08	13.08
34	SAGBEND	-67.29	-11.74	-.03	-.036	13.603	129.693	11.47	-1.88	125.21	-.14	137.64	38.23
35	SAGBEND	-79.10	-14.39	-.02	-.035	11.584	141.793	11.07	-2.31	175.75	.25	187.98	52.22
36	SAGBEND	-91.00	-16.57	-.01	-.030	9.084	153.893	10.74	-2.66	199.77	.42	211.85	58.85
37	SAGBEND	-102.99	-18.20	-.01	-.024	6.407	165.993	10.50	-2.92	203.04	.48	215.01	59.73
38	SAGBEND	-115.04	-19.27	.00	-.018	3.820	178.093	10.35	-3.09	185.53	.52	197.45	54.85
39	SAGBEND	-127.12	-19.84	.00	-.010	1.629	190.194	10.29	-3.18	141.65	.65	153.55	42.65
40	SEABED	-139.22	-20.02	.00	-.003	.254	202.294	10.28	-3.21	59.54	.45	71.48	19.86
41	SEABED	-151.32	-20.02	.00	.000	-.054	214.394	10.28	-3.21	2.04	.05	14.21	3.95
42	SEABED	-163.42	-20.01	.00	.000	-.092	226.495	10.28	-3.21	9.08	-.02	21.15	5.88
43	SEABED	-175.52	-19.98	.00	.000	-.224	238.595	10.29	-3.21	.00	.00	12.21	3.39

OFFPIPE - OFFSHORE PIPELINE ANALYSIS SYSTEM - VERSION 2.05 AC DATE - 7/ 1/2016 TIME - 5:25:59 PAGE 22
PROJECT - Abandonment and Recovery Analysis in Sangatta JOB NO. - 1
USER ID - Moch. Ardiansyah LICENSED TO: RICKY TAWEKAL CASE 2

S T A T I C P I P E C O O R D I N A T E S, F O R C E S A N D S T R E S S E S

NODE NO.	PIPE SECTION	X COORD (M)	Y COORD (M)	Z COORD (M)	SUPPORT REACTION VERT (KN)	SUPPORT REACTION HORIZ (KN)	SUPT SEPARATIONS VERT (M)	SUPT SEPARATIONS HORIZ (M)	PIPE TENSION (KN)	BENDING MOMENTS VERT (KN-M)	BENDING MOMENTS HORIZ (KN-M)	BENDING MOMENTS TOTAL (KN-M)
1	TENSIONR	61.00	2.52	.00	.50	.00	.00	.00	165.15	.00	.00	.00
3	LAYBARGE	38.00	2.52	.00	.63	.00	.00	.00	165.15	.12	.00	.00
5	LAYBARGE	32.09	2.52	.00	.25	.00	.00	.00	165.15	.05	.00	.00
7	TENSIONR	26.50	2.52	.00	.20	.00	.00	.00	330.15	.05	.00	.00
9	LAYBARGE	23.00	2.52	.00	6.33	.00	.00	.00	330.13	1.19	.00	.00
11	LAYBARGE	16.52	2.40	.00	9.02	.00	.00	.00	330.11	1.69	.00	.00
13	LAYBARGE	12.00	2.19	.00	9.13	.00	.00	.00	330.10	1.71	.00	.00
15	LAYBARGE	5.50	1.72	.00	8.91	.03	.00	.00	330.08	1.67	-.01	.00
17	LAYBARGE	.00	1.18	.00	.00	.00	.02	.00	330.08	.00	.00	.00
20	STINGER	-7.40	.38	-.01	33.53	.87	.00	-.01	326.37	-142.33	2.62	142.35
22	STINGER	-14.59	-.43	-.02	.00	.00	.14	-.02	323.79	-264.02	-.73	264.02
24	STINGER	-20.59	-1.18	-.03	.00	.00	.20	-.03	322.11	-475.82	-3.96	475.84
26	STINGER	-25.30	-1.85	-.03	.00	.00	.17	-.03	320.19	-706.62	-6.92	706.65
28	STINGER	-30.30	-2.67	-.04	1.26	.73	.02	-.04	317.09	-1028.29	-10.79	1028.34
30	STINGER	-32.06	-3.00	-.04	163.63	-2.34	.00	-.04	315.64	-1130.85	-13.13	1130.93
32	SAGBEND	-43.86	-5.70	-.04	.00	.00	.00	.00	315.39	-361.31	-6.60	361.37
33	SAGBEND	-55.56	-8.76	-.04	.00	.00	.00	.00	311.02	100.94	-2.60	100.97
34	SAGBEND	-67.29	-11.74	-.03	.00	.00	.00	.00	305.97	367.18	-.40	367.18
35	SAGBEND	-79.10	-14.39	-.02	.00	.00	.00	.00	301.42	515.38	.73	515.38
36	SAGBEND	-91.00	-16.57	-.01	.00	.00	.00	.00	297.79	585.82	1.23	585.82
37	SAGBEND	-102.99	-18.20	-.01	.00	.00	.00	.00	295.21	595.40	1.40	595.40
38	SAGBEND	-115.04	-19.27	.00	.00	.00	.00	.00	293.73	544.06	1.51	544.06
39	SAGBEND	-127.12	-19.84	.00	.07	.11	.00	.00	293.25	415.38	1.90	415.39
40	SEABED	-139.22	-20.02	.00	20.68	.09	.00	.00	293.45	174.59	1.33	174.59
41	SEABED	-151.32	-20.02	.00	34.37	-.08	.00	.00	293.55	5.98	.16	5.98
42	SEABED	-163.42	-20.01	.00	14.31	-.02	.00	.00	293.54	26.63	-.06	26.63
43	SEABED	-175.52	-19.98	.00	.00	.00	.00	.00	293.59	.00	.00	.00

OFFPIPE - OFFSHORE PIPELINE ANALYSIS SYSTEM - VERSION 2.05 AC PAGE 23
Abandonment and Recovery Analysis in Sangatta
JOB NO. - 1 LICENSED TO: RICKY TAWEKAL
USER ID - Moch. Ardiansyah DATE - 7/ 1/2016 TIME - 5:25:59 CASE 2

S T A T I C S O L U T I O N S U M M A R Y

PIPE PROPERTIES (2)

PIPE SECTION LENGTH ..	.00 M	ELASTIC MODULUS	207000. MPA
OUTSIDE DIAMETER	50.800 CM	CROSS SECTIONAL AREA .	250.00 CM2
WALL THICKNESS	1.590 CM	MOMENT OF INERTIA	74490.00 CM4
WEIGHT/LENGTH IN AIR .	4567.997 N/M	YIELD STRESS	360.00 MPA
SUBMERGED WGHT/LENG ..	1556.660 N/M	STRESS INTENS FACTOR .	1.000
SPECIFIC GRAVITY	1.517	STEEL DENSITY	77008.5 N/M3
WRAP COAT THICKNESS ..	.250 CM	WRAP COAT DENSITY	9397.6 N/M3
CONCRETE THICKNESS ...	5.000 CM	CONCRETE DENSITY	29822.4 N/M3

BARGE DATA

TOTAL PIPE TENSION ...	330.15 KN	RADIUS OF CURVATURE ..	.00 M
NUMBER OF TENSIONERS .	2	BARGE TRIM ANGLE	.000 DEG
NO. OF PIPE SUPPORTS .	7	PIPE ANGLE AT STERN ..	6.101 DEG
BARGE HEADING	.000 DEG	OFFSET FROM R.O.W. ...	.00 M

STINGER DATA

NO. OF PIPE SUPPORTS .	6	STINGER STERN DEPTH ..	-3.00 M
NO. STINGER SECTIONS .	6	PIPE ANGLE AT STERN ..	10.962 DEG
RADIUS OF CURVATURE ..	.00 M	STINGER LENGTH	31.90 M

SAGBEND DATA

WATER DEPTH	20.00 M	HORIZ PIPE TENSION ...	293.59 KN
TOUCHDOWN X-COORD. ...	-136.59 M	BOTTOM SLOPE ANGLE ...	.000 DEG

SOLUTION SUMMARY

NODE NO.	PIPE SECTION	X COORD	Y COORD	Z COORD	SUPPORT REACT VERT	SUPPORT REACT HORIZ	TOTAL MOMENT	TOTAL STRESS	PCT YLD
1	TENSIONR	61.0	2.5	.0	.5	.0	.0	.0	0.
3	LAYBARGE	38.0	2.5	.0	.6	.0	.0	.0	0.
5	LAYBARGE	32.1	2.5	.0	.2	.0	.0	.0	0.
7	TENSIONR	26.5	2.5	.0	.2	.0	.0	.0	0.
9	LAYBARGE	23.0	2.5	.0	6.3	.0	.0	.0	0.
11	LAYBARGE	16.5	2.4	.0	9.0	.0	.0	.0	0.
13	LAYBARGE	12.0	2.2	.0	9.1	.0	.0	.0	0.
15	LAYBARGE	5.5	1.7	.0	8.9	.0	.0	.0	0.

17	LAYBARGE	.0	1.2	.0	.0	.0	.0	13.4	4.
20	STINGER	-7.4	.4	.0	33.5	.9	142.4	61.8	17.
22	STINGER	-14.6	-.4	.0	.0	.0	264.0	103.2	29.
24	STINGER	-20.6	-1.2	.0	.0	.0	475.8	175.4	49.
26	STINGER	-25.3	-1.8	.0	.0	.0	706.7	254.0	71.
28	STINGER	-30.3	-2.7	.0	1.3	.7	1028.3	363.6	101.
30	STINGER	-32.1	-3.0	.0	163.6	-2.3	1130.9	398.5	111.
37	SAGBEND	-103.0	-18.2	.0	.0	.0	595.4	215.0	60.

S T A T I C S O L U T I O N S U M M A R Y

40	SEABED	-139.2	-20.0	.0	20.7	.1	174.6	71.5	20.

OFFPIPE - OFFSHORE PIPELINE ANALYSIS SYSTEM - VERSION 2.05 AC DATE - 7/ 1/2016 TIME - 5:25:59 PAGE 25
PROJECT - Abandonment and Recovery Analysis in Sangatta JOB NO. - 1
USER ID - Moch. Ardiansyah LICENSED TO: RICKY TAWEKAL CASE 3

S T A T I C P I P E C O O R D I N A T E S, F O R C E S A N D S T R E S S E S

NODE NO.	PIPE SECTION	X COORD (M)	Y COORD (M)	Z COORD (M)	HORIZ ANGLE (DEG)	VERT ANGLE (DEG)	PIPE LENGTH (M)	TENSILE STRESS (MPA)	HOOP STRESS (MPA)	BENDING STRESSES VERT (MPA)	BENDING STRESSES HORIZ (MPA)	TOTAL STRESS (MPA)	PERCNT YIELD (PCT)
1	TENSIONR	61.00	2.52	.00	.000	.000	.000	.00	.00	.00	.00	.00	.00
3	LAYBARGE	38.00	2.52	.00	.000	.000	23.000	.00	.00	.00	.00	.00	.00
5	LAYBARGE	32.09	2.52	.00	.000	.000	28.905	.00	.00	.00	.00	.00	.00
7	TENSIONR	26.50	2.52	.00	.000	.000	34.500	.00	.00	.00	.00	.00	.00
9	LAYBARGE	23.00	2.52	.00	.000	.531	38.000	.00	.00	.00	.00	.00	.00
11	LAYBARGE	16.52	2.40	.00	.000	1.823	44.481	.00	.00	.00	.00	.00	.00
13	LAYBARGE	12.00	2.19	.00	.030	3.208	49.006	.00	.00	.00	.00	.00	.00
15	LAYBARGE	5.50	1.76	-.01	.060	3.796	55.523	.00	.00	.00	.00	.00	.00
17	LAYBARGE	-.02	1.39	-.01	.060	3.723	61.052	.00	.00	.00	.00	.00	.00
20	STINGER	-7.43	.92	-.02	.060	3.641	68.482	.00	.00	.00	.00	.00	.00
22	STINGER	-14.65	.46	-.03	.060	3.558	75.715	.00	.00	.00	.00	.00	.00
24	STINGER	-20.94	.08	-.03	-.016	15.004	82.029	8.37	.00	.00	.00	8.37	2.33
26	STINGER	-25.50	-1.15	-.03	-.017	15.190	86.748	8.18	-.18	-74.28	-.48	82.56	22.93
28	STINGER	-30.35	-2.49	-.03	-.021	15.850	91.783	7.96	-.40	-169.35	-1.07	177.51	49.31
30	STINGER	-32.05	-2.98	-.03	-.024	16.214	93.558	7.87	-.48	-199.02	-1.26	207.14	57.54
32	SAGBEND	-43.48	-6.49	-.02	-.034	17.476	105.509	7.41	-1.04	-1.75	-.32	9.75	2.71
33	SAGBEND	-55.04	-10.06	-.02	-.034	16.557	117.609	6.87	-1.62	130.87	.26	138.56	38.49
34	SAGBEND	-66.70	-13.29	-.01	-.028	14.251	129.709	6.36	-2.13	211.53	.54	218.97	60.82
35	SAGBEND	-78.50	-15.96	-.01	-.020	11.149	141.809	5.95	-2.56	253.05	.62	260.29	72.30
36	SAGBEND	-90.43	-17.95	.00	-.012	7.725	153.909	5.66	-2.88	260.80	.54	267.91	74.42
37	SAGBEND	-102.46	-19.22	.00	-.006	4.420	166.009	5.49	-3.09	234.60	.39	241.65	67.12
38	SAGBEND	-114.55	-19.85	.00	-.002	1.709	178.109	5.42	-3.19	169.20	.24	176.24	48.96
39	SEABED	-126.65	-20.03	.00	.000	.173	190.209	5.43	-3.22	57.61	.07	64.70	17.97
40	SEABED	-138.75	-20.02	.00	.000	-.072	202.309	5.43	-3.21	-3.38	.00	10.79	3.00
41	SEABED	-150.85	-20.01	.00	.000	-.008	214.410	5.43	-3.21	-2.03	.00	9.49	2.63
42	SEABED	-162.95	-20.01	.00	.000	-.072	226.510	5.43	-3.21	12.45	.00	19.69	5.47
43	SEABED	-175.05	-19.98	.00	.000	-.228	238.611	5.44	-3.21	.00	.00	7.57	2.10

OFFPIPE - OFFSHORE PIPELINE ANALYSIS SYSTEM - VERSION 2.05 AC DATE - 7/ 1/2016 TIME - 5:25:59 PAGE 26
PROJECT - Abandonment and Recovery Analysis in Sangatta JOB NO. - 1
USER ID - Moch. Ardiansyah LICENSED TO: RICKY TAWEKAL CASE 3

S T A T I C P I P E C O O R D I N A T E S, F O R C E S A N D S T R E S S E S

NODE NO.	PIPE SECTION	X COORD (M)	Y COORD (M)	Z COORD (M)	SUPPORT REACTION VERT (KN)	SUPPORT REACTION HORIZ (KN)	SUPT SEPARATIONS VERT (M)	SUPT SEPARATIONS HORIZ (M)	PIPE TENSION (KN)	BENDING MOMENTS VERT (KN-M)	BENDING MOMENTS HORIZ (KN-M)	BENDING MOMENTS TOTAL (KN-M)
1	TENSIONR	61.00	2.52	.00	.50	.00	.00	.00	105.16	.00	.00	.00
3	LAYBARGE	38.00	2.52	.00	.63	.00	.00	.00	105.16	.12	.00	.00
5	LAYBARGE	32.09	2.52	.00	.25	.00	.00	.00	105.16	.05	.00	.00
7	TENSIONR	26.50	2.52	.00	.20	.00	.00	.00	210.16	.05	.00	.00
9	LAYBARGE	23.00	2.52	.00	4.11	.00	.00	.00	210.15	.77	.00	.00
11	LAYBARGE	16.52	2.40	.00	5.83	.00	.00	.00	210.13	1.09	.00	.00
13	LAYBARGE	12.00	2.19	.00	4.81	.22	.00	.00	210.13	.90	-.04	.00
15	LAYBARGE	5.50	1.76	-.01	.00	.00	.03	-.01	210.13	.00	.00	.00
17	LAYBARGE	-.02	1.39	-.01	.00	.00	.23	-.01	210.11	.00	.00	.00
20	STINGER	-7.43	.92	-.02	.00	.00	.52	-.02	210.09	.00	.00	.00
22	STINGER	-14.65	.46	-.03	.00	.00	1.04	-.03	210.07	.00	.00	.00
24	STINGER	-20.94	.08	-.03	.00	.00	1.51	-.03	205.82	.00	.00	.00
26	STINGER	-25.50	-1.15	-.03	.00	.00	.90	-.03	203.53	-217.82	-1.40	217.82
28	STINGER	-30.35	-2.49	-.03	.00	.00	.21	-.03	200.79	-496.61	-3.14	496.62
30	STINGER	-32.05	-2.98	-.03	126.67	-.70	.00	-.03	199.63	-583.63	-3.71	583.64
32	SAGBEND	-43.48	-6.49	-.02	.00	.00	.00	.00	195.37	-5.12	-.94	5.20
33	SAGBEND	-55.04	-10.06	-.02	.00	.00	.00	.00	189.33	383.78	.76	383.78
34	SAGBEND	-66.70	-13.29	-.01	.00	.00	.00	.00	183.53	620.30	1.59	620.30
35	SAGBEND	-78.50	-15.96	-.01	.00	.00	.00	.00	178.84	742.05	1.80	742.06
36	SAGBEND	-90.43	-17.95	.00	.00	.00	.00	.00	175.64	764.78	1.59	764.78
37	SAGBEND	-102.46	-19.22	.00	.00	.00	.00	.00	174.02	687.96	1.14	687.97
38	SAGBEND	-114.55	-19.85	.00	.49	.01	.00	.00	173.77	496.18	.70	496.18
39	SEABED	-126.65	-20.03	.00	29.29	-.02	.00	.00	174.25	168.93	.20	168.93
40	SEABED	-138.75	-20.02	.00	33.89	-.02	.00	.00	174.34	-9.91	-.01	9.91
41	SEABED	-150.85	-20.01	.00	21.97	.00	.00	.00	174.33	-5.95	-.01	5.95
42	SEABED	-162.95	-20.01	.00	12.00	.00	.00	.00	174.33	36.52	.00	36.52
43	SEABED	-175.05	-19.98	.00	.00	.00	.00	.00	174.38	.00	.00	.00

OFFPIPE - OFFSHORE PIPELINE ANALYSIS SYSTEM - VERSION 2.05 AC PAGE 27
Abandonment and Recovery Analysis in Sangatta
JOB NO. - 1 LICENSED TO: RICKY TAWEKAL
USER ID - Moch. Ardiansyah DATE - 7/ 1/2016 TIME - 5:25:59 CASE 3

S T A T I C S O L U T I O N S U M M A R Y

PIPE PROPERTIES (2)

PIPE SECTION LENGTH ..	.00 M	ELASTIC MODULUS	207000. MPA
OUTSIDE DIAMETER	50.800 CM	CROSS SECTIONAL AREA .	250.00 CM2
WALL THICKNESS	1.590 CM	MOMENT OF INERTIA	74490.00 CM4
WEIGHT/LENGTH IN AIR .	4567.997 N/M	YIELD STRESS	360.00 MPA
SUBMERGED WGHT/LENG ..	1556.660 N/M	STRESS INTENS FACTOR .	1.000
SPECIFIC GRAVITY	1.517	STEEL DENSITY	77008.5 N/M3
WRAP COAT THICKNESS ..	.250 CM	WRAP COAT DENSITY	9397.6 N/M3
CONCRETE THICKNESS ...	5.000 CM	CONCRETE DENSITY	29822.4 N/M3

BARGE DATA

TOTAL PIPE TENSION ...	210.16 KN	RADIUS OF CURVATURE ..	.00 M
NUMBER OF TENSIONERS .	2	BARGE TRIM ANGLE	.000 DEG
NO. OF PIPE SUPPORTS .	7	PIPE ANGLE AT STERN ..	3.723 DEG
BARGE HEADING	.000 DEG	OFFSET FROM R.O.W. ...	.00 M

STINGER DATA

NO. OF PIPE SUPPORTS .	6	STINGER STERN DEPTH ..	-2.98 M
NO. STINGER SECTIONS .	6	PIPE ANGLE AT STERN ..	16.214 DEG
RADIUS OF CURVATURE ..	.00 M	STINGER LENGTH	31.90 M

SAGBEND DATA

WATER DEPTH	20.00 M	HORIZ PIPE TENSION ...	174.38 KN
TOUCHDOWN X-COORD. ...	-122.33 M	BOTTOM SLOPE ANGLE ...	.000 DEG

SOLUTION SUMMARY

NODE NO.	PIPE SECTION	X COORD	Y COORD	Z COORD	SUPPORT REACT VERT	SUPPORT REACT HORIZ	TOTAL MOMENT	TOTAL STRESS	PCT YLD
1	TENSIONR	61.0	2.5	.0	.5	.0	.0	.0	0.
3	LAYBARGE	38.0	2.5	.0	.6	.0	.0	.0	0.
5	LAYBARGE	32.1	2.5	.0	.2	.0	.0	.0	0.
7	TENSIONR	26.5	2.5	.0	.2	.0	.0	.0	0.
9	LAYBARGE	23.0	2.5	.0	4.1	.0	.0	.0	0.
11	LAYBARGE	16.5	2.4	.0	5.8	.0	.0	.0	0.
13	LAYBARGE	12.0	2.2	.0	4.8	.2	.0	.0	0.

15	LAYBARGE	5.5	1.8	.0	.0	.0	.0	.0	0.
17	LAYBARGE	.0	1.4	.0	.0	.0	.0	.0	0.
20	STINGER	-7.4	.9	.0	.0	.0	.0	.0	0.
22	STINGER	-14.7	.5	.0	.0	.0	.0	.0	0.
24	STINGER	-20.9	.1	.0	.0	.0	.0	8.4	2.
26	STINGER	-25.5	-1.2	.0	.0	.0	217.8	82.6	23.
28	STINGER	-30.3	-2.5	.0	.0	.0	496.6	177.5	49.
30	STINGER	-32.1	-3.0	.0	126.7	-.7	583.6	207.1	58.
36	SAGBEND	-90.4	-17.9	.0	.0	.0	764.8	267.9	74.

S T A T I C S O L U T I O N S U M M A R Y

39	SEABED	-126.6	-20.0	.0	29.3	.0	168.9	64.7	18.

OFFPIPE - OFFSHORE PIPELINE ANALYSIS SYSTEM - VERSION 2.05 AC DATE - 7/ 1/2016 TIME - 5:25:59 PAGE 29
PROJECT - Abandonment and Recovery Analysis in Sangatta JOB NO. - 1
USER ID - Moch. Ardiansyah LICENSED TO: RICKY TAWEKAL CASE 4

S T A T I C P I P E C O O R D I N A T E S, F O R C E S A N D S T R E S S E S

NODE NO.	PIPE SECTION	X COORD (M)	Y COORD (M)	Z COORD (M)	HORIZ ANGLE (DEG)	VERT ANGLE (DEG)	PIPE LENGTH (M)	TENSILE STRESS (MPA)	HOOP STRESS (MPA)	BENDING STRESSES VERT (MPA)	BENDING STRESSES HORIZ (MPA)	TOTAL STRESS (MPA)	PERCNT YIELD (PCT)
1	TENSIONR	61.00	2.52	.00	.000	.000	.000	.00	.00	.00	.00	.00	.00
3	LAYBARGE	38.00	2.52	.00	.000	.000	23.000	.00	.00	.00	.00	.00	.00
5	LAYBARGE	32.09	2.52	.00	.000	.000	28.905	.00	.00	.00	.00	.00	.00
7	TENSIONR	26.50	2.52	.00	.000	.000	34.500	.00	.00	.00	.00	.00	.00
9	LAYBARGE	23.00	2.52	.00	.000	.530	38.000	.00	.00	.00	.00	.00	.00
11	LAYBARGE	16.52	2.40	.00	.000	1.823	44.481	.00	.00	.00	.00	.00	.00
13	LAYBARGE	12.00	2.19	.00	.000	3.356	49.006	.00	.00	.00	.00	.00	.00
15	LAYBARGE	5.50	1.72	.00	.000	4.986	55.523	.00	.00	.00	.00	.00	.00
17	LAYBARGE	.00	1.16	.00	.005	5.865	61.052	.00	.00	.00	.00	.00	.00
20	STINGER	-7.40	.40	.00	.000	6.779	68.496	.00	.00	.00	.00	.00	.00
22	STINGER	-14.57	-.57	.00	-.005	7.683	75.728	.00	.00	.00	.00	.00	.00
24	STINGER	-20.57	-1.38	.00	.000	7.693	81.778	.00	.00	.00	.00	.00	.00
26	STINGER	-25.28	-2.01	.00	.015	7.703	86.529	.00	.00	.00	.00	.00	.00
28	STINGER	-30.30	-2.70	.00	.257	8.222	91.601	.00	.00	.00	.00	.00	.00
30	STINGER	-32.07	-2.97	-.02	.217	21.438	93.399	.00	.00	.00	.00	.00	.00
32	SAGBEND	-32.58	-3.31	-.02	-.038	20.637	94.010	6.84	-.53	.00	.00	7.12	1.98
33	SAGBEND	-43.64	-7.40	-.01	-.034	19.686	105.806	6.22	-1.19	138.24	.51	145.05	40.29
34	SAGBEND	-54.82	-11.16	.00	-.025	17.294	117.602	5.63	-1.79	226.98	.74	233.51	64.86
35	SAGBEND	-66.47	-14.43	.00	-.014	13.921	129.702	5.12	-2.32	278.45	.77	284.74	79.09
36	SAGBEND	-78.30	-16.95	.00	-.005	10.102	141.802	4.74	-2.72	295.09	.63	301.21	83.67
37	SAGBEND	-90.27	-18.67	.00	.002	6.289	153.902	4.50	-3.00	277.20	.37	283.22	78.67
38	SAGBEND	-102.33	-19.63	.00	.005	2.960	166.002	4.40	-3.15	220.83	.06	226.82	63.01
39	SAGBEND	-114.43	-19.99	.00	.004	.671	178.102	4.38	-3.21	117.38	-.28	123.40	34.28
40	SEABED	-126.53	-20.03	.00	.000	-.070	190.202	4.39	-3.22	10.58	-.12	16.81	4.67
41	SEABED	-138.63	-20.02	.00	.000	-.037	202.302	4.40	-3.21	-6.33	.01	12.64	3.51
42	SEABED	-150.73	-20.01	.00	.000	.008	214.403	4.40	-3.21	.32	.01	6.91	1.92
43	SEABED	-162.83	-20.01	.00	.000	-.073	226.503	4.40	-3.21	12.85	.00	19.05	5.29
44	SEABED	-174.93	-19.98	.00	.000	-.230	238.604	4.40	-3.21	.00	.00	6.62	1.84

OFFPIPE - OFFSHORE PIPELINE ANALYSIS SYSTEM - VERSION 2.05 AC DATE - 7/ 1/2016 TIME - 5:25:59 PAGE 30
PROJECT - Abandonment and Recovery Analysis in Sangatta JOB NO. - 1
USER ID - Moch. Ardiansyah LICENSED TO: RICKY TAWEKAL CASE 4

S T A T I C P I P E C O O R D I N A T E S, F O R C E S A N D S T R E S S E S

NODE NO.	PIPE SECTION	X COORD (M)	Y COORD (M)	Z COORD (M)	SUPPORT REACTION VERT (KN)	SUPPORT REACTION HORIZ (KN)	SUPT SEPARATIONS VERT (M)	SUPT SEPARATIONS HORIZ (M)	PIPE TENSION (KN)	BENDING MOMENTS VERT (KN-M)	BENDING MOMENTS HORIZ (KN-M)	BENDING MOMENTS TOTAL (KN-M)
1	TENSIONR	61.00	2.52	.00	.50	.00	.00	.00	90.01	.00	.00	.00
3	LAYBARGE	38.00	2.52	.00	.63	.00	.00	.00	90.01	.12	.00	.00
5	LAYBARGE	32.09	2.52	.00	.25	.00	.00	.00	90.01	.05	.00	.00
7	TENSIONR	26.50	2.52	.00	.20	.00	.00	.00	180.01	.05	.00	.00
9	LAYBARGE	23.00	2.52	.00	3.55	.00	.00	.00	180.00	.67	.00	.00
11	LAYBARGE	16.52	2.40	.00	5.02	.00	.00	.00	179.99	.94	.00	.00
13	LAYBARGE	12.00	2.19	.00	5.09	.00	.00	.00	179.98	.95	.00	.00
15	LAYBARGE	5.50	1.72	.00	5.66	.00	.00	.00	179.95	1.06	.00	.00
17	LAYBARGE	.00	1.16	.00	.41	.03	.00	.00	179.95	.08	-.01	.00
20	STINGER	-7.40	.40	.00	5.92	-.07	.00	.00	179.89	1.11	.01	.00
22	STINGER	-14.57	-.57	.00	.32	.03	.00	.00	179.88	.06	-.01	.00
24	STINGER	-20.57	-1.38	.00	.21	.00	.00	.00	179.85	.04	.00	.00
26	STINGER	-25.28	-2.01	.00	.24	.08	.00	.00	179.83	.05	-.02	.00
28	STINGER	-30.30	-2.70	.00	3.32	1.42	.00	.00	179.79	.62	-.27	.00
30	STINGER	-32.07	-2.97	-.02	79.16	-1.67	.00	-.02	175.45	14.84	.31	.00
32	SAGBEND	-32.58	-3.31	-.02	.00	.00	.00	.00	174.80	.01	.00	.01
33	SAGBEND	-43.64	-7.40	-.01	.00	.00	.00	.00	167.89	405.37	1.50	405.38
34	SAGBEND	-54.82	-11.16	.00	.00	.00	.00	.00	161.14	665.61	2.18	665.61
35	SAGBEND	-66.47	-14.43	.00	.00	.00	.00	.00	155.33	816.55	2.25	816.56
36	SAGBEND	-78.30	-16.95	.00	.00	.00	.00	.00	151.14	865.36	1.84	865.36
37	SAGBEND	-90.27	-18.67	.00	.00	.00	.00	.00	148.74	812.89	1.09	812.90
38	SAGBEND	-102.33	-19.63	.00	.00	.00	.00	.00	148.03	647.58	.16	647.58
39	SAGBEND	-114.43	-19.99	.00	13.34	-.14	.00	.00	148.44	344.22	-.83	344.22
40	SEABED	-126.53	-20.03	.00	41.10	.01	.00	.00	148.82	31.02	-.35	31.02
41	SEABED	-138.63	-20.02	.00	24.35	.03	.00	.00	148.81	-18.57	.02	18.57
42	SEABED	-150.73	-20.01	.00	20.28	.00	.00	.00	148.81	.95	.02	.95
43	SEABED	-162.83	-20.01	.00	12.46	.00	.00	.00	148.80	37.67	.00	37.67
44	SEABED	-174.93	-19.98	.00	.00	.00	.00	.00	148.86	.00	.00	.00

OFFPIPE - OFFSHORE PIPELINE ANALYSIS SYSTEM - VERSION 2.05 AC PAGE 31
Abandonment and Recovery Analysis in Sangatta
JOB NO. - 1 LICENSED TO: RICKY TAWEKAL
USER ID - Moch. Ardiansyah DATE - 7/ 1/2016 TIME - 5:25:59 CASE 4

S T A T I C S O L U T I O N S U M M A R Y

PIPE PROPERTIES (2)

PIPE SECTION LENGTH ..	.00 M	ELASTIC MODULUS	207000. MPA
OUTSIDE DIAMETER	50.800 CM	CROSS SECTIONAL AREA .	250.00 CM2
WALL THICKNESS	1.590 CM	MOMENT OF INERTIA	74490.00 CM4
WEIGHT/LENGTH IN AIR .	4567.997 N/M	YIELD STRESS	360.00 MPA
SUBMERGED WGHT/LENG ..	1556.660 N/M	STRESS INTENS FACTOR .	1.000
SPECIFIC GRAVITY	1.517	STEEL DENSITY	77008.5 N/M3
WRAP COAT THICKNESS ..	.250 CM	WRAP COAT DENSITY	9397.6 N/M3
CONCRETE THICKNESS ...	5.000 CM	CONCRETE DENSITY	29822.4 N/M3

BARGE DATA

TOTAL PIPE TENSION ...	180.01 KN	RADIUS OF CURVATURE ..	.00 M
NUMBER OF TENSIONERS .	2	BARGE TRIM ANGLE	.000 DEG
NO. OF PIPE SUPPORTS .	7	PIPE ANGLE AT STERN ..	5.865 DEG
BARGE HEADING	.000 DEG	OFFSET FROM R.O.W. ...	.00 M

STINGER DATA

NO. OF PIPE SUPPORTS .	6	STINGER STERN DEPTH ..	-2.97 M
NO. STINGER SECTIONS .	6	PIPE ANGLE AT STERN ..	21.438 DEG
RADIUS OF CURVATURE ..	.00 M	STINGER LENGTH	31.90 M

SAGBEND DATA

WATER DEPTH	20.00 M	HORIZ PIPE TENSION ...	148.86 KN
TOUCHDOWN X-COORD. ...	-115.13 M	BOTTOM SLOPE ANGLE ...	.000 DEG

SOLUTION SUMMARY

NODE NO.	PIPE SECTION	X COORD	Y COORD	Z COORD	SUPPORT REACT VERT	SUPPORT REACT HORIZ	TOTAL MOMENT	TOTAL STRESS	PCT YLD
1	TENSIONR	61.0	2.5	.0	.5	.0	.0	.0	0.
3	LAYBARGE	38.0	2.5	.0	.6	.0	.0	.0	0.
5	LAYBARGE	32.1	2.5	.0	.2	.0	.0	.0	0.
7	TENSIONR	26.5	2.5	.0	.2	.0	.0	.0	0.
9	LAYBARGE	23.0	2.5	.0	3.5	.0	.0	.0	0.

11	LAYBARGE	16.5	2.4	.0	5.0	.0	.0	.0	0.
13	LAYBARGE	12.0	2.2	.0	5.1	.0	.0	.0	0.
15	LAYBARGE	5.5	1.7	.0	5.7	.0	.0	.0	0.
17	LAYBARGE	.0	1.2	.0	.4	.0	.0	.0	0.
20	STINGER	-7.4	.4	.0	5.9	-.1	.0	.0	0.
22	STINGER	-14.6	-.6	.0	.3	.0	.0	.0	0.
24	STINGER	-20.6	-1.4	.0	.2	.0	.0	.0	0.
26	STINGER	-25.3	-2.0	.0	.2	.1	.0	.0	0.
28	STINGER	-30.3	-2.7	.0	3.3	1.4	.0	.0	0.
30	STINGER	-32.1	-3.0	.0	79.2	-1.7	.0	.0	0.
36	SAGBEND	-78.3	-16.9	.0	.0	.0	865.4	301.2	84.

S T A T I C S O L U T I O N S U M M A R Y

40	SEABED	-126.5	-20.0	.0	41.1	.0	31.0	16.8	5.

OFFPIPE - OFFSHORE PIPELINE ANALYSIS SYSTEM - VERSION 2.05 AC DATE - 7/ 1/2016 TIME - 5:25:59 PAGE 33
PROJECT - Abandonment and Recovery Analysis in Sangatta JOB NO. - 1
USER ID - Moch. Ardiansyah LICENSED TO: RICKY TAWEKAL CASE 5

S T A T I C P I P E C O O R D I N A T E S, F O R C E S A N D S T R E S S E S

NODE NO.	PIPE SECTION	X COORD (M)	Y COORD (M)	Z COORD (M)	HORIZ ANGLE (DEG)	VERT ANGLE (DEG)	PIPE LENGTH (M)	TENSILE STRESS (MPA)	HOOP STRESS (MPA)	BENDING STRESSES VERT (MPA)	BENDING STRESSES HORIZ (MPA)	TOTAL STRESS (MPA)	PERCNT YIELD (PCT)
1	TENSIONR	61.00	2.52	.00	.000	.000	.000	.00	.00	.00	.00	.00	.00
3	LAYBARGE	38.00	2.52	.00	.000	.000	23.000	.00	.00	.00	.00	.00	.00
5	LAYBARGE	32.09	2.52	.00	.000	.000	28.905	.00	.00	.00	.00	.00	.00
7	TENSIONR	26.50	2.52	.00	.000	.000	34.500	.00	.00	.00	.00	.00	.00
9	LAYBARGE	23.00	2.52	.00	.000	.530	38.000	.00	.00	.00	.00	.00	.00
11	LAYBARGE	16.52	2.40	.00	.000	1.823	44.481	.00	.00	.00	.00	.00	.00
13	LAYBARGE	12.00	2.19	.00	.000	3.356	49.006	.00	.00	.00	.00	.00	.00
15	LAYBARGE	5.50	1.72	.00	.000	4.986	55.523	.00	.00	.00	.00	.00	.00
17	LAYBARGE	.00	1.16	.00	.003	5.859	61.052	.00	.00	.00	.00	.00	.00
20	STINGER	-7.40	.40	.00	.000	6.778	68.496	.00	.00	.00	.00	.00	.00
22	STINGER	-14.57	-.57	.00	-.002	7.686	75.728	.00	.00	.00	.00	.00	.00
24	STINGER	-20.57	-1.38	.00	.000	7.691	81.778	.00	.00	.00	.00	.00	.00
26	STINGER	-25.28	-2.01	.00	.003	7.693	86.529	.00	.00	.00	.00	.00	.00
28	STINGER	-30.30	-2.69	.00	.125	7.923	91.601	.00	.00	.00	.00	.00	.00
30	STINGER	-32.08	-2.95	-.01	.118	21.164	93.399	.00	.00	.00	.00	.00	.00
32	SAGBEND	-42.09	-9.74	.00	-.025	33.480	105.539	.00	.00	.00	.00	.00	.00
33	SAGBEND	-52.15	-16.46	.00	-.020	32.085	117.639	.00	.00	.00	.00	.00	.00
34	SAGBEND	-54.19	-17.69	.00	.002	5.413	120.047	1.19	-2.84	3.60	.00	6.68	1.86
35	SAGBEND	-65.04	-18.67	.00	.002	4.716	130.942	1.04	-3.00	103.88	.04	106.44	29.57
36	SAGBEND	-75.91	-19.43	.00	.002	3.175	141.838	.92	-3.12	146.17	-.01	148.67	41.30
37	SAGBEND	-88.00	-19.90	.00	.002	1.296	153.938	.85	-3.19	127.32	-.10	129.80	36.06
38	SEABED	-100.10	-20.02	.00	.000	.119	166.038	.85	-3.21	43.62	-.08	46.17	12.82
39	SEABED	-112.20	-20.02	.00	.000	-.062	178.139	.85	-3.21	-2.71	-.01	5.87	1.63
40	SEABED	-124.30	-20.01	.00	.000	-.011	190.239	.85	-3.21	-2.72	.00	5.88	1.63
41	SEABED	-136.40	-20.01	.00	.000	.007	202.339	.85	-3.21	-.64	.00	4.17	1.16
42	SEABED	-148.50	-20.01	.00	.000	.008	214.439	.85	-3.21	1.40	.00	4.76	1.32
43	SEABED	-160.60	-20.01	.00	.000	-.075	226.540	.85	-3.21	12.71	.00	15.42	4.28
44	SEABED	-172.70	-19.98	.00	.000	-.232	238.640	.86	-3.21	.00	.00	3.71	1.03

OFFPIPE - OFFSHORE PIPELINE ANALYSIS SYSTEM - VERSION 2.05 AC DATE - 7/ 1/2016 TIME - 5:25:59 PAGE 34
PROJECT - Abandonment and Recovery Analysis in Sangatta JOB NO. - 1
USER ID - Moch. Ardiansyah LICENSED TO: RICKY TAWEKAL CASE 5

S T A T I C P I P E C O O R D I N A T E S, F O R C E S A N D S T R E S S E S

NODE NO.	PIPE SECTION	X COORD (M)	Y COORD (M)	Z COORD (M)	SUPPORT REACTION VERT (KN)	SUPPORT REACTION HORIZ (KN)	SUPT SEPARATIONS VERT (M)	SUPT SEPARATIONS HORIZ (M)	PIPE TENSION (KN)	BENDING MOMENTS VERT (KN-M)	BENDING MOMENTS HORIZ (KN-M)	BENDING MOMENTS TOTAL (KN-M)
1	TENSIONR	61.00	2.52	.00	.50	.00	.00	.00	37.48	.00	.00	.00
3	LAYBARGE	38.00	2.52	.00	.63	.00	.00	.00	37.48	.12	.00	.00
5	LAYBARGE	32.09	2.52	.00	.25	.00	.00	.00	37.48	.05	.00	.00
7	TENSIONR	26.50	2.52	.00	.20	.00	.00	.00	74.98	.05	.00	.00
9	LAYBARGE	23.00	2.52	.00	1.60	.00	.00	.00	74.97	.30	.00	.00
11	LAYBARGE	16.52	2.40	.00	2.23	.00	.00	.00	74.96	.42	.00	.00
13	LAYBARGE	12.00	2.19	.00	2.26	.00	.00	.00	74.95	.42	.00	.00
15	LAYBARGE	5.50	1.72	.00	2.51	.00	.00	.00	74.93	.47	.00	.00
17	LAYBARGE	.00	1.16	.00	.32	.01	.00	.00	74.92	.06	.00	.00
20	STINGER	-7.40	.40	.00	2.67	-.01	.00	.00	74.87	.50	.00	.00
22	STINGER	-14.57	-.57	.00	.27	.00	.00	.00	74.85	.05	.00	.00
24	STINGER	-20.57	-1.38	.00	.20	.00	.00	.00	74.82	.04	.00	.00
26	STINGER	-25.28	-2.01	.00	.19	.01	.00	.00	74.79	.04	.00	.00
28	STINGER	-30.30	-2.69	.00	.72	.31	.00	.00	74.76	.14	-.06	.00
30	STINGER	-32.08	-2.95	-.01	33.89	-.32	.00	-.01	72.86	6.35	.06	.00
32	SAGBEND	-42.09	-9.74	.00	.00	.00	.00	.00	74.53	.00	.00	.00
33	SAGBEND	-52.15	-16.46	.00	.00	.00	.00	.00	74.25	2.89	.00	.00
34	SAGBEND	-54.19	-17.69	.00	.00	.00	.00	.00	65.38	10.55	.01	10.55
35	SAGBEND	-65.04	-18.67	.00	.00	.00	.00	.00	63.55	304.62	.12	304.62
36	SAGBEND	-75.91	-19.43	.00	.00	.00	.00	.00	62.08	428.64	-.02	428.64
37	SAGBEND	-88.00	-19.90	.00	.76	-.03	.00	.00	61.49	373.38	-.28	373.38
38	SEABED	-100.10	-20.02	.00	28.02	-.02	.00	.00	61.73	127.93	-.24	127.93
39	SEABED	-112.20	-20.02	.00	30.04	.02	.00	.00	61.78	-7.94	-.02	7.94
40	SEABED	-124.30	-20.01	.00	19.19	.00	.00	.00	61.77	-7.96	.01	7.96
41	SEABED	-136.40	-20.01	.00	18.79	.00	.00	.00	61.77	-1.88	.00	1.88
42	SEABED	-148.50	-20.01	.00	21.19	.00	.00	.00	61.77	4.10	.00	4.10
43	SEABED	-160.60	-20.01	.00	13.01	.00	.00	.00	61.77	37.27	.00	37.27
44	SEABED	-172.70	-19.98	.00	.00	.00	.00	.00	61.82	.00	.00	.00

OFFPIPE - OFFSHORE PIPELINE ANALYSIS SYSTEM - VERSION 2.05 AC PAGE 35
Abandonment and Recovery Analysis in Sangatta
JOB NO. - 1 LICENSED TO: RICKY TAWEKAL
USER ID - Moch. Ardiansyah DATE - 7/ 1/2016 TIME - 5:25:59 CASE 5

S T A T I C S O L U T I O N S U M M A R Y

PIPE PROPERTIES (2)

PIPE SECTION LENGTH ..	.00 M	ELASTIC MODULUS	207000. MPA
OUTSIDE DIAMETER	50.800 CM	CROSS SECTIONAL AREA .	250.00 CM2
WALL THICKNESS	1.590 CM	MOMENT OF INERTIA	74490.00 CM4
WEIGHT/LENGTH IN AIR .	4567.997 N/M	YIELD STRESS	360.00 MPA
SUBMERGED WGHT/LENG ..	1556.660 N/M	STRESS INTENS FACTOR .	1.000
SPECIFIC GRAVITY	1.517	STEEL DENSITY	77008.5 N/M3
WRAP COAT THICKNESS ..	.250 CM	WRAP COAT DENSITY	9397.6 N/M3
CONCRETE THICKNESS ...	5.000 CM	CONCRETE DENSITY	29822.4 N/M3

BARGE DATA

TOTAL PIPE TENSION ...	74.98 KN	RADIUS OF CURVATURE ..	.00 M
NUMBER OF TENSIONERS .	2	BARGE TRIM ANGLE	.000 DEG
NO. OF PIPE SUPPORTS .	7	PIPE ANGLE AT STERN ..	5.859 DEG
BARGE HEADING	.000 DEG	OFFSET FROM R.O.W. ...	.00 M

STINGER DATA

NO. OF PIPE SUPPORTS .	6	STINGER STERN DEPTH ..	-2.95 M
NO. STINGER SECTIONS .	6	PIPE ANGLE AT STERN ..	21.164 DEG
RADIUS OF CURVATURE ..	.00 M	STINGER LENGTH	31.90 M

SAGBEND DATA

WATER DEPTH	20.00 M	HORIZ PIPE TENSION ...	61.82 KN
TOUCHDOWN X-COORD. ...	-95.03 M	BOTTOM SLOPE ANGLE ...	.000 DEG

SOLUTION SUMMARY

NODE NO.	PIPE SECTION	X COORD	Y COORD	Z COORD	SUPPORT REACT VERT	SUPPORT REACT HORIZ	TOTAL MOMENT	TOTAL STRESS	PCT YLD
1	TENSIONR	61.0	2.5	.0	.5	.0	.0	.0	0.
3	LAYBARGE	38.0	2.5	.0	.6	.0	.0	.0	0.
5	LAYBARGE	32.1	2.5	.0	.2	.0	.0	.0	0.
7	TENSIONR	26.5	2.5	.0	.2	.0	.0	.0	0.
9	LAYBARGE	23.0	2.5	.0	1.6	.0	.0	.0	0.

11	LAYBARGE	16.5	2.4	.0	2.2	.0	.0	.0	0.
13	LAYBARGE	12.0	2.2	.0	2.3	.0	.0	.0	0.
15	LAYBARGE	5.5	1.7	.0	2.5	.0	.0	.0	0.
17	LAYBARGE	.0	1.2	.0	.3	.0	.0	.0	0.
20	STINGER	-7.4	.4	.0	2.7	.0	.0	.0	0.
22	STINGER	-14.6	-.6	.0	.3	.0	.0	.0	0.
24	STINGER	-20.6	-1.4	.0	.2	.0	.0	.0	0.
26	STINGER	-25.3	-2.0	.0	.2	.0	.0	.0	0.
28	STINGER	-30.3	-2.7	.0	.7	.3	.0	.0	0.
30	STINGER	-32.1	-2.9	.0	33.9	-.3	.0	.0	0.
36	SAGBEND	-75.9	-19.4	.0	.0	.0	428.6	148.7	41.

S T A T I C S O L U T I O N S U M M A R Y

38	SEABED	-100.1	-20.0	.0	28.0	.0	127.9	46.2	13.

OFFPIPE - OFFSHORE PIPELINE ANALYSIS SYSTEM - VERSION 2.05 AC DATE - 7/ 1/2016 TIME - 5:25:59 PAGE 37
PROJECT - Abandonment and Recovery Analysis in Sangatta JOB NO. - 1
USER ID - Moch. Ardiansyah LICENSED TO: RICKY TAWEKAL CASE 6

S T A T I C P I P E C O O R D I N A T E S, F O R C E S A N D S T R E S S E S

NODE NO.	PIPE SECTION	X COORD (M)	Y COORD (M)	Z COORD (M)	HORIZ ANGLE (DEG)	VERT ANGLE (DEG)	PIPE LENGTH (M)	TENSILE STRESS (MPA)	HOOP STRESS (MPA)	BENDING STRESSES VERT (MPA)	BENDING STRESSES HORIZ (MPA)	TOTAL STRESS (MPA)	PERCNT YIELD (PCT)
1	TENSIONR	61.00	2.52	.00	.000	.000	.000	.00	.00	.00	.00	.00	.00
3	LAYBARGE	38.00	2.52	.00	.000	.000	23.000	.00	.00	.00	.00	.00	.00
5	LAYBARGE	32.09	2.52	.00	.000	.000	28.905	.00	.00	.00	.00	.00	.00
7	TENSIONR	26.50	2.52	.00	.000	.000	34.500	.00	.00	.00	.00	.00	.00
9	LAYBARGE	23.00	2.52	.00	.000	.530	38.000	.00	.00	.00	.00	.00	.00
11	LAYBARGE	16.52	2.40	.00	.000	1.823	44.481	.00	.00	.00	.00	.00	.00
13	LAYBARGE	12.00	2.19	.00	.000	3.356	49.006	.00	.00	.00	.00	.00	.00
15	LAYBARGE	5.50	1.72	.00	.000	4.986	55.523	.00	.00	.00	.00	.00	.00
17	LAYBARGE	.00	1.16	.00	.001	5.856	61.052	.00	.00	.00	.00	.00	.00
20	STINGER	-7.40	.40	.00	.000	6.777	68.496	.00	.00	.00	.00	.00	.00
22	STINGER	-14.57	-.57	.00	-.001	7.688	75.728	.00	.00	.00	.00	.00	.00
24	STINGER	-20.57	-1.38	.00	.000	7.689	81.778	.00	.00	.00	.00	.00	.00
26	STINGER	-25.28	-2.01	.00	.000	7.690	86.529	.00	.00	.00	.00	.00	.00
28	STINGER	-30.30	-2.69	.00	.018	7.722	91.601	.00	.00	.00	.00	.00	.00
30	STINGER	-32.08	-2.93	.00	.009	14.409	93.394	.00	.00	.00	.00	.00	.00
32	SAGBEND	-43.37	-7.28	.00	-.012	20.420	105.505	.00	.00	.00	.00	.00	.00
33	SAGBEND	-54.75	-11.38	.00	.001	19.114	117.605	.00	.00	.00	.00	.00	.00
34	SAGBEND	-66.23	-15.22	.00	.012	17.520	129.705	.00	.00	.00	.00	.00	.00
35	SAGBEND	-74.49	-17.78	.00	.009	14.297	138.359	.00	.00	.00	.00	.00	.00
36	SEABED	-82.82	-20.00	.00	.000	.087	147.013	-.91	-3.21	1.85	.00	3.77	1.05
37	SEABED	-89.71	-20.01	.00	.000	.049	153.905	-.91	-3.21	6.05	.00	7.30	2.03
38	SEABED	-101.81	-20.01	.00	.000	.000	166.005	-.91	-3.21	1.29	.00	3.42	.95
39	SEABED	-113.91	-20.01	.00	.000	-.003	178.105	-.91	-3.21	-.23	.00	2.93	.81
40	SEABED	-126.01	-20.01	.00	.000	.000	190.205	-.91	-3.21	-.20	.00	2.92	.81
41	SEABED	-138.11	-20.01	.00	.000	.005	202.305	-.91	-3.21	-.63	.00	3.08	.86
42	SEABED	-150.21	-20.01	.00	.000	.008	214.406	-.91	-3.21	1.25	.00	3.39	.94
43	SEABED	-162.31	-20.01	.00	.000	-.075	226.506	-.91	-3.21	12.75	.00	13.74	3.82
44	SEABED	-174.41	-19.98	.00	.000	-.233	238.607	-.90	-3.21	.00	.00	2.86	.80

OFFPIPE - OFFSHORE PIPELINE ANALYSIS SYSTEM - VERSION 2.05 AC DATE - 7/ 1/2016 TIME - 5:25:59 PAGE 38
PROJECT - Abandonment and Recovery Analysis in Sangatta JOB NO. - 1
USER ID - Moch. Ardiansyah LICENSED TO: RICKY TAWEKAL CASE 6

S T A T I C P I P E C O O R D I N A T E S, F O R C E S A N D S T R E S S E S

NODE NO.	PIPE SECTION	X COORD (M)	Y COORD (M)	Z COORD (M)	SUPPORT REACTION VERT (KN)	SUPPORT REACTION HORIZ (KN)	SUPT SEPARATIONS VERT (M)	SUPT SEPARATIONS HORIZ (M)	PIPE TENSION (KN)	BENDING MOMENTS VERT (KN-M)	BENDING MOMENTS HORIZ (KN-M)	BENDING MOMENTS TOTAL (KN-M)
1	TENSIONR	61.00	2.52	.00	.50	.00	.00	.00	10.00	.00	.00	.00
3	LAYBARGE	38.00	2.52	.00	.63	.00	.00	.00	10.00	.12	.00	.00
5	LAYBARGE	32.09	2.52	.00	.25	.00	.00	.00	10.00	.05	.00	.00
7	TENSIONR	26.50	2.52	.00	.20	.00	.00	.00	20.00	.05	.00	.00
9	LAYBARGE	23.00	2.52	.00	.59	.00	.00	.00	20.00	.11	.00	.00
11	LAYBARGE	16.52	2.40	.00	.77	.00	.00	.00	19.99	.14	.00	.00
13	LAYBARGE	12.00	2.19	.00	.78	.00	.00	.00	19.98	.15	.00	.00
15	LAYBARGE	5.50	1.72	.00	.86	.00	.00	.00	19.96	.16	.00	.00
17	LAYBARGE	.00	1.16	.00	.29	.00	.00	.00	19.94	.05	.00	.00
20	STINGER	-7.40	.40	.00	.94	.00	.00	.00	19.91	.18	.00	.00
22	STINGER	-14.57	-.57	.00	.26	.00	.00	.00	19.87	.05	.00	.00
24	STINGER	-20.57	-1.38	.00	.20	.00	.00	.00	19.84	.04	.00	.00
26	STINGER	-25.28	-2.01	.00	.18	.00	.00	.00	19.82	.03	.00	.00
28	STINGER	-30.30	-2.69	.00	.15	.01	.00	.00	19.79	.03	.00	.00
30	STINGER	-32.08	-2.93	.00	4.83	-.02	.00	.00	19.65	.90	.00	.00
32	SAGBEND	-43.37	-7.28	.00	.00	.00	.00	.00	19.64	.00	.00	.00
33	SAGBEND	-54.75	-11.38	.00	.00	.00	.00	.00	19.49	.03	.00	.00
34	SAGBEND	-66.23	-15.22	.00	.00	.00	.00	.00	19.34	.18	.00	.00
35	SAGBEND	-74.49	-17.78	.00	.00	-.01	.00	.00	19.22	.93	.00	.00
36	SEABED	-82.82	-20.00	.00	1.77	.00	.00	.00	18.41	5.41	.00	5.41
37	SEABED	-89.71	-20.01	.00	11.85	.00	.00	.00	18.40	17.75	.00	17.75
38	SEABED	-101.81	-20.01	.00	19.72	.00	.00	.00	18.41	3.79	.00	3.79
39	SEABED	-113.91	-20.01	.00	19.20	.00	.00	.00	18.41	-.68	.00	.68
40	SEABED	-126.01	-20.01	.00	18.71	.00	.00	.00	18.41	-.58	.00	.58
41	SEABED	-138.11	-20.01	.00	19.36	.00	.00	.00	18.41	-1.85	.00	1.85
42	SEABED	-150.21	-20.01	.00	21.29	.00	.00	.00	18.41	3.65	.00	3.65
43	SEABED	-162.31	-20.01	.00	13.07	.00	.00	.00	18.40	37.40	.00	37.40
44	SEABED	-174.41	-19.98	.00	.00	.00	.00	.00	18.45	.00	.00	.00

OFFPIPE - OFFSHORE PIPELINE ANALYSIS SYSTEM - VERSION 2.05 AC PAGE 39
Abandonment and Recovery Analysis in Sangatta
JOB NO. - 1 LICENSED TO: RICKY TAWEKAL
USER ID - Moch. Ardiansyah DATE - 7/ 1/2016 TIME - 5:25:59 CASE 6

S T A T I C S O L U T I O N S U M M A R Y

PIPE PROPERTIES (2)

PIPE SECTION LENGTH ..	.00 M	ELASTIC MODULUS	207000. MPA
OUTSIDE DIAMETER	50.800 CM	CROSS SECTIONAL AREA .	250.00 CM2
WALL THICKNESS	1.590 CM	MOMENT OF INERTIA	74490.00 CM4
WEIGHT/LENGTH IN AIR .	4567.997 N/M	YIELD STRESS	360.00 MPA
SUBMERGED WGHT/LENG ..	1556.660 N/M	STRESS INTENS FACTOR .	1.000
SPECIFIC GRAVITY	1.517	STEEL DENSITY	77008.5 N/M3
WRAP COAT THICKNESS ..	.250 CM	WRAP COAT DENSITY	9397.6 N/M3
CONCRETE THICKNESS ...	5.000 CM	CONCRETE DENSITY	29822.4 N/M3

BARGE DATA

TOTAL PIPE TENSION ...	20.00 KN	RADIUS OF CURVATURE ..	.00 M
NUMBER OF TENSIONERS .	2	BARGE TRIM ANGLE	.000 DEG
NO. OF PIPE SUPPORTS .	7	PIPE ANGLE AT STERN ..	5.856 DEG
BARGE HEADING	.000 DEG	OFFSET FROM R.O.W. ...	.00 M

STINGER DATA

NO. OF PIPE SUPPORTS .	6	STINGER STERN DEPTH ..	-2.93 M
NO. STINGER SECTIONS .	6	PIPE ANGLE AT STERN ..	14.409 DEG
RADIUS OF CURVATURE ..	.00 M	STINGER LENGTH	31.90 M

SAGBEND DATA

WATER DEPTH	20.00 M	HORIZ PIPE TENSION ...	18.45 KN
TOUCHDOWN X-COORD. ...	-82.74 M	BOTTOM SLOPE ANGLE ...	.000 DEG

SOLUTION SUMMARY

NODE NO.	PIPE SECTION	X COORD	Y COORD	Z COORD	SUPPORT REACT VERT	SUPPORT REACT HORIZ	TOTAL MOMENT	TOTAL STRESS	PCT YLD
1	TENSIONR	61.0	2.5	.0	.5	.0	.0	.0	0.
3	LAYBARGE	38.0	2.5	.0	.6	.0	.0	.0	0.
5	LAYBARGE	32.1	2.5	.0	.2	.0	.0	.0	0.
7	TENSIONR	26.5	2.5	.0	.2	.0	.0	.0	0.
9	LAYBARGE	23.0	2.5	.0	.6	.0	.0	.0	0.

11	LAYBARGE	16.5	2.4	.0	.8	.0	.0	.0	0.
13	LAYBARGE	12.0	2.2	.0	.8	.0	.0	.0	0.
15	LAYBARGE	5.5	1.7	.0	.9	.0	.0	.0	0.
17	LAYBARGE	.0	1.2	.0	.3	.0	.0	.0	0.
20	STINGER	-7.4	.4	.0	.9	.0	.0	.0	0.
22	STINGER	-14.6	-.6	.0	.3	.0	.0	.0	0.
24	STINGER	-20.6	-1.4	.0	.2	.0	.0	.0	0.
26	STINGER	-25.3	-2.0	.0	.2	.0	.0	.0	0.
28	STINGER	-30.3	-2.7	.0	.1	.0	.0	.0	0.
30	STINGER	-32.1	-2.9	.0	4.8	.0	.0	.0	0.
36	SEABED	-82.8	-20.0	.0	1.8	.0	5.4	3.8	1.

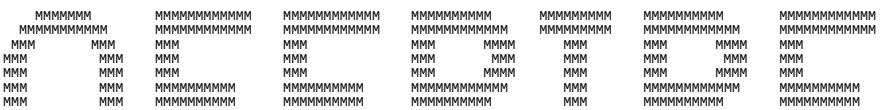
S T A T I C S O L U T I O N S U M M A R Y

43	SEABED	-162.3	-20.0	.0	13.1	.0	37.4	13.7	4.

LAMPIRAN C-2

HASIL *OUTPUT SOFTWARE* OFFPIPE

(*STINGER STERN DEPTH* = 4m)



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*******************************************************************************
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*                                                                             *
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*                                                                             *
*                        VERSION NO. - 2.05 AC                                *
*                        RELEASED ON - 10/24/1993                             *
*                        LICENSED TO - RICKY TAWEKAL                          *
*                                                                             *
*******************************************************************************
*                                                                             *
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*    STATIC AND DYNAMIC ANALYSIS OF PROBLEMS ARISING IN THE DESIGN OF MARINE PIPELINES.    *
*    THIS VERSION  OF OFFPIPE MAY BE USED FOR THE ANALYSIS OF OFFSHORE PIPELAYING OPER-    *
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*                  8007 MULLINS                    FACSIMILE: (713) 664-0962  *
*                  HOUSTON, TEXAS 77081                                       *
*                  U.S.A.                                                     *
*                                                                             *
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I N P U T D A T A E C H O

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PRINTED OUTPUT SELECTED
=======================
   PRINT PIPE STRAINS IN OUTPUT ......NO
   USE DNV STRESS FORMULA ............NO
   STATIC PIPE FORCES AND STRESSES ...YES
   STATIC SOLUTION SUMMARY ...........YES
   OVERBEND PIPE SUPPORT GEOMETRY ....NO
   STINGER BALLAST SCHEDULE DATA .....NO
   DYNAMIC PIPE FORCES AND STRESSES ..YES
   DYNAMIC RANGE OF PIPE DATA ........NO
   DYNAMIC TRACKING OF PIPE DATA .....NO
   PLOT DATA FILE SUMMARY TABLES .....NO

PROFILE PLOT TABLE ENTRIES
==========================
   PLOT TABLE INDEX ..................         1
   PLOT NUMBER .......................         1
   PLOT TYPE OPTION NUMBER ...........         4
   DYNAMIC PROFILE TIME POINT ........      .000
   DYNAMIC PROFILE TIME INCREMENT ....      .000
   ORDINATE PARAMETER CODE NUMBER ....         2
   AXIS LABEL FOR ORDINATE ........... "Pipe Elevation or Y Coordinate  "
   ABSCISSA PARAMETER CODE NUMBER ....         1
   AXIS LABEL FOR ABSCISSA ........... "Pipe Horizontal X Coordinate    "

   PLOT TITLE ........................ "Pipeline Elevation Profile                              "
   MINIMUM HORIZONTAL AXIS RANGE .....      .000
   MAXIMUM HORIZONTAL AXIS RANGE .....      .000
   MINIMUM VERTICAL AXIS RANGE .......      .000
   MAXIMUM VERTICAL AXIS RANGE .......      .000

PROFILE PLOT TABLE ENTRIES
==========================
   PLOT TABLE INDEX ..................         2
   PLOT NUMBER .......................         2
   PLOT TYPE OPTION NUMBER ...........         4
   DYNAMIC PROFILE TIME POINT ........      .000
   DYNAMIC PROFILE TIME INCREMENT ....      .000
   ORDINATE PARAMETER CODE NUMBER ....        14
   AXIS LABEL FOR ORDINATE ........... "Total Von Mises Pipe Stress     "
   ABSCISSA PARAMETER CODE NUMBER ....         1
   AXIS LABEL FOR ABSCISSA ........... "Pipe Horizontal X Coordinate    "

   PLOT TITLE ........................ "Pipeline Total Pipe Stress                              "
   MINIMUM HORIZONTAL AXIS RANGE .....      .000
   MAXIMUM HORIZONTAL AXIS RANGE .....      .000
   MINIMUM VERTICAL AXIS RANGE .......      .000
   MAXIMUM VERTICAL AXIS RANGE .......      .000
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I N P U T D A T A E C H O

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PIPE PROPERTIES
===============
   PIPE PROPERTY TABLE ROW ...........         2
   PIPE SECTION LENGTH ...............      .000 M
   STEEL MODULUS OF ELASTICITY .......   207000. MPA
   AREA OF STEEL CROSS SECTION .......   250.000 CM**2
   COATED PIPE AVG MOMENT OF INERTIA .  74490.00 CM**4
   WEIGHT PER-UNIT-LENGTH IN AIR .....   4568.00 N/M
   WEIGHT PER-UNIT-LENGTH SUBMERGED ..   1556.66 N/M
   MAXIMUM ALLOWABLE PIPE STRAIN .....   .205000 PCT

   STEEL OUTSIDE DIAMETER ............   50.8000 CM
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   STEEL WALL THICKNESS ..............    1.5900 CM
   YIELD STRESS ......................    360.00 MPA
   STRESS/STRAIN INTENSE FACTOR ......     .0000
   HYDRODYNAMIC OUTSIDE DIAMETER .....      .000 CM
   DRAG COEFFICIENT ..................     .0000
   HYDRODYNAMIC TOTAL AREA ...........      .000 CM**2
   ADDED MASS COEFFICIENT ............     .0000
   POISSON'S RATIO ...................     .3000
   COEFFICIENT OF THERMAL EXPANSION .. .00000000 1/DEG C

PIPE COATING PROPERTIES
=======================
   PIPE PROPERTY TABLE INDEX .........         2
   CORROSION COATING THICKNESS .......      .250 CM
   CONCRETE COATING THICKNESS ........     5.000 CM
   STEEL WEIGHT DENSITY ..............    77009. N/M**3
   CORROSION COATING WEIGHT DENSITY ..     9398. N/M**3
   CONCRETE COATING WEIGHT DENSITY ...    29822. N/M**3
   DESIRED PIPE SPECIFIC GRAVITY .....     .0000

   AVERAGE PIPE JOINT LENGTH .........    12.100 M
   FIELD JOINT LENGTH ................      .600 M
   JOINT FILL WEIGHT DENSITY .........    10055. N/M**3
   DENSITY OF PIPE CONTENTS ..........        0. N/M**3

================================================================================
OFFPIPE - OFFSHORE PIPELINE ANALYSIS SYSTEM - VERSION 2.05 AC          PAGE   5
Abandonment and Recovery Analysis in Sangatta
JOB NO. - 1                    LICENSED TO: RICKY TAWEKAL
USER ID - Moch. Ardiansyah     DATE -  7/ 1/2016   TIME -  5:34:12   CASE   1
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                        I N P U T   D A T A   E C H O


SUPPORT ELEMENT PROPERTIES
==========================
   SUPPORT PROPERTY TABLE INDEX ......          7
   SUPPORT ELEMENT TYPE ..............          2 TENSIONER
   TENSIONER AXIAL STIFFNESS (F/L) ...  0.000E+00 KN/M
   VERTICAL STIFFNESS (F/L) ..........  0.000E+00 KN/M
   STATIC VERTICAL DEFLECTION ........      .0000 CM
   LATERAL STIFFNESS (F/L) ...........  0.000E+00 KN/M
   BOTTOM ROLLER ANGLE TO HORIZONTAL .     30.000 DEG

   SIDE ROLLER ANGLE TO VERTICAL .....        .000 DEG
   SIDE ROLLER OFFSET FROM C.L. ......        .000 M
   BED ROLLER LENGTH .................      2.000 M
   HEIGHT OF TOP ROLLER ABOVE BED ....        .000 M
   TENSIONER X-AXIS ROTATIONAL STIF. .        .000 KN/DEG
   TENSIONER Y-AXIS ROTATIONAL STIF. .        .000 KN/DEG
   TENSIONER Y-AXIS ROTATIONAL STIF. .        .000 KN/DEG

SUPPORT ELEMENT PROPERTIES
==========================
   SUPPORT PROPERTY TABLE INDEX ......          8
   SUPPORT ELEMENT TYPE ..............          1 SIMPLE SUPPORT
   TENSIONER AXIAL STIFFNESS (F/L) ...  0.000E+00 KN/M
   VERTICAL STIFFNESS (F/L) ..........  0.000E+00 KN/M
   STATIC VERTICAL DEFLECTION ........      .0000 CM
   LATERAL STIFFNESS (F/L) ...........  0.000E+00 KN/M
   BOTTOM ROLLER ANGLE TO HORIZONTAL .     30.000 DEG

   SIDE ROLLER ANGLE TO VERTICAL .....     60.000 DEG
   SIDE ROLLER OFFSET FROM C.L. ......      1.000 M
   BED ROLLER LENGTH .................      1.500 M
   HEIGHT OF TOP ROLLER ABOVE BED ....        .000 M
   TENSIONER X-AXIS ROTATIONAL STIF. .        .000 KN/DEG
   TENSIONER Y-AXIS ROTATIONAL STIF. .        .000 KN/DEG
   TENSIONER Y-AXIS ROTATIONAL STIF. .        .000 KN/DEG

================================================================================
OFFPIPE - OFFSHORE PIPELINE ANALYSIS SYSTEM - VERSION 2.05 AC          PAGE   6
Abandonment and Recovery Analysis in Sangatta
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================================================================================

                        I N P U T   D A T A   E C H O


SUPPORT ELEMENT PROPERTIES
==========================
   SUPPORT PROPERTY TABLE INDEX ......          9
   SUPPORT ELEMENT TYPE ..............          1 SIMPLE SUPPORT
   TENSIONER AXIAL STIFFNESS (F/L) ...  0.000E+00 KN/M
   VERTICAL STIFFNESS (F/L) ..........  0.000E+00 KN/M
   STATIC VERTICAL DEFLECTION ........      .0350 CM
   LATERAL STIFFNESS (F/L) ...........  0.000E+00 KN/M
   BOTTOM ROLLER ANGLE TO HORIZONTAL .     30.000 DEG

   SIDE ROLLER ANGLE TO VERTICAL .....     60.000 DEG
   SIDE ROLLER OFFSET FROM C.L. ......      1.000 M
   BED ROLLER LENGTH .................      1.500 M
   HEIGHT OF TOP ROLLER ABOVE BED ....        .000 M
   TENSIONER X-AXIS ROTATIONAL STIF. .        .000 KN/DEG
   TENSIONER Y-AXIS ROTATIONAL STIF. .        .000 KN/DEG
   TENSIONER Y-AXIS ROTATIONAL STIF. .        .000 KN/DEG

LAYBARGE DESCRIPTION
====================
   NUMBER OF PIPE NODES ..............         9
   BARGE GEOMETRY SPECIFIED BY .......         1 X-Y COORDINATES
   OVERBEND PIPE SUPPORT RADIUS ......      .000 M
   TANGENT POINT X-COORDINATE ........      .000 M
   TANGENT POINT Y-COORDINATE ........      .000 M
   PIPE ANGLE RELATIVE TO DECK .......     .0000 DEG
   HEIGHT OF DECK ABOVE WATER ........     1.000 M
   LAYBARGE FORWARD (X) OFFSET .......      .000 M
   BARGE TRIM ANGLE ..................     .0000 DEG

   STERN SHOE X COORDINATE ..........       .000 M
   STERN SHOE Y COORDINATE ...........      .000 M
   ROTATION CENTER X COORDINATE ......    31.930 M
   ROTATION CENTER Y COORDINATE ......     3.940 M
   ROTATION CENTER Z COORDINATE ......      .000 M
   BARGE HEADING .....................     .0000 DEG
   BARGE OFFSET FROM RIGHT-OF-WAY ....      .000 M
   PIPE RAMP PIVOT X COORDINATE ......      .000 M
   PIPE RAMP PIVOT Y COORDINATE ......      .000 M
   PIPE RAMP PIVOT ROTATION ANGLE ....      .000 DEG

================================================================================
OFFPIPE - OFFSHORE PIPELINE ANALYSIS SYSTEM - VERSION 2.05 AC          PAGE   7
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NODE X COORD (M)	NODE Y COORD (M)	SUPPORT TYPE	DAVIT SPACING (M)
61.000	1.516	2 PIPE TENSIONER	.000
38.000	1.516	8 USER DEFINED	.000

32.095	1.516	8	USER DEFINED	.000	
26.500	1.516	7	USER DEFINED	.000	
23.000	1.516	8	USER DEFINED	.000	
16.520	1.396	8	USER DEFINED	.000	
12.000	1.192	8	USER DEFINED	.000	
5.500	.723	8	USER DEFINED	.000	
.000	.160	8	USER DEFINED	.000	

STINGER DESCRIPTION
==========

NUMBER OF PIPE/STINGER NODES	6	
STINGER GEOMETRY SPECIFIED BY	1	X-Y COORD AND TANGENT PT
STINGER TYPE	2	STRAIGHT CONVENTIONAL
OVERBEND PIPE SUPPORT RADIUS	.00	M
HITCH X-COORDINATE	-.399	M
HITCH Y-COORDINATE	-.744	M
X COORDINATE OF LOCAL ORIGIN	-.399	M
Y COORDINATE OF LOCAL ORIGIN	-.744	M
ROTATION ABOUT STINGER HITCH	10.700	DEG
TANGENT POINT X-COORDINATE	.000	M
TANGENT POINT Y-COORDINATE	.000	M
TANGENT POINT ANGLE	.000	DEG

NODE X COORD (M)	NODE Y COORD (M)	SUPPORT TYPE		ELEMENT TYPE		ELEMENT LENGTH (M)
-6.900	1.222	9	USER DEFINED	1	FIXED END	.000
-14.130	1.371	9	USER DEFINED	1	FIXED END	.000
-20.180	1.359	9	USER DEFINED	1	FIXED END	.000
-24.930	1.261	9	USER DEFINED	1	FIXED END	.000
-30.000	1.116	9	USER DEFINED	1	FIXED END	.000
-31.792	1.116	9	USER DEFINED	1	FIXED END	.000

I N P U T D A T A E C H O

CURRENT VELOCITIES
==========

WATER DEPTH (M)	CURRENT SPEED (M/S)	DIRECTION OF TRAVEL (DEG)
.000	.250	45.000
1.900	.246	45.000
3.800	.243	45.000
5.700	.238	45.000
7.600	.233	45.000
9.500	.228	45.000
11.400	.222	45.000
13.300	.214	45.000
15.200	.204	45.000
17.100	.190	45.000
19.000	.114	45.000
20.000	.000	45.000

BARGE MOTION RAO TABLE (OFFPIPE) SIGN CONVENTION
==========

WAVE FREQUENCY (RAD/S)	SURGE AMPLITUDE (M/M)	SURGE PHASE (DEG)	SWAY AMPLITUDE (M/M)	SWAY PHASE (DEG)	HEAVE AMPLITUDE (M/M)	HEAVE PHASE (DEG)
.2510	.6450	99.00	.6790	97.00	.9290	7.00
.3140	.6380	103.00	.6660	101.00	.9120	11.00
.3310	.6360	105.00	.6610	102.00	.9060	12.00
.3490	.6330	106.00	.6550	104.00	.8980	13.00
.3700	.6300	108.00	.6470	105.00	.8880	15.00
.3930	.6260	111.00	.6380	107.00	.8740	17.00
.4190	.6210	114.00	.6250	110.00	.8560	19.00
.4490	.6140	117.00	.6070	113.00	.8310	22.00
.4830	.6040	122.00	.5830	116.00	.7970	25.00
.5240	.5920	127.00	.5500	120.00	.7480	30.00
.5710	.5740	134.00	.5030	126.00	.6780	35.00
.6280	.5490	144.00	.4330	133.00	.5770	42.00
.6980	.5100	156.00	.3300	140.00	.4270	50.00
.7850	.4490	174.00	.1710	145.00	.2120	51.00
.8380	.4050	-173.00	.1190	133.00	.1160	8.00
.8980	.3490	-159.00	.1160	75.00	.2220	-44.00
1.0470	.1870	-120.00	.3650	72.00	.7380	-31.00
1.2570	.0290	122.00	.4790	129.00	1.0920	9.00
1.5710	.0880	-117.00	.1740	98.00	.2370	-74.00
2.0940	.0100	-40.00	.2350	176.00	.1390	26.00

I N P U T D A T A E C H O

WAVE FREQUENCY (RAD/S)	ROLL AMPLITUDE (DEG/M)	ROLL PHASE (DEG)	PITCH AMPLITUDE (DEG/M)	PITCH PHASE (DEG)	YAW AMPLITUDE (DEG/M)	YAW PHASE (DEG)
.2510	.2420	98.00	.7970	-107.00	.3010	-176.00
.3140	.3860	103.00	1.2460	-100.00	.4610	-169.00
.3310	.4300	105.00	1.3830	-99.00	.5080	-167.00
.3490	.4820	106.00	1.5430	-98.00	.5620	-165.00
.3700	.5440	108.00	1.7320	-97.00	.6250	-163.00
.3930	.6180	111.00	1.9530	-96.00	.6980	-160.00
.4190	.7090	113.00	2.2130	-94.00	.7840	-157.00
.4490	.8220	117.00	2.5130	-93.00	.8860	-153.00
.4830	.9650	121.00	2.8560	-92.00	1.0050	-148.00
.5240	1.1480	126.00	3.2330	-90.00	1.1440	-142.00
.5710	1.3920	133.00	3.6200	-88.00	1.3050	-135.00
.6280	1.7410	142.00	3.9690	-84.00	1.4840	-125.00
.6980	2.3590	153.00	4.1890	-77.00	1.6650	-111.00
.7850	4.5700	126.00	4.1270	-66.00	1.7980	-92.00
.8380	1.4180	16.00	3.9160	-58.00	1.8100	-79.00
.8980	.6500	-161.00	3.5290	-47.00	1.7500	-63.00
1.0470	1.0760	-117.00	2.0510	-13.00	1.2140	-19.00
1.2570	.2960	-41.00	.1320	-154.00	.2660	-131.00
1.5710	.2430	70.00	.5850	-10.00	1.1920	5.00
2.0940	.9390	158.00	.0590	110.00	.2070	107.00

TIME INTEGRATION PARAMETERS
==========

TIME STEP LENGTH	.4000	SEC
SOLUTION STARTS AT TIME	60.000	SEC
MAXIMUM TIME OF INTEGRATION	10860.000	SEC
SOLUTION SAMPLING TIME STEP.....	.800	SEC
DAMPING RATIO	.0000	

CONTROL SWITCHES
==========

MAXIMUM STATIC ITERATIONS	400
MAX DYNAMIC ITERATIONS PER STEP ...	400

```
   PROBLEM TYPE (0=STATIC,1=DYNAMIC) .   1
   PINNED PIPE END ON SEABED .........   1
   DAVIT LIFT ANALYSIS (1=YES,0=NO) ..   0
   STOP INTEGRATION AT TIME STEP .....   0
   NUMBER OF DIMENSIONS (2 OR 3) .....   2
   INITIATION BY BOWLINE (1=YES,0=NO)    0
   SUPPORT RELEASE LOGIC PARAMETER ...   0

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OFFPIPE - OFFSHORE PIPELINE ANALYSIS SYSTEM - VERSION 2.05 AC          PAGE  10
Abandonment and Recovery Analysis in Sangatta
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WAVE SPECTRUM COEFFICIENTS
==========================
   NUMBER OF WAVES IN SPECTRUM .......        20
   1ST SPECTRUM COEFFICIENT ..........     .6130 M2/S4
   2ND SPECTRUM COEFFICIENT ..........     .7230 1/S**4
   MINIMUM FREQUENCY IN SPECTRUM .....     .2513 RAD/S
   MAXIMUM FREQUENCY IN SPECTRUM .....    2.0944 RAD/S
   DIRECTION OF WAVE TRAVEL ..........    45.000 DEG

WAVE PARAMETERS
===============
   WAVE HEIGHT (PEAK TO TROUGH) ......     2.110 M
   WAVE PERIOD .......................     7.200 SEC
   WAVE DIRECTION OF TRAVEL ..........    45.000 DEG
   WATER DEPTH FOR WAVE CALCULATIONS .     20.00 M

SAGBEND GEOMETRY
================
   SAGBEND PIPE ELEMENT LENGTH .......    12.100 M
   WATER DEPTH .......................     20.00 M
   ESTIMATED SAGBEND X LENGTH ........    140.00 M
   ESTIMATED PIPE LENGTH ON SEABED ...       .00 M
   X-COORD OF PIPE FREE END ON SEABED        .00 M
   ESTIMATED SPAN DEPTH FOR BOW LINE .       .00 M
   PIPE VERTICAL ANGLE AT SEABED .....      .000 DEG
   X-COORDINATE OF SPECIFIED DEPTH ...       .00 M
   MAXIMUM SLOPE (ANGLE) OF SEABED ...      .000 DEG
   DIRECTION OF MAXIMUM SLOPE ........      .000 DEG

CABLE PROPERTIES
================
   PIPE PROPERTY TABLE INDEX .........         1
   CABLE SECTION LENGTH ..............    24.000 M
   AXIAL STIFFNESS (EA) ..............       .00 KN
   BENDING STIFFNESS (EI) ............     .0000 KN-M**2
   WEIGHT PER-UNIT-LENGTH IN AIR .....        .0 N/M
   WEIGHT PER-UNIT-LENGTH SUBMERGED ..        .0 N/M

   CABLE DIAMETER ....................     3.200 CM
   DRAG COEFFICIENT ..................      .000
   CABLE CROSS SECTIONAL AREA ........      .000 KN
   ADDED MASS COEFFICIENT ............      .000

PIPE TENSION
============
   STATIC PIPE TENSION ON LAYBARGE ...   330.000 KN
   MINIMUM DYNAMIC PIPE TENSION ......      .000 KN
   MAXIMUM DYNAMIC PIPE TENSION ......      .000 KN

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OFFPIPE - OFFSHORE PIPELINE ANALYSIS SYSTEM - VERSION 2.05 AC          PAGE  11
Abandonment and Recovery Analysis in Sangatta
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                                              E R R O R   M E S S A G E

             ***** WARNING / INFORMATIVE MESSAGE NO. -   1 *****

    The total stinger weight (




================================================================================
OFFPIPE - OFFSHORE PIPELINE ANALYSIS SYSTEM - VERSION 2.05 AC          PAGE  12
Abandonment and Recovery Analysis in Sangatta
JOB NO. - 1                     LICENSED TO: RICKY TAWEKAL
USER ID - Moch. Ardiansyah      DATE -  7/ 1/2016   TIME -  5:34:12   CASE   2
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                        I N P U T   D A T A   E C H O


CABLE PROPERTIES
================
   PIPE PROPERTY TABLE INDEX .........         1
   CABLE SECTION LENGTH ..............    62.000 M
   AXIAL STIFFNESS (EA) ..............       .00 KN
   BENDING STIFFNESS (EI) ............     .0000 KN-M**2
   WEIGHT PER-UNIT-LENGTH IN AIR .....        .0 N/M
   WEIGHT PER-UNIT-LENGTH SUBMERGED ..        .0 N/M

   CABLE DIAMETER ....................     3.200 CM
   DRAG COEFFICIENT ..................      .000
   CABLE CROSS SECTIONAL AREA ........      .000 KN
   ADDED MASS COEFFICIENT ............      .000

PIPE TENSION
============
   STATIC PIPE TENSION ON LAYBARGE ...   330.000 KN
   MINIMUM DYNAMIC PIPE TENSION ......      .000 KN
   MAXIMUM DYNAMIC PIPE TENSION ......      .000 KN

             ***** WARNING / INFORMATIVE MESSAGE NO. -   1 *****

    The total stinger weight (




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OFFPIPE - OFFSHORE PIPELINE ANALYSIS SYSTEM - VERSION 2.05 AC          PAGE  13
Abandonment and Recovery Analysis in Sangatta
JOB NO. - 1                     LICENSED TO: RICKY TAWEKAL
USER ID - Moch. Ardiansyah      DATE -  7/ 1/2016   TIME -  5:34:12   CASE   3
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                        I N P U T   D A T A   E C H O


CABLE PROPERTIES
================
   PIPE PROPERTY TABLE INDEX .........         1
```

```
   CABLE SECTION LENGTH ..............    83.000 M
   AXIAL STIFFNESS (EA) ..............       .00 KN
   BENDING STIFFNESS (EI) ............     .0000 KN-M**2
   WEIGHT PER-UNIT-LENGTH IN AIR .....        .0 N/M
   WEIGHT PER-UNIT-LENGTH SUBMERGED ..        .0 N/M

   CABLE DIAMETER .....................     3.200 CM
   DRAG COEFFICIENT ...................      .000
   CABLE CROSS SECTIONAL AREA ........      .000 KN
   ADDED MASS COEFFICIENT ............      .000

PIPE TENSION
============
   STATIC PIPE TENSION ON LAYBARGE ...   210.000 KN
   MINIMUM DYNAMIC PIPE TENSION ......      .000 KN
   MAXIMUM DYNAMIC PIPE TENSION ......      .000 KN

             ***** WARNING / INFORMATIVE MESSAGE NO. -   1 *****

    The total stinger weight (
```



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                        I N P U T   D A T A   E C H O


CABLE PROPERTIES
================
   PIPE PROPERTY TABLE INDEX .........         1
   CABLE SECTION LENGTH ..............    94.000 M
   AXIAL STIFFNESS (EA) ..............       .00 KN
   BENDING STIFFNESS (EI) ............     .0000 KN-M**2
   WEIGHT PER-UNIT-LENGTH IN AIR .....        .0 N/M
   WEIGHT PER-UNIT-LENGTH SUBMERGED ..        .0 N/M

   CABLE DIAMETER .....................     3.200 CM
   DRAG COEFFICIENT ...................      .000
   CABLE CROSS SECTIONAL AREA ........      .000 KN
   ADDED MASS COEFFICIENT ............      .000

PIPE TENSION
============
   STATIC PIPE TENSION ON LAYBARGE ...   180.000 KN
   MINIMUM DYNAMIC PIPE TENSION ......      .000 KN
   MAXIMUM DYNAMIC PIPE TENSION ......      .000 KN

             ***** WARNING / INFORMATIVE MESSAGE NO. -   1 *****

    The total stinger weight (
```



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                        I N P U T   D A T A   E C H O


CABLE PROPERTIES
================
   PIPE PROPERTY TABLE INDEX .........         1
   CABLE SECTION LENGTH ..............   120.000 M
   AXIAL STIFFNESS (EA) ..............       .00 KN
   BENDING STIFFNESS (EI) ............     .0000 KN-M**2
   WEIGHT PER-UNIT-LENGTH IN AIR .....        .0 N/M
   WEIGHT PER-UNIT-LENGTH SUBMERGED ..        .0 N/M

   CABLE DIAMETER .....................     3.200 CM
   DRAG COEFFICIENT ...................      .000
   CABLE CROSS SECTIONAL AREA ........      .000 KN
   ADDED MASS COEFFICIENT ............      .000

PIPE TENSION
============
   STATIC PIPE TENSION ON LAYBARGE ...    75.000 KN
   MINIMUM DYNAMIC PIPE TENSION ......      .000 KN
   MAXIMUM DYNAMIC PIPE TENSION ......      .000 KN

             ***** WARNING / INFORMATIVE MESSAGE NO. -   1 *****

    The total stinger weight (
```



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                        I N P U T   D A T A   E C H O


CABLE PROPERTIES
================
   PIPE PROPERTY TABLE INDEX .........         1
   CABLE SECTION LENGTH ..............   147.000 M
   AXIAL STIFFNESS (EA) ..............       .00 KN
   BENDING STIFFNESS (EI) ............     .0000 KN-M**2
   WEIGHT PER-UNIT-LENGTH IN AIR .....        .0 N/M
   WEIGHT PER-UNIT-LENGTH SUBMERGED ..        .0 N/M

   CABLE DIAMETER .....................     3.200 CM
   DRAG COEFFICIENT ...................      .000
   CABLE CROSS SECTIONAL AREA ........      .000 KN
   ADDED MASS COEFFICIENT ............      .000

PIPE TENSION
============
   STATIC PIPE TENSION ON LAYBARGE ...    20.000 KN
   MINIMUM DYNAMIC PIPE TENSION ......      .000 KN
   MAXIMUM DYNAMIC PIPE TENSION ......      .000 KN

             ***** WARNING / INFORMATIVE MESSAGE NO. -   1 *****

    The total stinger weight (

END OF INPUT DATA
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OFFPIPE - OFFSHORE PIPELINE ANALYSIS SYSTEM - VERSION 2.05 AC DATE - 7/ 1/2016 TIME - 5:34:12 PAGE 17
PROJECT - Abandonment and Recovery Analysis in Sangatta JOB NO. - 1
USER ID - Moch. Ardiansyah LICENSED TO: RICKY TAWEKAL CASE 1

S T A T I C P I P E C O O R D I N A T E S, F O R C E S A N D S T R E S S E S

NODE NO.	PIPE SECTION	X COORD (M)	Y COORD (M)	Z COORD (M)	HORIZ ANGLE (DEG)	VERT ANGLE (DEG)	PIPE LENGTH (M)	TENSILE STRESS (MPA)	HOOP STRESS (MPA)	BENDING STRESSES VERT (MPA)	BENDING STRESSES HORIZ (MPA)	TOTAL STRESS (MPA)	PERCNT YIELD (PCT)
1	TENSIONR	61.00	2.52	.00	.000	.000	.000	.00	.00	.00	.00	.00	.00
3	LAYBARGE	38.00	2.52	.00	.000	-.002	23.000	6.71	.00	.41	-.01	7.12	1.98
5	LAYBARGE	32.09	2.52	.00	.000	.019	28.905	6.71	.00	-11.39	-.21	18.11	5.03
7	TENSIONR	26.50	2.52	.00	.001	-.079	34.500	13.42	.00	20.49	.50	33.92	9.42
9	LAYBARGE	23.00	2.52	.00	.001	.253	38.000	13.37	.00	-203.07	-.52	216.44	60.12
11	LAYBARGE	16.52	2.40	.00	-.001	1.934	44.481	13.32	.00	-269.04	.11	282.36	78.43
13	LAYBARGE	12.00	2.19	.00	.001	3.217	49.006	13.29	.00	-253.36	.44	266.66	74.07
15	LAYBARGE	5.50	1.72	.00	-.003	5.074	55.523	13.19	.00	-278.41	-1.17	291.60	81.00
17	LAYBARGE	.00	1.16	.00	.010	6.547	61.052	13.12	.00	-213.26	5.36	226.45	62.90
20	STINGER	-7.41	.21	.00	.046	7.875	68.524	12.98	.00	-128.37	3.26	141.40	39.28
22	STINGER	-14.57	-.84	-.01	.064	8.819	75.756	12.82	-.13	-119.81	1.21	132.71	36.86
24	STINGER	-20.54	-1.81	-.02	.066	9.687	81.806	12.67	-.29	-148.38	-.48	161.19	44.78
26	STINGER	-25.22	-2.64	-.02	.060	10.560	86.557	12.53	-.42	-191.97	-1.91	204.73	56.87
28	STINGER	-30.19	-3.62	-.03	.045	11.801	91.629	12.35	-.58	-261.39	-3.60	274.06	76.13
30	STINGER	-31.94	-4.00	-.03	.037	12.341	93.421	12.28	-.64	-284.16	-4.17	296.79	82.44
32	SAGBEND	-43.70	-6.86	-.03	-.005	14.545	105.521	11.95	-1.10	-62.93	-2.07	75.47	20.96
33	SAGBEND	-55.41	-9.92	-.03	-.023	14.418	117.621	11.50	-1.59	70.16	-.81	82.48	22.91
34	SAGBEND	-67.16	-12.79	-.02	-.029	12.940	129.721	11.06	-2.05	146.65	-.12	158.75	44.10
35	SAGBEND	-79.00	-15.28	-.02	-.028	10.703	141.821	10.68	-2.45	187.96	.22	199.88	55.52
36	SAGBEND	-90.94	-17.26	-.01	-.024	8.091	153.921	10.39	-2.77	204.73	.36	216.52	60.14
37	SAGBEND	-102.95	-18.68	-.01	-.019	5.395	166.021	10.18	-3.00	200.56	.39	212.26	58.96
38	SAGBEND	-115.02	-19.55	.00	-.014	2.901	178.121	10.07	-3.14	173.44	.42	185.09	51.42
39	SAGBEND	-127.11	-19.94	.00	-.008	.956	190.222	10.03	-3.20	115.35	.53	127.01	35.28
40	SEABED	-139.21	-20.03	.00	-.002	.030	202.322	10.03	-3.22	26.00	.33	37.74	10.48
41	SEABED	-151.31	-20.02	.00	.000	-.043	214.422	10.03	-3.21	-2.90	.02	14.80	4.11
42	SEABED	-163.41	-20.01	.00	.000	-.066	226.522	10.03	-3.21	8.74	-.02	20.57	5.71
43	SEABED	-175.51	-19.98	.00	.000	-.192	238.623	10.04	-3.21	.00	.00	11.97	3.32

OFFPIPE - OFFSHORE PIPELINE ANALYSIS SYSTEM - VERSION 2.05 AC DATE - 7/ 1/2016 TIME - 5:34:12 PAGE 18
PROJECT - Abandonment and Recovery Analysis in Sangatta JOB NO. - 1
USER ID - Moch. Ardiansyah LICENSED TO: RICKY TAWEKAL CASE 1

S T A T I C P I P E C O O R D I N A T E S, F O R C E S A N D S T R E S S E S

NODE NO.	PIPE SECTION	X COORD (M)	Y COORD (M)	Z COORD (M)	SUPPORT REACTION VERT (KN)	SUPPORT REACTION HORIZ (KN)	SUPT SEPARATIONS VERT (M)	SUPT SEPARATIONS HORIZ (M)	PIPE TENSION (KN)	BENDING MOMENTS VERT (KN-M)	BENDING MOMENTS HORIZ (KN-M)	BENDING MOMENTS TOTAL (KN-M)
1	TENSIONR	61.00	2.52	.00	.50	.00	.00	.00	165.04	.00	.00	.00
3	LAYBARGE	38.00	2.52	.00	6.34	.12	.00	.00	165.04	1.19	-.02	1.19
5	LAYBARGE	32.09	2.52	.00	62.66	-.58	.00	.00	165.03	-33.40	-.62	33.41
7	TENSIONR	26.50	2.52	.00	-222.61	1.55	.00	.00	329.99	60.09	1.46	60.10
9	LAYBARGE	23.00	2.52	.00	218.11	-1.38	.00	.00	328.72	-595.49	-1.54	595.49
11	LAYBARGE	16.52	2.40	.00	72.31	.07	.00	.00	327.40	-788.96	.33	788.96
13	LAYBARGE	12.00	2.19	.00	7.57	1.16	.00	.00	326.76	-742.98	1.30	742.98
15	LAYBARGE	5.50	1.72	.00	86.99	-4.68	.00	.00	324.16	-816.44	-3.44	816.45
17	LAYBARGE	.00	1.16	.00	35.41	4.90	.00	.00	322.55	-625.39	15.73	625.59
20	STINGER	-7.41	.21	.00	.00	.00	.04	.00	319.06	-376.46	9.55	376.58
22	STINGER	-14.57	-.84	-.01	.00	.00	.19	-.01	316.84	-351.35	3.56	351.37
24	STINGER	-20.54	-1.81	-.02	.00	.00	.22	-.02	315.12	-435.11	-1.42	435.11
26	STINGER	-25.22	-2.64	-.02	.00	.00	.17	-.02	313.40	-562.96	-5.60	562.99
28	STINGER	-30.19	-3.62	-.03	.00	.00	.03	-.03	311.00	-766.53	-10.56	766.61
30	STINGER	-31.94	-4.00	-.03	125.26	-1.79	.00	-.03	309.94	-833.30	-12.23	833.39
32	SAGBEND	-43.70	-6.86	-.03	.00	.00	.00	.00	307.75	-184.54	-6.08	184.64
33	SAGBEND	-55.41	-9.92	-.03	.00	.00	.00	.00	302.97	205.76	-2.37	205.77
34	SAGBEND	-67.16	-12.79	-.02	.00	.00	.00	.00	298.03	430.04	-.36	430.04
35	SAGBEND	-79.00	-15.28	-.02	.00	.00	.00	.00	293.77	551.19	.65	551.19
36	SAGBEND	-90.94	-17.26	-.01	.00	.00	.00	.00	290.50	600.37	1.04	600.37
37	SAGBEND	-102.95	-18.68	-.01	.00	.00	.00	.00	288.34	588.13	1.14	588.14
38	SAGBEND	-115.02	-19.55	.00	.00	.00	.00	.00	287.27	508.61	1.23	508.61
39	SAGBEND	-127.11	-19.94	.00	2.87	.10	.00	.00	287.13	338.25	1.56	338.26
40	SEABED	-139.21	-20.03	.00	32.57	.06	.00	.00	287.39	76.24	.98	76.24
41	SEABED	-151.31	-20.02	.00	28.60	-.07	.00	.00	287.40	-8.50	.05	8.50
42	SEABED	-163.41	-20.01	.00	13.49	-.01	.00	.00	287.40	25.64	-.05	25.64
43	SEABED	-175.51	-19.98	.00	.00	.00	.00	.00	287.44	.00	.00	.00

OFFPIPE - OFFSHORE PIPELINE ANALYSIS SYSTEM - VERSION 2.05 AC PAGE 19
Abandonment and Recovery Analysis in Sangatta
JOB NO. - 1 LICENSED TO: RICKY TAWEKAL
USER ID - Moch. Ardiansyah DATE - 7/ 1/2016 TIME - 5:34:12 CASE 1

S T A T I C S O L U T I O N S U M M A R Y

PIPE PROPERTIES (2)

PIPE SECTION LENGTH ..	.00 M	ELASTIC MODULUS	207000. MPA
OUTSIDE DIAMETER	50.800 CM	CROSS SECTIONAL AREA .	250.00 CM2
WALL THICKNESS	1.590 CM	MOMENT OF INERTIA	74490.00 CM4
WEIGHT/LENGTH IN AIR .	4567.997 N/M	YIELD STRESS	360.00 MPA
SUBMERGED WGHT/LENG ..	1556.660 N/M	STRESS INTENS FACTOR .	1.000
SPECIFIC GRAVITY	1.517	STEEL DENSITY	77008.5 N/M3
WRAP COAT THICKNESS ..	.250 CM	WRAP COAT DENSITY	9397.6 N/M3
CONCRETE THICKNESS ...	5.000 CM	CONCRETE DENSITY	29822.4 N/M3

BARGE DATA

TOTAL PIPE TENSION ...	330.04 KN	RADIUS OF CURVATURE ..	.00 M
NUMBER OF TENSIONERS .	2	BARGE TRIM ANGLE	.000 DEG
NO. OF PIPE SUPPORTS .	7	PIPE ANGLE AT STERN ..	6.547 DEG
BARGE HEADING	.000 DEG	OFFSET FROM R.O.W. ...	.00 M

STINGER DATA

NO. OF PIPE SUPPORTS .	6	STINGER STERN DEPTH ..	-4.00 M
NO. STINGER SECTIONS .	6	PIPE ANGLE AT STERN ..	12.341 DEG
RADIUS OF CURVATURE ..	.00 M	STINGER LENGTH	31.90 M

SAGBEND DATA

WATER DEPTH	20.00 M	HORIZ PIPE TENSION ...	287.44 KN
TOUCHDOWN X-COORD. ...	-131.72 M	BOTTOM SLOPE ANGLE ...	.000 DEG

SOLUTION SUMMARY

NODE NO.	PIPE SECTION	X COORD	Y COORD	Z COORD	SUPPORT REACT VERT	SUPPORT REACT HORIZ	TOTAL MOMENT	TOTAL STRESS	PCT YLD
1	TENSIONR	61.0	2.5	.0	.5	.0	.0	.0	0.
3	LAYBARGE	38.0	2.5	.0	6.3	.1	1.2	7.1	2.
5	LAYBARGE	32.1	2.5	.0	62.7	-.6	33.4	18.1	5.
7	TENSIONR	26.5	2.5	.0	-222.6	1.6	60.1	33.9	9.
9	LAYBARGE	23.0	2.5	.0	218.1	-1.4	595.5	216.4	60.
11	LAYBARGE	16.5	2.4	.0	72.3	.1	789.0	282.4	78.
13	LAYBARGE	12.0	2.2	.0	7.6	1.2	743.0	266.7	74.

15	LAYBARGE	5.5	1.7	.0	87.0	-4.7	816.5	291.6	81.
17	LAYBARGE	.0	1.2	.0	35.4	4.9	625.6	226.5	63.
20	STINGER	-7.4	.2	.0	.0	.0	376.6	141.4	39.
22	STINGER	-14.6	-.8	.0	.0	.0	351.4	132.7	37.
24	STINGER	-20.5	-1.8	.0	.0	.0	435.1	161.2	45.
26	STINGER	-25.2	-2.6	.0	.0	.0	563.0	204.7	57.
28	STINGER	-30.2	-3.6	.0	.0	.0	766.6	274.1	76.
30	STINGER	-31.9	-4.0	.0	125.3	-1.8	833.4	296.8	82.
36	SAGBEND	-90.9	-17.3	.0	.0	.0	600.4	216.5	60.

S T A T I C S O L U T I O N S U M M A R Y

40	SEABED	-139.2	-20.0	.0	32.6	.1	76.2	37.7	10.

OFFPIPE - OFFSHORE PIPELINE ANALYSIS SYSTEM - VERSION 2.05 AC DATE - 7/ 1/2016 TIME - 5:34:12 PAGE 21
PROJECT - Abandonment and Recovery Analysis in Sangatta JOB NO. - 1
USER ID - Moch. Ardiansyah LICENSED TO: RICKY TAWEKAL CASE 2

S T A T I C P I P E C O O R D I N A T E S, F O R C E S A N D S T R E S S E S

NODE NO.	PIPE SECTION	X COORD (M)	Y COORD (M)	Z COORD (M)	HORIZ ANGLE (DEG)	VERT ANGLE (DEG)	PIPE LENGTH (M)	TENSILE STRESS (MPA)	HOOP STRESS (MPA)	BENDING STRESSES VERT (MPA)	BENDING STRESSES HORIZ (MPA)	TOTAL STRESS (MPA)	PERCNT YIELD (PCT)
1	TENSIONR	61.00	2.52	.00	.000	.000	.000	.00	.00	.00	.00	.00	.00
3	LAYBARGE	38.00	2.52	.00	.000	.000	23.000	.00	.00	.00	.00	.00	.00
5	LAYBARGE	32.09	2.52	.00	.000	.000	28.905	.00	.00	.00	.00	.00	.00
7	TENSIONR	26.50	2.52	.00	.000	.000	34.500	.00	.00	.00	.00	.00	.00
9	LAYBARGE	23.00	2.52	.00	.000	.531	38.000	.00	.00	.00	.00	.00	.00
11	LAYBARGE	16.52	2.40	.00	.000	1.823	44.481	.00	.00	.00	.00	.00	.00
13	LAYBARGE	12.00	2.19	.00	.000	3.356	49.006	.00	.00	.00	.00	.00	.00
15	LAYBARGE	5.50	1.72	.00	.034	4.859	55.523	.00	.00	.00	.00	.00	.00
17	LAYBARGE	.00	1.18	-.01	.050	7.857	61.053	13.41	.00	.00	.00	13.41	3.73
20	STINGER	-7.40	.15	-.01	.049	8.113	68.524	13.21	.00	-74.38	-.26	87.60	24.33
22	STINGER	-14.56	-.91	-.02	.046	8.747	75.756	13.05	-.15	-90.68	-.62	103.80	28.83
24	STINGER	-20.53	-1.86	-.02	.040	9.471	81.806	12.90	-.30	-133.55	-1.07	146.60	40.72
26	STINGER	-25.21	-2.67	-.03	.034	10.294	86.557	12.76	-.43	-187.68	-1.56	200.67	55.74
28	STINGER	-30.19	-3.63	-.03	.023	11.543	91.629	12.58	-.58	-268.19	-2.31	281.08	78.08
30	STINGER	-31.95	-4.00	-.03	.018	12.099	93.421	12.50	-.64	-293.45	-3.16	306.29	85.08
32	SAGBEND	-43.71	-6.82	-.03	-.014	14.402	105.521	12.19	-1.10	-68.77	-1.49	81.53	22.65
33	SAGBEND	-55.42	-9.86	-.03	-.026	14.339	117.621	11.75	-1.58	65.93	-.47	78.48	21.80
34	SAGBEND	-67.18	-12.73	-.02	-.029	12.913	129.722	11.31	-2.04	143.08	.07	155.42	43.17
35	SAGBEND	-79.02	-15.21	-.01	-.026	10.720	141.822	10.93	-2.44	184.83	.32	196.99	54.72
36	SAGBEND	-90.96	-17.20	-.01	-.021	8.145	153.922	10.63	-2.76	202.18	.40	214.21	59.50
37	SAGBEND	-102.97	-18.63	-.01	-.016	5.477	166.022	10.42	-2.99	199.02	.38	210.96	58.60
38	SAGBEND	-115.04	-19.52	.00	-.011	2.993	178.122	10.30	-3.13	173.61	.36	185.50	51.53
39	SAGBEND	-127.13	-19.93	.00	-.006	1.030	190.222	10.26	-3.20	118.23	.41	130.13	36.15
40	SEABED	-139.23	-20.03	.00	-.001	.050	202.322	10.26	-3.22	29.53	.24	41.50	11.53
41	SEABED	-151.33	-20.02	.00	.000	-.045	214.422	10.27	-3.21	-2.60	.01	14.74	4.09
42	SEABED	-163.43	-20.01	.00	.000	-.067	226.523	10.27	-3.21	8.57	-.01	20.63	5.73
43	SEABED	-175.53	-19.98	.00	.000	-.192	238.623	10.27	-3.21	.00	.00	12.20	3.39

OFFPIPE - OFFSHORE PIPELINE ANALYSIS SYSTEM - VERSION 2.05 AC DATE - 7/ 1/2016 TIME - 5:34:12 PAGE 22
PROJECT - Abandonment and Recovery Analysis in Sangatta JOB NO. - 1
USER ID - Moch. Ardiansyah LICENSED TO: RICKY TAWEKAL CASE 2

S T A T I C P I P E C O O R D I N A T E S, F O R C E S A N D S T R E S S E S

NODE NO.	PIPE SECTION	X COORD (M)	Y COORD (M)	Z COORD (M)	SUPPORT REACTION VERT (KN)	SUPPORT REACTION HORIZ (KN)	SUPT SEPARATIONS VERT (M)	SUPT SEPARATIONS HORIZ (M)	PIPE TENSION (KN)	BENDING MOMENTS VERT (KN-M)	BENDING MOMENTS HORIZ (KN-M)	BENDING MOMENTS TOTAL (KN-M)
1	TENSIONR	61.00	2.52	.00	.50	.00	.00	.00	165.00	.00	.00	.00
3	LAYBARGE	38.00	2.52	.00	.63	.00	.00	.00	165.00	.12	.00	.00
5	LAYBARGE	32.09	2.52	.00	.25	.00	.00	.00	165.00	.05	.00	.00
7	TENSIONR	26.50	2.52	.00	.20	.00	.00	.00	330.00	.05	.00	.00
9	LAYBARGE	23.00	2.52	.00	6.33	.00	.00	.00	329.98	1.19	.00	.00
11	LAYBARGE	16.52	2.40	.00	9.01	.00	.00	.00	329.96	1.69	.00	.00
13	LAYBARGE	12.00	2.19	.00	9.12	.00	.00	.00	329.95	1.71	.00	.00
15	LAYBARGE	5.50	1.72	.00	8.69	.39	.00	.00	329.94	1.63	-.07	.00
17	LAYBARGE	.00	1.18	-.01	.00	.00	.02	-.01	329.68	.00	.00	.00
20	STINGER	-7.40	.15	-.01	52.04	.01	.00	-.01	324.80	-218.12	-.76	218.12
22	STINGER	-14.56	-.91	-.02	.00	.00	.12	-.02	322.63	-265.91	-1.82	265.91
24	STINGER	-20.53	-1.86	-.02	.00	.00	.16	-.02	320.88	-391.63	-3.15	391.65
26	STINGER	-25.21	-2.67	-.03	.00	.00	.14	-.03	319.12	-550.38	-4.57	550.40
28	STINGER	-30.19	-3.63	-.03	2.22	1.28	.02	-.03	316.61	-786.48	-6.77	786.51
30	STINGER	-31.95	-4.00	-.03	131.16	-2.33	.00	-.03	315.50	-860.54	-9.27	860.59
32	SAGBEND	-43.71	-6.82	-.03	.00	.00	.00	.00	313.51	-201.67	-4.38	201.71
33	SAGBEND	-55.42	-9.86	-.03	.00	.00	.00	.00	308.80	193.33	-1.38	193.33
34	SAGBEND	-67.18	-12.73	-.02	.00	.00	.00	.00	303.89	419.59	.21	419.59
35	SAGBEND	-79.02	-15.21	-.01	.00	.00	.00	.00	299.64	542.00	.95	542.00
36	SAGBEND	-90.96	-17.20	-.01	.00	.00	.00	.00	296.36	592.89	1.17	592.89
37	SAGBEND	-102.97	-18.63	-.01	.00	.00	.00	.00	294.16	583.63	1.12	583.63
38	SAGBEND	-115.04	-19.52	.00	.00	.00	.00	.00	293.04	509.10	1.06	509.10
39	SAGBEND	-127.13	-19.93	.00	2.10	.07	.00	.00	292.85	346.72	1.19	346.72
40	SEABED	-139.23	-20.03	.00	31.28	.04	.00	.00	293.11	86.59	.70	86.60
41	SEABED	-151.33	-20.02	.00	29.26	-.05	.00	.00	293.13	-7.62	.03	7.62
42	SEABED	-163.43	-20.01	.00	13.64	-.01	.00	.00	293.13	25.12	-.04	25.12
43	SEABED	-175.53	-19.98	.00	.00	.00	.00	.00	293.17	.00	.00	.00

OFFPIPE - OFFSHORE PIPELINE ANALYSIS SYSTEM - VERSION 2.05 AC PAGE 23
Abandonment and Recovery Analysis in Sangatta
JOB NO. - 1 LICENSED TO: RICKY TAWEKAL
USER ID - Moch. Ardiansyah DATE - 7/ 1/2016 TIME - 5:34:12 CASE 2

S T A T I C S O L U T I O N S U M M A R Y

PIPE PROPERTIES (2)

PIPE SECTION LENGTH ..	.00 M	ELASTIC MODULUS	207000. MPA
OUTSIDE DIAMETER	50.800 CM	CROSS SECTIONAL AREA .	250.00 CM2
WALL THICKNESS	1.590 CM	MOMENT OF INERTIA	74490.00 CM4
WEIGHT/LENGTH IN AIR .	4567.997 N/M	YIELD STRESS	360.00 MPA
SUBMERGED WGHT/LENG ..	1556.660 N/M	STRESS INTENS FACTOR .	1.000
SPECIFIC GRAVITY	1.517	STEEL DENSITY	77008.5 N/M3
WRAP COAT THICKNESS ..	.250 CM	WRAP COAT DENSITY	9397.6 N/M3
CONCRETE THICKNESS ...	5.000 CM	CONCRETE DENSITY	29822.4 N/M3

BARGE DATA

TOTAL PIPE TENSION ...	330.00 KN	RADIUS OF CURVATURE ..	.00 M
NUMBER OF TENSIONERS .	2	BARGE TRIM ANGLE	.000 DEG
NO. OF PIPE SUPPORTS .	7	PIPE ANGLE AT STERN ..	7.857 DEG
BARGE HEADING	.000 DEG	OFFSET FROM R.O.W. ...	.00 M

STINGER DATA

NO. OF PIPE SUPPORTS .	6	STINGER STERN DEPTH ..	-4.00 M
NO. STINGER SECTIONS .	6	PIPE ANGLE AT STERN ..	12.099 DEG
RADIUS OF CURVATURE ..	.00 M	STINGER LENGTH	31.90 M

SAGBEND DATA

WATER DEPTH	20.00 M	HORIZ PIPE TENSION ...	293.17 KN
TOUCHDOWN X-COORD. ...	-132.38 M	BOTTOM SLOPE ANGLE ...	.000 DEG

SOLUTION SUMMARY

NODE NO.	PIPE SECTION	X COORD	Y COORD	Z COORD	SUPPORT REACT VERT	SUPPORT REACT HORIZ	TOTAL MOMENT	TOTAL STRESS	PCT YLD
1	TENSIONR	61.0	2.5	.0	.5	.0	.0	.0	0.
3	LAYBARGE	38.0	2.5	.0	.6	.0	.0	.0	0.
5	LAYBARGE	32.1	2.5	.0	.2	.0	.0	.0	0.
7	TENSIONR	26.5	2.5	.0	.2	.0	.0	.0	0.
9	LAYBARGE	23.0	2.5	.0	6.3	.0	.0	.0	0.
11	LAYBARGE	16.5	2.4	.0	9.0	.0	.0	.0	0.
13	LAYBARGE	12.0	2.2	.0	9.1	.0	.0	.0	0.

15	LAYBARGE	5.5	1.7	.0	8.7	.4	.0	.0	0.
17	LAYBARGE	.0	1.2	.0	.0	.0	.0	13.4	4.
20	STINGER	-7.4	.2	.0	52.0	.0	218.1	87.6	24.
22	STINGER	-14.6	-.9	.0	.0	.0	265.9	103.8	29.
24	STINGER	-20.5	-1.9	.0	.0	.0	391.6	146.6	41.
26	STINGER	-25.2	-2.7	.0	.0	.0	550.4	200.7	56.
28	STINGER	-30.2	-3.6	.0	2.2	1.3	786.5	281.1	78.
30	STINGER	-31.9	-4.0	.0	131.2	-2.3	860.6	306.3	85.
36	SAGBEND	-91.0	-17.2	.0	.0	.0	592.9	214.2	60.

S T A T I C S O L U T I O N S U M M A R Y

40	SEABED	-139.2	-20.0	.0	31.3	.0	86.6	41.5	12.

OFFPIPE - OFFSHORE PIPELINE ANALYSIS SYSTEM - VERSION 2.05 AC DATE - 7/ 1/2016 TIME - 5:34:12 PAGE 25
PROJECT - Abandonment and Recovery Analysis in Sangatta JOB NO. - 1
USER ID - Moch. Ardiansyah LICENSED TO: RICKY TAWEKAL CASE 3

S T A T I C P I P E C O O R D I N A T E S, F O R C E S A N D S T R E S S E S

NODE NO.	PIPE SECTION	X COORD (M)	Y COORD (M)	Z COORD (M)	HORIZ ANGLE (DEG)	VERT ANGLE (DEG)	PIPE LENGTH (M)	TENSILE STRESS (MPA)	HOOP STRESS (MPA)	BENDING STRESSES VERT (MPA)	BENDING STRESSES HORIZ (MPA)	TOTAL STRESS (MPA)	PERCNT YIELD (PCT)
1	TENSIONR	61.00	2.52	.00	.000	.000	.000	.00	.00	.00	.00	.00	.00
3	LAYBARGE	38.00	2.52	.00	.000	.000	23.000	.00	.00	.00	.00	.00	.00
5	LAYBARGE	32.09	2.52	.00	.000	.000	28.905	.00	.00	.00	.00	.00	.00
7	TENSIONR	26.50	2.52	.00	.000	.000	34.500	.00	.00	.00	.00	.00	.00
9	LAYBARGE	23.00	2.52	.00	.000	.531	38.000	.00	.00	.00	.00	.00	.00
11	LAYBARGE	16.52	2.40	.00	.000	1.823	44.481	.00	.00	.00	.00	.00	.00
13	LAYBARGE	12.00	2.19	.00	.000	3.356	49.006	.00	.00	.00	.00	.00	.00
15	LAYBARGE	5.50	1.72	.00	.000	4.986	55.523	.00	.00	.00	.00	.00	.00
17	LAYBARGE	.00	1.16	.00	.040	5.822	61.052	.00	.00	.00	.00	.00	.00
20	STINGER	-7.43	.41	-.01	.081	5.758	68.523	.00	.00	.00	.00	.00	.00
22	STINGER	-14.61	-.31	-.02	.081	5.680	75.734	.00	.00	.00	.00	.00	.00
24	STINGER	-20.79	-.92	-.03	-.006	15.053	81.962	8.35	-.15	.00	.00	8.42	2.34
26	STINGER	-25.36	-2.16	-.03	-.008	15.207	86.694	8.16	-.35	-61.60	-.55	69.94	19.43
28	STINGER	-30.23	-3.50	-.03	-.013	15.760	91.743	7.95	-.56	-142.11	-1.23	150.34	41.76
30	STINGER	-31.94	-3.99	-.03	-.016	16.067	93.525	7.86	-.64	-167.32	-1.45	175.52	48.75
32	SAGBEND	-43.44	-7.45	-.02	-.028	16.989	105.531	7.39	-1.20	19.22	-.46	27.23	7.56
33	SAGBEND	-55.04	-10.90	-.02	-.030	15.856	117.631	6.87	-1.75	142.78	.15	150.53	41.81
34	SAGBEND	-66.74	-13.97	-.01	-.026	13.441	129.731	6.39	-2.24	216.53	.45	224.05	62.24
35	SAGBEND	-78.58	-16.47	-.01	-.019	10.312	141.831	6.00	-2.64	252.18	.53	259.52	72.09
36	SAGBEND	-90.54	-18.29	.00	-.012	6.937	153.931	5.74	-2.94	254.26	.48	261.47	72.63
37	SAGBEND	-102.59	-19.41	.00	-.007	3.758	166.031	5.59	-3.12	221.78	.36	228.94	63.60
38	SAGBEND	-114.67	-19.92	.00	-.003	1.266	178.131	5.55	-3.20	148.49	.25	155.66	43.24
39	SEABED	-126.77	-20.03	.00	.000	.046	190.231	5.56	-3.22	36.31	.09	43.56	12.10
40	SEABED	-138.87	-20.02	.00	.000	-.061	202.332	5.56	-3.21	-5.45	.00	12.92	3.59
41	SEABED	-150.97	-20.01	.00	.000	-.001	214.432	5.56	-3.21	-1.34	.00	8.94	2.48
42	SEABED	-163.07	-20.01	.00	.000	-.058	226.532	5.56	-3.21	10.78	.00	18.15	5.04
43	SEABED	-175.17	-19.98	.00	.000	-.198	238.632	5.56	-3.21	.00	.00	7.69	2.13

OFFPIPE - OFFSHORE PIPELINE ANALYSIS SYSTEM - VERSION 2.05 AC DATE - 7/ 1/2016 TIME - 5:34:12 PAGE 26
PROJECT - Abandonment and Recovery Analysis in Sangatta JOB NO. - 1
USER ID - Moch. Ardiansyah LICENSED TO: RICKY TAWEKAL CASE 3

S T A T I C P I P E C O O R D I N A T E S, F O R C E S A N D S T R E S S E S

NODE NO.	PIPE SECTION	X COORD (M)	Y COORD (M)	Z COORD (M)	SUPPORT REACTION VERT (KN)	SUPPORT REACTION HORIZ (KN)	SUPT SEPARATIONS VERT (M)	SUPT SEPARATIONS HORIZ (M)	PIPE TENSION (KN)	BENDING MOMENTS VERT (KN-M)	BENDING MOMENTS HORIZ (KN-M)	BENDING MOMENTS TOTAL (KN-M)
1	TENSIONR	61.00	2.52	.00	.50	.00	.00	.00	105.06	.00	.00	.00
3	LAYBARGE	38.00	2.52	.00	.63	.00	.00	.00	105.06	.12	.00	.00
5	LAYBARGE	32.09	2.52	.00	.25	.00	.00	.00	105.06	.05	.00	.00
7	TENSIONR	26.50	2.52	.00	.20	.00	.00	.00	210.06	.05	.00	.00
9	LAYBARGE	23.00	2.52	.00	4.11	.00	.00	.00	210.05	.77	.00	.00
11	LAYBARGE	16.52	2.40	.00	5.82	.00	.00	.00	210.04	1.09	.00	.00
13	LAYBARGE	12.00	2.19	.00	5.89	.00	.00	.00	210.03	1.10	.00	.00
15	LAYBARGE	5.50	1.72	.00	6.56	.00	.00	.00	210.00	1.23	.00	.00
17	LAYBARGE	.00	1.16	.00	.12	.29	.00	.00	210.00	.02	-.06	.00
20	STINGER	-7.43	.41	-.01	.00	.00	.23	-.01	209.97	.00	.00	.00
22	STINGER	-14.61	-.31	-.02	.00	.00	.71	-.02	209.94	.00	.00	.00
24	STINGER	-20.79	-.92	-.03	.00	.00	1.14	-.03	207.07	.00	.00	.00
26	STINGER	-25.36	-2.16	-.03	.00	.00	.68	-.03	205.05	-180.64	-1.62	180.65
28	STINGER	-30.23	-3.50	-.03	.00	.00	.15	-.03	202.50	-416.73	-3.61	416.74
30	STINGER	-31.94	-3.99	-.03	114.07	-.77	.00	-.03	201.45	-490.67	-4.26	490.69
32	SAGBEND	-43.44	-7.45	-.02	.00	.00	.00	.00	196.91	56.35	-1.35	56.36
33	SAGBEND	-55.04	-10.90	-.02	.00	.00	.00	.00	190.98	418.70	.43	418.70
34	SAGBEND	-66.74	-13.97	-.01	.00	.00	.00	.00	185.46	634.98	1.31	634.98
35	SAGBEND	-78.58	-16.47	-.01	.00	.00	.00	.00	181.10	739.53	1.57	739.53
36	SAGBEND	-90.54	-18.29	.00	.00	.00	.00	.00	178.25	745.61	1.40	745.61
37	SAGBEND	-102.59	-19.41	.00	.00	.00	.00	.00	176.93	650.37	1.05	650.37
38	SAGBEND	-114.67	-19.92	.00	2.45	.02	.00	.00	176.89	435.45	.74	435.45
39	SEABED	-126.77	-20.03	.00	35.52	-.01	.00	.00	177.35	106.46	.26	106.47
40	SEABED	-138.87	-20.02	.00	29.83	-.02	.00	.00	177.37	-15.98	-.01	15.98
41	SEABED	-150.97	-20.01	.00	20.74	.00	.00	.00	177.37	-3.92	-.01	3.92
42	SEABED	-163.07	-20.01	.00	13.14	.00	.00	.00	177.37	31.60	.00	31.60
43	SEABED	-175.17	-19.98	.00	.00	.00	.00	.00	177.41	.00	.00	.00

OFFPIPE - OFFSHORE PIPELINE ANALYSIS SYSTEM - VERSION 2.05 AC PAGE 27
Abandonment and Recovery Analysis in Sangatta
JOB NO. - 1 LICENSED TO: RICKY TAWEKAL
USER ID - Moch. Ardiansyah DATE - 7/ 1/2016 TIME - 5:34:12 CASE 3

S T A T I C S O L U T I O N S U M M A R Y

PIPE PROPERTIES (2)

PIPE SECTION LENGTH ..	.00 M	ELASTIC MODULUS	207000. MPA
OUTSIDE DIAMETER	50.800 CM	CROSS SECTIONAL AREA .	250.00 CM2
WALL THICKNESS	1.590 CM	MOMENT OF INERTIA	74490.00 CM4
WEIGHT/LENGTH IN AIR .	4567.997 N/M	YIELD STRESS	360.00 MPA
SUBMERGED WGHT/LENG ..	1556.660 N/M	STRESS INTENS FACTOR .	1.000
SPECIFIC GRAVITY	1.517	STEEL DENSITY	77008.5 N/M3
WRAP COAT THICKNESS ..	.250 CM	WRAP COAT DENSITY	9397.6 N/M3
CONCRETE THICKNESS ...	5.000 CM	CONCRETE DENSITY	29822.4 N/M3

BARGE DATA

TOTAL PIPE TENSION ...	210.06 KN	RADIUS OF CURVATURE ..	.00 M
NUMBER OF TENSIONERS .	2	BARGE TRIM ANGLE	.000 DEG
NO. OF PIPE SUPPORTS .	7	PIPE ANGLE AT STERN ..	5.822 DEG
BARGE HEADING	.000 DEG	OFFSET FROM R.O.W. ...	.00 M

STINGER DATA

NO. OF PIPE SUPPORTS .	6	STINGER STERN DEPTH ..	-3.99 M
NO. STINGER SECTIONS .	6	PIPE ANGLE AT STERN ..	16.067 DEG
RADIUS OF CURVATURE ..	.00 M	STINGER LENGTH	31.90 M

SAGBEND DATA

WATER DEPTH	20.00 M	HORIZ PIPE TENSION ...	177.41 KN
TOUCHDOWN X-COORD. ...	-119.96 M	BOTTOM SLOPE ANGLE ...	.000 DEG

SOLUTION SUMMARY

NODE NO.	PIPE SECTION	X COORD	Y COORD	Z COORD	SUPPORT REACT VERT	SUPPORT REACT HORIZ	TOTAL MOMENT	TOTAL STRESS	PCT YLD
1	TENSIONR	61.0	2.5	.0	.5	.0	.0	.0	0.
3	LAYBARGE	38.0	2.5	.0	.6	.0	.0	.0	0.
5	LAYBARGE	32.1	2.5	.0	.2	.0	.0	.0	0.
7	TENSIONR	26.5	2.5	.0	.2	.0	.0	.0	0.
9	LAYBARGE	23.0	2.5	.0	4.1	.0	.0	.0	0.
11	LAYBARGE	16.5	2.4	.0	5.8	.0	.0	.0	0.
13	LAYBARGE	12.0	2.2	.0	5.9	.0	.0	.0	0.

15	LAYBARGE	5.5	1.7	.0	6.6	.0	.0	.0	0.
17	LAYBARGE	.0	1.2	.0	.1	.3	.0	.0	0.
20	STINGER	-7.4	.4	.0	.0	.0	.0	.0	0.
22	STINGER	-14.6	-.3	.0	.0	.0	.0	.0	0.
24	STINGER	-20.8	-.9	.0	.0	.0	.0	8.4	2.
26	STINGER	-25.4	-2.2	.0	.0	.0	180.6	69.9	19.
28	STINGER	-30.2	-3.5	.0	.0	.0	416.7	150.3	42.
30	STINGER	-31.9	-4.0	.0	114.1	-.8	490.7	175.5	49.
36	SAGBEND	-90.5	-18.3	.0	.0	.0	745.6	261.5	73.

S T A T I C S O L U T I O N S U M M A R Y

39	SEABED	-126.8	-20.0	.0	35.5	.0	106.5	43.6	12.

OFFPIPE - OFFSHORE PIPELINE ANALYSIS SYSTEM - VERSION 2.05 AC DATE - 7/ 1/2016 TIME - 5:34:12 PAGE 29
PROJECT - Abandonment and Recovery Analysis in Sangatta JOB NO. - 1
USER ID - Moch. Ardiansyah LICENSED TO: RICKY TAWEKAL CASE 4

S T A T I C P I P E C O O R D I N A T E S, F O R C E S A N D S T R E S S E S

NODE NO.	PIPE SECTION	X COORD (M)	Y COORD (M)	Z COORD (M)	HORIZ ANGLE (DEG)	VERT ANGLE (DEG)	PIPE LENGTH (M)	TENSILE STRESS (MPA)	HOOP STRESS (MPA)	BENDING STRESSES VERT (MPA)	BENDING STRESSES HORIZ (MPA)	TOTAL STRESS (MPA)	PERCNT YIELD (PCT)
1	TENSIONR	61.00	2.52	.00	.000	.000	.000	.00	.00	.00	.00	.00	.00
3	LAYBARGE	38.00	2.52	.00	.000	.000	23.000	.00	.00	.00	.00	.00	.00
5	LAYBARGE	32.09	2.52	.00	.000	.000	28.905	.00	.00	.00	.00	.00	.00
7	TENSIONR	26.50	2.52	.00	.000	.000	34.500	.00	.00	.00	.00	.00	.00
9	LAYBARGE	23.00	2.52	.00	.000	.530	38.000	.00	.00	.00	.00	.00	.00
11	LAYBARGE	16.52	2.40	.00	.000	1.823	44.481	.00	.00	.00	.00	.00	.00
13	LAYBARGE	12.00	2.19	.00	.000	3.356	49.006	.00	.00	.00	.00	.00	.00
15	LAYBARGE	5.50	1.72	.00	.000	4.986	55.523	.00	.00	.00	.00	.00	.00
17	LAYBARGE	.00	1.16	.00	.006	6.719	61.052	.00	.00	.00	.00	.00	.00
20	STINGER	-7.41	.17	.00	.000	8.547	68.523	.00	.00	.00	.00	.00	.00
22	STINGER	-14.54	-1.02	.00	-.006	9.512	75.755	.00	.00	.00	.00	.00	.00
24	STINGER	-20.50	-2.02	.00	.000	9.523	81.805	.00	.00	.00	.00	.00	.00
26	STINGER	-25.19	-2.81	.00	.013	9.532	86.556	.00	.00	.00	.00	.00	.00
28	STINGER	-30.19	-3.65	.00	.231	9.996	91.628	.00	.00	.00	.00	.00	.00
30	STINGER	-31.95	-3.97	-.02	.192	21.849	93.425	.00	.00	.00	.00	.00	.00
32	SAGBEND	-32.44	-4.29	-.02	-.034	19.789	94.009	6.76	-.69	.00	.00	7.13	1.98
33	SAGBEND	-43.57	-8.23	-.01	-.030	18.842	105.818	6.16	-1.32	137.48	.49	144.31	40.09
34	SAGBEND	-54.82	-11.83	.00	-.022	16.464	117.628	5.60	-1.90	224.92	.70	231.48	64.30
35	SAGBEND	-66.52	-14.93	.00	-.012	13.131	129.728	5.12	-2.40	274.42	.70	280.74	77.98
36	SAGBEND	-78.38	-17.29	.00	-.003	9.382	141.828	4.76	-2.78	288.44	.54	294.60	81.83
37	SAGBEND	-90.37	-18.87	.00	.002	5.678	153.928	4.54	-3.03	267.11	.27	273.18	75.88
38	SAGBEND	-102.44	-19.72	.00	.004	2.511	166.028	4.45	-3.17	206.11	-.06	212.17	58.94
39	SEABED	-114.54	-20.01	.00	.002	.456	178.128	4.45	-3.21	96.30	-.18	102.39	28.44
40	SEABED	-126.64	-20.03	.00	.000	-.083	190.228	4.46	-3.22	3.86	-.06	10.31	2.86
41	SEABED	-138.74	-20.01	.00	.000	-.027	202.328	4.46	-3.21	-5.54	.01	11.94	3.32
42	SEABED	-150.84	-20.01	.00	.000	.009	214.429	4.46	-3.21	.42	.00	7.05	1.96
43	SEABED	-162.94	-20.01	.00	.000	-.059	226.529	4.46	-3.21	10.95	.00	17.24	4.79
44	SEABED	-175.04	-19.98	.00	.000	-.199	238.629	4.46	-3.21	.00	.00	6.67	1.85

OFFPIPE - OFFSHORE PIPELINE ANALYSIS SYSTEM - VERSION 2.05 AC DATE - 7/ 1/2016 TIME - 5:34:12 PAGE 30
PROJECT - Abandonment and Recovery Analysis in Sangatta JOB NO. - 1
USER ID - Moch. Ardiansyah LICENSED TO: RICKY TAWEKAL CASE 4

S T A T I C P I P E C O O R D I N A T E S, F O R C E S A N D S T R E S S E S

NODE NO.	PIPE SECTION	X COORD (M)	Y COORD (M)	Z COORD (M)	SUPPORT REACTION VERT (KN)	SUPPORT REACTION HORIZ (KN)	SUPT SEPARATIONS VERT (M)	SUPT SEPARATIONS HORIZ (M)	PIPE TENSION (KN)	BENDING MOMENTS VERT (KN-M)	BENDING MOMENTS HORIZ (KN-M)	BENDING MOMENTS TOTAL (KN-M)
1	TENSIONR	61.00	2.52	.00	.50	.00	.00	.00	90.01	.00	.00	.00
3	LAYBARGE	38.00	2.52	.00	.63	.00	.00	.00	90.01	.12	.00	.00
5	LAYBARGE	32.09	2.52	.00	.25	.00	.00	.00	90.01	.05	.00	.00
7	TENSIONR	26.50	2.52	.00	.20	.00	.00	.00	180.01	.05	.00	.00
9	LAYBARGE	23.00	2.52	.00	3.55	.00	.00	.00	180.00	.67	.00	.00
11	LAYBARGE	16.52	2.40	.00	5.02	.00	.00	.00	179.99	.94	.00	.00
13	LAYBARGE	12.00	2.19	.00	5.09	.00	.00	.00	179.98	.95	.00	.00
15	LAYBARGE	5.50	1.72	.00	5.66	.00	.00	.00	179.95	1.06	.00	.00
17	LAYBARGE	.00	1.16	.00	5.77	.04	.00	.00	179.93	1.08	-.01	.00
20	STINGER	-7.41	.17	.00	6.29	-.07	.00	.00	179.88	1.18	.01	.00
22	STINGER	-14.54	-1.02	.00	.32	.03	.00	.00	179.86	.06	-.01	.00
24	STINGER	-20.50	-2.02	.00	.21	.00	.00	.00	179.83	.04	.00	.00
26	STINGER	-25.19	-2.81	.00	.24	.07	.00	.00	179.80	.04	-.01	.00
28	STINGER	-30.19	-3.65	.00	2.99	1.27	.00	.00	179.76	.56	-.24	.00
30	STINGER	-31.95	-3.97	-.02	71.10	-1.51	.00	-.02	176.24	13.33	.28	.00
32	SAGBEND	-32.44	-4.29	-.02	.00	.00	.00	.00	174.80	.01	.00	.01
33	SAGBEND	-43.57	-8.23	-.01	.00	.00	.00	.00	168.15	403.17	1.43	403.17
34	SAGBEND	-54.82	-11.83	.00	.00	.00	.00	.00	161.66	659.58	2.05	659.59
35	SAGBEND	-66.52	-14.93	.00	.00	.00	.00	.00	156.15	804.72	2.06	804.72
36	SAGBEND	-78.38	-17.29	.00	.00	.00	.00	.00	152.25	845.86	1.59	845.86
37	SAGBEND	-90.37	-18.87	.00	.00	.00	.00	.00	150.12	783.30	.78	783.30
38	SAGBEND	-102.44	-19.72	.00	.00	-.06	.00	.00	149.60	604.43	-.18	604.43
39	SEABED	-114.54	-20.01	.00	19.43	-.07	.00	.00	150.08	282.40	-.53	282.40
40	SEABED	-126.64	-20.03	.00	39.19	.01	.00	.00	150.35	11.31	-.18	11.31
41	SEABED	-138.74	-20.01	.00	22.38	.02	.00	.00	150.34	-16.25	.02	16.25
42	SEABED	-150.84	-20.01	.00	19.96	.00	.00	.00	150.34	1.23	.01	1.23
43	SEABED	-162.94	-20.01	.00	13.55	.00	.00	.00	150.34	32.11	.00	32.11
44	SEABED	-175.04	-19.98	.00	.00	.00	.00	.00	150.38	.00	.00	.00

OFFPIPE - OFFSHORE PIPELINE ANALYSIS SYSTEM - VERSION 2.05 AC PAGE 31
Abandonment and Recovery Analysis in Sangatta
JOB NO. - 1 LICENSED TO: RICKY TAWEKAL
USER ID - Moch. Ardiansyah DATE - 7/ 1/2016 TIME - 5:34:12 CASE 4

S T A T I C S O L U T I O N S U M M A R Y

PIPE PROPERTIES (2)

PIPE SECTION LENGTH ..	.00 M	ELASTIC MODULUS	207000. MPA
OUTSIDE DIAMETER	50.800 CM	CROSS SECTIONAL AREA .	250.00 CM2
WALL THICKNESS	1.590 CM	MOMENT OF INERTIA	74490.00 CM4
WEIGHT/LENGTH IN AIR .	4567.997 N/M	YIELD STRESS	360.00 MPA
SUBMERGED WGHT/LENG ..	1556.660 N/M	STRESS INTENS FACTOR .	1.000
SPECIFIC GRAVITY	1.517	STEEL DENSITY	77008.5 N/M3
WRAP COAT THICKNESS ..	.250 CM	WRAP COAT DENSITY	9397.6 N/M3
CONCRETE THICKNESS ...	5.000 CM	CONCRETE DENSITY	29822.4 N/M3

BARGE DATA

TOTAL PIPE TENSION ...	180.01 KN	RADIUS OF CURVATURE ..	.00 M
NUMBER OF TENSIONERS .	2	BARGE TRIM ANGLE	.000 DEG
NO. OF PIPE SUPPORTS .	7	PIPE ANGLE AT STERN ..	6.719 DEG
BARGE HEADING	.000 DEG	OFFSET FROM R.O.W. ...	.00 M

STINGER DATA

NO. OF PIPE SUPPORTS .	6	STINGER STERN DEPTH ..	-3.97 M
NO. STINGER SECTIONS .	6	PIPE ANGLE AT STERN ..	21.849 DEG
RADIUS OF CURVATURE ..	.00 M	STINGER LENGTH	31.90 M

SAGBEND DATA

WATER DEPTH	20.00 M	HORIZ PIPE TENSION ...	150.38 KN
TOUCHDOWN X-COORD. ...	-113.44 M	BOTTOM SLOPE ANGLE ...	.000 DEG

SOLUTION SUMMARY

NODE NO.	PIPE SECTION	X COORD	Y COORD	Z COORD	SUPPORT REACT VERT	SUPPORT REACT HORIZ	TOTAL MOMENT	TOTAL STRESS	PCT YLD
1	TENSIONR	61.0	2.5	.0	.5	.0	.0	.0	0.
3	LAYBARGE	38.0	2.5	.0	.6	.0	.0	.0	0.
5	LAYBARGE	32.1	2.5	.0	.2	.0	.0	.0	0.
7	TENSIONR	26.5	2.5	.0	.2	.0	.0	.0	0.
9	LAYBARGE	23.0	2.5	.0	3.5	.0	.0	.0	0.

11	LAYBARGE	16.5	2.4	.0	5.0	.0	.0	.0	0.
13	LAYBARGE	12.0	2.2	.0	5.1	.0	.0	.0	0.
15	LAYBARGE	5.5	1.7	.0	5.7	.0	.0	.0	0.
17	LAYBARGE	.0	1.2	.0	5.8	.0	.0	.0	0.
20	STINGER	-7.4	.2	.0	6.3	-.1	.0	.0	0.
22	STINGER	-14.5	-1.0	.0	.3	.0	.0	.0	0.
24	STINGER	-20.5	-2.0	.0	.2	.0	.0	.0	0.
26	STINGER	-25.2	-2.8	.0	.2	.1	.0	.0	0.
28	STINGER	-30.2	-3.6	.0	3.0	1.3	.0	.0	0.
30	STINGER	-32.0	-4.0	.0	71.1	-1.5	.0	.0	0.
36	SAGBEND	-78.4	-17.3	.0	.0	.0	845.9	294.6	82.

S T A T I C S O L U T I O N S U M M A R Y

39	SEABED	-114.5	-20.0	.0	19.4	-.1	282.4	102.4	28.

OFFPIPE - OFFSHORE PIPELINE ANALYSIS SYSTEM - VERSION 2.05 AC DATE - 7/ 1/2016 TIME - 5:34:12 PAGE 33
PROJECT - Abandonment and Recovery Analysis in Sangatta JOB NO. - 1
USER ID - Moch. Ardiansyah LICENSED TO: RICKY TAWEKAL CASE 5

S T A T I C P I P E C O O R D I N A T E S, F O R C E S A N D S T R E S S E S

NODE NO.	PIPE SECTION	X COORD (M)	Y COORD (M)	Z COORD (M)	HORIZ ANGLE (DEG)	VERT ANGLE (DEG)	PIPE LENGTH (M)	TENSILE STRESS (MPA)	HOOP STRESS (MPA)	BENDING STRESSES VERT (MPA)	BENDING STRESSES HORIZ (MPA)	TOTAL STRESS (MPA)	PERCNT YIELD (PCT)
1	TENSIONR	61.00	2.52	.00	.000	.000	.000	.00	.00	.00	.00	.00	.00
3	LAYBARGE	38.00	2.52	.00	.000	.000	23.000	.00	.00	.00	.00	.00	.00
5	LAYBARGE	32.09	2.52	.00	.000	.000	28.905	.00	.00	.00	.00	.00	.00
7	TENSIONR	26.50	2.52	.00	.000	.000	34.500	.00	.00	.00	.00	.00	.00
9	LAYBARGE	23.00	2.52	.00	.000	.530	38.000	.00	.00	.00	.00	.00	.00
11	LAYBARGE	16.52	2.40	.00	.000	1.823	44.481	.00	.00	.00	.00	.00	.00
13	LAYBARGE	12.00	2.19	.00	.000	3.356	49.006	.00	.00	.00	.00	.00	.00
15	LAYBARGE	5.50	1.72	.00	.000	4.986	55.523	.00	.00	.00	.00	.00	.00
17	LAYBARGE	.00	1.16	.00	.003	6.713	61.052	.00	.00	.00	.00	.00	.00
20	STINGER	-7.41	.17	.00	.000	8.546	68.523	.00	.00	.00	.00	.00	.00
22	STINGER	-14.54	-1.02	.00	-.003	9.516	75.755	.00	.00	.00	.00	.00	.00
24	STINGER	-20.50	-2.02	.00	.000	9.521	81.805	.00	.00	.00	.00	.00	.00
26	STINGER	-25.19	-2.81	.00	.003	9.522	86.556	.00	.00	.00	.00	.00	.00
28	STINGER	-30.19	-3.65	.00	.109	9.722	91.628	.00	.00	.00	.00	.00	.00
30	STINGER	-31.96	-3.96	-.01	.102	21.203	93.425	.00	.00	.00	.00	.00	.00
32	SAGBEND	-42.16	-10.45	.00	-.021	31.814	105.555	.00	.00	.00	.00	.00	.00
33	SAGBEND	-52.42	-16.87	.00	-.016	30.463	117.655	.00	.00	.00	.00	.00	.00
34	SAGBEND	-54.47	-18.03	.00	.001	4.812	120.036	1.19	-2.89	3.43	.00	6.57	1.82
35	SAGBEND	-65.34	-18.90	.00	.002	4.144	130.945	1.05	-3.03	99.03	.03	101.64	28.23
36	SAGBEND	-76.23	-19.56	.00	.002	2.689	141.855	.95	-3.14	136.29	-.01	138.83	38.56
37	SAGBEND	-88.33	-19.94	.00	.001	.980	153.955	.90	-3.20	111.28	-.07	113.81	31.61
38	SEABED	-100.43	-20.03	.00	.000	.038	166.055	.90	-3.22	28.81	-.06	31.45	8.74
39	SEABED	-112.53	-20.02	.00	.000	-.052	178.155	.90	-3.21	-3.85	.00	6.94	1.93
40	SEABED	-124.63	-20.01	.00	.000	-.006	190.255	.90	-3.21	-1.94	.00	5.25	1.46
41	SEABED	-136.73	-20.01	.00	.000	.006	202.355	.90	-3.21	-.44	.00	4.06	1.13
42	SEABED	-148.83	-20.01	.00	.000	.007	214.456	.90	-3.21	1.05	.00	4.52	1.26
43	SEABED	-160.93	-20.01	.00	.000	-.061	226.556	.90	-3.21	10.79	.00	13.59	3.78
44	SEABED	-173.03	-19.98	.00	.000	-.201	238.656	.91	-3.21	.00	.00	3.74	1.04

OFFPIPE - OFFSHORE PIPELINE ANALYSIS SYSTEM - VERSION 2.05 AC DATE - 7/ 1/2016 TIME - 5:34:12 PAGE 34
PROJECT - Abandonment and Recovery Analysis in Sangatta JOB NO. - 1
USER ID - Moch. Ardiansyah LICENSED TO: RICKY TAWEKAL CASE 5

S T A T I C P I P E C O O R D I N A T E S, F O R C E S A N D S T R E S S E S

NODE NO.	PIPE SECTION	X COORD (M)	Y COORD (M)	Z COORD (M)	SUPPORT REACTION VERT (KN)	SUPPORT REACTION HORIZ (KN)	SUPT SEPARATIONS VERT (M)	SUPT SEPARATIONS HORIZ (M)	PIPE TENSION (KN)	BENDING MOMENTS VERT (KN-M)	BENDING MOMENTS HORIZ (KN-M)	BENDING MOMENTS TOTAL (KN-M)
1	TENSIONR	61.00	2.52	.00	.50	.00	.00	.00	37.48	.00	.00	.00
3	LAYBARGE	38.00	2.52	.00	.63	.00	.00	.00	37.48	.12	.00	.00
5	LAYBARGE	32.09	2.52	.00	.25	.00	.00	.00	37.48	.05	.00	.00
7	TENSIONR	26.50	2.52	.00	.20	.00	.00	.00	74.98	.05	.00	.00
9	LAYBARGE	23.00	2.52	.00	1.60	.00	.00	.00	74.97	.30	.00	.00
11	LAYBARGE	16.52	2.40	.00	2.23	.00	.00	.00	74.97	.42	.00	.00
13	LAYBARGE	12.00	2.19	.00	2.26	.00	.00	.00	74.96	.42	.00	.00
15	LAYBARGE	5.50	1.72	.00	2.51	.00	.00	.00	74.93	.47	.00	.00
17	LAYBARGE	.00	1.16	.00	2.55	.01	.00	.00	74.91	.48	.00	.00
20	STINGER	-7.41	.17	.00	2.82	-.01	.00	.00	74.86	.53	.00	.00
22	STINGER	-14.54	-1.02	.00	.26	.00	.00	.00	74.83	.05	.00	.00
24	STINGER	-20.50	-2.02	.00	.20	.00	.00	.00	74.79	.04	.00	.00
26	STINGER	-25.19	-2.81	.00	.19	.00	.00	.00	74.76	.04	.00	.00
28	STINGER	-30.19	-3.65	.00	.64	.26	.00	.00	74.73	.12	-.05	.00
30	STINGER	-31.96	-3.96	-.01	29.47	-.28	.00	-.01	73.29	5.52	.05	.00
32	SAGBEND	-42.16	-10.45	.00	.00	.00	.00	.00	74.51	.00	.00	.00
33	SAGBEND	-52.42	-16.87	.00	.00	.00	.00	.00	74.24	2.75	.00	.00
34	SAGBEND	-54.47	-18.03	.00	.00	.00	.00	.00	66.03	10.06	.01	10.06
35	SAGBEND	-65.34	-18.90	.00	.00	.00	.00	.00	64.40	290.41	.09	290.41
36	SAGBEND	-76.23	-19.56	.00	.00	.00	.00	.00	63.13	399.66	-.02	399.66
37	SAGBEND	-88.33	-19.94	.00	2.42	-.02	.00	.00	62.71	326.33	-.21	326.33
38	SEABED	-100.43	-20.03	.00	31.63	-.01	.00	.00	62.94	84.50	-.18	84.50
39	SEABED	-112.53	-20.02	.00	27.10	.01	.00	.00	62.95	-11.29	-.01	11.29
40	SEABED	-124.63	-20.01	.00	18.62	.00	.00	.00	62.95	-5.69	.01	5.69
41	SEABED	-136.73	-20.01	.00	18.81	.00	.00	.00	62.95	-1.30	.00	1.30
42	SEABED	-148.83	-20.01	.00	20.92	.00	.00	.00	62.95	3.08	.00	3.08
43	SEABED	-160.93	-20.01	.00	13.97	.00	.00	.00	62.95	31.65	.00	31.65
44	SEABED	-173.03	-19.98	.00	.00	.00	.00	.00	62.99	.00	.00	.00

OFFPIPE - OFFSHORE PIPELINE ANALYSIS SYSTEM - VERSION 2.05 AC PAGE 35
Abandonment and Recovery Analysis in Sangatta
JOB NO. - 1 LICENSED TO: RICKY TAWEKAL
USER ID - Moch. Ardiansyah DATE - 7/ 1/2016 TIME - 5:34:12 CASE 5

S T A T I C S O L U T I O N S U M M A R Y

PIPE PROPERTIES (2)

PIPE SECTION LENGTH ..	.00 M	ELASTIC MODULUS	207000. MPA
OUTSIDE DIAMETER	50.800 CM	CROSS SECTIONAL AREA .	250.00 CM2
WALL THICKNESS	1.590 CM	MOMENT OF INERTIA	74490.00 CM4
WEIGHT/LENGTH IN AIR .	4567.997 N/M	YIELD STRESS	360.00 MPA
SUBMERGED WGHT/LENG ..	1556.660 N/M	STRESS INTENS FACTOR .	1.000
SPECIFIC GRAVITY	1.517	STEEL DENSITY	77008.5 N/M3
WRAP COAT THICKNESS ..	.250 CM	WRAP COAT DENSITY	9397.6 N/M3
CONCRETE THICKNESS ...	5.000 CM	CONCRETE DENSITY	29822.4 N/M3

BARGE DATA

TOTAL PIPE TENSION ...	74.98 KN	RADIUS OF CURVATURE ..	.00 M
NUMBER OF TENSIONERS .	2	BARGE TRIM ANGLE	.000 DEG
NO. OF PIPE SUPPORTS .	7	PIPE ANGLE AT STERN ..	6.713 DEG
BARGE HEADING	.000 DEG	OFFSET FROM R.O.W. ...	.00 M

STINGER DATA

NO. OF PIPE SUPPORTS .	6	STINGER STERN DEPTH ..	-3.96 M
NO. STINGER SECTIONS .	6	PIPE ANGLE AT STERN ..	21.203 DEG
RADIUS OF CURVATURE ..	.00 M	STINGER LENGTH	31.90 M

SAGBEND DATA

WATER DEPTH	20.00 M	HORIZ PIPE TENSION ...	62.99 KN
TOUCHDOWN X-COORD. ...	-93.29 M	BOTTOM SLOPE ANGLE ...	.000 DEG

SOLUTION SUMMARY

NODE NO.	PIPE SECTION	X COORD	Y COORD	Z COORD	SUPPORT REACT VERT	SUPPORT REACT HORIZ	TOTAL MOMENT	TOTAL STRESS	PCT YLD
1	TENSIONR	61.0	2.5	.0	.5	.0	.0	.0	0.
3	LAYBARGE	38.0	2.5	.0	.6	.0	.0	.0	0.
5	LAYBARGE	32.1	2.5	.0	.2	.0	.0	.0	0.
7	TENSIONR	26.5	2.5	.0	.2	.0	.0	.0	0.
9	LAYBARGE	23.0	2.5	.0	1.6	.0	.0	.0	0.

11	LAYBARGE	16.5	2.4	.0	2.2	.0	.0	.0	0.
13	LAYBARGE	12.0	2.2	.0	2.3	.0	.0	.0	0.
15	LAYBARGE	5.5	1.7	.0	2.5	.0	.0	.0	0.
17	LAYBARGE	.0	1.2	.0	2.5	.0	.0	.0	0.
20	STINGER	-7.4	.2	.0	2.8	.0	.0	.0	0.
22	STINGER	-14.5	-1.0	.0	.3	.0	.0	.0	0.
24	STINGER	-20.5	-2.0	.0	.2	.0	.0	.0	0.
26	STINGER	-25.2	-2.8	.0	.2	.0	.0	.0	0.
28	STINGER	-30.2	-3.6	.0	.6	.3	.0	.0	0.
30	STINGER	-32.0	-4.0	.0	29.5	-.3	.0	.0	0.
36	SAGBEND	-76.2	-19.6	.0	.0	.0	399.7	138.8	39.

S T A T I C S O L U T I O N S U M M A R Y

38	SEABED	-100.4	-20.0	.0	31.6	.0	84.5	31.4	9.

OFFPIPE - OFFSHORE PIPELINE ANALYSIS SYSTEM - VERSION 2.05 AC DATE - 7/ 1/2016 TIME - 5:34:12 PAGE 37
PROJECT - Abandonment and Recovery Analysis in Sangatta JOB NO. - 1
USER ID - Moch. Ardiansyah LICENSED TO: RICKY TAWEKAL CASE 6

S T A T I C P I P E C O O R D I N A T E S, F O R C E S A N D S T R E S S E S

NODE NO.	PIPE SECTION	X COORD (M)	Y COORD (M)	Z COORD (M)	HORIZ ANGLE (DEG)	VERT ANGLE (DEG)	PIPE LENGTH (M)	TENSILE STRESS (MPA)	HOOP STRESS (MPA)	BENDING STRESSES VERT (MPA)	BENDING STRESSES HORIZ (MPA)	TOTAL STRESS (MPA)	PERCNT YIELD (PCT)
1	TENSIONR	61.00	2.52	.00	.000	.000	.000	.00	.00	.00	.00	.00	.00
3	LAYBARGE	38.00	2.52	.00	.000	.000	23.000	.00	.00	.00	.00	.00	.00
5	LAYBARGE	32.09	2.52	.00	.000	.000	28.905	.00	.00	.00	.00	.00	.00
7	TENSIONR	26.50	2.52	.00	.000	.000	34.500	.00	.00	.00	.00	.00	.00
9	LAYBARGE	23.00	2.52	.00	.000	.530	38.000	.00	.00	.00	.00	.00	.00
11	LAYBARGE	16.52	2.40	.00	.000	1.823	44.481	.00	.00	.00	.00	.00	.00
13	LAYBARGE	12.00	2.19	.00	.000	3.356	49.006	.00	.00	.00	.00	.00	.00
15	LAYBARGE	5.50	1.72	.00	.000	4.986	55.523	.00	.00	.00	.00	.00	.00
17	LAYBARGE	.00	1.16	.00	.001	6.709	61.052	.00	.00	.00	.00	.00	.00
20	STINGER	-7.41	.18	.00	.000	8.546	68.523	.00	.00	.00	.00	.00	.00
22	STINGER	-14.54	-1.02	.00	-.001	9.518	75.755	.00	.00	.00	.00	.00	.00
24	STINGER	-20.50	-2.02	.00	.000	9.519	81.805	.00	.00	.00	.00	.00	.00
26	STINGER	-25.19	-2.81	.00	.000	9.519	86.556	.00	.00	.00	.00	.00	.00
28	STINGER	-30.19	-3.65	.00	.014	9.545	91.628	.00	.00	.00	.00	.00	.00
30	STINGER	-31.96	-3.94	.00	.005	14.749	93.421	.00	.00	.00	.00	.00	.00
32	SAGBEND	-43.33	-8.07	.00	-.012	19.281	105.527	.00	.00	.00	.00	.00	.00
33	SAGBEND	-54.80	-11.94	.00	.001	17.969	117.627	.00	.00	.00	.00	.00	.00
34	SAGBEND	-66.35	-15.55	.00	.012	16.388	129.728	.00	.00	.00	.00	.00	.00
35	SAGBEND	-74.65	-17.93	.00	.009	13.325	138.368	.00	.00	.00	.00	.00	.00
36	SEABED	-83.01	-20.00	.00	.000	.081	147.008	-.90	-3.21	1.71	.00	3.68	1.02
37	SEABED	-89.93	-20.01	.00	.000	.045	153.927	-.91	-3.21	5.63	.00	6.91	1.92
38	SEABED	-102.03	-20.01	.00	.000	.000	166.028	-.91	-3.21	1.20	.00	3.37	.94
39	SEABED	-114.13	-20.01	.00	.000	-.003	178.128	-.91	-3.21	-.22	.00	2.93	.81
40	SEABED	-126.23	-20.01	.00	.000	.000	190.228	-.91	-3.21	-.17	.00	2.92	.81
41	SEABED	-138.33	-20.01	.00	.000	.004	202.328	-.91	-3.21	-.54	.00	3.05	.85
42	SEABED	-150.43	-20.01	.00	.000	.007	214.428	-.91	-3.21	.93	.00	3.23	.90
43	SEABED	-162.53	-20.01	.00	.000	-.061	226.529	-.91	-3.21	10.84	.00	11.87	3.30
44	SEABED	-174.63	-19.98	.00	.000	-.201	238.629	-.90	-3.21	.00	.00	2.87	.80

OFFPIPE - OFFSHORE PIPELINE ANALYSIS SYSTEM - VERSION 2.05 AC DATE - 7/ 1/2016 TIME - 5:34:12 PAGE 38
PROJECT - Abandonment and Recovery Analysis in Sangatta JOB NO. - 1
USER ID - Moch. Ardiansyah LICENSED TO: RICKY TAWEKAL CASE 6

S T A T I C P I P E C O O R D I N A T E S, F O R C E S A N D S T R E S S E S

NODE NO.	PIPE SECTION	X COORD (M)	Y COORD (M)	Z COORD (M)	SUPPORT REACTION VERT (KN)	SUPPORT REACTION HORIZ (KN)	SUPT SEPARATIONS VERT (M)	SUPT SEPARATIONS HORIZ (M)	PIPE TENSION (KN)	BENDING MOMENTS VERT (KN-M)	BENDING MOMENTS HORIZ (KN-M)	BENDING MOMENTS TOTAL (KN-M)
1	TENSIONR	61.00	2.52	.00	.50	.00	.00	.00	10.00	.00	.00	.00
3	LAYBARGE	38.00	2.52	.00	.63	.00	.00	.00	10.00	.12	.00	.00
5	LAYBARGE	32.09	2.52	.00	.25	.00	.00	.00	10.00	.05	.00	.00
7	TENSIONR	26.50	2.52	.00	.20	.00	.00	.00	20.00	.05	.00	.00
9	LAYBARGE	23.00	2.52	.00	.59	.00	.00	.00	20.00	.11	.00	.00
11	LAYBARGE	16.52	2.40	.00	.77	.00	.00	.00	19.99	.14	.00	.00
13	LAYBARGE	12.00	2.19	.00	.78	.00	.00	.00	19.98	.15	.00	.00
15	LAYBARGE	5.50	1.72	.00	.86	.00	.00	.00	19.96	.16	.00	.00
17	LAYBARGE	.00	1.16	.00	.88	.00	.00	.00	19.94	.16	.00	.00
20	STINGER	-7.41	.18	.00	.97	.00	.00	.00	19.90	.18	.00	.00
22	STINGER	-14.54	-1.02	.00	.25	.00	.00	.00	19.85	.05	.00	.00
24	STINGER	-20.50	-2.02	.00	.20	.00	.00	.00	19.82	.04	.00	.00
26	STINGER	-25.19	-2.81	.00	.18	.00	.00	.00	19.79	.03	.00	.00
28	STINGER	-30.19	-3.65	.00	.14	.01	.00	.00	19.76	.03	.00	.00
30	STINGER	-31.96	-3.94	.00	3.81	-.02	.00	.00	19.66	.71	.00	.00
32	SAGBEND	-43.33	-8.07	.00	.00	.00	.00	.00	19.61	.00	.00	.00
33	SAGBEND	-54.80	-11.94	.00	.00	.00	.00	.00	19.46	.03	.00	.00
34	SAGBEND	-66.35	-15.55	.00	.00	.00	.00	.00	19.32	.17	.00	.00
35	SAGBEND	-74.65	-17.93	.00	.00	-.01	.00	.00	19.21	.86	.00	.00
36	SEABED	-83.01	-20.00	.00	2.04	.00	.00	.00	18.51	5.02	.00	5.02
37	SEABED	-89.93	-20.01	.00	12.08	.00	.00	.00	18.50	16.51	.00	16.51
38	SEABED	-102.03	-20.01	.00	19.66	.00	.00	.00	18.51	3.51	.00	3.51
39	SEABED	-114.13	-20.01	.00	19.18	.00	.00	.00	18.51	-.63	.00	.63
40	SEABED	-126.23	-20.01	.00	18.72	.00	.00	.00	18.51	-.49	.00	.49
41	SEABED	-138.33	-20.01	.00	19.25	.00	.00	.00	18.51	-1.59	.00	1.59
42	SEABED	-150.43	-20.01	.00	20.97	.00	.00	.00	18.51	2.74	.00	2.74
43	SEABED	-162.53	-20.01	.00	14.02	.00	.00	.00	18.50	31.78	.00	31.78
44	SEABED	-174.63	-19.98	.00	.00	.00	.00	.00	18.54	.00	.00	.00

OFFPIPE - OFFSHORE PIPELINE ANALYSIS SYSTEM - VERSION 2.05 AC PAGE 39
Abandonment and Recovery Analysis in Sangatta
JOB NO. - 1 LICENSED TO: RICKY TAWEKAL
USER ID - Moch. Ardiansyah DATE - 7/ 1/2016 TIME - 5:34:12 CASE 6

S T A T I C S O L U T I O N S U M M A R Y

PIPE PROPERTIES (2)

PIPE SECTION LENGTH ..	.00 M	ELASTIC MODULUS	207000. MPA
OUTSIDE DIAMETER	50.800 CM	CROSS SECTIONAL AREA .	250.00 CM2
WALL THICKNESS	1.590 CM	MOMENT OF INERTIA	74490.00 CM4
WEIGHT/LENGTH IN AIR .	4567.997 N/M	YIELD STRESS	360.00 MPA
SUBMERGED WGHT/LENG ..	1556.660 N/M	STRESS INTENS FACTOR .	1.000
SPECIFIC GRAVITY	1.517	STEEL DENSITY	77008.5 N/M3
WRAP COAT THICKNESS ..	.250 CM	WRAP COAT DENSITY	9397.6 N/M3
CONCRETE THICKNESS ...	5.000 CM	CONCRETE DENSITY	29822.4 N/M3

BARGE DATA

TOTAL PIPE TENSION ...	20.00 KN	RADIUS OF CURVATURE ..	.00 M
NUMBER OF TENSIONERS .	2	BARGE TRIM ANGLE	.000 DEG
NO. OF PIPE SUPPORTS .	7	PIPE ANGLE AT STERN ..	6.709 DEG
BARGE HEADING	.000 DEG	OFFSET FROM R.O.W. ...	.00 M

STINGER DATA

NO. OF PIPE SUPPORTS .	6	STINGER STERN DEPTH ..	-3.94 M
NO. STINGER SECTIONS .	6	PIPE ANGLE AT STERN ..	14.749 DEG
RADIUS OF CURVATURE ..	.00 M	STINGER LENGTH	31.90 M

SAGBEND DATA

WATER DEPTH	20.00 M	HORIZ PIPE TENSION ...	18.54 KN
TOUCHDOWN X-COORD. ...	-82.88 M	BOTTOM SLOPE ANGLE ...	.000 DEG

SOLUTION SUMMARY

NODE NO.	PIPE SECTION	X COORD	Y COORD	Z COORD	SUPPORT REACT VERT	SUPPORT REACT HORIZ	TOTAL MOMENT	TOTAL STRESS	PCT YLD
1	TENSIONR	61.0	2.5	.0	.5	.0	.0	.0	0.
3	LAYBARGE	38.0	2.5	.0	.6	.0	.0	.0	0.
5	LAYBARGE	32.1	2.5	.0	.2	.0	.0	.0	0.
7	TENSIONR	26.5	2.5	.0	.2	.0	.0	.0	0.
9	LAYBARGE	23.0	2.5	.0	.6	.0	.0	.0	0.

11	LAYBARGE	16.5	2.4	.0	.8	.0	.0	.0	0.
13	LAYBARGE	12.0	2.2	.0	.8	.0	.0	.0	0.
15	LAYBARGE	5.5	1.7	.0	.9	.0	.0	.0	0.
17	LAYBARGE	.0	1.2	.0	.9	.0	.0	.0	0.
20	STINGER	-7.4	.2	.0	1.0	.0	.0	.0	0.
22	STINGER	-14.5	-1.0	.0	.3	.0	.0	.0	0.
24	STINGER	-20.5	-2.0	.0	.2	.0	.0	.0	0.
26	STINGER	-25.2	-2.8	.0	.2	.0	.0	.0	0.
28	STINGER	-30.2	-3.6	.0	.1	.0	.0	.0	0.
30	STINGER	-32.0	-3.9	.0	3.8	.0	.0	.0	0.
36	SEABED	-83.0	-20.0	.0	2.0	.0	5.0	3.7	1.

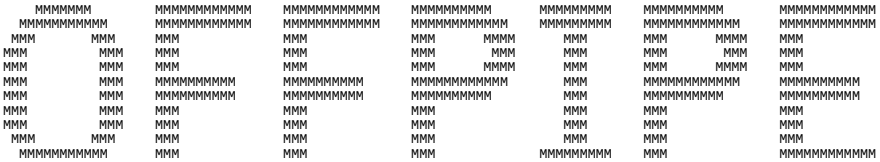
S T A T I C S O L U T I O N S U M M A R Y

43	SEABED	-162.5	-20.0	.0	14.0	.0	31.8	11.9	3.

LAMPIRAN C-3

HASIL *OUTPUT SOFTWARE* OFFPIPE

(*STINGER STERN DEPTH* = 5m)



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*******************************************************************************
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*                                                                             *
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*                                                                             *
*                        VERSION NO. - 2.05 AC                                *
*                        RELEASED ON - 10/24/1993                             *
*                        LICENSED TO - RICKY TAWEKAL                          *
*                                                                             *
*******************************************************************************
*                                                                             *
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*                  ROBERT C. MALAHY, JR.           TELEPHONE: (713) 664-8635  *
*                  8007 MULLINS                    FACSIMILE: (713) 664-0962  *
*                  HOUSTON, TEXAS 77081                                       *
*                  U.S.A.                                                     *
*                                                                             *
*******************************************************************************
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I N P U T D A T A E C H O

```
PRINTED OUTPUT SELECTED
=======================
   PRINT PIPE STRAINS IN OUTPUT ......NO
   USE DNV STRESS FORMULA ............NO
   STATIC PIPE FORCES AND STRESSES ...YES
   STATIC SOLUTION SUMMARY ...........YES
   OVERBEND PIPE SUPPORT GEOMETRY ....NO
   STINGER BALLAST SCHEDULE DATA .....NO
   DYNAMIC PIPE FORCES AND STRESSES ..YES
   DYNAMIC RANGE OF PIPE DATA ........NO
   DYNAMIC TRACKING OF PIPE DATA .....NO
   PLOT DATA FILE SUMMARY TABLES .....NO

PROFILE PLOT TABLE ENTRIES
==========================
   PLOT TABLE INDEX ..................        1
   PLOT NUMBER .......................        1
   PLOT TYPE OPTION NUMBER ...........        4
   DYNAMIC PROFILE TIME POINT ........     .000
   DYNAMIC PROFILE TIME INCREMENT ....     .000
   ORDINATE PARAMETER CODE NUMBER ....        2
   AXIS LABEL FOR ORDINATE ........... "Pipe Elevation or Y Coordinate  "
   ABSCISSA PARAMETER CODE NUMBER ....        1
   AXIS LABEL FOR ABSCISSA ........... "Pipe Horizontal X Coordinate    "

   PLOT TITLE ........................ "Pipeline Elevation Profile                              "
   MINIMUM HORIZONTAL AXIS RANGE .....     .000
   MAXIMUM HORIZONTAL AXIS RANGE .....     .000
   MINIMUM VERTICAL AXIS RANGE .......     .000
   MAXIMUM VERTICAL AXIS RANGE .......     .000

PROFILE PLOT TABLE ENTRIES
==========================
   PLOT TABLE INDEX ..................        2
   PLOT NUMBER .......................        2
   PLOT TYPE OPTION NUMBER ...........        4
   DYNAMIC PROFILE TIME POINT ........     .000
   DYNAMIC PROFILE TIME INCREMENT ....     .000
   ORDINATE PARAMETER CODE NUMBER ....       14
   AXIS LABEL FOR ORDINATE ........... "Total Von Mises Pipe Stress     "
   ABSCISSA PARAMETER CODE NUMBER ....        1
   AXIS LABEL FOR ABSCISSA ........... "Pipe Horizontal X Coordinate    "

   PLOT TITLE ........................ "Pipeline Total Pipe Stress                              "
   MINIMUM HORIZONTAL AXIS RANGE .....     .000
   MAXIMUM HORIZONTAL AXIS RANGE .....     .000
   MINIMUM VERTICAL AXIS RANGE .......     .000
   MAXIMUM VERTICAL AXIS RANGE .......     .000
```


I N P U T D A T A E C H O

```
PIPE PROPERTIES
===============
   PIPE PROPERTY TABLE ROW ...........        2
   PIPE SECTION LENGTH ...............     .000 M
   STEEL MODULUS OF ELASTICITY .......   207000. MPA
   AREA OF STEEL CROSS SECTION .......   250.000 CM**2
   COATED PIPE AVG MOMENT OF INERTIA .  74490.00 CM**4
   WEIGHT PER-UNIT-LENGTH IN AIR .....   4568.00 N/M
   WEIGHT PER-UNIT-LENGTH SUBMERGED ..   1556.66 N/M
   MAXIMUM ALLOWABLE PIPE STRAIN .....   .205000 PCT

   STEEL OUTSIDE DIAMETER ............   50.8000 CM
```

```
   STEEL WALL THICKNESS ..............    1.5900 CM
   YIELD STRESS ......................    360.00 MPA
   STRESS/STRAIN INTENSE FACTOR ......     .0000
   HYDRODYNAMIC OUTSIDE DIAMETER .....      .000 CM
   DRAG COEFFICIENT ..................     .0000
   HYDRODYNAMIC TOTAL AREA ...........      .000 CM**2
   ADDED MASS COEFFICIENT ............     .0000
   POISSON'S RATIO ...................     .3000
   COEFFICIENT OF THERMAL EXPANSION .. .00000000 1/DEG C

PIPE COATING PROPERTIES
=======================
   PIPE PROPERTY TABLE INDEX .........         2
   CORROSION COATING THICKNESS .......      .250 CM
   CONCRETE COATING THICKNESS ........     5.000 CM
   STEEL WEIGHT DENSITY ..............    77009. N/M**3
   CORROSION COATING WEIGHT DENSITY ..     9398. N/M**3
   CONCRETE COATING WEIGHT DENSITY ...    29822. N/M**3
   DESIRED PIPE SPECIFIC GRAVITY .....     .0000

   AVERAGE PIPE JOINT LENGTH .........    12.100 M
   FIELD JOINT LENGTH ................      .600 M
   JOINT FILL WEIGHT DENSITY .........    10055. N/M**3
   DENSITY OF PIPE CONTENTS ..........        0. N/M**3
```



```
                        I N P U T   D A T A   E C H O


SUPPORT ELEMENT PROPERTIES
==========================
   SUPPORT PROPERTY TABLE INDEX ......          7
   SUPPORT ELEMENT TYPE ..............          2 TENSIONER
   TENSIONER AXIAL STIFFNESS (F/L) ...   0.000E+00 KN/M
   VERTICAL STIFFNESS (F/L) ..........   0.000E+00 KN/M
   STATIC VERTICAL DEFLECTION ........      .0000 CM
   LATERAL STIFFNESS (F/L) ...........   0.000E+00 KN/M
   BOTTOM ROLLER ANGLE TO HORIZONTAL .     30.000 DEG

   SIDE ROLLER ANGLE TO VERTICAL .....       .000 DEG
   SIDE ROLLER OFFSET FROM C.L. ......       .000 M
   BED ROLLER LENGTH .................      2.000 M
   HEIGHT OF TOP ROLLER ABOVE BED ....       .000 M
   TENSIONER X-AXIS ROTATIONAL STIF. .       .000 KN/DEG
   TENSIONER Y-AXIS ROTATIONAL STIF. .       .000 KN/DEG
   TENSIONER Y-AXIS ROTATIONAL STIF. .       .000 KN/DEG

SUPPORT ELEMENT PROPERTIES
==========================
   SUPPORT PROPERTY TABLE INDEX ......          8
   SUPPORT ELEMENT TYPE ..............          1 SIMPLE SUPPORT
   TENSIONER AXIAL STIFFNESS (F/L) ...   0.000E+00 KN/M
   VERTICAL STIFFNESS (F/L) ..........   0.000E+00 KN/M
   STATIC VERTICAL DEFLECTION ........      .0000 CM
   LATERAL STIFFNESS (F/L) ...........   0.000E+00 KN/M
   BOTTOM ROLLER ANGLE TO HORIZONTAL .     30.000 DEG

   SIDE ROLLER ANGLE TO VERTICAL .....     60.000 DEG
   SIDE ROLLER OFFSET FROM C.L. ......      1.000 M
   BED ROLLER LENGTH .................      1.500 M
   HEIGHT OF TOP ROLLER ABOVE BED ....       .000 M
   TENSIONER X-AXIS ROTATIONAL STIF. .       .000 KN/DEG
   TENSIONER Y-AXIS ROTATIONAL STIF. .       .000 KN/DEG
   TENSIONER Y-AXIS ROTATIONAL STIF. .       .000 KN/DEG
```



```
                        I N P U T   D A T A   E C H O


SUPPORT ELEMENT PROPERTIES
==========================
   SUPPORT PROPERTY TABLE INDEX ......          9
   SUPPORT ELEMENT TYPE ..............          1 SIMPLE SUPPORT
   TENSIONER AXIAL STIFFNESS (F/L) ...   0.000E+00 KN/M
   VERTICAL STIFFNESS (F/L) ..........   0.000E+00 KN/M
   STATIC VERTICAL DEFLECTION ........      .0350 CM
   LATERAL STIFFNESS (F/L) ...........   0.000E+00 KN/M
   BOTTOM ROLLER ANGLE TO HORIZONTAL .     30.000 DEG

   SIDE ROLLER ANGLE TO VERTICAL .....     60.000 DEG
   SIDE ROLLER OFFSET FROM C.L. ......      1.000 M
   BED ROLLER LENGTH .................      1.500 M
   HEIGHT OF TOP ROLLER ABOVE BED ....       .000 M
   TENSIONER X-AXIS ROTATIONAL STIF. .       .000 KN/DEG
   TENSIONER Y-AXIS ROTATIONAL STIF. .       .000 KN/DEG
   TENSIONER Y-AXIS ROTATIONAL STIF. .       .000 KN/DEG

LAYBARGE DESCRIPTION
====================
   NUMBER OF PIPE NODES ..............         9
   BARGE GEOMETRY SPECIFIED BY .......         1 X-Y COORDINATES
   OVERBEND PIPE SUPPORT RADIUS ......      .000 M
   TANGENT POINT X-COORDINATE ........      .000 M
   TANGENT POINT Y-COORDINATE ........      .000 M
   PIPE ANGLE RELATIVE TO DECK .......     .0000 DEG
   HEIGHT OF DECK ABOVE WATER ........     1.000 M
   LAYBARGE FORWARD (X) OFFSET .......      .000 M
   BARGE TRIM ANGLE ..................     .0000 DEG

   STERN SHOE X COORDINATE ..........       .000 M
   STERN SHOE Y COORDINATE ...........      .000 M
   ROTATION CENTER X COORDINATE ......    31.930 M
   ROTATION CENTER Y COORDINATE ......     3.940 M
   ROTATION CENTER Z COORDINATE ......      .000 M
   BARGE HEADING .....................     .0000 DEG
   BARGE OFFSET FROM RIGHT-OF-WAY ....      .000 M
   PIPE RAMP PIVOT X COORDINATE ......      .000 M
   PIPE RAMP PIVOT Y COORDINATE ......      .000 M
   PIPE RAMP PIVOT ROTATION ANGLE ....      .000 DEG
```



```
                        I N P U T   D A T A   E C H O


    NODE X     NODE Y           SUPPORT          DAVIT
     COORD      COORD             TYPE          SPACING
     (M   )     (M   )                           (M   )
   ========   ========   ====================   =======
     61.000      1.516     2  PIPE TENSIONER        .000
     38.000      1.516     8  USER DEFINED          .000
```

32.095	1.516	8	USER DEFINED	.000	
26.500	1.516	7	USER DEFINED	.000	
23.000	1.516	8	USER DEFINED	.000	
16.520	1.396	8	USER DEFINED	.000	
12.000	1.192	8	USER DEFINED	.000	
5.500	.723	8	USER DEFINED	.000	
.000	.160	8	USER DEFINED	.000	

STINGER DESCRIPTION
==========

NUMBER OF PIPE/STINGER NODES	6	
STINGER GEOMETRY SPECIFIED BY	1	X-Y COORD AND TANGENT PT
STINGER TYPE	2	STRAIGHT CONVENTIONAL
OVERBEND PIPE SUPPORT RADIUS	.00	M
HITCH X-COORDINATE	-.399	M
HITCH Y-COORDINATE	-.744	M
X COORDINATE OF LOCAL ORIGIN	-.399	M
Y COORDINATE OF LOCAL ORIGIN	-.744	M
ROTATION ABOUT STINGER HITCH	12.570	DEG
TANGENT POINT X-COORDINATE	.000	M
TANGENT POINT Y-COORDINATE	.000	M
TANGENT POINT ANGLE	.000	DEG

NODE X COORD (M)	NODE Y COORD (M)	SUPPORT TYPE		ELEMENT TYPE		ELEMENT LENGTH (M)
-6.900	1.222	9	USER DEFINED	1	FIXED END	.000
-14.130	1.371	9	USER DEFINED	1	FIXED END	.000
-20.180	1.359	9	USER DEFINED	1	FIXED END	.000
-24.930	1.261	9	USER DEFINED	1	FIXED END	.000
-30.000	1.116	9	USER DEFINED	1	FIXED END	.000
-31.792	1.116	9	USER DEFINED	1	FIXED END	.000

I N P U T D A T A E C H O

CURRENT VELOCITIES
==========

WATER DEPTH (M)	CURRENT SPEED (M/S)	DIRECTION OF TRAVEL (DEG)
.000	.250	45.000
1.900	.246	45.000
3.800	.243	45.000
5.700	.238	45.000
7.600	.233	45.000
9.500	.228	45.000
11.400	.222	45.000
13.300	.214	45.000
15.200	.204	45.000
17.100	.190	45.000
19.000	.114	45.000
20.000	.000	45.000

BARGE MOTION RAO TABLE (OFFPIPE) SIGN CONVENTION
==========

WAVE FREQUENCY (RAD/S)	SURGE AMPLITUDE (M/M)	SURGE PHASE (DEG)	SWAY AMPLITUDE (M/M)	SWAY PHASE (DEG)	HEAVE AMPLITUDE (M/M)	HEAVE PHASE (DEG)
.2510	.6450	99.00	.6790	97.00	.9290	7.00
.3140	.6380	103.00	.6660	101.00	.9120	11.00
.3310	.6360	105.00	.6610	102.00	.9060	12.00
.3490	.6330	106.00	.6550	104.00	.8980	13.00
.3700	.6300	108.00	.6470	105.00	.8880	15.00
.3930	.6260	111.00	.6380	107.00	.8740	17.00
.4190	.6210	114.00	.6250	110.00	.8560	19.00
.4490	.6140	117.00	.6070	113.00	.8310	22.00
.4830	.6040	122.00	.5830	116.00	.7970	25.00
.5240	.5920	127.00	.5500	120.00	.7480	30.00
.5710	.5740	134.00	.5030	126.00	.6780	35.00
.6280	.5490	144.00	.4330	133.00	.5770	42.00
.6980	.5100	156.00	.3300	140.00	.4270	50.00
.7850	.4490	174.00	.1710	145.00	.2120	51.00
.8380	.4050	-173.00	.1190	133.00	.1160	8.00
.8980	.3490	-159.00	.1160	75.00	.2220	-44.00
1.0470	.1870	-120.00	.3650	72.00	.7380	-31.00
1.2570	.0290	122.00	.4790	129.00	1.0920	9.00
1.5710	.0880	-117.00	.1740	98.00	.2370	-74.00
2.0940	.0100	-40.00	.2350	176.00	.1390	26.00

I N P U T D A T A E C H O

WAVE FREQUENCY (RAD/S)	ROLL AMPLITUDE (DEG/M)	ROLL PHASE (DEG)	PITCH AMPLITUDE (DEG/M)	PITCH PHASE (DEG)	YAW AMPLITUDE (DEG/M)	YAW PHASE (DEG)
.2510	.2420	98.00	.7970	-107.00	.3010	-176.00
.3140	.3860	103.00	1.2460	-100.00	.4610	-169.00
.3310	.4300	105.00	1.3830	-99.00	.5080	-167.00
.3490	.4820	106.00	1.5430	-98.00	.5620	-165.00
.3700	.5440	108.00	1.7320	-97.00	.6250	-163.00
.3930	.6180	111.00	1.9530	-96.00	.6980	-160.00
.4190	.7090	113.00	2.2130	-94.00	.7840	-157.00
.4490	.8220	117.00	2.5130	-93.00	.8860	-153.00
.4830	.9650	121.00	2.8560	-92.00	1.0050	-148.00
.5240	1.1480	126.00	3.2330	-90.00	1.1440	-142.00
.5710	1.3920	133.00	3.6200	-88.00	1.3050	-135.00
.6280	1.7410	142.00	3.9690	-84.00	1.4840	-125.00
.6980	2.3590	153.00	4.1890	-77.00	1.6650	-111.00
.7850	4.5700	126.00	4.1270	-66.00	1.7980	-92.00
.8380	1.4180	16.00	3.9160	-58.00	1.8100	-79.00
.8980	.6500	-161.00	3.5290	-47.00	1.7500	-63.00
1.0470	1.0760	-117.00	2.0510	-13.00	1.2140	-19.00
1.2570	.2960	-41.00	.1320	-154.00	.2660	-131.00
1.5710	.2430	70.00	.5850	-10.00	1.1920	5.00
2.0940	.9390	158.00	.0590	110.00	.2070	107.00

TIME INTEGRATION PARAMETERS
==========

TIME STEP LENGTH	.4000	SEC
SOLUTION STARTS AT TIME	60.000	SEC
MAXIMUM TIME OF INTEGRATION	10860.000	SEC
SOLUTION SAMPLING TIME STEP.....	.800	SEC
DAMPING RATIO	.0000	

CONTROL SWITCHES
==========

MAXIMUM STATIC ITERATIONS	400
MAX DYNAMIC ITERATIONS PER STEP ...	400

```
   PROBLEM TYPE (0=STATIC,1=DYNAMIC) .   1
   PINNED PIPE END ON SEABED .........   1
   DAVIT LIFT ANALYSIS (1=YES,0=NO) ..   0
   STOP INTEGRATION AT TIME STEP .....   0
   NUMBER OF DIMENSIONS (2 OR 3) .....   2
   INITIATION BY BOWLINE (1=YES,0=NO)    0
   SUPPORT RELEASE LOGIC PARAMETER ...   0

================================================================================
OFFPIPE - OFFSHORE PIPELINE ANALYSIS SYSTEM - VERSION 2.05 AC          PAGE  10
Abandonment and Recovery Analysis in Sangatta
JOB NO. - 1                     LICENSED TO: RICKY TAWEKAL
USER ID - Moch. Ardiansyah      DATE -  7/ 1/2016   TIME -  5:44:26   CASE   1
================================================================================

                        I N P U T   D A T A   E C H O


WAVE SPECTRUM COEFFICIENTS
==========================
   NUMBER OF WAVES IN SPECTRUM .......        20
   1ST SPECTRUM COEFFICIENT ..........     .6130 M2/S4
   2ND SPECTRUM COEFFICIENT ..........     .7230 1/S**4
   MINIMUM FREQUENCY IN SPECTRUM .....     .2513 RAD/S
   MAXIMUM FREQUENCY IN SPECTRUM .....    2.0944 RAD/S
   DIRECTION OF WAVE TRAVEL ..........    45.000 DEG

WAVE PARAMETERS
===============
   WAVE HEIGHT (PEAK TO TROUGH) ......     2.110 M
   WAVE PERIOD .......................     7.200 SEC
   WAVE DIRECTION OF TRAVEL ..........    45.000 DEG
   WATER DEPTH FOR WAVE CALCULATIONS .     20.00 M

SAGBEND GEOMETRY
================
   SAGBEND PIPE ELEMENT LENGTH .......    12.100 M
   WATER DEPTH .......................     20.00 M
   ESTIMATED SAGBEND X LENGTH ........    145.00 M
   ESTIMATED PIPE LENGTH ON SEABED ...       .00 M
   X-COORD OF PIPE FREE END ON SEABED        .00 M
   ESTIMATED SPAN DEPTH FOR BOW LINE .       .00 M
   PIPE VERTICAL ANGLE AT SEABED .....      .000 DEG
   X-COORDINATE OF SPECIFIED DEPTH ...       .00 M
   MAXIMUM SLOPE (ANGLE) OF SEABED ...      .000 DEG
   DIRECTION OF MAXIMUM SLOPE ........      .000 DEG

CABLE PROPERTIES
================
   PIPE PROPERTY TABLE INDEX .........         1
   CABLE SECTION LENGTH ..............    24.000 M
   AXIAL STIFFNESS (EA) ..............       .00 KN
   BENDING STIFFNESS (EI) ............     .0000 KN-M**2
   WEIGHT PER-UNIT-LENGTH IN AIR .....        .0 N/M
   WEIGHT PER-UNIT-LENGTH SUBMERGED ..        .0 N/M

   CABLE DIAMETER ....................     3.200 CM
   DRAG COEFFICIENT ..................      .000
   CABLE CROSS SECTIONAL AREA ........      .000 KN
   ADDED MASS COEFFICIENT ............      .000

PIPE TENSION
============
   STATIC PIPE TENSION ON LAYBARGE ...   330.000 KN
   MINIMUM DYNAMIC PIPE TENSION ......      .000 KN
   MAXIMUM DYNAMIC PIPE TENSION ......      .000 KN

================================================================================
OFFPIPE - OFFSHORE PIPELINE ANALYSIS SYSTEM - VERSION 2.05 AC          PAGE  11
Abandonment and Recovery Analysis in Sangatta
JOB NO. - 1                     LICENSED TO: RICKY TAWEKAL
USER ID - Moch. Ardiansyah      DATE -  7/ 1/2016   TIME -  5:44:26   CASE   1
================================================================================

                                              E R R O R   M E S S A G E

             ***** WARNING / INFORMATIVE MESSAGE NO. -   1 *****

    The total stinger weight (




================================================================================
OFFPIPE - OFFSHORE PIPELINE ANALYSIS SYSTEM - VERSION 2.05 AC          PAGE  12
Abandonment and Recovery Analysis in Sangatta
JOB NO. - 1                     LICENSED TO: RICKY TAWEKAL
USER ID - Moch. Ardiansyah      DATE -  7/ 1/2016   TIME -  5:44:26   CASE   2
================================================================================

                        I N P U T   D A T A   E C H O


CABLE PROPERTIES
================
   PIPE PROPERTY TABLE INDEX .........         1
   CABLE SECTION LENGTH ..............    62.000 M
   AXIAL STIFFNESS (EA) ..............       .00 KN
   BENDING STIFFNESS (EI) ............     .0000 KN-M**2
   WEIGHT PER-UNIT-LENGTH IN AIR .....        .0 N/M
   WEIGHT PER-UNIT-LENGTH SUBMERGED ..        .0 N/M

   CABLE DIAMETER ....................     3.200 CM
   DRAG COEFFICIENT ..................      .000
   CABLE CROSS SECTIONAL AREA ........      .000 KN
   ADDED MASS COEFFICIENT ............      .000

PIPE TENSION
============
   STATIC PIPE TENSION ON LAYBARGE ...   330.000 KN
   MINIMUM DYNAMIC PIPE TENSION ......      .000 KN
   MAXIMUM DYNAMIC PIPE TENSION ......      .000 KN

             ***** WARNING / INFORMATIVE MESSAGE NO. -   1 *****

    The total stinger weight (




================================================================================
OFFPIPE - OFFSHORE PIPELINE ANALYSIS SYSTEM - VERSION 2.05 AC          PAGE  13
Abandonment and Recovery Analysis in Sangatta
JOB NO. - 1                     LICENSED TO: RICKY TAWEKAL
USER ID - Moch. Ardiansyah      DATE -  7/ 1/2016   TIME -  5:44:26   CASE   3
================================================================================

                        I N P U T   D A T A   E C H O


CABLE PROPERTIES
================
   PIPE PROPERTY TABLE INDEX .........         1
```

```
   CABLE SECTION LENGTH ..............    83.000 M
   AXIAL STIFFNESS (EA) ..............       .00 KN
   BENDING STIFFNESS (EI) ............     .0000 KN-M**2
   WEIGHT PER-UNIT-LENGTH IN AIR .....       .0 N/M
   WEIGHT PER-UNIT-LENGTH SUBMERGED ..       .0 N/M

   CABLE DIAMETER .....................    3.200 CM
   DRAG COEFFICIENT ...................     .000
   CABLE CROSS SECTIONAL AREA ........     .000 KN
   ADDED MASS COEFFICIENT .............    .000

PIPE TENSION
============
   STATIC PIPE TENSION ON LAYBARGE ...   210.000 KN
   MINIMUM DYNAMIC PIPE TENSION ......     .000 KN
   MAXIMUM DYNAMIC PIPE TENSION ......     .000 KN

            ***** WARNING / INFORMATIVE MESSAGE NO. -   1 *****

    The total stinger weight (
```



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                       I N P U T   D A T A   E C H O


CABLE PROPERTIES
================
   PIPE PROPERTY TABLE INDEX .........        1
   CABLE SECTION LENGTH ..............    94.000 M
   AXIAL STIFFNESS (EA) ..............       .00 KN
   BENDING STIFFNESS (EI) ............     .0000 KN-M**2
   WEIGHT PER-UNIT-LENGTH IN AIR .....       .0 N/M
   WEIGHT PER-UNIT-LENGTH SUBMERGED ..       .0 N/M

   CABLE DIAMETER .....................    3.200 CM
   DRAG COEFFICIENT ...................     .000
   CABLE CROSS SECTIONAL AREA ........     .000 KN
   ADDED MASS COEFFICIENT .............    .000

PIPE TENSION
============
   STATIC PIPE TENSION ON LAYBARGE ...   180.000 KN
   MINIMUM DYNAMIC PIPE TENSION ......     .000 KN
   MAXIMUM DYNAMIC PIPE TENSION ......     .000 KN

            ***** WARNING / INFORMATIVE MESSAGE NO. -   1 *****

    The total stinger weight (
```



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                       I N P U T   D A T A   E C H O


CABLE PROPERTIES
================
   PIPE PROPERTY TABLE INDEX .........        1
   CABLE SECTION LENGTH ..............   120.000 M
   AXIAL STIFFNESS (EA) ..............       .00 KN
   BENDING STIFFNESS (EI) ............     .0000 KN-M**2
   WEIGHT PER-UNIT-LENGTH IN AIR .....       .0 N/M
   WEIGHT PER-UNIT-LENGTH SUBMERGED ..       .0 N/M

   CABLE DIAMETER .....................    3.200 CM
   DRAG COEFFICIENT ...................     .000
   CABLE CROSS SECTIONAL AREA ........     .000 KN
   ADDED MASS COEFFICIENT .............    .000

PIPE TENSION
============
   STATIC PIPE TENSION ON LAYBARGE ...    75.000 KN
   MINIMUM DYNAMIC PIPE TENSION ......     .000 KN
   MAXIMUM DYNAMIC PIPE TENSION ......     .000 KN

            ***** WARNING / INFORMATIVE MESSAGE NO. -   1 *****

    The total stinger weight (
```



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                       I N P U T   D A T A   E C H O


CABLE PROPERTIES
================
   PIPE PROPERTY TABLE INDEX .........        1
   CABLE SECTION LENGTH ..............   147.000 M
   AXIAL STIFFNESS (EA) ..............       .00 KN
   BENDING STIFFNESS (EI) ............     .0000 KN-M**2
   WEIGHT PER-UNIT-LENGTH IN AIR .....       .0 N/M
   WEIGHT PER-UNIT-LENGTH SUBMERGED ..       .0 N/M

   CABLE DIAMETER .....................    3.200 CM
   DRAG COEFFICIENT ...................     .000
   CABLE CROSS SECTIONAL AREA ........     .000 KN
   ADDED MASS COEFFICIENT .............    .000

PIPE TENSION
============
   STATIC PIPE TENSION ON LAYBARGE ...    20.000 KN
   MINIMUM DYNAMIC PIPE TENSION ......     .000 KN
   MAXIMUM DYNAMIC PIPE TENSION ......     .000 KN

            ***** WARNING / INFORMATIVE MESSAGE NO. -   1 *****

    The total stinger weight (

END OF INPUT DATA
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OFFPIPE - OFFSHORE PIPELINE ANALYSIS SYSTEM - VERSION 2.05 AC DATE - 7/ 1/2016 TIME - 5:44:26 PAGE 17
PROJECT - Abandonment and Recovery Analysis in Sangatta JOB NO. - 1
USER ID - Moch. Ardiansyah LICENSED TO: RICKY TAWEKAL CASE 1

S T A T I C P I P E C O O R D I N A T E S, F O R C E S A N D S T R E S S E S

NODE NO.	PIPE SECTION	X COORD (M)	Y COORD (M)	Z COORD (M)	HORIZ ANGLE (DEG)	VERT ANGLE (DEG)	PIPE LENGTH (M)	TENSILE STRESS (MPA)	HOOP STRESS (MPA)	BENDING STRESSES VERT (MPA)	BENDING STRESSES HORIZ (MPA)	TOTAL STRESS (MPA)	PERCNT YIELD (PCT)
1	TENSIONR	61.00	2.52	.00	.000	.000	.000	.00	.00	.00	.00	.00	.00
3	LAYBARGE	38.00	2.52	.00	.000	-.002	23.000	6.72	.00	.40	-.01	7.12	1.98
5	LAYBARGE	32.09	2.52	.00	.000	.019	28.905	6.72	.00	-11.45	-.20	18.17	5.05
7	TENSIONR	26.50	2.52	.00	.001	-.080	34.500	13.43	.00	20.65	.49	34.09	9.47
9	LAYBARGE	23.00	2.52	.00	.001	.255	38.000	13.38	.00	-204.51	-.29	217.88	60.52
11	LAYBARGE	16.52	2.40	.00	-.003	1.924	44.481	13.33	.00	-263.72	-.80	277.05	76.96
13	LAYBARGE	12.00	2.19	.00	-.005	3.170	49.006	13.30	.00	-244.48	.11	257.78	71.61
15	LAYBARGE	5.50	1.73	.00	.001	4.998	55.523	13.19	.00	-285.17	1.53	298.36	82.88
17	LAYBARGE	.00	1.16	.00	.014	7.002	61.052	13.00	.00	-381.14	2.77	394.15	109.49
20	STINGER	-7.42	.07	.00	.032	9.466	68.553	12.91	.00	-231.73	1.59	244.65	67.96
22	STINGER	-14.54	-1.22	-.01	.041	10.979	75.784	12.75	-.20	-160.97	.47	173.83	48.29
24	STINGER	-20.46	-2.42	-.01	.040	11.947	81.834	12.59	-.39	-137.71	-.53	150.50	41.80
26	STINGER	-25.11	-3.43	-.02	.035	12.659	86.585	12.44	-.55	-140.13	-1.42	152.85	42.46
28	STINGER	-30.05	-4.58	-.02	.024	13.486	91.658	12.26	-.74	-162.80	-2.50	175.45	48.74
30	STINGER	-31.79	-5.00	-.02	.019	13.816	93.450	12.20	-.80	-170.80	-2.86	183.42	50.95
32	SAGBEND	-43.50	-8.04	-.02	-.009	14.839	105.550	11.79	-1.29	4.55	-1.29	17.20	4.78
33	SAGBEND	-55.21	-11.08	-.02	-.020	14.026	117.650	11.33	-1.78	109.20	-.38	121.43	33.73
34	SAGBEND	-67.00	-13.83	-.01	-.021	12.156	129.750	10.91	-2.22	168.45	.10	180.48	50.13
35	SAGBEND	-78.88	-16.13	-.01	-.018	9.711	141.850	10.56	-2.59	198.36	.31	210.22	58.39
36	SAGBEND	-90.85	-17.89	.00	-.013	7.021	153.951	10.30	-2.87	206.21	.36	217.96	60.54
37	SAGBEND	-102.88	-19.09	.00	-.009	4.364	166.051	10.13	-3.07	193.17	.33	204.85	56.90
38	SAGBEND	-114.97	-19.76	.00	-.005	2.037	178.151	10.05	-3.17	154.91	.32	166.57	46.27
39	SEABED	-127.06	-20.00	.00	-.001	.436	190.251	10.03	-3.21	80.45	.18	92.13	25.59
40	SEABED	-139.16	-20.02	.00	.000	-.051	202.351	10.04	-3.21	5.81	.03	17.67	4.91
41	SEABED	-151.26	-20.02	.00	.000	-.017	214.451	10.04	-3.21	-4.83	-.01	16.71	4.64
42	SEABED	-163.36	-20.02	.00	.000	.000	226.551	10.04	-3.21	4.42	.00	16.30	4.53
43	SEABED	-175.46	-20.00	.00	.000	-.194	238.651	10.04	-3.21	24.86	.00	36.61	10.17
44	SEABED	-187.56	-19.93	.00	.000	-.438	250.752	10.05	-3.20	.00	.00	11.97	3.33

OFFPIPE - OFFSHORE PIPELINE ANALYSIS SYSTEM - VERSION 2.05 AC DATE - 7/ 1/2016 TIME - 5:44:26 PAGE 18
PROJECT - Abandonment and Recovery Analysis in Sangatta JOB NO. - 1
USER ID - Moch. Ardiansyah LICENSED TO: RICKY TAWEKAL CASE 1

S T A T I C P I P E C O O R D I N A T E S, F O R C E S A N D S T R E S S E S

NODE NO.	PIPE SECTION	X COORD (M)	Y COORD (M)	Z COORD (M)	SUPPORT REACTION VERT (KN)	SUPPORT REACTION HORIZ (KN)	SUPT SEPARATIONS VERT (M)	SUPT SEPARATIONS HORIZ (M)	PIPE TENSION (KN)	BENDING MOMENTS VERT (KN-M)	BENDING MOMENTS HORIZ (KN-M)	BENDING MOMENTS TOTAL (KN-M)
1	TENSIONR	61.00	2.52	.00	.50	.00	.00	.00	165.12	.00	.00	.00
3	LAYBARGE	38.00	2.52	.00	6.30	.12	.00	.00	165.12	1.18	-.02	1.18
5	LAYBARGE	32.09	2.52	.00	62.91	-.55	.00	.00	165.11	-33.58	-.60	33.58
7	TENSIONR	26.50	2.52	.00	-224.57	1.23	.00	.00	330.08	60.56	1.42	60.58
9	LAYBARGE	23.00	2.52	.00	223.08	-.53	.00	.00	328.79	-599.71	-.84	599.71
11	LAYBARGE	16.52	2.40	.00	71.53	-.90	.00	.00	327.56	-773.37	-2.36	773.37
13	LAYBARGE	12.00	2.19	.00	.00	.00	.00	.00	326.98	-716.93	.32	716.93
15	LAYBARGE	5.50	1.73	.00	.00	.00	.01	.00	324.27	-836.25	4.50	836.27
17	LAYBARGE	.00	1.16	.00	161.75	1.29	.00	.00	319.65	-1117.69	8.13	1117.72
20	STINGER	-7.42	.07	.00	.00	.00	.13	.00	317.46	-679.54	4.66	679.56
22	STINGER	-14.54	-1.22	-.01	.00	.00	.27	-.01	316.01	-472.05	1.37	472.05
24	STINGER	-20.46	-2.42	-.01	.00	.00	.26	-.01	314.33	-403.84	-1.57	403.84
26	STINGER	-25.11	-3.43	-.02	.00	.00	.18	-.02	312.74	-410.94	-4.15	410.96
28	STINGER	-30.05	-4.58	-.02	.00	.00	.04	-.02	310.76	-477.42	-7.32	477.48
30	STINGER	-31.79	-5.00	-.02	80.46	-1.24	.00	-.02	309.98	-500.86	-8.38	500.93
32	SAGBEND	-43.50	-8.04	-.02	.00	.00	.00	.00	306.12	13.35	-3.79	13.88
33	SAGBEND	-55.21	-11.08	-.02	.00	.00	.00	.00	301.05	320.24	-1.10	320.24
34	SAGBEND	-67.00	-13.83	-.01	.00	.00	.00	.00	296.31	493.97	.30	493.97
35	SAGBEND	-78.88	-16.13	-.01	.00	.00	.00	.00	292.42	581.67	.92	581.68
36	SAGBEND	-90.85	-17.89	.00	.00	.00	.00	.00	289.59	604.70	1.05	604.71
37	SAGBEND	-102.88	-19.09	.00	.00	.00	.00	.00	287.87	566.48	.96	566.48
38	SAGBEND	-114.97	-19.76	.00	.00	.05	.00	.00	287.20	454.28	.94	454.28
39	SEABED	-127.06	-20.00	.00	13.11	.02	.00	.00	287.31	235.91	.53	235.91
40	SEABED	-139.16	-20.02	.00	34.26	-.03	.00	.00	287.49	17.03	.08	17.03
41	SEABED	-151.26	-20.02	.00	23.62	-.01	.00	.00	287.49	-14.18	-.02	14.18
42	SEABED	-163.36	-20.02	.00	21.53	.00	.00	.00	287.49	12.97	-.01	12.97
43	SEABED	-175.46	-20.00	.00	6.16	.00	.00	.00	287.48	72.91	.00	72.91
44	SEABED	-187.56	-19.93	.00	.00	.00	.00	.00	287.61	.00	.00	.00

OFFPIPE - OFFSHORE PIPELINE ANALYSIS SYSTEM - VERSION 2.05 AC PAGE 19
Abandonment and Recovery Analysis in Sangatta
JOB NO. - 1 LICENSED TO: RICKY TAWEKAL
USER ID - Moch. Ardiansyah DATE - 7/ 1/2016 TIME - 5:44:26 CASE 1

S T A T I C S O L U T I O N S U M M A R Y

PIPE PROPERTIES (2)

PIPE SECTION LENGTH ..	.00 M	ELASTIC MODULUS	207000. MPA
OUTSIDE DIAMETER	50.800 CM	CROSS SECTIONAL AREA .	250.00 CM2
WALL THICKNESS	1.590 CM	MOMENT OF INERTIA	74490.00 CM4
WEIGHT/LENGTH IN AIR .	4567.997 N/M	YIELD STRESS	360.00 MPA
SUBMERGED WGHT/LENG ..	1556.660 N/M	STRESS INTENS FACTOR .	1.000
SPECIFIC GRAVITY	1.517	STEEL DENSITY	77008.5 N/M3
WRAP COAT THICKNESS ..	.250 CM	WRAP COAT DENSITY	9397.6 N/M3
CONCRETE THICKNESS ...	5.000 CM	CONCRETE DENSITY	29822.4 N/M3

BARGE DATA

TOTAL PIPE TENSION ...	330.12 KN	RADIUS OF CURVATURE ..	.00 M
NUMBER OF TENSIONERS .	2	BARGE TRIM ANGLE	.000 DEG
NO. OF PIPE SUPPORTS .	7	PIPE ANGLE AT STERN ..	7.002 DEG
BARGE HEADING	.000 DEG	OFFSET FROM R.O.W. ...	.00 M

STINGER DATA

NO. OF PIPE SUPPORTS .	6	STINGER STERN DEPTH ..	-5.00 M
NO. STINGER SECTIONS .	6	PIPE ANGLE AT STERN ..	13.816 DEG
RADIUS OF CURVATURE ..	.00 M	STINGER LENGTH	31.90 M

SAGBEND DATA

WATER DEPTH	20.00 M	HORIZ PIPE TENSION ...	287.61 KN
TOUCHDOWN X-COORD. ...	-126.84 M	BOTTOM SLOPE ANGLE ...	.000 DEG

SOLUTION SUMMARY

NODE NO.	PIPE SECTION	X COORD	Y COORD	Z COORD	SUPPORT REACT VERT	SUPPORT REACT HORIZ	TOTAL MOMENT	TOTAL STRESS	PCT YLD
1	TENSIONR	61.0	2.5	.0	.5	.0	.0	.0	0.
3	LAYBARGE	38.0	2.5	.0	6.3	.1	1.2	7.1	2.
5	LAYBARGE	32.1	2.5	.0	62.9	-.6	33.6	18.2	5.
7	TENSIONR	26.5	2.5	.0	-224.6	1.2	60.6	34.1	9.
9	LAYBARGE	23.0	2.5	.0	223.1	-.5	599.7	217.9	61.

11	LAYBARGE	16.5	2.4	.0	71.5	-.9	773.4	277.1	77.
13	LAYBARGE	12.0	2.2	.0	.0	.0	716.9	257.8	72.
15	LAYBARGE	5.5	1.7	.0	.0	.0	836.3	298.4	83.
17	LAYBARGE	.0	1.2	.0	161.8	1.3	1117.7	394.2	109.
20	STINGER	-7.4	.1	.0	.0	.0	679.6	244.6	68.
22	STINGER	-14.5	-1.2	.0	.0	.0	472.1	173.8	48.
24	STINGER	-20.5	-2.4	.0	.0	.0	403.8	150.5	42.
26	STINGER	-25.1	-3.4	.0	.0	.0	411.0	152.9	42.
28	STINGER	-30.0	-4.6	.0	.0	.0	477.5	175.5	49.
30	STINGER	-31.8	-5.0	.0	80.5	-1.2	500.9	183.4	51.
36	SAGBEND	-90.8	-17.9	.0	.0	.0	604.7	218.0	61.

S T A T I C S O L U T I O N S U M M A R Y

39	SEABED	-127.1	-20.0	.0	13.1	.0	235.9	92.1	26.

OFFPIPE - OFFSHORE PIPELINE ANALYSIS SYSTEM - VERSION 2.05 AC DATE - 7/ 1/2016 TIME - 5:44:26 PAGE 21
PROJECT - Abandonment and Recovery Analysis in Sangatta JOB NO. - 1
USER ID - Moch. Ardiansyah LICENSED TO: RICKY TAWEKAL CASE 2

S T A T I C P I P E C O O R D I N A T E S, F O R C E S A N D S T R E S S E S

NODE NO.	PIPE SECTION	X COORD (M)	Y COORD (M)	Z COORD (M)	HORIZ ANGLE (DEG)	VERT ANGLE (DEG)	PIPE LENGTH (M)	TENSILE STRESS (MPA)	HOOP STRESS (MPA)	BENDING STRESSES VERT (MPA)	BENDING STRESSES HORIZ (MPA)	TOTAL STRESS (MPA)	PERCNT YIELD (PCT)
1	TENSIONR	61.00	2.52	.00	.000	.000	.000	.00	.00	.00	.00	.00	.00
3	LAYBARGE	38.00	2.52	.00	.000	.000	23.000	.00	.00	.00	.00	.00	.00
5	LAYBARGE	32.09	2.52	.00	.000	.000	28.905	.00	.00	.00	.00	.00	.00
7	TENSIONR	26.50	2.52	.00	.000	.000	34.500	.00	.00	.00	.00	.00	.00
9	LAYBARGE	23.00	2.52	.00	.000	.531	38.000	.00	.00	.00	.00	.00	.00
11	LAYBARGE	16.52	2.40	.00	.000	1.823	44.481	.00	.00	.00	.00	.00	.00
13	LAYBARGE	12.00	2.19	.00	.000	3.356	49.006	.00	.00	.00	.00	.00	.00
15	LAYBARGE	5.50	1.72	.00	.069	4.817	55.523	.00	.00	.00	.00	.00	.00
17	LAYBARGE	.00	1.19	-.01	.030	9.686	61.054	13.39	.00	.00	.00	13.39	3.72
20	STINGER	-7.39	-.08	-.02	.024	10.054	68.554	13.14	-.01	-100.08	-1.57	113.24	31.45
22	STINGER	-14.51	-1.39	-.02	.013	10.787	75.786	12.95	-.22	-87.57	-1.03	100.64	27.96
24	STINGER	-20.44	-2.56	-.02	.007	11.397	81.836	12.78	-.41	-101.72	-.72	114.70	31.86
26	STINGER	-25.10	-3.52	-.02	.004	11.993	86.587	12.63	-.56	-131.59	-.58	144.50	40.14
28	STINGER	-30.05	-4.61	-.02	.001	12.854	91.659	12.45	-.74	-183.06	-.68	195.88	54.41
30	STINGER	-31.80	-5.01	-.02	-.002	13.232	93.451	12.38	-.80	-198.32	-1.74	211.11	58.64
32	SAGBEND	-43.53	-7.96	-.02	-.018	14.547	105.552	12.00	-1.28	-12.49	-.69	25.17	6.99
33	SAGBEND	-55.25	-10.96	-.01	-.023	13.913	117.652	11.55	-1.76	98.46	-.03	110.91	30.81
34	SAGBEND	-67.04	-13.70	-.01	-.021	12.159	129.752	11.13	-2.20	161.31	.29	173.55	48.21
35	SAGBEND	-78.92	-16.01	-.01	-.016	9.792	141.852	10.78	-2.57	193.57	.41	205.64	57.12
36	SAGBEND	-90.88	-17.80	.00	-.010	7.152	153.952	10.52	-2.86	203.39	.38	215.35	59.82
37	SAGBEND	-102.92	-19.03	.00	-.006	4.518	166.053	10.34	-3.05	192.57	.28	204.46	56.79
38	SAGBEND	-115.00	-19.72	.00	-.003	2.180	178.153	10.25	-3.17	157.32	.19	169.18	46.99
39	SAGBEND	-127.09	-19.99	.00	-.001	.521	190.253	10.23	-3.21	87.28	.13	99.16	27.54
40	SEABED	-139.19	-20.03	.00	.000	-.043	202.353	10.24	-3.22	8.75	.03	20.79	5.77
41	SEABED	-151.29	-20.02	.00	.000	-.021	214.453	10.24	-3.21	-4.98	.00	17.05	4.74
42	SEABED	-163.39	-20.02	.00	.000	-.001	226.553	10.24	-3.21	4.26	.00	16.35	4.54
43	SEABED	-175.49	-20.00	.00	.000	-.194	238.653	10.24	-3.21	24.83	.00	36.78	10.22
44	SEABED	-187.59	-19.93	.00	.000	-.438	250.753	10.25	-3.20	.00	.00	12.17	3.38

OFFPIPE - OFFSHORE PIPELINE ANALYSIS SYSTEM - VERSION 2.05 AC DATE - 7/ 1/2016 TIME - 5:44:26 PAGE 22
PROJECT - Abandonment and Recovery Analysis in Sangatta JOB NO. - 1
USER ID - Moch. Ardiansyah LICENSED TO: RICKY TAWEKAL CASE 2

S T A T I C P I P E C O O R D I N A T E S, F O R C E S A N D S T R E S S E S

NODE NO.	PIPE SECTION	X COORD (M)	Y COORD (M)	Z COORD (M)	SUPPORT REACTION VERT (KN)	SUPPORT REACTION HORIZ (KN)	SUPT SEPARATIONS VERT (M)	SUPT SEPARATIONS HORIZ (M)	PIPE TENSION (KN)	BENDING MOMENTS VERT (KN-M)	BENDING MOMENTS HORIZ (KN-M)	BENDING MOMENTS TOTAL (KN-M)
1	TENSIONR	61.00	2.52	.00	.50	.00	.00	.00	165.00	.00	.00	.00
3	LAYBARGE	38.00	2.52	.00	.63	.00	.00	.00	165.00	.12	.00	.00
5	LAYBARGE	32.09	2.52	.00	.25	.00	.00	.00	165.00	.05	.00	.00
7	TENSIONR	26.50	2.52	.00	.20	.00	.00	.00	330.00	.05	.00	.00
9	LAYBARGE	23.00	2.52	.00	6.33	.00	.00	.00	329.98	1.19	.00	.00
11	LAYBARGE	16.52	2.40	.00	9.01	.00	.00	.00	329.96	1.69	.00	.00
13	LAYBARGE	12.00	2.19	.00	9.12	.00	.00	.00	329.95	1.71	.00	.00
15	LAYBARGE	5.50	1.72	.00	8.21	.80	.00	.00	329.94	1.54	-.15	.00
17	LAYBARGE	.00	1.19	-.01	.00	.00	.03	-.01	329.05	.00	.00	.00
20	STINGER	-7.39	-.08	-.02	73.19	-.97	.00	-.02	323.17	-293.48	-4.61	293.51
22	STINGER	-14.51	-1.39	-.02	.00	.00	.09	-.02	321.22	-256.81	-3.02	256.83
24	STINGER	-20.44	-2.56	-.02	.00	.00	.12	-.02	319.34	-298.28	-2.11	298.29
26	STINGER	-25.10	-3.52	-.02	.00	.00	.10	-.02	317.65	-385.88	-1.71	385.89
28	STINGER	-30.05	-4.61	-.02	3.86	2.23	.01	-.02	315.50	-536.81	-1.99	536.82
30	STINGER	-31.80	-5.01	-.02	97.66	-2.64	.00	-.02	314.64	-581.56	-5.11	581.58
32	SAGBEND	-43.53	-7.96	-.02	.00	.00	.00	.00	311.21	-36.63	-2.03	36.69
33	SAGBEND	-55.25	-10.96	-.01	.00	.00	.00	.00	306.28	288.75	-.08	288.75
34	SAGBEND	-67.04	-13.70	-.01	.00	.00	.00	.00	301.55	473.04	.86	473.04
35	SAGBEND	-78.92	-16.01	-.01	.00	.00	.00	.00	297.64	567.63	1.19	567.63
36	SAGBEND	-90.88	-17.80	.00	.00	.00	.00	.00	294.75	596.45	1.11	596.45
37	SAGBEND	-102.92	-19.03	.00	.00	.00	.00	.00	292.96	564.72	.82	564.72
38	SAGBEND	-115.00	-19.72	.00	.00	.00	.00	.00	292.21	461.33	.54	461.33
39	SAGBEND	-127.09	-19.99	.00	10.41	.02	.00	.00	292.27	255.96	.37	255.96
40	SEABED	-139.19	-20.03	.00	34.43	-.02	.00	.00	292.47	25.67	.07	25.67
41	SEABED	-151.29	-20.02	.00	24.37	-.01	.00	.00	292.47	-14.60	-.01	14.60
42	SEABED	-163.39	-20.02	.00	21.56	.00	.00	.00	292.47	12.49	.00	12.49
43	SEABED	-175.49	-20.00	.00	6.11	.00	.00	.00	292.46	72.81	.00	72.81
44	SEABED	-187.59	-19.93	.00	.00	.00	.00	.00	292.59	.00	.00	.00

OFFPIPE - OFFSHORE PIPELINE ANALYSIS SYSTEM - VERSION 2.05 AC PAGE 23
Abandonment and Recovery Analysis in Sangatta
JOB NO. - 1 LICENSED TO: RICKY TAWEKAL
USER ID - Moch. Ardiansyah DATE - 7/ 1/2016 TIME - 5:44:26 CASE 2

S T A T I C S O L U T I O N S U M M A R Y

PIPE PROPERTIES (2)

PIPE SECTION LENGTH ..	.00 M	ELASTIC MODULUS	207000. MPA
OUTSIDE DIAMETER	50.800 CM	CROSS SECTIONAL AREA .	250.00 CM2
WALL THICKNESS	1.590 CM	MOMENT OF INERTIA	74490.00 CM4
WEIGHT/LENGTH IN AIR .	4567.997 N/M	YIELD STRESS	360.00 MPA
SUBMERGED WGHT/LENG ..	1556.660 N/M	STRESS INTENS FACTOR .	1.000
SPECIFIC GRAVITY	1.517	STEEL DENSITY	77008.5 N/M3
WRAP COAT THICKNESS ..	.250 CM	WRAP COAT DENSITY	9397.6 N/M3
CONCRETE THICKNESS ...	5.000 CM	CONCRETE DENSITY	29822.4 N/M3

BARGE DATA

TOTAL PIPE TENSION ...	330.00 KN	RADIUS OF CURVATURE ..	.00 M
NUMBER OF TENSIONERS .	2	BARGE TRIM ANGLE	.000 DEG
NO. OF PIPE SUPPORTS .	7	PIPE ANGLE AT STERN ..	9.686 DEG
BARGE HEADING	.000 DEG	OFFSET FROM R.O.W. ...	.00 M

STINGER DATA

NO. OF PIPE SUPPORTS .	6	STINGER STERN DEPTH ..	-5.01 M
NO. STINGER SECTIONS .	6	PIPE ANGLE AT STERN ..	13.232 DEG
RADIUS OF CURVATURE ..	.00 M	STINGER LENGTH	31.90 M

SAGBEND DATA

WATER DEPTH	20.00 M	HORIZ PIPE TENSION ...	292.59 KN
TOUCHDOWN X-COORD. ...	-127.84 M	BOTTOM SLOPE ANGLE ...	.000 DEG

SOLUTION SUMMARY

NODE NO.	PIPE SECTION	X COORD	Y COORD	Z COORD	SUPPORT REACT VERT	SUPPORT REACT HORIZ	TOTAL MOMENT	TOTAL STRESS	PCT YLD
1	TENSIONR	61.0	2.5	.0	.5	.0	.0	.0	0.
3	LAYBARGE	38.0	2.5	.0	.6	.0	.0	.0	0.
5	LAYBARGE	32.1	2.5	.0	.2	.0	.0	.0	0.
7	TENSIONR	26.5	2.5	.0	.2	.0	.0	.0	0.
9	LAYBARGE	23.0	2.5	.0	6.3	.0	.0	.0	0.

11	LAYBARGE	16.5	2.4	.0	9.0	.0	.0	.0	0.
13	LAYBARGE	12.0	2.2	.0	9.1	.0	.0	.0	0.
15	LAYBARGE	5.5	1.7	.0	8.2	.8	.0	.0	0.
17	LAYBARGE	.0	1.2	.0	.0	.0	.0	13.4	4.
20	STINGER	-7.4	-.1	.0	73.2	-1.0	293.5	113.2	31.
22	STINGER	-14.5	-1.4	.0	.0	.0	256.8	100.6	28.
24	STINGER	-20.4	-2.6	.0	.0	.0	298.3	114.7	32.
26	STINGER	-25.1	-3.5	.0	.0	.0	385.9	144.5	40.
28	STINGER	-30.1	-4.6	.0	3.9	2.2	536.8	195.9	54.
30	STINGER	-31.8	-5.0	.0	97.7	-2.6	581.6	211.1	59.
36	SAGBEND	-90.9	-17.8	.0	.0	.0	596.5	215.4	60.

S T A T I C S O L U T I O N S U M M A R Y

40	SEABED	-139.2	-20.0	.0	34.4	.0	25.7	20.8	6.

OFFPIPE - OFFSHORE PIPELINE ANALYSIS SYSTEM - VERSION 2.05 AC DATE - 7/ 1/2016 TIME - 5:44:26 PAGE 25
PROJECT - Abandonment and Recovery Analysis in Sangatta JOB NO. - 1
USER ID - Moch. Ardiansyah LICENSED TO: RICKY TAWEKAL CASE 3

S T A T I C P I P E C O O R D I N A T E S, F O R C E S A N D S T R E S S E S

NODE NO.	PIPE SECTION	X COORD (M)	Y COORD (M)	Z COORD (M)	HORIZ ANGLE (DEG)	VERT ANGLE (DEG)	PIPE LENGTH (M)	TENSILE STRESS (MPA)	HOOP STRESS (MPA)	BENDING STRESSES VERT (MPA)	BENDING STRESSES HORIZ (MPA)	TOTAL STRESS (MPA)	PERCNT YIELD (PCT)
1	TENSIONR	61.00	2.52	.00	.000	.000	.000	.00	.00	.00	.00	.00	.00
3	LAYBARGE	38.00	2.52	.00	.000	.000	23.000	.00	.00	.00	.00	.00	.00
5	LAYBARGE	32.09	2.52	.00	.000	.000	28.905	.00	.00	.00	.00	.00	.00
7	TENSIONR	26.50	2.52	.00	.000	.000	34.500	.00	.00	.00	.00	.00	.00
9	LAYBARGE	23.00	2.52	.00	.000	.531	38.000	.00	.00	.00	.00	.00	.00
11	LAYBARGE	16.52	2.40	.00	.000	1.823	44.481	.00	.00	.00	.00	.00	.00
13	LAYBARGE	12.00	2.19	.00	.000	3.356	49.006	.00	.00	.00	.00	.00	.00
15	LAYBARGE	5.50	1.72	.00	.000	4.986	55.523	.00	.00	.00	.00	.00	.00
17	LAYBARGE	.00	1.16	.00	.035	7.205	61.052	.00	.00	.00	.00	.00	.00
20	STINGER	-7.41	.04	-.01	.071	8.525	68.551	.00	.00	.00	.00	.00	.00
22	STINGER	-14.57	-1.02	-.02	.072	8.450	75.782	.00	.00	.00	.00	.00	.00
24	STINGER	-20.59	-1.92	-.03	-.006	15.212	81.881	8.32	-.31	.00	.00	8.48	2.35
26	STINGER	-25.17	-3.16	-.03	-.007	15.326	86.626	8.13	-.51	-46.36	-.49	54.75	15.21
28	STINGER	-30.05	-4.52	-.02	-.012	15.751	91.691	7.92	-.73	-110.19	-1.11	118.48	32.91
30	STINGER	-31.77	-5.01	-.02	-.014	15.991	93.479	7.84	-.80	-130.27	-1.31	138.53	38.48
32	SAGBEND	-43.35	-8.43	-.02	-.026	16.514	105.554	7.36	-1.35	43.59	-.38	51.64	14.35
33	SAGBEND	-54.99	-11.75	-.01	-.027	15.133	117.654	6.85	-1.89	156.65	.17	164.46	45.68
34	SAGBEND	-66.73	-14.66	-.01	-.022	12.589	129.754	6.40	-2.35	222.42	.43	230.00	63.89
35	SAGBEND	-78.61	-16.98	-.01	-.016	9.428	141.854	6.04	-2.73	251.25	.49	258.67	71.85
36	SAGBEND	-90.59	-18.61	.00	-.010	6.109	153.954	5.81	-2.99	246.64	.42	253.95	70.54
37	SAGBEND	-102.65	-19.57	.00	-.005	3.078	166.054	5.69	-3.14	206.61	.30	213.89	59.41
38	SAGBEND	-114.75	-19.97	.00	-.002	.847	178.154	5.66	-3.21	123.66	.20	130.96	36.38
39	SEABED	-126.85	-20.03	.00	.000	-.034	190.255	5.67	-3.22	18.62	.06	26.05	7.24
40	SEABED	-138.95	-20.02	.00	.000	-.048	202.355	5.67	-3.21	-5.76	-.01	13.33	3.70
41	SEABED	-151.05	-20.01	.00	.000	.009	214.455	5.67	-3.21	-2.42	.00	10.09	2.80
42	SEABED	-163.15	-20.02	.00	.000	.003	226.555	5.67	-3.21	5.13	.00	12.71	3.53
43	SEABED	-175.25	-20.00	.00	.000	-.195	238.655	5.67	-3.21	25.19	.00	32.59	9.05
44	SEABED	-187.35	-19.93	.00	.000	-.443	250.755	5.68	-3.20	.00	.00	7.79	2.16

OFFPIPE - OFFSHORE PIPELINE ANALYSIS SYSTEM - VERSION 2.05 AC DATE - 7/ 1/2016 TIME - 5:44:26 PAGE 26
PROJECT - Abandonment and Recovery Analysis in Sangatta JOB NO. - 1
USER ID - Moch. Ardiansyah LICENSED TO: RICKY TAWEKAL CASE 3

S T A T I C P I P E C O O R D I N A T E S, F O R C E S A N D S T R E S S E S

NODE NO.	PIPE SECTION	X COORD (M)	Y COORD (M)	Z COORD (M)	SUPPORT REACTION VERT (KN)	SUPPORT REACTION HORIZ (KN)	SUPT SEPARATIONS VERT (M)	SUPT SEPARATIONS HORIZ (M)	PIPE TENSION (KN)	BENDING MOMENTS VERT (KN-M)	BENDING MOMENTS HORIZ (KN-M)	BENDING MOMENTS TOTAL (KN-M)
1	TENSIONR	61.00	2.52	.00	.50	.00	.00	.00	105.03	.00	.00	.00
3	LAYBARGE	38.00	2.52	.00	.63	.00	.00	.00	105.03	.12	.00	.00
5	LAYBARGE	32.09	2.52	.00	.25	.00	.00	.00	105.03	.05	.00	.00
7	TENSIONR	26.50	2.52	.00	.20	.00	.00	.00	210.03	.05	.00	.00
9	LAYBARGE	23.00	2.52	.00	4.11	.00	.00	.00	210.02	.77	.00	.00
11	LAYBARGE	16.52	2.40	.00	5.82	.00	.00	.00	210.01	1.09	.00	.00
13	LAYBARGE	12.00	2.19	.00	5.89	.00	.00	.00	210.00	1.10	.00	.00
15	LAYBARGE	5.50	1.72	.00	6.56	.00	.00	.00	209.97	1.23	.00	.00
17	LAYBARGE	.00	1.16	.00	10.25	.26	.00	.00	209.91	1.92	-.05	.00
20	STINGER	-7.41	.04	-.01	.00	.00	.10	-.01	209.92	.00	.00	.00
22	STINGER	-14.57	-1.02	-.02	.00	.00	.47	-.02	209.88	.00	.00	.00
24	STINGER	-20.59	-1.92	-.03	.00	.00	.78	-.03	208.36	.00	.00	.00
26	STINGER	-25.17	-3.16	-.03	.00	.00	.46	-.03	206.36	-135.95	-1.45	135.95
28	STINGER	-30.05	-4.52	-.02	.00	.00	.10	-.02	203.97	-323.13	-3.24	323.15
30	STINGER	-31.77	-5.01	-.02	99.58	-.70	.00	-.02	203.03	-382.03	-3.83	382.05
32	SAGBEND	-43.35	-8.43	-.02	.00	.00	.00	.00	198.18	127.82	-1.11	127.82
33	SAGBEND	-54.99	-11.75	-.01	.00	.00	.00	.00	192.37	459.38	.50	459.38
34	SAGBEND	-66.73	-14.66	-.01	.00	.00	.00	.00	187.14	652.24	1.26	652.25
35	SAGBEND	-78.61	-16.98	-.01	.00	.00	.00	.00	183.15	736.79	1.42	736.79
36	SAGBEND	-90.59	-18.61	.00	.00	.00	.00	.00	180.67	723.27	1.22	723.27
37	SAGBEND	-102.65	-19.57	.00	.00	.00	.00	.00	179.68	605.88	.88	605.88
38	SAGBEND	-114.75	-19.97	.00	7.41	.02	.00	.00	179.83	362.64	.60	362.64
39	SEABED	-126.85	-20.03	.00	38.74	-.02	.00	.00	180.21	54.60	.17	54.60
40	SEABED	-138.95	-20.02	.00	25.41	-.02	.00	.00	180.20	-16.89	-.02	16.89
41	SEABED	-151.05	-20.01	.00	19.79	.00	.00	.00	180.20	-7.10	-.01	7.10
42	SEABED	-163.15	-20.02	.00	22.02	.00	.00	.00	180.20	15.03	.00	15.03
43	SEABED	-175.25	-20.00	.00	6.67	.00	.00	.00	180.19	73.87	.00	73.87
44	SEABED	-187.35	-19.93	.00	.00	.00	.00	.00	180.32	.00	.00	.00

OFFPIPE - OFFSHORE PIPELINE ANALYSIS SYSTEM - VERSION 2.05 AC PAGE 27
Abandonment and Recovery Analysis in Sangatta
JOB NO. - 1 LICENSED TO: RICKY TAWEKAL
USER ID - Moch. Ardiansyah DATE - 7/ 1/2016 TIME - 5:44:26 CASE 3

S T A T I C S O L U T I O N S U M M A R Y

PIPE PROPERTIES (2)

PIPE SECTION LENGTH ..	.00 M	ELASTIC MODULUS	207000. MPA
OUTSIDE DIAMETER	50.800 CM	CROSS SECTIONAL AREA .	250.00 CM2
WALL THICKNESS	1.590 CM	MOMENT OF INERTIA	74490.00 CM4
WEIGHT/LENGTH IN AIR .	4567.997 N/M	YIELD STRESS	360.00 MPA
SUBMERGED WGHT/LENG ..	1556.660 N/M	STRESS INTENS FACTOR .	1.000
SPECIFIC GRAVITY	1.517	STEEL DENSITY	77008.5 N/M3
WRAP COAT THICKNESS ..	.250 CM	WRAP COAT DENSITY	9397.6 N/M3
CONCRETE THICKNESS ...	5.000 CM	CONCRETE DENSITY	29822.4 N/M3

BARGE DATA

TOTAL PIPE TENSION ...	210.03 KN	RADIUS OF CURVATURE ..	.00 M
NUMBER OF TENSIONERS .	2	BARGE TRIM ANGLE	.000 DEG
NO. OF PIPE SUPPORTS .	7	PIPE ANGLE AT STERN ..	7.205 DEG
BARGE HEADING	.000 DEG	OFFSET FROM R.O.W. ...	.00 M

STINGER DATA

NO. OF PIPE SUPPORTS .	6	STINGER STERN DEPTH ..	-5.01 M
NO. STINGER SECTIONS .	6	PIPE ANGLE AT STERN ..	15.991 DEG
RADIUS OF CURVATURE ..	.00 M	STINGER LENGTH	31.90 M

SAGBEND DATA

WATER DEPTH	20.00 M	HORIZ PIPE TENSION ...	180.32 KN
TOUCHDOWN X-COORD. ...	-117.26 M	BOTTOM SLOPE ANGLE ...	.000 DEG

SOLUTION SUMMARY

NODE NO.	PIPE SECTION	X COORD	Y COORD	Z COORD	SUPPORT REACT VERT	SUPPORT REACT HORIZ	TOTAL MOMENT	TOTAL STRESS	PCT YLD
1	TENSIONR	61.0	2.5	.0	.5	.0	.0	.0	0.
3	LAYBARGE	38.0	2.5	.0	.6	.0	.0	.0	0.
5	LAYBARGE	32.1	2.5	.0	.2	.0	.0	.0	0.
7	TENSIONR	26.5	2.5	.0	.2	.0	.0	.0	0.
9	LAYBARGE	23.0	2.5	.0	4.1	.0	.0	.0	0.

11	LAYBARGE	16.5	2.4	.0	5.8	.0	.0	.0	0.
13	LAYBARGE	12.0	2.2	.0	5.9	.0	.0	.0	0.
15	LAYBARGE	5.5	1.7	.0	6.6	.0	.0	.0	0.
17	LAYBARGE	.0	1.2	.0	10.2	.3	.0	.0	0.
20	STINGER	-7.4	.0	.0	.0	.0	.0	.0	0.
22	STINGER	-14.6	-1.0	.0	.0	.0	.0	.0	0.
24	STINGER	-20.6	-1.9	.0	.0	.0	.0	8.5	2.
26	STINGER	-25.2	-3.2	.0	.0	.0	136.0	54.7	15.
28	STINGER	-30.1	-4.5	.0	.0	.0	323.2	118.5	33.
30	STINGER	-31.8	-5.0	.0	99.6	-.7	382.0	138.5	38.
35	SAGBEND	-78.6	-17.0	.0	.0	.0	736.8	258.7	72.

S T A T I C S O L U T I O N S U M M A R Y

39	SEABED	-126.8	-20.0	.0	38.7	.0	54.6	26.0	7.

OFFPIPE - OFFSHORE PIPELINE ANALYSIS SYSTEM - VERSION 2.05 AC DATE - 7/ 1/2016 TIME - 5:44:26 PAGE 29
PROJECT - Abandonment and Recovery Analysis in Sangatta JOB NO. - 1
USER ID - Moch. Ardiansyah LICENSED TO: RICKY TAWEKAL CASE 4

S T A T I C P I P E C O O R D I N A T E S, F O R C E S A N D S T R E S S E S

NODE NO.	PIPE SECTION	X COORD (M)	Y COORD (M)	Z COORD (M)	HORIZ ANGLE (DEG)	VERT ANGLE (DEG)	PIPE LENGTH (M)	TENSILE STRESS (MPA)	HOOP STRESS (MPA)	BENDING STRESSES VERT (MPA)	BENDING STRESSES HORIZ (MPA)	TOTAL STRESS (MPA)	PERCNT YIELD (PCT)
1	TENSIONR	61.00	2.52	.00	.000	.000	.000	.00	.00	.00	.00	.00	.00
3	LAYBARGE	38.00	2.52	.00	.000	.000	23.000	.00	.00	.00	.00	.00	.00
5	LAYBARGE	32.09	2.52	.00	.000	.000	28.905	.00	.00	.00	.00	.00	.00
7	TENSIONR	26.50	2.52	.00	.000	.000	34.500	.00	.00	.00	.00	.00	.00
9	LAYBARGE	23.00	2.52	.00	.000	.530	38.000	.00	.00	.00	.00	.00	.00
11	LAYBARGE	16.52	2.40	.00	.000	1.823	44.481	.00	.00	.00	.00	.00	.00
13	LAYBARGE	12.00	2.19	.00	.000	3.356	49.006	.00	.00	.00	.00	.00	.00
15	LAYBARGE	5.50	1.72	.00	.000	4.986	55.523	.00	.00	.00	.00	.00	.00
17	LAYBARGE	.00	1.16	.00	.006	7.588	61.052	.00	.00	.00	.00	.00	.00
20	STINGER	-7.40	-.06	.00	.000	10.351	68.551	.00	.00	.00	.00	.00	.00
22	STINGER	-14.49	-1.48	.00	-.006	11.381	75.783	.00	.00	.00	.00	.00	.00
24	STINGER	-20.42	-2.68	.00	.000	11.392	81.833	.00	.00	.00	.00	.00	.00
26	STINGER	-25.08	-3.62	.00	.012	11.400	86.584	.00	.00	.00	.00	.00	.00
28	STINGER	-30.05	-4.62	.00	.204	11.809	91.656	.00	.00	.00	.00	.00	.00
30	STINGER	-31.80	-5.00	-.01	.165	22.257	93.452	.00	.00	.00	.00	.00	.00
32	SAGBEND	-32.27	-5.29	-.01	-.031	18.909	94.008	6.67	-.85	.00	.00	7.14	1.98
33	SAGBEND	-43.48	-9.06	-.01	-.027	17.966	105.831	6.10	-1.45	136.60	.47	143.44	39.84
34	SAGBEND	-54.79	-12.49	.00	-.019	15.605	117.655	5.56	-2.01	222.59	.67	229.17	63.66
35	SAGBEND	-66.53	-15.42	.00	-.010	12.316	129.755	5.11	-2.48	269.92	.66	276.28	76.74
36	SAGBEND	-78.42	-17.63	.00	-.002	8.644	141.855	4.78	-2.83	281.09	.50	287.30	79.81
37	SAGBEND	-90.44	-19.06	.00	.003	5.061	153.955	4.59	-3.06	255.98	.22	262.11	72.81
38	SAGBEND	-102.51	-19.80	.00	.004	2.072	166.055	4.51	-3.18	189.87	-.09	195.99	54.44
39	SEABED	-114.61	-20.02	.00	.002	.276	178.155	4.51	-3.21	74.38	-.20	80.55	22.38
40	SEABED	-126.71	-20.02	.00	.000	-.085	190.256	4.52	-3.21	-.84	-.04	7.51	2.09
41	SEABED	-138.81	-20.01	.00	.000	-.020	202.356	4.52	-3.21	-4.48	.01	10.97	3.05
42	SEABED	-150.91	-20.01	.00	.000	.014	214.456	4.52	-3.21	-1.28	.00	7.92	2.20
43	SEABED	-163.01	-20.02	.00	.000	.003	226.556	4.52	-3.21	5.11	.00	11.58	3.22
44	SEABED	-175.11	-20.00	.00	.000	-.195	238.656	4.52	-3.21	25.22	.00	31.47	8.74
45	SEABED	-187.21	-19.93	.00	.000	-.444	250.756	4.53	-3.20	.00	.00	6.73	1.87

OFFPIPE - OFFSHORE PIPELINE ANALYSIS SYSTEM - VERSION 2.05 AC DATE - 7/ 1/2016 TIME - 5:44:26 PAGE 30
PROJECT - Abandonment and Recovery Analysis in Sangatta JOB NO. - 1
USER ID - Moch. Ardiansyah LICENSED TO: RICKY TAWEKAL CASE 4

S T A T I C P I P E C O O R D I N A T E S, F O R C E S A N D S T R E S S E S

NODE NO.	PIPE SECTION	X COORD (M)	Y COORD (M)	Z COORD (M)	SUPPORT REACTION VERT (KN)	SUPPORT REACTION HORIZ (KN)	SUPT SEPARATIONS VERT (M)	SUPT SEPARATIONS HORIZ (M)	PIPE TENSION (KN)	BENDING MOMENTS VERT (KN-M)	BENDING MOMENTS HORIZ (KN-M)	BENDING MOMENTS TOTAL (KN-M)
1	TENSIONR	61.00	2.52	.00	.50	.00	.00	.00	90.01	.00	.00	.00
3	LAYBARGE	38.00	2.52	.00	.63	.00	.00	.00	90.01	.12	.00	.00
5	LAYBARGE	32.09	2.52	.00	.25	.00	.00	.00	90.01	.05	.00	.00
7	TENSIONR	26.50	2.52	.00	.20	.00	.00	.00	180.01	.05	.00	.00
9	LAYBARGE	23.00	2.52	.00	3.55	.00	.00	.00	180.00	.67	.00	.00
11	LAYBARGE	16.52	2.40	.00	5.02	.00	.00	.00	179.99	.94	.00	.00
13	LAYBARGE	12.00	2.19	.00	5.09	.00	.00	.00	179.98	.95	.00	.00
15	LAYBARGE	5.50	1.72	.00	5.66	.00	.00	.00	179.95	1.06	.00	.00
17	LAYBARGE	.00	1.16	.00	11.23	.04	.00	.00	179.86	2.10	-.01	.00
20	STINGER	-7.40	-.06	.00	6.69	-.08	.00	.00	179.87	1.25	.01	.00
22	STINGER	-14.49	-1.48	.00	.31	.03	.00	.00	179.85	.06	-.01	.00
24	STINGER	-20.42	-2.68	.00	.20	.00	.00	.00	179.80	.04	.00	.00
26	STINGER	-25.08	-3.62	.00	.23	.06	.00	.00	179.77	.04	-.01	.00
28	STINGER	-30.05	-4.62	.00	2.64	1.12	.00	.00	179.72	.50	-.21	.00
30	STINGER	-31.80	-5.00	-.01	62.76	-1.36	.00	-.01	176.98	11.76	.25	.00
32	SAGBEND	-32.27	-5.29	-.01	.00	.00	.00	.00	174.81	.01	.00	.01
33	SAGBEND	-43.48	-9.06	-.01	.00	.00	.00	.00	168.43	400.58	1.37	400.59
34	SAGBEND	-54.79	-12.49	.00	.00	.00	.00	.00	162.22	652.75	1.95	652.75
35	SAGBEND	-66.53	-15.42	.00	.00	.00	.00	.00	157.01	791.54	1.94	791.54
36	SAGBEND	-78.42	-17.63	.00	.00	.00	.00	.00	153.41	824.30	1.46	824.30
37	SAGBEND	-90.44	-19.06	.00	.00	.00	.00	.00	151.55	750.67	.66	750.67
38	SAGBEND	-102.51	-19.80	.00	.14	-.05	.00	.00	151.22	556.78	-.27	556.78
39	SEABED	-114.61	-20.02	.00	26.17	-.08	.00	.00	151.76	218.13	-.58	218.13
40	SEABED	-126.71	-20.02	.00	36.24	.03	.00	.00	151.92	-2.47	-.11	2.48
41	SEABED	-138.81	-20.01	.00	20.34	.01	.00	.00	151.91	-13.14	.02	13.14
42	SEABED	-150.91	-20.01	.00	19.57	.00	.00	.00	151.91	-3.76	.01	3.76
43	SEABED	-163.01	-20.02	.00	22.35	.00	.00	.00	151.91	15.00	.00	15.00
44	SEABED	-175.11	-20.00	.00	6.78	.00	.00	.00	151.90	73.96	.00	73.96
45	SEABED	-187.21	-19.93	.00	.00	.00	.00	.00	152.03	.00	.00	.00

OFFPIPE - OFFSHORE PIPELINE ANALYSIS SYSTEM - VERSION 2.05 AC PAGE 31
Abandonment and Recovery Analysis in Sangatta
JOB NO. - 1 LICENSED TO: RICKY TAWEKAL
USER ID - Moch. Ardiansyah DATE - 7/ 1/2016 TIME - 5:44:26 CASE 4

S T A T I C S O L U T I O N S U M M A R Y

PIPE PROPERTIES (2)

PIPE SECTION LENGTH ..	.00 M	ELASTIC MODULUS	207000. MPA
OUTSIDE DIAMETER	50.800 CM	CROSS SECTIONAL AREA .	250.00 CM2
WALL THICKNESS	1.590 CM	MOMENT OF INERTIA	74490.00 CM4
WEIGHT/LENGTH IN AIR .	4567.997 N/M	YIELD STRESS	360.00 MPA
SUBMERGED WGHT/LENG ..	1556.660 N/M	STRESS INTENS FACTOR .	1.000
SPECIFIC GRAVITY	1.517	STEEL DENSITY	77008.5 N/M3
WRAP COAT THICKNESS ..	.250 CM	WRAP COAT DENSITY	9397.6 N/M3
CONCRETE THICKNESS ...	5.000 CM	CONCRETE DENSITY	29822.4 N/M3

BARGE DATA

TOTAL PIPE TENSION ...	180.01 KN	RADIUS OF CURVATURE ..	.00 M
NUMBER OF TENSIONERS .	2	BARGE TRIM ANGLE	.000 DEG
NO. OF PIPE SUPPORTS .	7	PIPE ANGLE AT STERN ..	7.588 DEG
BARGE HEADING	.000 DEG	OFFSET FROM R.O.W. ...	.00 M

STINGER DATA

NO. OF PIPE SUPPORTS .	6	STINGER STERN DEPTH ..	-5.00 M
NO. STINGER SECTIONS .	6	PIPE ANGLE AT STERN ..	22.257 DEG
RADIUS OF CURVATURE ..	.00 M	STINGER LENGTH	31.90 M

SAGBEND DATA

WATER DEPTH	20.00 M	HORIZ PIPE TENSION ...	152.03 KN
TOUCHDOWN X-COORD. ...	-111.60 M	BOTTOM SLOPE ANGLE ...	.000 DEG

SOLUTION SUMMARY

NODE NO.	PIPE SECTION	X COORD	Y COORD	Z COORD	SUPPORT REACT VERT	SUPPORT REACT HORIZ	TOTAL MOMENT	TOTAL STRESS	PCT YLD
1	TENSIONR	61.0	2.5	.0	.5	.0	.0	.0	0.
3	LAYBARGE	38.0	2.5	.0	.6	.0	.0	.0	0.
5	LAYBARGE	32.1	2.5	.0	.2	.0	.0	.0	0.

7	TENSIONR	26.5	2.5	.0	.2	.0	.0	.0	0.
9	LAYBARGE	23.0	2.5	.0	3.5	.0	.0	.0	0.
11	LAYBARGE	16.5	2.4	.0	5.0	.0	.0	.0	0.
13	LAYBARGE	12.0	2.2	.0	5.1	.0	.0	.0	0.
15	LAYBARGE	5.5	1.7	.0	5.7	.0	.0	.0	0.
17	LAYBARGE	.0	1.2	.0	11.2	.0	.0	.0	0.
20	STINGER	-7.4	-.1	.0	6.7	-.1	.0	.0	0.
22	STINGER	-14.5	-1.5	.0	.3	.0	.0	.0	0.
24	STINGER	-20.4	-2.7	.0	.2	.0	.0	.0	0.
26	STINGER	-25.1	-3.6	.0	.2	.1	.0	.0	0.
28	STINGER	-30.0	-4.6	.0	2.6	1.1	.0	.0	0.
30	STINGER	-31.8	-5.0	.0	62.8	-1.4	.0	.0	0.
36	SAGBEND	-78.4	-17.6	.0	.0	.0	824.3	287.3	80.

S T A T I C S O L U T I O N S U M M A R Y

39	SEABED	-114.6	-20.0	.0	26.2	-.1	218.1	80.6	22.

OFFPIPE - OFFSHORE PIPELINE ANALYSIS SYSTEM - VERSION 2.05 AC DATE - 7/ 1/2016 TIME - 5:44:26 PAGE 33
PROJECT - Abandonment and Recovery Analysis in Sangatta JOB NO. - 1
USER ID - Moch. Ardiansyah LICENSED TO: RICKY TAWEKAL CASE 5

S T A T I C P I P E C O O R D I N A T E S, F O R C E S A N D S T R E S S E S

NODE NO.	PIPE SECTION	X COORD (M)	Y COORD (M)	Z COORD (M)	HORIZ ANGLE (DEG)	VERT ANGLE (DEG)	PIPE LENGTH (M)	TENSILE STRESS (MPA)	HOOP STRESS (MPA)	BENDING STRESSES VERT (MPA)	BENDING STRESSES HORIZ (MPA)	TOTAL STRESS (MPA)	PERCNT YIELD (PCT)
1	TENSIONR	61.00	2.52	.00	.000	.000	.000	.00	.00	.00	.00	.00	.00
3	LAYBARGE	38.00	2.52	.00	.000	.000	23.000	.00	.00	.00	.00	.00	.00
5	LAYBARGE	32.09	2.52	.00	.000	.000	28.905	.00	.00	.00	.00	.00	.00
7	TENSIONR	26.50	2.52	.00	.000	.000	34.500	.00	.00	.00	.00	.00	.00
9	LAYBARGE	23.00	2.52	.00	.000	.530	38.000	.00	.00	.00	.00	.00	.00
11	LAYBARGE	16.52	2.40	.00	.000	1.823	44.481	.00	.00	.00	.00	.00	.00
13	LAYBARGE	12.00	2.19	.00	.000	3.356	49.006	.00	.00	.00	.00	.00	.00
15	LAYBARGE	5.50	1.72	.00	.000	4.986	55.523	.00	.00	.00	.00	.00	.00
17	LAYBARGE	.00	1.16	.00	.003	7.582	61.052	.00	.00	.00	.00	.00	.00
20	STINGER	-7.40	-.05	.00	.000	10.350	68.551	.00	.00	.00	.00	.00	.00
22	STINGER	-14.49	-1.48	.00	-.003	11.386	75.783	.00	.00	.00	.00	.00	.00
24	STINGER	-20.42	-2.68	.00	.000	11.390	81.833	.00	.00	.00	.00	.00	.00
26	STINGER	-25.08	-3.61	.00	.002	11.392	86.584	.00	.00	.00	.00	.00	.00
28	STINGER	-30.05	-4.62	.00	.092	11.560	91.656	.00	.00	.00	.00	.00	.00
30	STINGER	-31.80	-4.98	-.01	.086	21.228	93.452	.00	.00	.00	.00	.00	.00
32	SAGBEND	-42.20	-11.16	.00	-.017	30.080	105.573	.00	.00	.00	.00	.00	.00
33	SAGBEND	-52.66	-17.26	.00	-.013	28.777	117.673	.00	.00	.00	.00	.00	.00
34	SAGBEND	-54.71	-18.35	.00	.001	4.222	120.027	1.19	-2.95	3.25	.00	6.44	1.79
35	SAGBEND	-65.61	-19.11	.00	.001	3.584	130.950	1.07	-3.07	93.79	.02	96.43	26.79
36	SAGBEND	-76.52	-19.67	.00	.001	2.222	141.873	.98	-3.16	125.58	-.01	128.17	35.60
37	SAGBEND	-88.61	-19.97	.00	.001	.697	153.973	.95	-3.21	93.91	-.06	96.50	26.81
38	SEABED	-100.71	-20.03	.00	.000	-.013	166.074	.95	-3.22	16.91	-.04	19.67	5.46
39	SEABED	-112.81	-20.02	.00	.000	-.040	178.174	.95	-3.21	-4.05	.00	7.17	1.99
40	SEABED	-124.91	-20.01	.00	.000	-.002	190.274	.95	-3.21	-1.16	.00	4.65	1.29
41	SEABED	-137.01	-20.01	.00	.000	.003	202.374	.95	-3.21	-.19	.00	3.91	1.09
42	SEABED	-149.11	-20.01	.00	.000	.011	214.474	.95	-3.21	-1.03	.00	4.54	1.26
43	SEABED	-161.21	-20.02	.00	.000	.002	226.574	.95	-3.21	4.83	.00	7.89	2.19
44	SEABED	-173.31	-20.00	.00	.000	-.195	238.674	.95	-3.21	25.47	.00	28.17	7.82
45	SEABED	-185.41	-19.93	.00	.000	-.447	250.774	.96	-3.20	.00	.00	3.77	1.05

OFFPIPE - OFFSHORE PIPELINE ANALYSIS SYSTEM - VERSION 2.05 AC DATE - 7/ 1/2016 TIME - 5:44:26 PAGE 34
PROJECT - Abandonment and Recovery Analysis in Sangatta JOB NO. - 1
USER ID - Moch. Ardiansyah LICENSED TO: RICKY TAWEKAL CASE 5

S T A T I C P I P E C O O R D I N A T E S, F O R C E S A N D S T R E S S E S

NODE NO.	PIPE SECTION	X COORD (M)	Y COORD (M)	Z COORD (M)	SUPPORT REACTION VERT (KN)	SUPPORT REACTION HORIZ (KN)	SUPT SEPARATIONS VERT (M)	SUPT SEPARATIONS HORIZ (M)	PIPE TENSION (KN)	BENDING MOMENTS VERT (KN-M)	BENDING MOMENTS HORIZ (KN-M)	BENDING MOMENTS TOTAL (KN-M)
1	TENSIONR	61.00	2.52	.00	.50	.00	.00	.00	37.48	.00	.00	.00
3	LAYBARGE	38.00	2.52	.00	.63	.00	.00	.00	37.48	.12	.00	.00
5	LAYBARGE	32.09	2.52	.00	.25	.00	.00	.00	37.48	.05	.00	.00
7	TENSIONR	26.50	2.52	.00	.20	.00	.00	.00	74.98	.05	.00	.00
9	LAYBARGE	23.00	2.52	.00	1.60	.00	.00	.00	74.98	.30	.00	.00
11	LAYBARGE	16.52	2.40	.00	2.23	.00	.00	.00	74.97	.42	.00	.00
13	LAYBARGE	12.00	2.19	.00	2.26	.00	.00	.00	74.96	.42	.00	.00
15	LAYBARGE	5.50	1.72	.00	2.51	.00	.00	.00	74.94	.47	.00	.00
17	LAYBARGE	.00	1.16	.00	4.82	.01	.00	.00	74.89	.90	.00	.00
20	STINGER	-7.40	-.05	.00	2.99	-.02	.00	.00	74.86	.56	.00	.00
22	STINGER	-14.49	-1.48	.00	.26	.00	.00	.00	74.82	.05	.00	.00
24	STINGER	-20.42	-2.68	.00	.20	.00	.00	.00	74.77	.04	.00	.00
26	STINGER	-25.08	-3.61	.00	.19	.00	.00	.00	74.74	.03	.00	.00
28	STINGER	-30.05	-4.62	.00	.56	.22	.00	.00	74.70	.10	-.04	.00
30	STINGER	-31.80	-4.98	-.01	24.89	-.24	.00	-.01	73.67	4.66	.04	.00
32	SAGBEND	-42.20	-11.16	.00	.00	.00	.00	.00	74.48	.00	.00	.00
33	SAGBEND	-52.66	-17.26	.00	.00	.00	.00	.00	74.23	2.61	.00	.00
34	SAGBEND	-54.71	-18.35	.00	.00	.00	.00	.00	66.70	9.54	.00	9.54
35	SAGBEND	-65.61	-19.11	.00	.00	.00	.00	.00	65.27	275.03	.06	275.03
36	SAGBEND	-76.52	-19.67	.00	.00	.00	.00	.00	64.21	368.28	-.03	368.28
37	SAGBEND	-88.61	-19.97	.00	5.59	-.02	.00	.00	63.93	275.39	-.17	275.39
38	SEABED	-100.71	-20.03	.00	33.31	.00	.00	.00	64.13	49.60	-.10	49.60
39	SEABED	-112.81	-20.02	.00	24.46	.01	.00	.00	64.12	-11.89	.00	11.89
40	SEABED	-124.91	-20.01	.00	18.30	.00	.00	.00	64.12	-3.41	.01	3.41
41	SEABED	-137.01	-20.01	.00	18.38	.00	.00	.00	64.12	-.56	.00	.56
42	SEABED	-149.11	-20.01	.00	20.42	.00	.00	.00	64.12	-3.03	.00	3.03
43	SEABED	-161.21	-20.02	.00	22.73	.00	.00	.00	64.13	14.17	.00	14.17
44	SEABED	-173.31	-20.00	.00	7.02	.00	.00	.00	64.11	74.69	.00	74.69
45	SEABED	-185.41	-19.93	.00	.00	.00	.00	.00	64.25	.00	.00	.00

OFFPIPE - OFFSHORE PIPELINE ANALYSIS SYSTEM - VERSION 2.05 AC PAGE 35
Abandonment and Recovery Analysis in Sangatta
JOB NO. - 1 LICENSED TO: RICKY TAWEKAL
USER ID - Moch. Ardiansyah DATE - 7/ 1/2016 TIME - 5:44:26 CASE 5

S T A T I C S O L U T I O N S U M M A R Y

PIPE PROPERTIES (2)

PIPE SECTION LENGTH ..	.00 M	ELASTIC MODULUS	207000. MPA
OUTSIDE DIAMETER	50.800 CM	CROSS SECTIONAL AREA .	250.00 CM2
WALL THICKNESS	1.590 CM	MOMENT OF INERTIA	74490.00 CM4
WEIGHT/LENGTH IN AIR .	4567.997 N/M	YIELD STRESS	360.00 MPA
SUBMERGED WGHT/LENG ..	1556.660 N/M	STRESS INTENS FACTOR .	1.000
SPECIFIC GRAVITY	1.517	STEEL DENSITY	77008.5 N/M3
WRAP COAT THICKNESS ..	.250 CM	WRAP COAT DENSITY	9397.6 N/M3
CONCRETE THICKNESS ...	5.000 CM	CONCRETE DENSITY	29822.4 N/M3

BARGE DATA

TOTAL PIPE TENSION ...	74.98 KN	RADIUS OF CURVATURE ..	.00 M
NUMBER OF TENSIONERS .	2	BARGE TRIM ANGLE	.000 DEG
NO. OF PIPE SUPPORTS .	7	PIPE ANGLE AT STERN ..	7.582 DEG
BARGE HEADING	.000 DEG	OFFSET FROM R.O.W. ...	.00 M

STINGER DATA

NO. OF PIPE SUPPORTS .	6	STINGER STERN DEPTH ..	-4.98 M
NO. STINGER SECTIONS .	6	PIPE ANGLE AT STERN ..	21.228 DEG
RADIUS OF CURVATURE ..	.00 M	STINGER LENGTH	31.90 M

SAGBEND DATA

WATER DEPTH	20.00 M	HORIZ PIPE TENSION ...	64.25 KN
TOUCHDOWN X-COORD. ...	-91.40 M	BOTTOM SLOPE ANGLE ...	.000 DEG

SOLUTION SUMMARY

NODE NO.	PIPE SECTION	X COORD	Y COORD	Z COORD	SUPPORT REACT VERT	SUPPORT REACT HORIZ	TOTAL MOMENT	TOTAL STRESS	PCT YLD
1	TENSIONR	61.0	2.5	.0	.5	.0	.0	.0	0.
3	LAYBARGE	38.0	2.5	.0	.6	.0	.0	.0	0.
5	LAYBARGE	32.1	2.5	.0	.2	.0	.0	.0	0.

7	TENSIONR	26.5	2.5	.0	.2	.0	.0	.0	0.
9	LAYBARGE	23.0	2.5	.0	1.6	.0	.0	.0	0.
11	LAYBARGE	16.5	2.4	.0	2.2	.0	.0	.0	0.
13	LAYBARGE	12.0	2.2	.0	2.3	.0	.0	.0	0.
15	LAYBARGE	5.5	1.7	.0	2.5	.0	.0	.0	0.
17	LAYBARGE	.0	1.2	.0	4.8	.0	.0	.0	0.
20	STINGER	-7.4	-.1	.0	3.0	.0	.0	.0	0.
22	STINGER	-14.5	-1.5	.0	.3	.0	.0	.0	0.
24	STINGER	-20.4	-2.7	.0	.2	.0	.0	.0	0.
26	STINGER	-25.1	-3.6	.0	.2	.0	.0	.0	0.
28	STINGER	-30.0	-4.6	.0	.6	.2	.0	.0	0.
30	STINGER	-31.8	-5.0	.0	24.9	-.2	.0	.0	0.
36	SAGBEND	-76.5	-19.7	.0	.0	.0	368.3	128.2	36.

S T A T I C S O L U T I O N S U M M A R Y

38	SEABED	-100.7	-20.0	.0	33.3	.0	49.6	19.7	5.

OFFPIPE - OFFSHORE PIPELINE ANALYSIS SYSTEM - VERSION 2.05 AC DATE - 7/ 1/2016 TIME - 5:44:26 PAGE 37
PROJECT - Abandonment and Recovery Analysis in Sangatta JOB NO. - 1
USER ID - Moch. Ardiansyah LICENSED TO: RICKY TAWEKAL CASE 6

S T A T I C P I P E C O O R D I N A T E S, F O R C E S A N D S T R E S S E S

NODE NO.	PIPE SECTION	X COORD (M)	Y COORD (M)	Z COORD (M)	HORIZ ANGLE (DEG)	VERT ANGLE (DEG)	PIPE LENGTH (M)	TENSILE STRESS (MPA)	HOOP STRESS (MPA)	BENDING STRESSES VERT (MPA)	BENDING STRESSES HORIZ (MPA)	TOTAL STRESS (MPA)	PERCNT YIELD (PCT)
1	TENSIONR	61.00	2.52	.00	.000	.000	.000	.00	.00	.00	.00	.00	.00
3	LAYBARGE	38.00	2.52	.00	.000	.000	23.000	.00	.00	.00	.00	.00	.00
5	LAYBARGE	32.09	2.52	.00	.000	.000	28.905	.00	.00	.00	.00	.00	.00
7	TENSIONR	26.50	2.52	.00	.000	.000	34.500	.00	.00	.00	.00	.00	.00
9	LAYBARGE	23.00	2.52	.00	.000	.530	38.000	.00	.00	.00	.00	.00	.00
11	LAYBARGE	16.52	2.40	.00	.000	1.823	44.481	.00	.00	.00	.00	.00	.00
13	LAYBARGE	12.00	2.19	.00	.000	3.356	49.006	.00	.00	.00	.00	.00	.00
15	LAYBARGE	5.50	1.72	.00	.000	4.986	55.523	.00	.00	.00	.00	.00	.00
17	LAYBARGE	.00	1.16	.00	.000	7.579	61.052	.00	.00	.00	.00	.00	.00
20	STINGER	-7.40	-.05	.00	.000	10.350	68.551	.00	.00	.00	.00	.00	.00
22	STINGER	-14.49	-1.48	.00	-.001	11.388	75.783	.00	.00	.00	.00	.00	.00
24	STINGER	-20.42	-2.68	.00	.000	11.389	81.833	.00	.00	.00	.00	.00	.00
26	STINGER	-25.08	-3.61	.00	.000	11.389	86.584	.00	.00	.00	.00	.00	.00
28	STINGER	-30.05	-4.62	.00	.010	11.408	91.656	.00	.00	.00	.00	.00	.00
30	STINGER	-31.81	-4.97	.00	-.001	15.104	93.449	.00	.00	.00	.00	.00	.00
32	SAGBEND	-43.26	-8.87	.00	-.014	18.130	105.552	.00	.00	.00	.00	.00	.00
33	SAGBEND	-54.80	-12.51	.01	-.001	16.810	117.652	.00	.00	.00	.00	.00	.00
34	SAGBEND	-66.42	-15.88	.00	.009	15.242	129.752	.00	.00	.00	.00	.00	.00
35	SAGBEND	-74.76	-18.09	.00	.013	12.341	138.379	.00	.00	.00	.00	.00	.00
36	SEABED	-83.14	-20.00	.00	.000	.075	147.006	-.90	-3.21	1.57	.00	3.59	1.00
37	SEABED	-90.09	-20.01	.00	.000	.042	153.953	-.90	-3.21	5.20	-.01	6.53	1.81
38	SEABED	-102.19	-20.01	.00	.000	.000	166.053	-.90	-3.21	1.09	.00	3.31	.92
39	SEABED	-114.29	-20.01	.00	.000	-.002	178.153	-.90	-3.21	-.20	.00	2.93	.81
40	SEABED	-126.39	-20.01	.00	.000	-.001	190.253	-.90	-3.21	-.03	.00	2.88	.80
41	SEABED	-138.49	-20.01	.00	.000	.001	202.353	-.90	-3.21	-.33	.00	2.97	.82
42	SEABED	-150.59	-20.01	.00	.000	.011	214.453	-.90	-3.21	-1.14	.00	3.34	.93
43	SEABED	-162.69	-20.02	.00	.000	.003	226.553	-.90	-3.21	4.80	.00	6.16	1.71
44	SEABED	-174.79	-20.00	.00	.000	-.195	238.654	-.90	-3.21	25.63	.00	26.48	7.36
45	SEABED	-186.89	-19.93	.00	.000	-.449	250.754	-.89	-3.20	.00	.00	2.86	.79

OFFPIPE - OFFSHORE PIPELINE ANALYSIS SYSTEM - VERSION 2.05 AC DATE - 7/ 1/2016 TIME - 5:44:26 PAGE 38
PROJECT - Abandonment and Recovery Analysis in Sangatta JOB NO. - 1
USER ID - Moch. Ardiansyah LICENSED TO: RICKY TAWEKAL CASE 6

S T A T I C P I P E C O O R D I N A T E S, F O R C E S A N D S T R E S S E S

NODE NO.	PIPE SECTION	X COORD (M)	Y COORD (M)	Z COORD (M)	SUPPORT REACTION VERT (KN)	SUPPORT REACTION HORIZ (KN)	SUPT SEPARATIONS VERT (M)	SUPT SEPARATIONS HORIZ (M)	PIPE TENSION (KN)	BENDING MOMENTS VERT (KN-M)	BENDING MOMENTS HORIZ (KN-M)	BENDING MOMENTS TOTAL (KN-M)
1	TENSIONR	61.00	2.52	.00	.50	.00	.00	.00	9.99	.00	.00	.00
3	LAYBARGE	38.00	2.52	.00	.63	.00	.00	.00	9.99	.12	.00	.00
5	LAYBARGE	32.09	2.52	.00	.25	.00	.00	.00	9.99	.05	.00	.00
7	TENSIONR	26.50	2.52	.00	.20	.00	.00	.00	19.99	.05	.00	.00
9	LAYBARGE	23.00	2.52	.00	.59	.00	.00	.00	19.98	.11	.00	.00
11	LAYBARGE	16.52	2.40	.00	.77	.00	.00	.00	19.98	.14	.00	.00
13	LAYBARGE	12.00	2.19	.00	.78	.00	.00	.00	19.97	.15	.00	.00
15	LAYBARGE	5.50	1.72	.00	.86	.00	.00	.00	19.95	.16	.00	.00
17	LAYBARGE	.00	1.16	.00	1.48	.00	.00	.00	19.91	.28	.00	.00
20	STINGER	-7.40	-.05	.00	1.01	.00	.00	.00	19.87	.19	.00	.00
22	STINGER	-14.49	-1.48	.00	.25	.00	.00	.00	19.82	.05	.00	.00
24	STINGER	-20.42	-2.68	.00	.20	.00	.00	.00	19.78	.04	.00	.00
26	STINGER	-25.08	-3.61	.00	.18	.00	.00	.00	19.74	.03	.00	.00
28	STINGER	-30.05	-4.62	.00	.14	.01	.00	.00	19.70	.03	.00	.00
30	STINGER	-31.81	-4.97	.00	2.78	-.02	.00	.00	19.65	.52	.00	.00
32	SAGBEND	-43.26	-8.87	.00	.00	.00	.00	.00	19.56	.00	.00	.00
33	SAGBEND	-54.80	-12.51	.01	.00	.00	.00	.00	19.42	.03	.00	.00
34	SAGBEND	-66.42	-15.88	.00	.00	.00	.00	.00	19.29	.16	.00	.00
35	SAGBEND	-74.76	-18.09	.00	.00	.00	.00	.00	19.19	.79	.00	.00
36	SEABED	-83.14	-20.00	.00	2.33	.00	.00	.00	18.59	4.61	-.01	4.61
37	SEABED	-90.09	-20.01	.00	12.31	.00	.00	.00	18.58	15.25	-.02	15.25
38	SEABED	-102.19	-20.01	.00	19.60	.00	.00	.00	18.58	3.20	.00	3.20
39	SEABED	-114.29	-20.01	.00	19.18	.00	.00	.00	18.58	-.59	.00	.59
40	SEABED	-126.39	-20.01	.00	18.72	.00	.00	.00	18.58	-.10	.00	.10
41	SEABED	-138.49	-20.01	.00	18.69	.00	.00	.00	18.58	-.98	.00	.98
42	SEABED	-150.59	-20.01	.00	20.42	.00	.00	.00	18.58	-3.33	.00	3.33
43	SEABED	-162.69	-20.02	.00	22.83	.00	.00	.00	18.58	14.06	.00	14.06
44	SEABED	-174.79	-20.00	.00	7.15	.00	.00	.00	18.57	75.16	.00	75.16
45	SEABED	-186.89	-19.93	.00	.00	.00	.00	.00	18.71	.00	.00	.00

OFFPIPE - OFFSHORE PIPELINE ANALYSIS SYSTEM - VERSION 2.05 AC PAGE 39
Abandonment and Recovery Analysis in Sangatta
JOB NO. - 1 LICENSED TO: RICKY TAWEKAL
USER ID - Moch. Ardiansyah DATE - 7/ 1/2016 TIME - 5:44:26 CASE 6

S T A T I C S O L U T I O N S U M M A R Y

PIPE PROPERTIES (2)

PIPE SECTION LENGTH ..	.00 M	ELASTIC MODULUS	207000. MPA
OUTSIDE DIAMETER	50.800 CM	CROSS SECTIONAL AREA .	250.00 CM2
WALL THICKNESS	1.590 CM	MOMENT OF INERTIA	74490.00 CM4
WEIGHT/LENGTH IN AIR .	4567.997 N/M	YIELD STRESS	360.00 MPA
SUBMERGED WGHT/LENG ..	1556.660 N/M	STRESS INTENS FACTOR .	1.000
SPECIFIC GRAVITY	1.517	STEEL DENSITY	77008.5 N/M3
WRAP COAT THICKNESS ..	.250 CM	WRAP COAT DENSITY	9397.6 N/M3
CONCRETE THICKNESS ...	5.000 CM	CONCRETE DENSITY	29822.4 N/M3

BARGE DATA

TOTAL PIPE TENSION ...	19.99 KN	RADIUS OF CURVATURE ..	.00 M
NUMBER OF TENSIONERS .	2	BARGE TRIM ANGLE	.000 DEG
NO. OF PIPE SUPPORTS .	7	PIPE ANGLE AT STERN ..	7.579 DEG
BARGE HEADING	.000 DEG	OFFSET FROM R.O.W. ...	.00 M

STINGER DATA

NO. OF PIPE SUPPORTS .	6	STINGER STERN DEPTH ..	-4.97 M
NO. STINGER SECTIONS .	6	PIPE ANGLE AT STERN ..	15.104 DEG
RADIUS OF CURVATURE ..	.00 M	STINGER LENGTH	31.90 M

SAGBEND DATA

WATER DEPTH	20.00 M	HORIZ PIPE TENSION ...	18.71 KN
TOUCHDOWN X-COORD. ...	-82.97 M	BOTTOM SLOPE ANGLE ...	.000 DEG

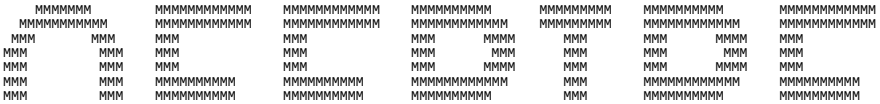
SOLUTION SUMMARY

NODE NO.	PIPE SECTION	X COORD	Y COORD	Z COORD	SUPPORT REACT VERT	SUPPORT REACT HORIZ	TOTAL MOMENT	TOTAL STRESS	PCT YLD
1	TENSIONR	61.0	2.5	.0	.5	.0	.0	.0	0.
3	LAYBARGE	38.0	2.5	.0	.6	.0	.0	.0	0.
5	LAYBARGE	32.1	2.5	.0	.2	.0	.0	.0	0.

7	TENSIONR	26.5	2.5	.0	.2	.0	.0	.0	0.
9	LAYBARGE	23.0	2.5	.0	.6	.0	.0	.0	0.
11	LAYBARGE	16.5	2.4	.0	.8	.0	.0	.0	0.
13	LAYBARGE	12.0	2.2	.0	.8	.0	.0	.0	0.
15	LAYBARGE	5.5	1.7	.0	.9	.0	.0	.0	0.
17	LAYBARGE	.0	1.2	.0	1.5	.0	.0	.0	0.
20	STINGER	-7.4	-.1	.0	1.0	.0	.0	.0	0.
22	STINGER	-14.5	-1.5	.0	.2	.0	.0	.0	0.
24	STINGER	-20.4	-2.7	.0	.2	.0	.0	.0	0.
26	STINGER	-25.1	-3.6	.0	.2	.0	.0	.0	0.
28	STINGER	-30.0	-4.6	.0	.1	.0	.0	.0	0.
30	STINGER	-31.8	-5.0	.0	2.8	.0	.0	.0	0.
36	SEABED	-83.1	-20.0	.0	2.3	.0	4.6	3.6	1.

S T A T I C S O L U T I O N S U M M A R Y

44	SEABED	-174.8	-20.0	.0	7.2	.0	75.2	26.5	7.



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*******************************************************************************
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*                                                                             *
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*                                                                             *
*                        VERSION NO. - 2.05 AC                                *
*                        RELEASED ON - 10/24/1993                             *
*                        LICENSED TO - RICKY TAWEKAL                          *
*                                                                             *
*******************************************************************************
*                                                                             *
*    OFFPIPE IS A NONLINEAR,  3-DIMENSIONAL FINITE ELEMENT METHOD BASED PROGRAM FOR THE    *
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*    THIS VERSION  OF OFFPIPE MAY BE USED FOR THE ANALYSIS OF OFFSHORE PIPELAYING OPER-    *
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*                  8007 MULLINS                    FACSIMILE: (713) 664-0962  *
*                  HOUSTON, TEXAS 77081                                       *
*                  U.S.A.                                                     *
*                                                                             *
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I N P U T D A T A E C H O

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PRINTED OUTPUT SELECTED
=======================
   PRINT PIPE STRAINS IN OUTPUT ......NO
   USE DNV STRESS FORMULA ............NO
   STATIC PIPE FORCES AND STRESSES ...YES
   STATIC SOLUTION SUMMARY ...........YES
   OVERBEND PIPE SUPPORT GEOMETRY ....NO
   STINGER BALLAST SCHEDULE DATA .....NO
   DYNAMIC PIPE FORCES AND STRESSES ..YES
   DYNAMIC RANGE OF PIPE DATA ........NO
   DYNAMIC TRACKING OF PIPE DATA .....NO
   PLOT DATA FILE SUMMARY TABLES .....NO

PROFILE PLOT TABLE ENTRIES
==========================
   PLOT TABLE INDEX ..................         1
   PLOT NUMBER .......................         1
   PLOT TYPE OPTION NUMBER ...........         4
   DYNAMIC PROFILE TIME POINT ........      .000
   DYNAMIC PROFILE TIME INCREMENT ....      .000
   ORDINATE PARAMETER CODE NUMBER ....         2
   AXIS LABEL FOR ORDINATE ........... "Pipe Elevation or Y Coordinate  "
   ABSCISSA PARAMETER CODE NUMBER ....         1
   AXIS LABEL FOR ABSCISSA ........... "Pipe Horizontal X Coordinate    "

   PLOT TITLE ........................ "Pipeline Elevation Profile                              "
   MINIMUM HORIZONTAL AXIS RANGE .....      .000
   MAXIMUM HORIZONTAL AXIS RANGE .....      .000
   MINIMUM VERTICAL AXIS RANGE .......      .000
   MAXIMUM VERTICAL AXIS RANGE .......      .000

PROFILE PLOT TABLE ENTRIES
==========================
   PLOT TABLE INDEX ..................         2
   PLOT NUMBER .......................         2
   PLOT TYPE OPTION NUMBER ...........         4
   DYNAMIC PROFILE TIME POINT ........      .000
   DYNAMIC PROFILE TIME INCREMENT ....      .000
   ORDINATE PARAMETER CODE NUMBER ....        14
   AXIS LABEL FOR ORDINATE ........... "Total Von Mises Pipe Stress     "
   ABSCISSA PARAMETER CODE NUMBER ....         1
   AXIS LABEL FOR ABSCISSA ........... "Pipe Horizontal X Coordinate    "

   PLOT TITLE ........................ "Pipeline Total Pipe Stress                              "
   MINIMUM HORIZONTAL AXIS RANGE .....      .000
   MAXIMUM HORIZONTAL AXIS RANGE .....      .000
   MINIMUM VERTICAL AXIS RANGE .......      .000
   MAXIMUM VERTICAL AXIS RANGE .......      .000
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I N P U T D A T A E C H O

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PIPE PROPERTIES
===============
   PIPE PROPERTY TABLE ROW ...........         2
   PIPE SECTION LENGTH ...............      .000 M
   STEEL MODULUS OF ELASTICITY .......   207000. MPA
   AREA OF STEEL CROSS SECTION .......   250.000 CM**2
   COATED PIPE AVG MOMENT OF INERTIA .  74490.00 CM**4
   WEIGHT PER-UNIT-LENGTH IN AIR .....   4568.00 N/M
   WEIGHT PER-UNIT-LENGTH SUBMERGED ..   1556.66 N/M
   MAXIMUM ALLOWABLE PIPE STRAIN .....   .205000 PCT

   STEEL OUTSIDE DIAMETER ............   50.8000 CM
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   STEEL WALL THICKNESS ..............    1.5900 CM
   YIELD STRESS ......................    360.00 MPA
   STRESS/STRAIN INTENSE FACTOR ......     .0000
   HYDRODYNAMIC OUTSIDE DIAMETER .....      .000 CM
   DRAG COEFFICIENT ..................     .0000
   HYDRODYNAMIC TOTAL AREA ...........      .000 CM**2
   ADDED MASS COEFFICIENT ............     .0000
   POISSON'S RATIO ...................     .3000
   COEFFICIENT OF THERMAL EXPANSION .. .00000000 1/DEG C

PIPE COATING PROPERTIES
=======================
   PIPE PROPERTY TABLE INDEX .........         2
   CORROSION COATING THICKNESS .......      .250 CM
   CONCRETE COATING THICKNESS ........     5.000 CM
   STEEL WEIGHT DENSITY ..............    77009. N/M**3
   CORROSION COATING WEIGHT DENSITY ..     9398. N/M**3
   CONCRETE COATING WEIGHT DENSITY ...    29822. N/M**3
   DESIRED PIPE SPECIFIC GRAVITY .....     .0000

   AVERAGE PIPE JOINT LENGTH .........    12.100 M
   FIELD JOINT LENGTH ................      .600 M
   JOINT FILL WEIGHT DENSITY .........    10055. N/M**3
   DENSITY OF PIPE CONTENTS ..........        0. N/M**3

================================================================================
OFFPIPE - OFFSHORE PIPELINE ANALYSIS SYSTEM - VERSION 2.05 AC          PAGE   5
Abandonment and Recovery Analysis in Sangatta
JOB NO. - 1                    LICENSED TO: RICKY TAWEKAL
USER ID - Moch. Ardiansyah     DATE -  7/ 1/2016   TIME -  5:46:57   CASE   1
================================================================================

                        I N P U T   D A T A   E C H O


SUPPORT ELEMENT PROPERTIES
==========================
   SUPPORT PROPERTY TABLE INDEX ......          7
   SUPPORT ELEMENT TYPE ..............          2 TENSIONER
   TENSIONER AXIAL STIFFNESS (F/L) ...  0.000E+00 KN/M
   VERTICAL STIFFNESS (F/L) ..........  0.000E+00 KN/M
   STATIC VERTICAL DEFLECTION ........      .0000 CM
   LATERAL STIFFNESS (F/L) ...........  0.000E+00 KN/M
   BOTTOM ROLLER ANGLE TO HORIZONTAL .     30.000 DEG

   SIDE ROLLER ANGLE TO VERTICAL .....        .000 DEG
   SIDE ROLLER OFFSET FROM C.L. ......        .000 M
   BED ROLLER LENGTH .................      2.000 M
   HEIGHT OF TOP ROLLER ABOVE BED ....        .000 M
   TENSIONER X-AXIS ROTATIONAL STIF. .        .000 KN/DEG
   TENSIONER Y-AXIS ROTATIONAL STIF. .        .000 KN/DEG
   TENSIONER Y-AXIS ROTATIONAL STIF. .        .000 KN/DEG

SUPPORT ELEMENT PROPERTIES
==========================
   SUPPORT PROPERTY TABLE INDEX ......          8
   SUPPORT ELEMENT TYPE ..............          1 SIMPLE SUPPORT
   TENSIONER AXIAL STIFFNESS (F/L) ...  0.000E+00 KN/M
   VERTICAL STIFFNESS (F/L) ..........  0.000E+00 KN/M
   STATIC VERTICAL DEFLECTION ........      .0000 CM
   LATERAL STIFFNESS (F/L) ...........  0.000E+00 KN/M
   BOTTOM ROLLER ANGLE TO HORIZONTAL .     30.000 DEG

   SIDE ROLLER ANGLE TO VERTICAL .....     60.000 DEG
   SIDE ROLLER OFFSET FROM C.L. ......      1.000 M
   BED ROLLER LENGTH .................      1.500 M
   HEIGHT OF TOP ROLLER ABOVE BED ....        .000 M
   TENSIONER X-AXIS ROTATIONAL STIF. .        .000 KN/DEG
   TENSIONER Y-AXIS ROTATIONAL STIF. .        .000 KN/DEG
   TENSIONER Y-AXIS ROTATIONAL STIF. .        .000 KN/DEG

================================================================================
OFFPIPE - OFFSHORE PIPELINE ANALYSIS SYSTEM - VERSION 2.05 AC          PAGE   6
Abandonment and Recovery Analysis in Sangatta
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================================================================================

                        I N P U T   D A T A   E C H O


SUPPORT ELEMENT PROPERTIES
==========================
   SUPPORT PROPERTY TABLE INDEX ......          9
   SUPPORT ELEMENT TYPE ..............          1 SIMPLE SUPPORT
   TENSIONER AXIAL STIFFNESS (F/L) ...  0.000E+00 KN/M
   VERTICAL STIFFNESS (F/L) ..........  0.000E+00 KN/M
   STATIC VERTICAL DEFLECTION ........      .0350 CM
   LATERAL STIFFNESS (F/L) ...........  0.000E+00 KN/M
   BOTTOM ROLLER ANGLE TO HORIZONTAL .     30.000 DEG

   SIDE ROLLER ANGLE TO VERTICAL .....     60.000 DEG
   SIDE ROLLER OFFSET FROM C.L. ......      1.000 M
   BED ROLLER LENGTH .................      1.500 M
   HEIGHT OF TOP ROLLER ABOVE BED ....        .000 M
   TENSIONER X-AXIS ROTATIONAL STIF. .        .000 KN/DEG
   TENSIONER Y-AXIS ROTATIONAL STIF. .        .000 KN/DEG
   TENSIONER Y-AXIS ROTATIONAL STIF. .        .000 KN/DEG

LAYBARGE DESCRIPTION
====================
   NUMBER OF PIPE NODES ..............         9
   BARGE GEOMETRY SPECIFIED BY .......         1 X-Y COORDINATES
   OVERBEND PIPE SUPPORT RADIUS ......      .000 M
   TANGENT POINT X-COORDINATE ........      .000 M
   TANGENT POINT Y-COORDINATE ........      .000 M
   PIPE ANGLE RELATIVE TO DECK .......     .0000 DEG
   HEIGHT OF DECK ABOVE WATER ........     1.000 M
   LAYBARGE FORWARD (X) OFFSET .......      .000 M
   BARGE TRIM ANGLE ..................     .0000 DEG

   STERN SHOE X COORDINATE ..........       .000 M
   STERN SHOE Y COORDINATE ...........      .000 M
   ROTATION CENTER X COORDINATE ......    31.930 M
   ROTATION CENTER Y COORDINATE ......     3.940 M
   ROTATION CENTER Z COORDINATE ......      .000 M
   BARGE HEADING .....................     .0000 DEG
   BARGE OFFSET FROM RIGHT-OF-WAY ....      .000 M
   PIPE RAMP PIVOT X COORDINATE ......      .000 M
   PIPE RAMP PIVOT Y COORDINATE ......      .000 M
   PIPE RAMP PIVOT ROTATION ANGLE ....      .000 DEG

================================================================================
OFFPIPE - OFFSHORE PIPELINE ANALYSIS SYSTEM - VERSION 2.05 AC          PAGE   7
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                        I N P U T   D A T A   E C H O


    NODE X     NODE Y           SUPPORT          DAVIT
     COORD      COORD             TYPE          SPACING
     (M   )     (M   )                           (M   )
   ========   ========   ====================   =======
     61.000      1.516     2  PIPE TENSIONER        .000
     38.000      1.516     8  USER DEFINED          .000
```

32.095	1.516	8	USER DEFINED	.000	
26.500	1.516	7	USER DEFINED	.000	
23.000	1.516	8	USER DEFINED	.000	
16.520	1.396	8	USER DEFINED	.000	
12.000	1.192	8	USER DEFINED	.000	
5.500	.723	8	USER DEFINED	.000	
.000	.160	8	USER DEFINED	.000	

STINGER DESCRIPTION
==========

NUMBER OF PIPE/STINGER NODES	6	
STINGER GEOMETRY SPECIFIED BY	1	X-Y COORD AND TANGENT PT
STINGER TYPE	2	STRAIGHT CONVENTIONAL
OVERBEND PIPE SUPPORT RADIUS	.00	M
HITCH X-COORDINATE	-.399	M
HITCH Y-COORDINATE	-.744	M
X COORDINATE OF LOCAL ORIGIN	-.399	M
Y COORDINATE OF LOCAL ORIGIN	-.744	M
ROTATION ABOUT STINGER HITCH	12.570	DEG
TANGENT POINT X-COORDINATE	.000	M
TANGENT POINT Y-COORDINATE	.000	M
TANGENT POINT ANGLE	.000	DEG

NODE X COORD (M)	NODE Y COORD (M)	SUPPORT TYPE		ELEMENT TYPE		ELEMENT LENGTH (M)
-6.900	1.222	9	USER DEFINED	1	FIXED END	.000
-14.130	1.371	9	USER DEFINED	1	FIXED END	.000
-20.180	1.359	9	USER DEFINED	1	FIXED END	.000
-24.930	1.261	9	USER DEFINED	1	FIXED END	.000
-30.000	1.116	9	USER DEFINED	1	FIXED END	.000
-31.792	1.116	9	USER DEFINED	1	FIXED END	.000

I N P U T D A T A E C H O

CURRENT VELOCITIES
==========

WATER DEPTH (M)	CURRENT SPEED (M/S)	DIRECTION OF TRAVEL (DEG)
.000	.250	135.000
1.900	.246	135.000
3.800	.243	135.000
5.700	.238	135.000
7.600	.233	135.000
9.500	.228	135.000
11.400	.222	135.000
13.300	.214	135.000
15.200	.204	135.000
17.100	.190	135.000
19.000	.114	135.000
20.000	.000	135.000

BARGE MOTION RAO TABLE (OFFPIPE) SIGN CONVENTION
==========

WAVE FREQUENCY (RAD/S)	SURGE AMPLITUDE (M/M)	SURGE PHASE (DEG)	SWAY AMPLITUDE (M/M)	SWAY PHASE (DEG)	HEAVE AMPLITUDE (M/M)	HEAVE PHASE (DEG)
.2510	.6450	-98.00	.6790	83.00	.9340	-5.00
.3140	.6380	-102.00	.6660	79.00	.9270	-9.00
.3310	.6360	-104.00	.6610	78.00	.9240	-10.00
.3490	.6330	-105.00	.6550	76.00	.9200	-11.00
.3700	.6290	-107.00	.6470	75.00	.9160	-13.00
.3930	.6250	-110.00	.6370	73.00	.9100	-15.00
.4190	.6200	-113.00	.6240	70.00	.9020	-17.00
.4490	.6130	-116.00	.6070	67.00	.8900	-20.00
.4830	.6030	-120.00	.5820	64.00	.8730	-23.00
.5240	.5910	-126.00	.5490	60.00	.8460	-28.00
.5710	.5730	-132.00	.5000	54.00	.8010	-34.00
.6280	.5480	-141.00	.4290	48.00	.7260	-41.00
.6980	.5090	-154.00	.3230	41.00	.5970	-52.00
.7850	.4480	-171.00	.1800	47.00	.3810	-63.00
.8380	.4050	177.00	.1170	56.00	.2120	-63.00
.8980	.3490	163.00	.1230	114.00	.1140	2.00
1.0470	.1880	124.00	.3790	117.00	.6550	21.00
1.2570	.0290	-119.00	.4740	67.00	.1010	-52.00
1.5710	.0880	118.00	.2030	117.00	.2350	-42.00
2.0940	.0100	39.00	.2410	72.00	.1390	-75.00

I N P U T D A T A E C H O

WAVE FREQUENCY (RAD/S)	ROLL AMPLITUDE (DEG/M)	ROLL PHASE (DEG)	PITCH AMPLITUDE (DEG/M)	PITCH PHASE (DEG)	YAW AMPLITUDE (DEG/M)	YAW PHASE (DEG)
.2510	.2420	81.00	.8280	93.00	.3010	-2.00
.3140	.3860	77.00	1.2950	77.00	.4610	-8.00
.3310	.4300	75.00	1.4380	73.00	.5080	-10.00
.3490	.4820	73.00	1.6050	69.00	.5620	-12.00
.3700	.5440	71.00	1.8010	64.00	.6240	-14.00
.3930	.6180	69.00	2.0310	58.00	.6980	-17.00
.4190	.7100	66.00	2.2990	52.00	.7840	-20.00
.4490	.8230	62.00	2.6110	44.00	.8850	-24.00
.4830	.9650	58.00	2.9640	35.00	1.0040	-28.00
.5240	1.1490	52.00	3.3500	24.00	1.1430	-34.00
.5710	1.3940	45.00	3.7440	11.00	1.3040	-41.00
.6280	1.7450	35.00	4.0920	-4.00	1.4830	-49.00
.6980	2.3730	21.00	4.2960	-24.00	1.6630	-61.00
.7850	4.6750	-41.00	4.1890	-50.00	1.7950	-77.00
.8380	1.5170	-179.00	3.9390	-66.00	1.8090	-87.00
.8980	.6060	-10.00	3.4980	-84.00	1.7510	-100.00
1.0470	1.0580	-50.00	1.8630	-134.00	1.2220	-135.00
1.2570	.2980	-106.00	.4220	-17.00	.2520	-6.00
1.5710	.2540	120.00	.5660	-130.00	1.1990	-118.00
2.0940	.9390	59.00	.0580	-161.00	.2190	178.00

TIME INTEGRATION PARAMETERS
==========

TIME STEP LENGTH	.4000	SEC
SOLUTION STARTS AT TIME	60.000	SEC
MAXIMUM TIME OF INTEGRATION	10860.000	SEC
SOLUTION SAMPLING TIME STEP.....	.800	SEC
DAMPING RATIO	.0000	

CONTROL SWITCHES
==========

MAXIMUM STATIC ITERATIONS	400
MAX DYNAMIC ITERATIONS PER STEP ...	400

```
   PROBLEM TYPE (0=STATIC,1=DYNAMIC) .   1
   PINNED PIPE END ON SEABED .........   1
   DAVIT LIFT ANALYSIS (1=YES,0=NO) ..   0
   STOP INTEGRATION AT TIME STEP .....   0
   NUMBER OF DIMENSIONS (2 OR 3) .....   2
   INITIATION BY BOWLINE (1=YES,0=NO)    0
   SUPPORT RELEASE LOGIC PARAMETER ...   0
```


I N P U T D A T A E C H O

```
WAVE SPECTRUM COEFFICIENTS
==========================
   NUMBER OF WAVES IN SPECTRUM .......        20
   1ST SPECTRUM COEFFICIENT ..........     .6130 M2/S4
   2ND SPECTRUM COEFFICIENT ..........     .7230 1/S**4
   MINIMUM FREQUENCY IN SPECTRUM .....     .2513 RAD/S
   MAXIMUM FREQUENCY IN SPECTRUM .....    2.0944 RAD/S
   DIRECTION OF WAVE TRAVEL ..........   135.000 DEG

WAVE PARAMETERS
===============
   WAVE HEIGHT (PEAK TO TROUGH) ......    2.110 M
   WAVE PERIOD .......................    7.200 SEC
   WAVE DIRECTION OF TRAVEL ..........   135.000 DEG
   WATER DEPTH FOR WAVE CALCULATIONS .    20.00 M

SAGBEND GEOMETRY
================
   SAGBEND PIPE ELEMENT LENGTH .......   12.100 M
   WATER DEPTH .......................    20.00 M
   ESTIMATED SAGBEND X LENGTH ........   140.00 M
   ESTIMATED PIPE LENGTH ON SEABED ...      .00 M
   X-COORD OF PIPE FREE END ON SEABED       .00 M
   ESTIMATED SPAN DEPTH FOR BOW LINE .      .00 M
   PIPE VERTICAL ANGLE AT SEABED .....     .000 DEG
   X-COORDINATE OF SPECIFIED DEPTH ...      .00 M
   MAXIMUM SLOPE (ANGLE) OF SEABED ...     .000 DEG
   DIRECTION OF MAXIMUM SLOPE ........     .000 DEG

CABLE PROPERTIES
================
   PIPE PROPERTY TABLE INDEX .........        1
   CABLE SECTION LENGTH ..............   24.000 M
   AXIAL STIFFNESS (EA) ..............      .00 KN
   BENDING STIFFNESS (EI) ............    .0000 KN-M**2
   WEIGHT PER-UNIT-LENGTH IN AIR .....      .0 N/M
   WEIGHT PER-UNIT-LENGTH SUBMERGED ..      .0 N/M

   CABLE DIAMETER ....................    3.200 CM
   DRAG COEFFICIENT ..................     .000
   CABLE CROSS SECTIONAL AREA ........     .000 KN
   ADDED MASS COEFFICIENT ............     .000

PIPE TENSION
============
   STATIC PIPE TENSION ON LAYBARGE ...  330.000 KN
   MINIMUM DYNAMIC PIPE TENSION ......     .000 KN
   MAXIMUM DYNAMIC PIPE TENSION ......     .000 KN
```


E R R O R M E S S A G E

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            ***** WARNING / INFORMATIVE MESSAGE NO. -   1 *****

    The total stinger weight (
```


I N P U T D A T A E C H O

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CABLE PROPERTIES
================
   PIPE PROPERTY TABLE INDEX .........        1
   CABLE SECTION LENGTH ..............   62.000 M
   AXIAL STIFFNESS (EA) ..............      .00 KN
   BENDING STIFFNESS (EI) ............    .0000 KN-M**2
   WEIGHT PER-UNIT-LENGTH IN AIR .....      .0 N/M
   WEIGHT PER-UNIT-LENGTH SUBMERGED ..      .0 N/M

   CABLE DIAMETER ....................    3.200 CM
   DRAG COEFFICIENT ..................     .000
   CABLE CROSS SECTIONAL AREA ........     .000 KN
   ADDED MASS COEFFICIENT ............     .000

PIPE TENSION
============
   STATIC PIPE TENSION ON LAYBARGE ...  330.000 KN
   MINIMUM DYNAMIC PIPE TENSION ......     .000 KN
   MAXIMUM DYNAMIC PIPE TENSION ......     .000 KN

            ***** WARNING / INFORMATIVE MESSAGE NO. -   1 *****

    The total stinger weight (
```


I N P U T D A T A E C H O

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CABLE PROPERTIES
================
   PIPE PROPERTY TABLE INDEX .........        1
```

```
   CABLE SECTION LENGTH ..............    83.000 M
   AXIAL STIFFNESS (EA) ..............       .00 KN
   BENDING STIFFNESS (EI) ............     .0000 KN-M**2
   WEIGHT PER-UNIT-LENGTH IN AIR .....       .0 N/M
   WEIGHT PER-UNIT-LENGTH SUBMERGED ..       .0 N/M

   CABLE DIAMETER .....................    3.200 CM
   DRAG COEFFICIENT ...................     .000
   CABLE CROSS SECTIONAL AREA ........     .000 KN
   ADDED MASS COEFFICIENT .............    .000

PIPE TENSION
============
   STATIC PIPE TENSION ON LAYBARGE ...   210.000 KN
   MINIMUM DYNAMIC PIPE TENSION ......     .000 KN
   MAXIMUM DYNAMIC PIPE TENSION ......     .000 KN

             ***** WARNING / INFORMATIVE MESSAGE NO. -   1 *****

    The total stinger weight (
```



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                        I N P U T   D A T A   E C H O


CABLE PROPERTIES
================
   PIPE PROPERTY TABLE INDEX .........        1
   CABLE SECTION LENGTH ..............    94.000 M
   AXIAL STIFFNESS (EA) ..............       .00 KN
   BENDING STIFFNESS (EI) ............     .0000 KN-M**2
   WEIGHT PER-UNIT-LENGTH IN AIR .....       .0 N/M
   WEIGHT PER-UNIT-LENGTH SUBMERGED ..       .0 N/M

   CABLE DIAMETER .....................    3.200 CM
   DRAG COEFFICIENT ...................     .000
   CABLE CROSS SECTIONAL AREA ........     .000 KN
   ADDED MASS COEFFICIENT .............    .000

PIPE TENSION
============
   STATIC PIPE TENSION ON LAYBARGE ...   180.000 KN
   MINIMUM DYNAMIC PIPE TENSION ......     .000 KN
   MAXIMUM DYNAMIC PIPE TENSION ......     .000 KN

             ***** WARNING / INFORMATIVE MESSAGE NO. -   1 *****

    The total stinger weight (
```



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                        I N P U T   D A T A   E C H O


CABLE PROPERTIES
================
   PIPE PROPERTY TABLE INDEX .........        1
   CABLE SECTION LENGTH ..............   120.000 M
   AXIAL STIFFNESS (EA) ..............       .00 KN
   BENDING STIFFNESS (EI) ............     .0000 KN-M**2
   WEIGHT PER-UNIT-LENGTH IN AIR .....       .0 N/M
   WEIGHT PER-UNIT-LENGTH SUBMERGED ..       .0 N/M

   CABLE DIAMETER .....................    3.200 CM
   DRAG COEFFICIENT ...................     .000
   CABLE CROSS SECTIONAL AREA ........     .000 KN
   ADDED MASS COEFFICIENT .............    .000

PIPE TENSION
============
   STATIC PIPE TENSION ON LAYBARGE ...    75.000 KN
   MINIMUM DYNAMIC PIPE TENSION ......     .000 KN
   MAXIMUM DYNAMIC PIPE TENSION ......     .000 KN

             ***** WARNING / INFORMATIVE MESSAGE NO. -   1 *****

    The total stinger weight (
```



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                        I N P U T   D A T A   E C H O


CABLE PROPERTIES
================
   PIPE PROPERTY TABLE INDEX .........        1
   CABLE SECTION LENGTH ..............   147.000 M
   AXIAL STIFFNESS (EA) ..............       .00 KN
   BENDING STIFFNESS (EI) ............     .0000 KN-M**2
   WEIGHT PER-UNIT-LENGTH IN AIR .....       .0 N/M
   WEIGHT PER-UNIT-LENGTH SUBMERGED ..       .0 N/M

   CABLE DIAMETER .....................    3.200 CM
   DRAG COEFFICIENT ...................     .000
   CABLE CROSS SECTIONAL AREA ........     .000 KN
   ADDED MASS COEFFICIENT .............    .000

PIPE TENSION
============
   STATIC PIPE TENSION ON LAYBARGE ...    20.000 KN
   MINIMUM DYNAMIC PIPE TENSION ......     .000 KN
   MAXIMUM DYNAMIC PIPE TENSION ......     .000 KN

             ***** WARNING / INFORMATIVE MESSAGE NO. -   1 *****

    The total stinger weight (

END OF INPUT DATA
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OFFPIPE - OFFSHORE PIPELINE ANALYSIS SYSTEM - VERSION 2.05 AC DATE - 7/ 1/2016 TIME - 5:46:57 PAGE 17
PROJECT - Abandonment and Recovery Analysis in Sangatta JOB NO. - 1
USER ID - Moch. Ardiansyah LICENSED TO: RICKY TAWEKAL CASE 1

S T A T I C P I P E C O O R D I N A T E S, F O R C E S A N D S T R E S S E S

NODE NO.	PIPE SECTION	X COORD (M)	Y COORD (M)	Z COORD (M)	HORIZ ANGLE (DEG)	VERT ANGLE (DEG)	PIPE LENGTH (M)	TENSILE STRESS (MPA)	HOOP STRESS (MPA)	BENDING STRESSES VERT (MPA)	BENDING STRESSES HORIZ (MPA)	TOTAL STRESS (MPA)	PERCNT YIELD (PCT)
1	TENSIONR	61.00	2.52	.00	.000	.000	.000	.00	.00	.00	.00	.00	.00
3	LAYBARGE	38.00	2.52	.00	.000	-.002	23.000	6.71	.00	.40	-.01	7.12	1.98
5	LAYBARGE	32.09	2.52	.00	.000	.019	28.905	6.71	.00	-11.45	-.20	18.17	5.05
7	TENSIONR	26.50	2.52	.00	.001	-.080	34.500	13.42	.00	20.65	.49	34.08	9.47
9	LAYBARGE	23.00	2.52	.00	.001	.255	38.000	13.37	.00	-204.51	-.29	217.88	60.52
11	LAYBARGE	16.52	2.40	.00	-.003	1.924	44.481	13.32	.00	-263.72	-.80	277.04	76.96
13	LAYBARGE	12.00	2.19	.00	-.005	3.170	49.006	13.30	.00	-244.48	.11	257.78	71.61
15	LAYBARGE	5.50	1.73	.00	.001	4.998	55.523	13.19	.00	-285.18	1.53	298.37	82.88
17	LAYBARGE	.00	1.16	.00	.014	7.002	61.052	13.00	.00	-381.15	2.77	394.16	109.49
20	STINGER	-7.42	.07	.00	.032	9.466	68.553	12.91	.00	-231.75	1.58	244.66	67.96
22	STINGER	-14.54	-1.22	-.01	.041	10.980	75.784	12.75	-.20	-160.97	.47	173.82	48.28
24	STINGER	-20.46	-2.42	-.01	.040	11.948	81.834	12.58	-.39	-137.64	-.53	150.42	41.78
26	STINGER	-25.11	-3.43	-.02	.035	12.658	86.585	12.43	-.55	-139.98	-1.41	152.70	42.42
28	STINGER	-30.05	-4.58	-.02	.024	13.485	91.658	12.26	-.74	-162.52	-2.49	175.17	48.66
30	STINGER	-31.79	-5.00	-.02	.019	13.814	93.450	12.19	-.80	-170.47	-2.85	183.09	50.86
32	SAGBEND	-43.50	-8.04	-.02	-.009	14.834	105.550	11.78	-1.29	4.57	-1.29	17.21	4.78
33	SAGBEND	-55.22	-11.07	-.02	-.019	14.022	117.650	11.33	-1.78	109.07	-.37	121.30	33.69
34	SAGBEND	-67.00	-13.83	-.01	-.021	12.155	129.750	10.90	-2.22	168.28	.10	180.31	50.09
35	SAGBEND	-78.88	-16.13	-.01	-.018	9.712	141.850	10.56	-2.59	198.21	.31	210.08	58.35
36	SAGBEND	-90.85	-17.89	.00	-.013	7.023	153.950	10.29	-2.87	206.12	.36	217.87	60.52
37	SAGBEND	-102.89	-19.09	.00	-.009	4.367	166.051	10.13	-3.06	193.15	.33	204.82	56.89
38	SAGBEND	-114.97	-19.76	.00	-.005	2.040	178.151	10.04	-3.17	154.93	.32	166.59	46.27
39	SEABED	-127.06	-20.00	.00	-.001	.439	190.251	10.03	-3.21	80.51	.18	92.18	25.61
40	SEABED	-139.16	-20.02	.00	.000	-.049	202.351	10.03	-3.21	5.82	.03	17.68	4.91
41	SEABED	-151.26	-20.02	.00	.000	-.022	214.451	10.03	-3.21	-3.17	-.01	15.07	4.19
42	SEABED	-163.36	-20.01	.00	.000	-.046	226.551	10.03	-3.21	7.69	.00	19.53	5.43
43	SEABED	-175.46	-19.99	.00	.000	-.157	238.652	10.04	-3.21	.00	.00	11.97	3.32

OFFPIPE - OFFSHORE PIPELINE ANALYSIS SYSTEM - VERSION 2.05 AC DATE - 7/ 1/2016 TIME - 5:46:57 PAGE 18
PROJECT - Abandonment and Recovery Analysis in Sangatta JOB NO. - 1
USER ID - Moch. Ardiansyah LICENSED TO: RICKY TAWEKAL CASE 1

S T A T I C P I P E C O O R D I N A T E S, F O R C E S A N D S T R E S S E S

NODE NO.	PIPE SECTION	X COORD (M)	Y COORD (M)	Z COORD (M)	SUPPORT REACTION VERT (KN)	SUPPORT REACTION HORIZ (KN)	SUPT SEPARATIONS VERT (M)	SUPT SEPARATIONS HORIZ (M)	PIPE TENSION (KN)	BENDING MOMENTS VERT (KN-M)	BENDING MOMENTS HORIZ (KN-M)	BENDING MOMENTS TOTAL (KN-M)
1	TENSIONR	61.00	2.52	.00	.50	.00	.00	.00	165.03	.00	.00	.00
3	LAYBARGE	38.00	2.52	.00	6.30	.12	.00	.00	165.03	1.18	-.02	1.18
5	LAYBARGE	32.09	2.52	.00	62.91	-.55	.00	.00	165.02	-33.58	-.60	33.58
7	TENSIONR	26.50	2.52	.00	-224.57	1.23	.00	.00	329.98	60.56	1.42	60.58
9	LAYBARGE	23.00	2.52	.00	223.08	-.53	.00	.00	328.69	-599.72	-.84	599.72
11	LAYBARGE	16.52	2.40	.00	71.52	-.89	.00	.00	327.47	-773.34	-2.35	773.35
13	LAYBARGE	12.00	2.19	.00	.00	.00	.00	.00	326.89	-716.94	.32	716.94
15	LAYBARGE	5.50	1.73	.00	.00	.00	.01	.00	324.18	-836.28	4.48	836.30
17	LAYBARGE	.00	1.16	.00	161.75	1.28	.00	.00	319.56	-1117.72	8.11	1117.75
20	STINGER	-7.42	.07	.00	.00	.00	.13	.00	317.36	-679.59	4.65	679.61
22	STINGER	-14.54	-1.22	-.01	.00	.00	.27	-.01	315.92	-472.03	1.37	472.04
24	STINGER	-20.46	-2.42	-.01	.00	.00	.26	-.01	314.24	-403.64	-1.56	403.64
26	STINGER	-25.11	-3.43	-.02	.00	.00	.18	-.02	312.64	-410.48	-4.14	410.51
28	STINGER	-30.05	-4.58	-.02	.00	.00	.04	-.02	310.67	-476.59	-7.31	476.65
30	STINGER	-31.79	-5.00	-.02	80.26	-1.23	.00	-.02	309.89	-499.91	-8.36	499.98
32	SAGBEND	-43.50	-8.04	-.02	.00	.00	.00	.00	306.02	13.39	-3.78	13.91
33	SAGBEND	-55.22	-11.07	-.02	.00	.00	.00	.00	300.96	319.85	-1.10	319.85
34	SAGBEND	-67.00	-13.83	-.01	.00	.00	.00	.00	296.22	493.49	.30	493.49
35	SAGBEND	-78.88	-16.13	-.01	.00	.00	.00	.00	292.33	581.26	.92	581.26
36	SAGBEND	-90.85	-17.89	.00	.00	.00	.00	.00	289.50	604.45	1.05	604.45
37	SAGBEND	-102.89	-19.09	.00	.00	.00	.00	.00	287.78	566.40	.96	566.40
38	SAGBEND	-114.97	-19.76	.00	.00	.05	.00	.00	287.11	454.34	.93	454.35
39	SEABED	-127.06	-20.00	.00	13.08	.02	.00	.00	287.22	236.09	.53	236.09
40	SEABED	-139.16	-20.02	.00	34.66	-.03	.00	.00	287.40	17.07	.08	17.07
41	SEABED	-151.26	-20.02	.00	23.61	-.01	.00	.00	287.39	-9.30	-.02	9.30
42	SEABED	-163.36	-20.01	.00	14.16	.00	.00	.00	287.39	22.56	-.01	22.56
43	SEABED	-175.46	-19.99	.00	.00	.00	.00	.00	287.42	.00	.00	.00

OFFPIPE - OFFSHORE PIPELINE ANALYSIS SYSTEM - VERSION 2.05 AC PAGE 19
Abandonment and Recovery Analysis in Sangatta
JOB NO. - 1 LICENSED TO: RICKY TAWEKAL
USER ID - Moch. Ardiansyah DATE - 7/ 1/2016 TIME - 5:46:57 CASE 1

S T A T I C S O L U T I O N S U M M A R Y

PIPE PROPERTIES (2)

PIPE SECTION LENGTH ..	.00 M	ELASTIC MODULUS	207000. MPA
OUTSIDE DIAMETER	50.800 CM	CROSS SECTIONAL AREA .	250.00 CM2
WALL THICKNESS	1.590 CM	MOMENT OF INERTIA	74490.00 CM4
WEIGHT/LENGTH IN AIR .	4567.997 N/M	YIELD STRESS	360.00 MPA
SUBMERGED WGHT/LENG ..	1556.660 N/M	STRESS INTENS FACTOR .	1.000
SPECIFIC GRAVITY	1.517	STEEL DENSITY	77008.5 N/M3
WRAP COAT THICKNESS ..	.250 CM	WRAP COAT DENSITY	9397.6 N/M3
CONCRETE THICKNESS ...	5.000 CM	CONCRETE DENSITY	29822.4 N/M3

BARGE DATA

TOTAL PIPE TENSION ...	330.03 KN	RADIUS OF CURVATURE ..	.00 M
NUMBER OF TENSIONERS .	2	BARGE TRIM ANGLE	.000 DEG
NO. OF PIPE SUPPORTS .	7	PIPE ANGLE AT STERN ..	7.002 DEG
BARGE HEADING	.000 DEG	OFFSET FROM R.O.W. ...	.00 M

STINGER DATA

NO. OF PIPE SUPPORTS .	6	STINGER STERN DEPTH ..	-5.00 M
NO. STINGER SECTIONS .	6	PIPE ANGLE AT STERN ..	13.814 DEG
RADIUS OF CURVATURE ..	.00 M	STINGER LENGTH	31.90 M

SAGBEND DATA

WATER DEPTH	20.00 M	HORIZ PIPE TENSION ...	287.42 KN
TOUCHDOWN X-COORD. ...	-126.87 M	BOTTOM SLOPE ANGLE ...	.000 DEG

SOLUTION SUMMARY

NODE NO.	PIPE SECTION	X COORD	Y COORD	Z COORD	SUPPORT REACT VERT	SUPPORT REACT HORIZ	TOTAL MOMENT	TOTAL STRESS	PCT YLD
1	TENSIONR	61.0	2.5	.0	.5	.0	.0	.0	0.
3	LAYBARGE	38.0	2.5	.0	6.3	.1	1.2	7.1	2.
5	LAYBARGE	32.1	2.5	.0	62.9	-.6	33.6	18.2	5.
7	TENSIONR	26.5	2.5	.0	-224.6	1.2	60.6	34.1	9.
9	LAYBARGE	23.0	2.5	.0	223.1	-.5	599.7	217.9	61.
11	LAYBARGE	16.5	2.4	.0	71.5	-.9	773.3	277.0	77.
13	LAYBARGE	12.0	2.2	.0	.0	.0	716.9	257.8	72.

15	LAYBARGE	5.5	1.7	.0	.0	.0	836.3	298.4	83.
17	LAYBARGE	.0	1.2	.0	161.7	1.3	1117.8	394.2	109.
20	STINGER	-7.4	.1	.0	.0	.0	679.6	244.7	68.
22	STINGER	-14.5	-1.2	.0	.0	.0	472.0	173.8	48.
24	STINGER	-20.5	-2.4	.0	.0	.0	403.6	150.4	42.
26	STINGER	-25.1	-3.4	.0	.0	.0	410.5	152.7	42.
28	STINGER	-30.0	-4.6	.0	.0	.0	476.6	175.2	49.
30	STINGER	-31.8	-5.0	.0	80.3	-1.2	500.0	183.1	51.
36	SAGBEND	-90.8	-17.9	.0	.0	.0	604.5	217.9	61.

S T A T I C S O L U T I O N S U M M A R Y

39	SEABED	-127.1	-20.0	.0	13.1	.0	236.1	92.2	26.

OFFPIPE - OFFSHORE PIPELINE ANALYSIS SYSTEM - VERSION 2.05 AC DATE - 7/ 1/2016 TIME - 5:46:57 PAGE 21
PROJECT - Abandonment and Recovery Analysis in Sangatta JOB NO. - 1
USER ID - Moch. Ardiansyah LICENSED TO: RICKY TAWEKAL CASE 2

S T A T I C P I P E C O O R D I N A T E S, F O R C E S A N D S T R E S S E S

NODE NO.	PIPE SECTION	X COORD (M)	Y COORD (M)	Z COORD (M)	HORIZ ANGLE (DEG)	VERT ANGLE (DEG)	PIPE LENGTH (M)	TENSILE STRESS (MPA)	HOOP STRESS (MPA)	BENDING STRESSES VERT (MPA)	BENDING STRESSES HORIZ (MPA)	TOTAL STRESS (MPA)	PERCNT YIELD (PCT)
1	TENSIONR	61.00	2.52	.00	.000	.000	.000	.00	.00	.00	.00	.00	.00
3	LAYBARGE	38.00	2.52	.00	.000	.000	23.000	.00	.00	.00	.00	.00	.00
5	LAYBARGE	32.09	2.52	.00	.000	.000	28.905	.00	.00	.00	.00	.00	.00
7	TENSIONR	26.50	2.52	.00	.000	.000	34.500	.00	.00	.00	.00	.00	.00
9	LAYBARGE	23.00	2.52	.00	.000	.531	38.000	.00	.00	.00	.00	.00	.00
11	LAYBARGE	16.52	2.40	.00	.000	1.823	44.481	.00	.00	.00	.00	.00	.00
13	LAYBARGE	12.00	2.19	.00	.000	3.356	49.006	.00	.00	.00	.00	.00	.00
15	LAYBARGE	5.50	1.72	.00	.070	4.817	55.523	.00	.00	.00	.00	.00	.00
17	LAYBARGE	.00	1.19	-.01	.030	9.687	61.054	13.39	.00	.00	.00	13.39	3.72
20	STINGER	-7.39	-.08	-.02	.024	10.055	68.554	13.14	-.01	-100.09	-1.58	113.25	31.46
22	STINGER	-14.51	-1.39	-.02	.013	10.788	75.786	12.95	-.22	-87.55	-1.03	100.62	27.95
24	STINGER	-20.44	-2.56	-.02	.007	11.397	81.836	12.78	-.41	-101.61	-.72	114.60	31.83
26	STINGER	-25.10	-3.52	-.02	.004	11.993	86.587	12.63	-.56	-131.39	-.59	144.31	40.09
28	STINGER	-30.05	-4.61	-.02	.001	12.852	91.659	12.45	-.74	-182.72	-.68	195.55	54.32
30	STINGER	-31.80	-5.01	-.02	-.002	13.229	93.451	12.38	-.80	-197.95	-1.74	210.75	58.54
32	SAGBEND	-43.53	-7.96	-.02	-.018	14.542	105.552	12.00	-1.28	-12.46	-.69	25.15	6.99
33	SAGBEND	-55.25	-10.96	-.01	-.023	13.909	117.652	11.55	-1.76	98.33	-.03	110.77	30.77
34	SAGBEND	-67.04	-13.70	-.01	-.021	12.157	129.752	11.13	-2.20	161.12	.29	173.36	48.16
35	SAGBEND	-78.92	-16.01	-.01	-.016	9.793	141.852	10.78	-2.57	193.39	.41	205.47	57.07
36	SAGBEND	-90.88	-17.80	.00	-.010	7.155	153.952	10.52	-2.86	203.27	.38	215.23	59.79
37	SAGBEND	-102.92	-19.02	.00	-.006	4.522	166.053	10.34	-3.05	192.52	.28	204.41	56.78
38	SAGBEND	-115.00	-19.72	.00	-.003	2.184	178.153	10.25	-3.17	157.33	.18	169.19	47.00
39	SAGBEND	-127.09	-19.99	.00	-.001	.524	190.253	10.23	-3.21	87.38	.13	99.25	27.57
40	SEABED	-139.19	-20.03	.00	.000	-.040	202.353	10.24	-3.22	8.80	.03	20.83	5.79
41	SEABED	-151.29	-20.02	.00	.000	-.026	214.453	10.24	-3.21	-3.32	.00	15.42	4.28
42	SEABED	-163.40	-20.01	.00	.000	-.046	226.553	10.24	-3.21	7.51	.00	19.55	5.43
43	SEABED	-175.50	-19.99	.00	.000	-.156	238.653	10.24	-3.21	.00	.00	12.17	3.38

OFFPIPE - OFFSHORE PIPELINE ANALYSIS SYSTEM - VERSION 2.05 AC DATE - 7/ 1/2016 TIME - 5:46:57 PAGE 22
PROJECT - Abandonment and Recovery Analysis in Sangatta JOB NO. - 1
USER ID - Moch. Ardiansyah LICENSED TO: RICKY TAWEKAL CASE 2

S T A T I C P I P E C O O R D I N A T E S, F O R C E S A N D S T R E S S E S

NODE NO.	PIPE SECTION	X COORD (M)	Y COORD (M)	Z COORD (M)	SUPPORT REACTION VERT (KN)	SUPPORT REACTION HORIZ (KN)	SUPT SEPARATIONS VERT (M)	SUPT SEPARATIONS HORIZ (M)	PIPE TENSION (KN)	BENDING MOMENTS VERT (KN-M)	BENDING MOMENTS HORIZ (KN-M)	BENDING MOMENTS TOTAL (KN-M)
1	TENSIONR	61.00	2.52	.00	.50	.00	.00	.00	165.00	.00	.00	.00
3	LAYBARGE	38.00	2.52	.00	.63	.00	.00	.00	165.00	.12	.00	.00
5	LAYBARGE	32.09	2.52	.00	.25	.00	.00	.00	165.00	.05	.00	.00
7	TENSIONR	26.50	2.52	.00	.20	.00	.00	.00	330.00	.05	.00	.00
9	LAYBARGE	23.00	2.52	.00	6.33	.00	.00	.00	329.98	1.19	.00	.00
11	LAYBARGE	16.52	2.40	.00	9.01	.00	.00	.00	329.96	1.69	.00	.00
13	LAYBARGE	12.00	2.19	.00	9.12	.00	.00	.00	329.95	1.71	.00	.00
15	LAYBARGE	5.50	1.72	.00	8.20	.80	.00	.00	329.94	1.54	-.15	.00
17	LAYBARGE	.00	1.19	-.01	.00	.00	.03	-.01	329.05	.00	.00	.00
20	STINGER	-7.39	-.08	-.02	73.20	-.97	.00	-.02	323.17	-293.52	-4.62	293.56
22	STINGER	-14.51	-1.39	-.02	.00	.00	.09	-.02	321.22	-256.73	-3.03	256.75
24	STINGER	-20.44	-2.56	-.02	.00	.00	.12	-.02	319.34	-297.98	-2.12	297.98
26	STINGER	-25.10	-3.52	-.02	.00	.00	.10	-.02	317.65	-385.30	-1.72	385.31
28	STINGER	-30.05	-4.61	-.02	3.83	2.21	.01	-.02	315.50	-535.84	-1.99	535.84
30	STINGER	-31.80	-5.01	-.02	97.47	-2.62	.00	-.02	314.64	-580.49	-5.09	580.51
32	SAGBEND	-43.53	-7.96	-.02	.00	.00	.00	.00	311.21	-36.55	-2.02	36.61
33	SAGBEND	-55.25	-10.96	-.01	.00	.00	.00	.00	306.28	288.34	-.08	288.34
34	SAGBEND	-67.04	-13.70	-.01	.00	.00	.00	.00	301.56	472.48	.86	472.48
35	SAGBEND	-78.92	-16.01	-.01	.00	.00	.00	.00	297.64	567.12	1.19	567.12
36	SAGBEND	-90.88	-17.80	.00	.00	.00	.00	.00	294.75	596.10	1.11	596.10
37	SAGBEND	-102.92	-19.02	.00	.00	.00	.00	.00	292.96	564.56	.82	564.56
38	SAGBEND	-115.00	-19.72	.00	.00	.00	.00	.00	292.22	461.38	.54	461.38
39	SAGBEND	-127.09	-19.99	.00	10.36	.02	.00	.00	292.27	256.23	.37	256.23
40	SEABED	-139.19	-20.03	.00	34.83	-.02	.00	.00	292.47	25.81	.07	25.81
41	SEABED	-151.29	-20.02	.00	24.36	-.01	.00	.00	292.47	-9.73	-.01	9.73
42	SEABED	-163.40	-20.01	.00	14.21	.00	.00	.00	292.46	22.02	-.01	22.02
43	SEABED	-175.50	-19.99	.00	.00	.00	.00	.00	292.49	.00	.00	.00

OFFPIPE - OFFSHORE PIPELINE ANALYSIS SYSTEM - VERSION 2.05 AC PAGE 23
Abandonment and Recovery Analysis in Sangatta
JOB NO. - 1 LICENSED TO: RICKY TAWEKAL
USER ID - Moch. Ardiansyah DATE - 7/ 1/2016 TIME - 5:46:57 CASE 2

S T A T I C S O L U T I O N S U M M A R Y

PIPE PROPERTIES (2)

PIPE SECTION LENGTH ..	.00 M	ELASTIC MODULUS	207000. MPA
OUTSIDE DIAMETER	50.800 CM	CROSS SECTIONAL AREA .	250.00 CM2
WALL THICKNESS	1.590 CM	MOMENT OF INERTIA	74490.00 CM4
WEIGHT/LENGTH IN AIR .	4567.997 N/M	YIELD STRESS	360.00 MPA
SUBMERGED WGHT/LENG ..	1556.660 N/M	STRESS INTENS FACTOR .	1.000
SPECIFIC GRAVITY	1.517	STEEL DENSITY	77008.5 N/M3
WRAP COAT THICKNESS ..	.250 CM	WRAP COAT DENSITY	9397.6 N/M3
CONCRETE THICKNESS ...	5.000 CM	CONCRETE DENSITY	29822.4 N/M3

BARGE DATA

TOTAL PIPE TENSION ...	330.00 KN	RADIUS OF CURVATURE ..	.00 M
NUMBER OF TENSIONERS .	2	BARGE TRIM ANGLE	.000 DEG
NO. OF PIPE SUPPORTS .	7	PIPE ANGLE AT STERN ..	9.687 DEG
BARGE HEADING	.000 DEG	OFFSET FROM R.O.W. ...	.00 M

STINGER DATA

NO. OF PIPE SUPPORTS .	6	STINGER STERN DEPTH ..	-5.01 M
NO. STINGER SECTIONS .	6	PIPE ANGLE AT STERN ..	13.229 DEG
RADIUS OF CURVATURE ..	.00 M	STINGER LENGTH	31.90 M

SAGBEND DATA

WATER DEPTH	20.00 M	HORIZ PIPE TENSION ...	292.49 KN
TOUCHDOWN X-COORD. ...	-127.87 M	BOTTOM SLOPE ANGLE ...	.000 DEG

SOLUTION SUMMARY

NODE NO.	PIPE SECTION	X COORD	Y COORD	Z COORD	SUPPORT REACT VERT	SUPPORT REACT HORIZ	TOTAL MOMENT	TOTAL STRESS	PCT YLD
1	TENSIONR	61.0	2.5	.0	.5	.0	.0	.0	0.
3	LAYBARGE	38.0	2.5	.0	.6	.0	.0	.0	0.
5	LAYBARGE	32.1	2.5	.0	.2	.0	.0	.0	0.
7	TENSIONR	26.5	2.5	.0	.2	.0	.0	.0	0.
9	LAYBARGE	23.0	2.5	.0	6.3	.0	.0	.0	0.
11	LAYBARGE	16.5	2.4	.0	9.0	.0	.0	.0	0.
13	LAYBARGE	12.0	2.2	.0	9.1	.0	.0	.0	0.

15	LAYBARGE	5.5	1.7	.0	8.2	.8	.0	.0	0.
17	LAYBARGE	.0	1.2	.0	.0	.0	.0	13.4	4.
20	STINGER	-7.4	-.1	.0	73.2	-1.0	293.6	113.3	31.
22	STINGER	-14.5	-1.4	.0	.0	.0	256.7	100.6	28.
24	STINGER	-20.4	-2.6	.0	.0	.0	298.0	114.6	32.
26	STINGER	-25.1	-3.5	.0	.0	.0	385.3	144.3	40.
28	STINGER	-30.1	-4.6	.0	3.8	2.2	535.8	195.5	54.
30	STINGER	-31.8	-5.0	.0	97.5	-2.6	580.5	210.7	59.
36	SAGBEND	-90.9	-17.8	.0	.0	.0	596.1	215.2	60.

S T A T I C S O L U T I O N S U M M A R Y

40	SEABED	-139.2	-20.0	.0	34.8	.0	25.8	20.8	6.

OFFPIPE - OFFSHORE PIPELINE ANALYSIS SYSTEM - VERSION 2.05 AC DATE - 7/ 1/2016 TIME - 5:46:57 PAGE 25
PROJECT - Abandonment and Recovery Analysis in Sangatta JOB NO. - 1
USER ID - Moch. Ardiansyah LICENSED TO: RICKY TAWEKAL CASE 3

S T A T I C P I P E C O O R D I N A T E S, F O R C E S A N D S T R E S S E S

NODE NO.	PIPE SECTION	X COORD (M)	Y COORD (M)	Z COORD (M)	HORIZ ANGLE (DEG)	VERT ANGLE (DEG)	PIPE LENGTH (M)	TENSILE STRESS (MPA)	HOOP STRESS (MPA)	BENDING STRESSES VERT (MPA)	BENDING STRESSES HORIZ (MPA)	TOTAL STRESS (MPA)	PERCNT YIELD (PCT)
1	TENSIONR	61.00	2.52	.00	.000	.000	.000	.00	.00	.00	.00	.00	.00
3	LAYBARGE	38.00	2.52	.00	.000	.000	23.000	.00	.00	.00	.00	.00	.00
5	LAYBARGE	32.09	2.52	.00	.000	.000	28.905	.00	.00	.00	.00	.00	.00
7	TENSIONR	26.50	2.52	.00	.000	.000	34.500	.00	.00	.00	.00	.00	.00
9	LAYBARGE	23.00	2.52	.00	.000	.531	38.000	.00	.00	.00	.00	.00	.00
11	LAYBARGE	16.52	2.40	.00	.000	1.823	44.481	.00	.00	.00	.00	.00	.00
13	LAYBARGE	12.00	2.19	.00	.000	3.356	49.006	.00	.00	.00	.00	.00	.00
15	LAYBARGE	5.50	1.72	.00	.000	4.986	55.523	.00	.00	.00	.00	.00	.00
17	LAYBARGE	.00	1.16	.00	.035	7.206	61.052	.00	.00	.00	.00	.00	.00
20	STINGER	-7.41	.04	-.01	.071	8.527	68.551	.00	.00	.00	.00	.00	.00
22	STINGER	-14.57	-1.02	-.02	.072	8.453	75.782	.00	.00	.00	.00	.00	.00
24	STINGER	-20.59	-1.92	-.03	-.006	15.207	81.880	8.32	-.31	.00	.00	8.48	2.35
26	STINGER	-25.17	-3.16	-.03	-.007	15.321	86.626	8.13	-.51	-46.30	-.49	54.69	15.19
28	STINGER	-30.05	-4.52	-.02	-.012	15.746	91.691	7.92	-.73	-110.03	-1.10	118.32	32.87
30	STINGER	-31.77	-5.01	-.02	-.014	15.985	93.479	7.84	-.80	-130.08	-1.30	138.33	38.43
32	SAGBEND	-43.35	-8.42	-.02	-.026	16.507	105.553	7.36	-1.35	43.49	-.38	51.54	14.32
33	SAGBEND	-54.99	-11.75	-.01	-.027	15.129	117.654	6.85	-1.89	156.41	.17	164.22	45.62
34	SAGBEND	-66.73	-14.66	-.01	-.022	12.588	129.754	6.40	-2.35	222.17	.43	229.75	63.82
35	SAGBEND	-78.61	-16.98	-.01	-.016	9.430	141.854	6.04	-2.73	251.06	.48	258.48	71.80
36	SAGBEND	-90.59	-18.61	.00	-.010	6.113	153.954	5.81	-2.99	246.55	.41	253.87	70.52
37	SAGBEND	-102.65	-19.57	.00	-.005	3.083	166.054	5.69	-3.14	206.65	.30	213.92	59.42
38	SAGBEND	-114.75	-19.97	.00	-.002	.850	178.154	5.66	-3.21	123.83	.20	131.12	36.42
39	SEABED	-126.85	-20.03	.00	.000	-.033	190.255	5.67	-3.22	18.65	.06	26.08	7.25
40	SEABED	-138.95	-20.02	.00	.000	-.046	202.355	5.67	-3.21	-5.83	-.01	13.41	3.72
41	SEABED	-151.05	-20.01	.00	.000	.004	214.455	5.67	-3.21	-.72	.00	8.47	2.35
42	SEABED	-163.15	-20.01	.00	.000	-.044	226.555	5.67	-3.21	8.64	.00	16.16	4.49
43	SEABED	-175.25	-19.99	.00	.000	-.161	238.655	5.68	-3.21	.00	.00	7.79	2.16

OFFPIPE - OFFSHORE PIPELINE ANALYSIS SYSTEM - VERSION 2.05 AC DATE - 7/ 1/2016 TIME - 5:46:57 PAGE 26
PROJECT - Abandonment and Recovery Analysis in Sangatta JOB NO. - 1
USER ID - Moch. Ardiansyah LICENSED TO: RICKY TAWEKAL CASE 3

S T A T I C P I P E C O O R D I N A T E S, F O R C E S A N D S T R E S S E S

NODE NO.	PIPE SECTION	X COORD (M)	Y COORD (M)	Z COORD (M)	SUPPORT REACTION VERT (KN)	SUPPORT REACTION HORIZ (KN)	SUPT SEPARATIONS VERT (M)	SUPT SEPARATIONS HORIZ (M)	PIPE TENSION (KN)	BENDING MOMENTS VERT (KN-M)	BENDING MOMENTS HORIZ (KN-M)	BENDING MOMENTS TOTAL (KN-M)
1	TENSIONR	61.00	2.52	.00	.50	.00	.00	.00	105.03	.00	.00	.00
3	LAYBARGE	38.00	2.52	.00	.63	.00	.00	.00	105.03	.12	.00	.00
5	LAYBARGE	32.09	2.52	.00	.25	.00	.00	.00	105.03	.05	.00	.00
7	TENSIONR	26.50	2.52	.00	.20	.00	.00	.00	210.03	.05	.00	.00
9	LAYBARGE	23.00	2.52	.00	4.11	.00	.00	.00	210.02	.77	.00	.00
11	LAYBARGE	16.52	2.40	.00	5.82	.00	.00	.00	210.00	1.09	.00	.00
13	LAYBARGE	12.00	2.19	.00	5.89	.00	.00	.00	209.99	1.10	.00	.00
15	LAYBARGE	5.50	1.72	.00	6.56	.00	.00	.00	209.97	1.23	.00	.00
17	LAYBARGE	.00	1.16	.00	10.26	.26	.00	.00	209.91	1.92	-.05	.00
20	STINGER	-7.41	.04	-.01	.00	.00	.10	-.01	209.92	.00	.00	.00
22	STINGER	-14.57	-1.02	-.02	.00	.00	.46	-.02	209.88	.00	.00	.00
24	STINGER	-20.59	-1.92	-.03	.00	.00	.78	-.03	208.36	.00	.00	.00
26	STINGER	-25.17	-3.16	-.03	.00	.00	.46	-.03	206.36	-135.76	-1.45	135.77
28	STINGER	-30.05	-4.52	-.02	.00	.00	.10	-.02	203.98	-322.65	-3.24	322.67
30	STINGER	-31.77	-5.01	-.02	99.39	-.70	.00	-.02	203.04	-381.45	-3.82	381.47
32	SAGBEND	-43.35	-8.42	-.02	.00	.00	.00	.00	198.18	127.52	-1.11	127.53
33	SAGBEND	-54.99	-11.75	-.01	.00	.00	.00	.00	192.38	458.69	.50	458.69
34	SAGBEND	-66.73	-14.66	-.01	.00	.00	.00	.00	187.15	651.50	1.26	651.50
35	SAGBEND	-78.61	-16.98	-.01	.00	.00	.00	.00	183.16	736.24	1.42	736.24
36	SAGBEND	-90.59	-18.61	.00	.00	.00	.00	.00	180.68	723.02	1.22	723.02
37	SAGBEND	-102.65	-19.57	.00	.00	.00	.00	.00	179.69	605.99	.88	605.99
38	SAGBEND	-114.75	-19.97	.00	7.34	.02	.00	.00	179.84	363.13	.60	363.13
39	SEABED	-126.85	-20.03	.00	38.74	-.02	.00	.00	180.21	54.70	.17	54.70
40	SEABED	-138.95	-20.02	.00	25.87	-.02	.00	.00	180.21	-17.11	-.02	17.11
41	SEABED	-151.05	-20.01	.00	19.85	.00	.00	.00	180.21	-2.11	-.01	2.11
42	SEABED	-163.15	-20.01	.00	14.49	.00	.00	.00	180.20	25.35	.00	25.35
43	SEABED	-175.25	-19.99	.00	.00	.00	.00	.00	180.23	.00	.00	.00

OFFPIPE - OFFSHORE PIPELINE ANALYSIS SYSTEM - VERSION 2.05 AC PAGE 27
Abandonment and Recovery Analysis in Sangatta
JOB NO. - 1 LICENSED TO: RICKY TAWEKAL
USER ID - Moch. Ardiansyah DATE - 7/ 1/2016 TIME - 5:46:57 CASE 3

S T A T I C S O L U T I O N S U M M A R Y

PIPE PROPERTIES (2)

PIPE SECTION LENGTH ..	.00 M	ELASTIC MODULUS	207000. MPA
OUTSIDE DIAMETER	50.800 CM	CROSS SECTIONAL AREA .	250.00 CM2
WALL THICKNESS	1.590 CM	MOMENT OF INERTIA	74490.00 CM4
WEIGHT/LENGTH IN AIR .	4567.997 N/M	YIELD STRESS	360.00 MPA
SUBMERGED WGHT/LENG ..	1556.660 N/M	STRESS INTENS FACTOR .	1.000
SPECIFIC GRAVITY	1.517	STEEL DENSITY	77008.5 N/M3
WRAP COAT THICKNESS ..	.250 CM	WRAP COAT DENSITY	9397.6 N/M3
CONCRETE THICKNESS ...	5.000 CM	CONCRETE DENSITY	29822.4 N/M3

BARGE DATA

TOTAL PIPE TENSION ...	210.03 KN	RADIUS OF CURVATURE ..	.00 M
NUMBER OF TENSIONERS .	2	BARGE TRIM ANGLE	.000 DEG
NO. OF PIPE SUPPORTS .	7	PIPE ANGLE AT STERN ..	7.206 DEG
BARGE HEADING	.000 DEG	OFFSET FROM R.O.W. ...	.00 M

STINGER DATA

NO. OF PIPE SUPPORTS .	6	STINGER STERN DEPTH ..	-5.01 M
NO. STINGER SECTIONS .	6	PIPE ANGLE AT STERN ..	15.985 DEG
RADIUS OF CURVATURE ..	.00 M	STINGER LENGTH	31.90 M

SAGBEND DATA

WATER DEPTH	20.00 M	HORIZ PIPE TENSION ...	180.23 KN
TOUCHDOWN X-COORD. ...	-117.29 M	BOTTOM SLOPE ANGLE ...	.000 DEG

SOLUTION SUMMARY

NODE NO.	PIPE SECTION	X COORD	Y COORD	Z COORD	SUPPORT REACT VERT	SUPPORT REACT HORIZ	TOTAL MOMENT	TOTAL STRESS	PCT YLD
1	TENSIONR	61.0	2.5	.0	.5	.0	.0	.0	0.
3	LAYBARGE	38.0	2.5	.0	.6	.0	.0	.0	0.
5	LAYBARGE	32.1	2.5	.0	.2	.0	.0	.0	0.
7	TENSIONR	26.5	2.5	.0	.2	.0	.0	.0	0.
9	LAYBARGE	23.0	2.5	.0	4.1	.0	.0	.0	0.
11	LAYBARGE	16.5	2.4	.0	5.8	.0	.0	.0	0.
13	LAYBARGE	12.0	2.2	.0	5.9	.0	.0	.0	0.

15	LAYBARGE	5.5	1.7	.0	6.6	.0	.0	.0	0.
17	LAYBARGE	.0	1.2	.0	10.3	.3	.0	.0	0.
20	STINGER	-7.4	.0	.0	.0	.0	.0	.0	0.
22	STINGER	-14.6	-1.0	.0	.0	.0	.0	.0	0.
24	STINGER	-20.6	-1.9	.0	.0	.0	.0	8.5	2.
26	STINGER	-25.2	-3.2	.0	.0	.0	135.8	54.7	15.
28	STINGER	-30.1	-4.5	.0	.0	.0	322.7	118.3	33.
30	STINGER	-31.8	-5.0	.0	99.4	-.7	381.5	138.3	38.
35	SAGBEND	-78.6	-17.0	.0	.0	.0	736.2	258.5	72.

S T A T I C S O L U T I O N S U M M A R Y

39	SEABED	-126.8	-20.0	.0	38.7	.0	54.7	26.1	7.

OFFPIPE - OFFSHORE PIPELINE ANALYSIS SYSTEM - VERSION 2.05 AC DATE - 7/ 1/2016 TIME - 5:46:57 PAGE 29
PROJECT - Abandonment and Recovery Analysis in Sangatta JOB NO. - 1
USER ID - Moch. Ardiansyah LICENSED TO: RICKY TAWEKAL CASE 4

S T A T I C P I P E C O O R D I N A T E S, F O R C E S A N D S T R E S S E S

NODE NO.	PIPE SECTION	X COORD (M)	Y COORD (M)	Z COORD (M)	HORIZ ANGLE (DEG)	VERT ANGLE (DEG)	PIPE LENGTH (M)	TENSILE STRESS (MPA)	HOOP STRESS (MPA)	BENDING STRESSES VERT (MPA)	BENDING STRESSES HORIZ (MPA)	TOTAL STRESS (MPA)	PERCNT YIELD (PCT)
1	TENSIONR	61.00	2.52	.00	.000	.000	.000	.00	.00	.00	.00	.00	.00
3	LAYBARGE	38.00	2.52	.00	.000	.000	23.000	.00	.00	.00	.00	.00	.00
5	LAYBARGE	32.09	2.52	.00	.000	.000	28.905	.00	.00	.00	.00	.00	.00
7	TENSIONR	26.50	2.52	.00	.000	.000	34.500	.00	.00	.00	.00	.00	.00
9	LAYBARGE	23.00	2.52	.00	.000	.530	38.000	.00	.00	.00	.00	.00	.00
11	LAYBARGE	16.52	2.40	.00	.000	1.823	44.481	.00	.00	.00	.00	.00	.00
13	LAYBARGE	12.00	2.19	.00	.000	3.356	49.006	.00	.00	.00	.00	.00	.00
15	LAYBARGE	5.50	1.72	.00	.000	4.986	55.523	.00	.00	.00	.00	.00	.00
17	LAYBARGE	.00	1.16	.00	.006	7.588	61.052	.00	.00	.00	.00	.00	.00
20	STINGER	-7.40	-.06	.00	.000	10.351	68.551	.00	.00	.00	.00	.00	.00
22	STINGER	-14.49	-1.48	.00	-.006	11.381	75.783	.00	.00	.00	.00	.00	.00
24	STINGER	-20.42	-2.68	.00	.000	11.392	81.833	.00	.00	.00	.00	.00	.00
26	STINGER	-25.08	-3.62	.00	.012	11.400	86.584	.00	.00	.00	.00	.00	.00
28	STINGER	-30.05	-4.62	.00	.204	11.809	91.656	.00	.00	.00	.00	.00	.00
30	STINGER	-31.80	-5.00	-.01	.165	22.237	93.452	.00	.00	.00	.00	.00	.00
32	SAGBEND	-32.27	-5.29	-.01	-.031	18.899	94.008	6.67	-.85	.00	.00	7.14	1.98
33	SAGBEND	-43.48	-9.06	-.01	-.027	17.958	105.831	6.10	-1.45	136.35	.47	143.19	39.77
34	SAGBEND	-54.79	-12.49	.00	-.019	15.601	117.655	5.57	-2.01	222.26	.67	228.84	63.57
35	SAGBEND	-66.53	-15.42	.00	-.010	12.317	129.755	5.11	-2.48	269.62	.66	275.98	76.66
36	SAGBEND	-78.42	-17.62	.00	-.002	8.648	141.855	4.78	-2.83	280.90	.50	287.11	79.75
37	SAGBEND	-90.44	-19.06	.00	.003	5.067	153.955	4.59	-3.06	255.94	.22	262.07	72.80
38	SAGBEND	-102.51	-19.80	.00	.004	2.077	166.055	4.51	-3.18	189.99	-.09	196.11	54.48
39	SEABED	-114.61	-20.02	.00	.002	.278	178.155	4.52	-3.21	74.65	-.20	80.82	22.45
40	SEABED	-126.71	-20.02	.00	.000	-.085	190.255	4.52	-3.21	-.88	-.04	7.55	2.10
41	SEABED	-138.81	-20.01	.00	.000	-.018	202.356	4.52	-3.21	-4.57	.01	11.06	3.07
42	SEABED	-150.91	-20.01	.00	.000	.009	214.456	4.52	-3.21	.43	.00	7.12	1.98
43	SEABED	-163.01	-20.01	.00	.000	-.045	226.556	4.52	-3.21	8.68	.00	15.07	4.19
44	SEABED	-175.11	-19.99	.00	.000	-.162	238.656	4.53	-3.21	.00	.00	6.73	1.87

OFFPIPE - OFFSHORE PIPELINE ANALYSIS SYSTEM - VERSION 2.05 AC DATE - 7/ 1/2016 TIME - 5:46:57 PAGE 30
PROJECT - Abandonment and Recovery Analysis in Sangatta JOB NO. - 1
USER ID - Moch. Ardiansyah LICENSED TO: RICKY TAWEKAL CASE 4

S T A T I C P I P E C O O R D I N A T E S, F O R C E S A N D S T R E S S E S

NODE NO.	PIPE SECTION	X COORD (M)	Y COORD (M)	Z COORD (M)	SUPPORT REACTION VERT (KN)	SUPPORT REACTION HORIZ (KN)	SUPT SEPARATIONS VERT (M)	SUPT SEPARATIONS HORIZ (M)	PIPE TENSION (KN)	BENDING MOMENTS VERT (KN-M)	BENDING MOMENTS HORIZ (KN-M)	BENDING MOMENTS TOTAL (KN-M)
1	TENSIONR	61.00	2.52	.00	.50	.00	.00	.00	90.01	.00	.00	.00
3	LAYBARGE	38.00	2.52	.00	.63	.00	.00	.00	90.01	.12	.00	.00
5	LAYBARGE	32.09	2.52	.00	.25	.00	.00	.00	90.01	.05	.00	.00
7	TENSIONR	26.50	2.52	.00	.20	.00	.00	.00	180.01	.05	.00	.00
9	LAYBARGE	23.00	2.52	.00	3.55	.00	.00	.00	180.00	.67	.00	.00
11	LAYBARGE	16.52	2.40	.00	5.02	.00	.00	.00	179.99	.94	.00	.00
13	LAYBARGE	12.00	2.19	.00	5.09	.00	.00	.00	179.98	.95	.00	.00
15	LAYBARGE	5.50	1.72	.00	5.66	.00	.00	.00	179.95	1.06	.00	.00
17	LAYBARGE	.00	1.16	.00	11.23	.04	.00	.00	179.86	2.10	-.01	.00
20	STINGER	-7.40	-.06	.00	6.69	-.08	.00	.00	179.87	1.25	.01	.00
22	STINGER	-14.49	-1.48	.00	.31	.03	.00	.00	179.85	.06	-.01	.00
24	STINGER	-20.42	-2.68	.00	.20	.00	.00	.00	179.80	.04	.00	.00
26	STINGER	-25.08	-3.62	.00	.23	.06	.00	.00	179.77	.04	-.01	.00
28	STINGER	-30.05	-4.62	.00	2.64	1.11	.00	.00	179.72	.49	-.21	.00
30	STINGER	-31.80	-5.00	-.01	62.64	-1.35	.00	-.01	176.99	11.74	.25	.00
32	SAGBEND	-32.27	-5.29	-.01	.00	.00	.00	.00	174.83	.01	.00	.01
33	SAGBEND	-43.48	-9.06	-.01	.00	.00	.00	.00	168.45	399.86	1.37	399.86
34	SAGBEND	-54.79	-12.49	.00	.00	.00	.00	.00	162.25	651.78	1.95	651.78
35	SAGBEND	-66.53	-15.42	.00	.00	.00	.00	.00	157.04	790.66	1.94	790.66
36	SAGBEND	-78.42	-17.62	.00	.00	.00	.00	.00	153.44	823.74	1.46	823.74
37	SAGBEND	-90.44	-19.06	.00	.00	.00	.00	.00	151.57	750.54	.66	750.54
38	SAGBEND	-102.51	-19.80	.00	.13	-.05	.00	.00	151.24	557.14	-.27	557.14
39	SEABED	-114.61	-20.02	.00	26.04	-.08	.00	.00	151.78	218.91	-.59	218.91
40	SEABED	-126.71	-20.02	.00	36.30	.03	.00	.00	151.94	-2.59	-.11	2.60
41	SEABED	-138.81	-20.01	.00	20.79	.01	.00	.00	151.93	-13.40	.02	13.40
42	SEABED	-150.91	-20.01	.00	19.64	.00	.00	.00	151.93	1.26	.01	1.26
43	SEABED	-163.01	-20.01	.00	14.80	.00	.00	.00	151.93	25.46	.00	25.46
44	SEABED	-175.11	-19.99	.00	.00	.00	.00	.00	151.96	.00	.00	.00

OFFPIPE - OFFSHORE PIPELINE ANALYSIS SYSTEM - VERSION 2.05 AC PAGE 31
Abandonment and Recovery Analysis in Sangatta
JOB NO. - 1 LICENSED TO: RICKY TAWEKAL
USER ID - Moch. Ardiansyah DATE - 7/ 1/2016 TIME - 5:46:57 CASE 4

S T A T I C S O L U T I O N S U M M A R Y

PIPE PROPERTIES (2)

PIPE SECTION LENGTH ..	.00 M	ELASTIC MODULUS	207000. MPA
OUTSIDE DIAMETER	50.800 CM	CROSS SECTIONAL AREA .	250.00 CM2
WALL THICKNESS	1.590 CM	MOMENT OF INERTIA	74490.00 CM4
WEIGHT/LENGTH IN AIR .	4567.997 N/M	YIELD STRESS	360.00 MPA
SUBMERGED WGHT/LENG ..	1556.660 N/M	STRESS INTENS FACTOR .	1.000
SPECIFIC GRAVITY	1.517	STEEL DENSITY	77008.5 N/M3
WRAP COAT THICKNESS ..	.250 CM	WRAP COAT DENSITY	9397.6 N/M3
CONCRETE THICKNESS ...	5.000 CM	CONCRETE DENSITY	29822.4 N/M3

BARGE DATA

TOTAL PIPE TENSION ...	180.01 KN	RADIUS OF CURVATURE ..	.00 M
NUMBER OF TENSIONERS .	2	BARGE TRIM ANGLE	.000 DEG
NO. OF PIPE SUPPORTS .	7	PIPE ANGLE AT STERN ..	7.588 DEG
BARGE HEADING	.000 DEG	OFFSET FROM R.O.W. ...	.00 M

STINGER DATA

NO. OF PIPE SUPPORTS .	6	STINGER STERN DEPTH ..	-5.00 M
NO. STINGER SECTIONS .	6	PIPE ANGLE AT STERN ..	22.237 DEG
RADIUS OF CURVATURE ..	.00 M	STINGER LENGTH	31.90 M

SAGBEND DATA

WATER DEPTH	20.00 M	HORIZ PIPE TENSION ...	151.96 KN
TOUCHDOWN X-COORD. ...	-111.63 M	BOTTOM SLOPE ANGLE ...	.000 DEG

SOLUTION SUMMARY

NODE NO.	PIPE SECTION	X COORD	Y COORD	Z COORD	SUPPORT REACT VERT	SUPPORT REACT HORIZ	TOTAL MOMENT	TOTAL STRESS	PCT YLD
1	TENSIONR	61.0	2.5	.0	.5	.0	.0	.0	0.
3	LAYBARGE	38.0	2.5	.0	.6	.0	.0	.0	0.
5	LAYBARGE	32.1	2.5	.0	.2	.0	.0	.0	0.
7	TENSIONR	26.5	2.5	.0	.2	.0	.0	.0	0.
9	LAYBARGE	23.0	2.5	.0	3.5	.0	.0	.0	0.

11	LAYBARGE	16.5	2.4	.0	5.0	.0	.0	.0	0.
13	LAYBARGE	12.0	2.2	.0	5.1	.0	.0	.0	0.
15	LAYBARGE	5.5	1.7	.0	5.7	.0	.0	.0	0.
17	LAYBARGE	.0	1.2	.0	11.2	.0	.0	.0	0.
20	STINGER	-7.4	-.1	.0	6.7	-.1	.0	.0	0.
22	STINGER	-14.5	-1.5	.0	.3	.0	.0	.0	0.
24	STINGER	-20.4	-2.7	.0	.2	.0	.0	.0	0.
26	STINGER	-25.1	-3.6	.0	.2	.1	.0	.0	0.
28	STINGER	-30.0	-4.6	.0	2.6	1.1	.0	.0	0.
30	STINGER	-31.8	-5.0	.0	62.6	-1.4	.0	.0	0.
36	SAGBEND	-78.4	-17.6	.0	.0	.0	823.7	287.1	80.

S T A T I C S O L U T I O N S U M M A R Y

39	SEABED	-114.6	-20.0	.0	26.0	-.1	218.9	80.8	22.

OFFPIPE - OFFSHORE PIPELINE ANALYSIS SYSTEM - VERSION 2.05 AC DATE - 7/ 1/2016 TIME - 5:46:57 PAGE 33
PROJECT - Abandonment and Recovery Analysis in Sangatta JOB NO. - 1
USER ID - Moch. Ardiansyah LICENSED TO: RICKY TAWEKAL CASE 5

S T A T I C P I P E C O O R D I N A T E S, F O R C E S A N D S T R E S S E S

NODE NO.	PIPE SECTION	X COORD (M)	Y COORD (M)	Z COORD (M)	HORIZ ANGLE (DEG)	VERT ANGLE (DEG)	PIPE LENGTH (M)	TENSILE STRESS (MPA)	HOOP STRESS (MPA)	BENDING STRESSES VERT (MPA)	BENDING STRESSES HORIZ (MPA)	TOTAL STRESS (MPA)	PERCNT YIELD (PCT)
1	TENSIONR	61.00	2.52	.00	.000	.000	.000	.00	.00	.00	.00	.00	.00
3	LAYBARGE	38.00	2.52	.00	.000	.000	23.000	.00	.00	.00	.00	.00	.00
5	LAYBARGE	32.09	2.52	.00	.000	.000	28.905	.00	.00	.00	.00	.00	.00
7	TENSIONR	26.50	2.52	.00	.000	.000	34.500	.00	.00	.00	.00	.00	.00
9	LAYBARGE	23.00	2.52	.00	.000	.530	38.000	.00	.00	.00	.00	.00	.00
11	LAYBARGE	16.52	2.40	.00	.000	1.823	44.481	.00	.00	.00	.00	.00	.00
13	LAYBARGE	12.00	2.19	.00	.000	3.356	49.006	.00	.00	.00	.00	.00	.00
15	LAYBARGE	5.50	1.72	.00	.000	4.986	55.523	.00	.00	.00	.00	.00	.00
17	LAYBARGE	.00	1.16	.00	.003	7.582	61.052	.00	.00	.00	.00	.00	.00
20	STINGER	-7.40	-.05	.00	.000	10.350	68.551	.00	.00	.00	.00	.00	.00
22	STINGER	-14.49	-1.48	.00	-.003	11.386	75.783	.00	.00	.00	.00	.00	.00
24	STINGER	-20.42	-2.68	.00	.000	11.390	81.833	.00	.00	.00	.00	.00	.00
26	STINGER	-25.08	-3.61	.00	.002	11.392	86.584	.00	.00	.00	.00	.00	.00
28	STINGER	-30.05	-4.62	.00	.092	11.560	91.656	.00	.00	.00	.00	.00	.00
30	STINGER	-31.80	-4.98	-.01	.086	21.226	93.452	.00	.00	.00	.00	.00	.00
32	SAGBEND	-42.21	-11.16	.00	-.017	30.079	105.573	.00	.00	.00	.00	.00	.00
33	SAGBEND	-52.66	-17.26	.00	-.013	28.778	117.673	.00	.00	.00	.00	.00	.00
34	SAGBEND	-54.71	-18.35	.00	.001	4.223	120.027	1.19	-2.95	3.25	.00	6.44	1.79
35	SAGBEND	-65.61	-19.11	.00	.001	3.586	130.950	1.07	-3.07	93.79	.02	96.44	26.79
36	SAGBEND	-76.52	-19.67	.00	.001	2.223	141.873	.98	-3.16	125.61	-.01	128.20	35.61
37	SAGBEND	-88.61	-19.97	.00	.001	.698	153.973	.95	-3.21	93.95	-.06	96.54	26.82
38	SEABED	-100.71	-20.03	.00	.000	-.013	166.074	.95	-3.22	16.94	-.04	19.70	5.47
39	SEABED	-112.81	-20.02	.00	.000	-.040	178.174	.95	-3.21	-4.06	.00	7.17	1.99
40	SEABED	-124.91	-20.01	.00	.000	-.002	190.274	.95	-3.21	-1.27	.00	4.73	1.31
41	SEABED	-137.01	-20.01	.00	.000	.005	202.374	.95	-3.21	-.28	.00	3.98	1.10
42	SEABED	-149.11	-20.01	.00	.000	.006	214.474	.95	-3.21	.72	.00	4.30	1.19
43	SEABED	-161.21	-20.01	.00	.000	-.046	226.574	.95	-3.21	8.53	.00	11.43	3.18
44	SEABED	-173.31	-19.99	.00	.000	-.162	238.674	.95	-3.21	.00	.00	3.78	1.05

OFFPIPE - OFFSHORE PIPELINE ANALYSIS SYSTEM - VERSION 2.05 AC DATE - 7/ 1/2016 TIME - 5:46:57 PAGE 34
PROJECT - Abandonment and Recovery Analysis in Sangatta JOB NO. - 1
USER ID - Moch. Ardiansyah LICENSED TO: RICKY TAWEKAL CASE 5

S T A T I C P I P E C O O R D I N A T E S, F O R C E S A N D S T R E S S E S

NODE NO.	PIPE SECTION	X COORD (M)	Y COORD (M)	Z COORD (M)	SUPPORT REACTION VERT (KN)	SUPPORT REACTION HORIZ (KN)	SUPT SEPARATIONS VERT (M)	SUPT SEPARATIONS HORIZ (M)	PIPE TENSION (KN)	BENDING MOMENTS VERT (KN-M)	BENDING MOMENTS HORIZ (KN-M)	BENDING MOMENTS TOTAL (KN-M)
1	TENSIONR	61.00	2.52	.00	.50	.00	.00	.00	37.48	.00	.00	.00
3	LAYBARGE	38.00	2.52	.00	.63	.00	.00	.00	37.48	.12	.00	.00
5	LAYBARGE	32.09	2.52	.00	.25	.00	.00	.00	37.48	.05	.00	.00
7	TENSIONR	26.50	2.52	.00	.20	.00	.00	.00	74.98	.05	.00	.00
9	LAYBARGE	23.00	2.52	.00	1.60	.00	.00	.00	74.98	.30	.00	.00
11	LAYBARGE	16.52	2.40	.00	2.23	.00	.00	.00	74.97	.42	.00	.00
13	LAYBARGE	12.00	2.19	.00	2.26	.00	.00	.00	74.96	.42	.00	.00
15	LAYBARGE	5.50	1.72	.00	2.51	.00	.00	.00	74.94	.47	.00	.00
17	LAYBARGE	.00	1.16	.00	4.82	.01	.00	.00	74.89	.90	.00	.00
20	STINGER	-7.40	-.05	.00	2.99	-.02	.00	.00	74.86	.56	.00	.00
22	STINGER	-14.49	-1.48	.00	.26	.00	.00	.00	74.82	.05	.00	.00
24	STINGER	-20.42	-2.68	.00	.20	.00	.00	.00	74.77	.04	.00	.00
26	STINGER	-25.08	-3.61	.00	.18	.00	.00	.00	74.74	.03	.00	.00
28	STINGER	-30.05	-4.62	.00	.56	.22	.00	.00	74.70	.10	-.04	.00
30	STINGER	-31.80	-4.98	-.01	24.89	-.24	.00	-.01	73.67	4.66	.04	.00
32	SAGBEND	-42.21	-11.16	.00	.00	.00	.00	.00	74.48	.00	.00	.00
33	SAGBEND	-52.66	-17.26	.00	.00	.00	.00	.00	74.22	2.61	.00	.00
34	SAGBEND	-54.71	-18.35	.00	.00	.00	.00	.00	66.70	9.54	.00	9.54
35	SAGBEND	-65.61	-19.11	.00	.00	.00	.00	.00	65.27	275.05	.06	275.05
36	SAGBEND	-76.52	-19.67	.00	.00	.00	.00	.00	64.20	368.34	-.03	368.34
37	SAGBEND	-88.61	-19.97	.00	5.58	-.02	.00	.00	63.93	275.51	-.17	275.51
38	SEABED	-100.71	-20.03	.00	33.31	.00	.00	.00	64.13	49.68	-.10	49.68
39	SEABED	-112.81	-20.02	.00	24.44	.01	.00	.00	64.12	-11.89	.00	11.89
40	SEABED	-124.91	-20.01	.00	18.32	.00	.00	.00	64.12	-3.72	.01	3.72
41	SEABED	-137.01	-20.01	.00	18.82	.00	.00	.00	64.12	-.83	.00	.83
42	SEABED	-149.11	-20.01	.00	20.55	.00	.00	.00	64.12	2.10	.00	2.10
43	SEABED	-161.21	-20.01	.00	15.10	.00	.00	.00	64.12	25.01	.00	25.01
44	SEABED	-173.31	-19.99	.00	.00	.00	.00	.00	64.15	.00	.00	.00

OFFPIPE - OFFSHORE PIPELINE ANALYSIS SYSTEM - VERSION 2.05 AC PAGE 35
Abandonment and Recovery Analysis in Sangatta
JOB NO. - 1 LICENSED TO: RICKY TAWEKAL
USER ID - Moch. Ardiansyah DATE - 7/ 1/2016 TIME - 5:46:57 CASE 5

S T A T I C S O L U T I O N S U M M A R Y

PIPE PROPERTIES (2)

PIPE SECTION LENGTH ..	.00 M	ELASTIC MODULUS	207000. MPA
OUTSIDE DIAMETER	50.800 CM	CROSS SECTIONAL AREA .	250.00 CM2
WALL THICKNESS	1.590 CM	MOMENT OF INERTIA	74490.00 CM4
WEIGHT/LENGTH IN AIR .	4567.997 N/M	YIELD STRESS	360.00 MPA
SUBMERGED WGHT/LENG ..	1556.660 N/M	STRESS INTENS FACTOR .	1.000
SPECIFIC GRAVITY	1.517	STEEL DENSITY	77008.5 N/M3
WRAP COAT THICKNESS ..	.250 CM	WRAP COAT DENSITY	9397.6 N/M3
CONCRETE THICKNESS ...	5.000 CM	CONCRETE DENSITY	29822.4 N/M3

BARGE DATA

TOTAL PIPE TENSION ...	74.98 KN	RADIUS OF CURVATURE ..	.00 M
NUMBER OF TENSIONERS .	2	BARGE TRIM ANGLE	.000 DEG
NO. OF PIPE SUPPORTS .	7	PIPE ANGLE AT STERN ..	7.582 DEG
BARGE HEADING	.000 DEG	OFFSET FROM R.O.W. ...	.00 M

STINGER DATA

NO. OF PIPE SUPPORTS .	6	STINGER STERN DEPTH ..	-4.98 M
NO. STINGER SECTIONS .	6	PIPE ANGLE AT STERN ..	21.226 DEG
RADIUS OF CURVATURE ..	.00 M	STINGER LENGTH	31.90 M

SAGBEND DATA

WATER DEPTH	20.00 M	HORIZ PIPE TENSION ...	64.15 KN
TOUCHDOWN X-COORD. ...	-91.40 M	BOTTOM SLOPE ANGLE ...	.000 DEG

SOLUTION SUMMARY

NODE NO.	PIPE SECTION	X COORD	Y COORD	Z COORD	SUPPORT REACT VERT	SUPPORT REACT HORIZ	TOTAL MOMENT	TOTAL STRESS	PCT YLD
1	TENSIONR	61.0	2.5	.0	.5	.0	.0	.0	0.
3	LAYBARGE	38.0	2.5	.0	.6	.0	.0	.0	0.
5	LAYBARGE	32.1	2.5	.0	.2	.0	.0	.0	0.
7	TENSIONR	26.5	2.5	.0	.2	.0	.0	.0	0.
9	LAYBARGE	23.0	2.5	.0	1.6	.0	.0	.0	0.

11	LAYBARGE	16.5	2.4	.0	2.2	.0	.0	.0	0.
13	LAYBARGE	12.0	2.2	.0	2.3	.0	.0	.0	0.
15	LAYBARGE	5.5	1.7	.0	2.5	.0	.0	.0	0.
17	LAYBARGE	.0	1.2	.0	4.8	.0	.0	.0	0.
20	STINGER	-7.4	-.1	.0	3.0	.0	.0	.0	0.
22	STINGER	-14.5	-1.5	.0	.3	.0	.0	.0	0.
24	STINGER	-20.4	-2.7	.0	.2	.0	.0	.0	0.
26	STINGER	-25.1	-3.6	.0	.2	.0	.0	.0	0.
28	STINGER	-30.0	-4.6	.0	.6	.2	.0	.0	0.
30	STINGER	-31.8	-5.0	.0	24.9	-.2	.0	.0	0.
36	SAGBEND	-76.5	-19.7	.0	.0	.0	368.3	128.2	36.

S T A T I C S O L U T I O N S U M M A R Y

38	SEABED	-100.7	-20.0	.0	33.3	.0	49.7	19.7	5.

OFFPIPE - OFFSHORE PIPELINE ANALYSIS SYSTEM - VERSION 2.05 AC DATE - 7/ 1/2016 TIME - 5:46:57 PAGE 37
PROJECT - Abandonment and Recovery Analysis in Sangatta JOB NO. - 1
USER ID - Moch. Ardiansyah LICENSED TO: RICKY TAWEKAL CASE 6

S T A T I C P I P E C O O R D I N A T E S, F O R C E S A N D S T R E S S E S

NODE NO.	PIPE SECTION	X COORD (M)	Y COORD (M)	Z COORD (M)	HORIZ ANGLE (DEG)	VERT ANGLE (DEG)	PIPE LENGTH (M)	TENSILE STRESS (MPA)	HOOP STRESS (MPA)	BENDING STRESSES VERT (MPA)	BENDING STRESSES HORIZ (MPA)	TOTAL STRESS (MPA)	PERCNT YIELD (PCT)
1	TENSIONR	61.00	2.52	.00	.000	.000	.000	.00	.00	.00	.00	.00	.00
3	LAYBARGE	38.00	2.52	.00	.000	.000	23.000	.00	.00	.00	.00	.00	.00
5	LAYBARGE	32.09	2.52	.00	.000	.000	28.905	.00	.00	.00	.00	.00	.00
7	TENSIONR	26.50	2.52	.00	.000	.000	34.500	.00	.00	.00	.00	.00	.00
9	LAYBARGE	23.00	2.52	.00	.000	.530	38.000	.00	.00	.00	.00	.00	.00
11	LAYBARGE	16.52	2.40	.00	.000	1.823	44.481	.00	.00	.00	.00	.00	.00
13	LAYBARGE	12.00	2.19	.00	.000	3.356	49.006	.00	.00	.00	.00	.00	.00
15	LAYBARGE	5.50	1.72	.00	.000	4.986	55.523	.00	.00	.00	.00	.00	.00
17	LAYBARGE	.00	1.16	.00	.000	7.579	61.052	.00	.00	.00	.00	.00	.00
20	STINGER	-7.40	-.05	.00	.000	10.350	68.551	.00	.00	.00	.00	.00	.00
22	STINGER	-14.49	-1.48	.00	-.001	11.388	75.783	.00	.00	.00	.00	.00	.00
24	STINGER	-20.42	-2.68	.00	.000	11.389	81.833	.00	.00	.00	.00	.00	.00
26	STINGER	-25.08	-3.61	.00	.000	11.389	86.584	.00	.00	.00	.00	.00	.00
28	STINGER	-30.05	-4.62	.00	.010	11.408	91.656	.00	.00	.00	.00	.00	.00
30	STINGER	-31.81	-4.97	.00	-.001	15.098	93.449	.00	.00	.00	.00	.00	.00
32	SAGBEND	-43.26	-8.86	.00	-.014	18.123	105.552	.00	.00	.00	.00	.00	.00
33	SAGBEND	-54.80	-12.50	.01	-.001	16.810	117.652	.00	.00	.00	.00	.00	.00
34	SAGBEND	-66.42	-15.88	.00	.009	15.247	129.752	.00	.00	.00	.00	.00	.00
35	SAGBEND	-74.76	-18.09	.00	.013	12.348	138.379	.00	.00	.00	.00	.00	.00
36	SEABED	-83.14	-20.00	.00	.000	.075	147.006	-.90	-3.21	1.57	.00	3.60	1.00
37	SEABED	-90.09	-20.01	.00	.000	.042	153.952	-.90	-3.21	5.21	-.01	6.53	1.81
38	SEABED	-102.19	-20.01	.00	.000	.000	166.053	-.90	-3.21	1.10	.00	3.32	.92
39	SEABED	-114.29	-20.01	.00	.000	-.003	178.153	-.90	-3.21	-.20	.00	2.93	.81
40	SEABED	-126.39	-20.01	.00	.000	.000	190.253	-.90	-3.21	-.14	.00	2.91	.81
41	SEABED	-138.49	-20.01	.00	.000	.003	202.353	-.90	-3.21	-.43	.00	3.01	.84
42	SEABED	-150.59	-20.01	.00	.000	.006	214.453	-.90	-3.21	.63	.00	3.09	.86
43	SEABED	-162.69	-20.01	.00	.000	-.046	226.553	-.90	-3.21	8.57	.00	9.68	2.69
44	SEABED	-174.79	-19.99	.00	.000	-.163	238.654	-.90	-3.21	.00	.00	2.87	.80

OFFPIPE - OFFSHORE PIPELINE ANALYSIS SYSTEM - VERSION 2.05 AC DATE - 7/ 1/2016 TIME - 5:46:57 PAGE 38
PROJECT - Abandonment and Recovery Analysis in Sangatta JOB NO. - 1
USER ID - Moch. Ardiansyah LICENSED TO: RICKY TAWEKAL CASE 6

S T A T I C P I P E C O O R D I N A T E S, F O R C E S A N D S T R E S S E S

NODE NO.	PIPE SECTION	X COORD (M)	Y COORD (M)	Z COORD (M)	SUPPORT REACTION VERT (KN)	SUPPORT REACTION HORIZ (KN)	SUPT SEPARATIONS VERT (M)	SUPT SEPARATIONS HORIZ (M)	PIPE TENSION (KN)	BENDING MOMENTS VERT (KN-M)	BENDING MOMENTS HORIZ (KN-M)	BENDING MOMENTS TOTAL (KN-M)
1	TENSIONR	61.00	2.52	.00	.50	.00	.00	.00	9.99	.00	.00	.00
3	LAYBARGE	38.00	2.52	.00	.63	.00	.00	.00	9.99	.12	.00	.00
5	LAYBARGE	32.09	2.52	.00	.25	.00	.00	.00	9.99	.05	.00	.00
7	TENSIONR	26.50	2.52	.00	.20	.00	.00	.00	19.99	.05	.00	.00
9	LAYBARGE	23.00	2.52	.00	.59	.00	.00	.00	19.98	.11	.00	.00
11	LAYBARGE	16.52	2.40	.00	.77	.00	.00	.00	19.98	.14	.00	.00
13	LAYBARGE	12.00	2.19	.00	.78	.00	.00	.00	19.97	.15	.00	.00
15	LAYBARGE	5.50	1.72	.00	.86	.00	.00	.00	19.95	.16	.00	.00
17	LAYBARGE	.00	1.16	.00	1.48	.00	.00	.00	19.91	.28	.00	.00
20	STINGER	-7.40	-.05	.00	1.01	.00	.00	.00	19.87	.19	.00	.00
22	STINGER	-14.49	-1.48	.00	.25	.00	.00	.00	19.82	.05	.00	.00
24	STINGER	-20.42	-2.68	.00	.20	.00	.00	.00	19.78	.04	.00	.00
26	STINGER	-25.08	-3.61	.00	.18	.00	.00	.00	19.74	.03	.00	.00
28	STINGER	-30.05	-4.62	.00	.14	.01	.00	.00	19.70	.03	.00	.00
30	STINGER	-31.81	-4.97	.00	2.77	-.02	.00	.00	19.65	.52	.00	.00
32	SAGBEND	-43.26	-8.86	.00	.00	.00	.00	.00	19.56	.00	.00	.00
33	SAGBEND	-54.80	-12.50	.01	.00	.00	.00	.00	19.42	.03	.00	.00
34	SAGBEND	-66.42	-15.88	.00	.00	.00	.00	.00	19.29	.16	.00	.00
35	SAGBEND	-74.76	-18.09	.00	.00	.00	.00	.00	19.19	.79	.00	.00
36	SEABED	-83.14	-20.00	.00	2.33	.00	.00	.00	18.59	4.62	-.01	4.62
37	SEABED	-90.09	-20.01	.00	12.31	.00	.00	.00	18.58	15.27	-.02	15.27
38	SEABED	-102.19	-20.01	.00	19.60	.00	.00	.00	18.58	3.22	.00	3.22
39	SEABED	-114.29	-20.01	.00	19.16	.00	.00	.00	18.58	-.60	.00	.60
40	SEABED	-126.39	-20.01	.00	18.74	.00	.00	.00	18.58	-.41	.00	.41
41	SEABED	-138.49	-20.01	.00	19.14	.00	.00	.00	18.58	-1.27	.00	1.27
42	SEABED	-150.59	-20.01	.00	20.57	.00	.00	.00	18.58	1.86	.00	1.86
43	SEABED	-162.69	-20.01	.00	15.14	.00	.00	.00	18.58	25.13	.00	25.13
44	SEABED	-174.79	-19.99	.00	.00	.00	.00	.00	18.61	.00	.00	.00

OFFPIPE - OFFSHORE PIPELINE ANALYSIS SYSTEM - VERSION 2.05 AC PAGE 39
Abandonment and Recovery Analysis in Sangatta
JOB NO. - 1 LICENSED TO: RICKY TAWEKAL
USER ID - Moch. Ardiansyah DATE - 7/ 1/2016 TIME - 5:46:57 CASE 6

S T A T I C S O L U T I O N S U M M A R Y

PIPE PROPERTIES (2)

PIPE SECTION LENGTH ..	.00 M	ELASTIC MODULUS	207000. MPA
OUTSIDE DIAMETER	50.800 CM	CROSS SECTIONAL AREA .	250.00 CM2
WALL THICKNESS	1.590 CM	MOMENT OF INERTIA	74490.00 CM4
WEIGHT/LENGTH IN AIR .	4567.997 N/M	YIELD STRESS	360.00 MPA
SUBMERGED WGHT/LENG ..	1556.660 N/M	STRESS INTENS FACTOR .	1.000
SPECIFIC GRAVITY	1.517	STEEL DENSITY	77008.5 N/M3
WRAP COAT THICKNESS ..	.250 CM	WRAP COAT DENSITY	9397.6 N/M3
CONCRETE THICKNESS ...	5.000 CM	CONCRETE DENSITY	29822.4 N/M3

BARGE DATA

TOTAL PIPE TENSION ...	19.99 KN	RADIUS OF CURVATURE ..	.00 M
NUMBER OF TENSIONERS .	2	BARGE TRIM ANGLE	.000 DEG
NO. OF PIPE SUPPORTS .	7	PIPE ANGLE AT STERN ..	7.579 DEG
BARGE HEADING	.000 DEG	OFFSET FROM R.O.W. ...	.00 M

STINGER DATA

NO. OF PIPE SUPPORTS .	6	STINGER STERN DEPTH ..	-4.97 M
NO. STINGER SECTIONS .	6	PIPE ANGLE AT STERN ..	15.098 DEG
RADIUS OF CURVATURE ..	.00 M	STINGER LENGTH	31.90 M

SAGBEND DATA

WATER DEPTH	20.00 M	HORIZ PIPE TENSION ...	18.61 KN
TOUCHDOWN X-COORD. ...	-82.97 M	BOTTOM SLOPE ANGLE ...	.000 DEG

SOLUTION SUMMARY

NODE NO.	PIPE SECTION	X COORD	Y COORD	Z COORD	SUPPORT REACT VERT	SUPPORT REACT HORIZ	TOTAL MOMENT	TOTAL STRESS	PCT YLD
1	TENSIONR	61.0	2.5	.0	.5	.0	.0	.0	0.
3	LAYBARGE	38.0	2.5	.0	.6	.0	.0	.0	0.
5	LAYBARGE	32.1	2.5	.0	.2	.0	.0	.0	0.
7	TENSIONR	26.5	2.5	.0	.2	.0	.0	.0	0.
9	LAYBARGE	23.0	2.5	.0	.6	.0	.0	.0	0.

11	LAYBARGE	16.5	2.4	.0	.8	.0	.0	.0	0.
13	LAYBARGE	12.0	2.2	.0	.8	.0	.0	.0	0.
15	LAYBARGE	5.5	1.7	.0	.9	.0	.0	.0	0.
17	LAYBARGE	.0	1.2	.0	1.5	.0	.0	.0	0.
20	STINGER	-7.4	-.1	.0	1.0	.0	.0	.0	0.
22	STINGER	-14.5	-1.5	.0	.2	.0	.0	.0	0.
24	STINGER	-20.4	-2.7	.0	.2	.0	.0	.0	0.
26	STINGER	-25.1	-3.6	.0	.2	.0	.0	.0	0.
28	STINGER	-30.0	-4.6	.0	.1	.0	.0	.0	0.
30	STINGER	-31.8	-5.0	.0	2.8	.0	.0	.0	0.
36	SEABED	-83.1	-20.0	.0	2.3	.0	4.6	3.6	1.

S T A T I C S O L U T I O N S U M M A R Y

43	SEABED	-162.7	-20.0	.0	15.1	.0	25.1	9.7	3.

LAMPIRAN D-1

HASIL PERHITUNGAN *LOCAL BUCKLING*

(*STINGER STERN DEPTH* = 3m)

LOCAL BUCKLING CALCULATION

Stinger Stern Depth = 3m - *"OVERBEND"*

Data				
OD	=	0,508	m	
ID	=	0,4762	m	
t	=	0,0159	m	
E	=	207000	Mpa	
v	=	0,3		
SMYS	=	360	Mpa	
SMTS	=	460	MPa	
$f_{y,temp}$	=	0	Mpa	
$f_{u,temp}$	=	0	Mpa	
ρwater	=	1025	Kg/m³	
g	=	9,81	m/s²	
Wd	=	20	m	
fo	=	0,01		Ovalisation
αu	=	1		Tabel 5-4 DNV OS F-101(2013)
γSC	=	1,26		Tabel 5-3 DNV OS F-101(2013)
γm	=	1,15		Tabel 5-2 DNV OS F-101(2013)
αfab	=	0,93		Tabel 5-5 DNV OS F-101(2013)
fy	=	360	Mpa	Pers.(5.4) DNV OS F-101(2013)
fu	=	460	Mpa	Pers.(5.5) DNV OS F-101(2013)
Design Load Factor				
γc	=	1,07		Tabel 4-5 DNV OS F-101(2013)
γF	=	1,1		Tabel 4-4 DNV OS F-101(2013)
Bending Moment and Axial Force				
Mf	=	1130,93	kNm	OFFPIPE Output
Sf	=	330,08	kN	OFFPIPE Output
Mp	=	1386,138	kNm	Pers.(5.21) DNV OS F-101(2013)
Sp	=	8849,177	kN	Pers.(5.20) DNV OS F-101(2013)
Msd	=	1331,105		Pers.(4.6) DNV OS F-101(2013)
Ssd	=	388,504		Pers.(4.8) DNV OS F-101(2013)
Parameter				
β	=	0,623		Pers.(5.24) DNV OS F-101(2013)
αc	=	1,173		Pers.(5.22) DNV OS F-101(2013)
System Collapse Calculation				
Pel	=	13,950	MPa	Pers.(5.12) DNV OS F-101(2013)
Pp	=	20,958	MPa	Pers.(5.13) DNV OS F-101(2013)
b	=	-13,950	MPa	
c	=	-532,642	MPa^2	
d	=	6127,127	MPa^3	
u	=	-199,168	MPa^2	
v	=	1832,421	MPa^3	
ϕ	=	2,281		
y	=	6,619	MPa	
Maka,				
Pc	=	11,269	MPa	Pers.(13.13) DNV OS F-101(2013)
Pe	=	0,201	MPa	

$$\left\{\gamma_m \cdot \gamma_{SC} \cdot \frac{|M_{Sd}|}{\alpha_c \cdot M_p(t_2)} + \left\{\frac{\gamma_m \cdot \gamma_{SC} \cdot S_{Sd}}{\alpha_c \cdot S_p(t_2)}\right\}^2\right\}^2 + \left(\gamma_m \cdot \gamma_{SC} \cdot \frac{p_e - p_{min}}{p_c(t_2)}\right)^2 \leq 1$$

Local Buckling Check = 1,414 < 1

LOCAL BUCKLING CALCULATION

Stinger Stern Depth = 3m - *"SAGBEND"*

Data				
OD	=	0,508	m	
ID	=	0,4762	m	
t	=	0,0159	m	
E	=	207000	Mpa	
v	=	0,3		
SMYS	=	360	Mpa	
SMTS	=	460	MPa	
$f_{y,temp}$	=	0	Mpa	
$f_{u,temp}$	=	0	Mpa	
ρwater	=	1025	Kg/m³	
g	=	9,81	m/s²	
Wd	=	20	m	
fo	=	0,01		Ovalisation
αu	=	1		Tabel 5-4 DNV OS F-101(2013)
γSC	=	1,26		Tabel 5-3 DNV OS F-101(2013)
γm	=	1,15		Tabel 5-2 DNV OS F-101(2013)
αfab	=	0,93		Tabel 5-5 DNV OS F-101(2013)
fy	=	360	Mpa	Pers.(5.4) DNV OS F-101(2013)
fu	=	460	Mpa	Pers.(5.5) DNV OS F-101(2013)
Design Load Factor				
γc	=	1,07		Tabel 4-5 DNV OS F-101(2013)
γF	=	1,1		Tabel 4-4 DNV OS F-101(2013)
Bending Moment and Axial Force				
Mf	=	865,38	kNm	OFFPIPE Output
Sf	=	174,82	kN	OFFPIPE Output
Mp	=	1386,138	kNm	Pers.(5.21) DNV OS F-101(2013)
Sp	=	8849,177	kN	Pers.(5.20) DNV OS F-101(2013)
Msd	=	1018,549		Pers.(4.6) DNV OS F-101(2013)
Ssd	=	205,763		Pers.(4.8) DNV OS F-101(2013)
Parameter				
β	=	0,623		Pers.(5.24) DNV OS F-101(2013)
αc	=	1,173		Pers.(5.22) DNV OS F-101(2013)
System Collapse Calculation				
Pel	=	13,950	MPa	Pers.(5.12) DNV OS F-101(2013)
Pp	=	20,958	MPa	Pers.(5.13) DNV OS F-101(2013)
b	=	-13,950	MPa	
c	=	-532,642	MPa^2	
d	=	6127,127	MPa^3	
u	=	-199,168	MPa^2	
v	=	1832,421	MPa^3	
ϕ	=	2,281		
y	=	6,619	MPa	
Maka,				
Pc	=	11,269	MPa	Pers.(13.13) DNV OS F-101(2013)
Pe	=	0,201	MPa	

$$\left\{\gamma_m \cdot \gamma_{SC} \cdot \frac{|M_{Sd}|}{\alpha_c \cdot M_p(t_2)} + \left\{\frac{\gamma_m \cdot \gamma_{SC} \cdot S_{Sd}}{\alpha_c \cdot S_p(t_2)}\right\}^2\right\}^2 + \left(\gamma_m \cdot \gamma_{SC} \cdot \frac{p_e - p_{min}}{p_c(t_2)}\right)^2 \leq 1$$

Local Buckling Check = **0,826** < **1**

LAMPIRAN D-2

HASIL PERHITUNGAN *LOCAL BUCKLING*

(*STINGER STERN DEPTH* = 4m)

LOCAL BUCKLING CALCULATION

Stinger Stern Depth = 4m - *"OVERBEND"*

Data				
OD	=	0,508	m	
ID	=	0,4762	m	
t	=	0,0159	m	
E	=	207000	Mpa	
v	=	0,3		
SMYS	=	360	Mpa	
SMTS	=	460	MPa	
$f_{y,temp}$	=	0	Mpa	
$f_{u,temp}$	=	0	Mpa	
ρwater	=	1025	Kg/m³	
g	=	9,81	m/s²	
Wd	=	20	m	
fo	=	0,01		Ovalisation
αu	=	1		Tabel 5-4 DNV OS F-101(2013)
γSC	=	1,26		Tabel 5-3 DNV OS F-101(2013)
γm	=	1,15		Tabel 5-2 DNV OS F-101(2013)
αfab	=	0,93		Tabel 5-5 DNV OS F-101(2013)
fy	=	360	Mpa	Pers.(5.4) DNV OS F-101(2013)
fu	=	460	Mpa	Pers.(5.5) DNV OS F-101(2013)
Design Load Factor				
γc	=	1,07		Tabel 4-5 DNV OS F-101(2013)
γF	=	1,1		Tabel 4-4 DNV OS F-101(2013)
Bending Moment and Axial Force				
Mf	=	860,59	kNm	OFFPIPE Output
Sf	=	330,02	kN	OFFPIPE Output
Mp	=	1386,138	kNm	Pers.(5.21) DNV OS F-101(2013)
Sp	=	8849,177	kN	Pers.(5.20) DNV OS F-101(2013)
Msd	=	1012,914		Pers.(4.6) DNV OS F-101(2013)
Ssd	=	388,434		Pers.(4.8) DNV OS F-101(2013)
Parameter				
β	=	0,623		Pers.(5.24) DNV OS F-101(2013)
αc	=	1,173		Pers.(5.22) DNV OS F-101(2013)
System Collapse Calculation				
Pel	=	13,950	MPa	Pers.(5.12) DNV OS F-101(2013)
Pp	=	20,958	MPa	Pers.(5.13) DNV OS F-101(2013)
b	=	-13,950	MPa	
c	=	-532,642	MPa^2	
d	=	6127,127	MPa^3	
u	=	-199,168	MPa^2	
v	=	1832,421	MPa^3	
ϕ	=	2,281		
y	=	6,619	MPa	
Maka,				
Pc	=	11,269	MPa	Pers.(13.13) DNV OS F-101(2013)
Pe	=	0,201	MPa	

$$\left\{\gamma_m \cdot \gamma_{SC} \cdot \frac{|M_{Sd}|}{\alpha_c \cdot M_p(t_2)} + \left\{\frac{\gamma_m \cdot \gamma_{SC} \cdot S_{Sd}}{\alpha_c \cdot S_p(t_2)}\right\}^2\right\}^2 + \left(\gamma_m \cdot \gamma_{SC} \cdot \frac{p_e - p_{min}}{p_c(t_2)}\right)^2 \leq 1$$

Local Buckling Check =	**0,821**	<	**1**	

LOCAL BUCKLING CALCULATION

Stinger Stern Depth = 4m - *"SAGBEND"*

Data				
OD	=	0,508	m	
ID	=	0,4762	m	
t	=	0,0159	m	
E	=	207000	Mpa	
v	=	0,3		
SMYS	=	360	Mpa	
SMTS	=	460	MPa	
$f_{y,temp}$	=	0	Mpa	
$f_{u,temp}$	=	0	Mpa	
ρwater	=	1025	Kg/m³	
g	=	9,81	m/s²	
Wd	=	20	m	
fo	=	0,01		Ovalisation
αu	=	1		Tabel 5-4 DNV OS F-101(2013)
γSC	=	1,26		Tabel 5-3 DNV OS F-101(2013)
γm	=	1,15		Tabel 5-2 DNV OS F-101(2013)
αfab	=	0,93		Tabel 5-5 DNV OS F-101(2013)
fy	=	360	Mpa	Pers.(5.4) DNV OS F-101(2013)
fu	=	460	Mpa	Pers.(5.5) DNV OS F-101(2013)
Design Load Factor				
γc	=	1,07		Tabel 4-5 DNV OS F-101(2013)
γF	=	1,1		Tabel 4-4 DNV OS F-101(2013)
Bending Moment and Axial Force				
Mf	=	845,86	kNm	OFFPIPE Output
Sf	=	174,82	kN	OFFPIPE Output
Mp	=	1386,138	kNm	Pers.(5.21) DNV OS F-101(2013)
Sp	=	8849,177	kN	Pers.(5.20) DNV OS F-101(2013)
Msd	=	995,577		Pers.(4.6) DNV OS F-101(2013)
Ssd	=	205,763		Pers.(4.8) DNV OS F-101(2013)
Parameter				
β	=	0,623		Pers.(5.24) DNV OS F-101(2013)
αc	=	1,173		Pers.(5.22) DNV OS F-101(2013)
System Collapse Calculation				
Pel	=	13,950	MPa	Pers.(5.12) DNV OS F-101(2013)
Pp	=	20,958	MPa	Pers.(5.13) DNV OS F-101(2013)
b	=	-13,950	MPa	
c	=	-532,642	MPa^2	
d	=	6127,127	MPa^3	
u	=	-199,168	MPa^2	
v	=	1832,421	MPa^3	
ϕ	=	2,281		
y	=	6,619	MPa	
Maka,				
Pc	=	11,269	MPa	Pers.(13.13) DNV OS F-101(2013)
Pe	=	0,201	MPa	

$$\left\{\gamma_m \cdot \gamma_{SC} \cdot \frac{|M_{Sd}|}{\alpha_c \cdot M_p(t_2)} + \left\{\frac{\gamma_m \cdot \gamma_{SC} \cdot S_{Sd}}{\alpha_c \cdot S_p(t_2)}\right\}^2\right\}^2 + \left(\gamma_m \cdot \gamma_{SC} \cdot \frac{p_e - p_{min}}{p_c(t_2)}\right)^2 \leq 1$$

Local Buckling Check =	**0,789**	<	**1**	

LAMPIRAN D-3

HASIL PERHITUNGAN *LOCAL BUCKLING*

(*STINGER STERN DEPTH* = 5m)

LOCAL BUCKLING CALCULATION

Stinger Stern Depth = 5m - *"OVERBEND"*

Data				
OD	=	0,508	m	
ID	=	0,4762	m	
t	=	0,0159	m	
E	=	207000	Mpa	
v	=	0,3		
SMYS	=	360	Mpa	
SMTS	=	460	MPa	
$f_{y,temp}$	=	0	Mpa	
$f_{u,temp}$	=	0	Mpa	
ρwater	=	1025	Kg/m³	
g	=	9,81	m/s²	
Wd	=	20	m	
fo	=	0,01		Ovalisation
αu	=	1		Tabel 5-4 DNV OS F-101(2013)
γSC	=	1,26		Tabel 5-3 DNV OS F-101(2013)
γm	=	1,15		Tabel 5-2 DNV OS F-101(2013)
αfab	=	0,93		Tabel 5-5 DNV OS F-101(2013)
fy	=	360	Mpa	Pers.(5.4) DNV OS F-101(2013)
fu	=	460	Mpa	Pers.(5.5) DNV OS F-101(2013)
Design Load Factor				
γc	=	1,07		Tabel 4-5 DNV OS F-101(2013)
γF	=	1,1		Tabel 4-4 DNV OS F-101(2013)
Bending Moment and Axial Force				
Mf	=	1117,75	kNm	OFFPIPE Output
Sf	=	329,18	kN	OFFPIPE Output
Mp	=	1386,138	kNm	Pers.(5.21) DNV OS F-101(2013)
Sp	=	8849,177	kN	Pers.(5.20) DNV OS F-101(2013)
Msd	=	1315,592		Pers.(4.6) DNV OS F-101(2013)
Ssd	=	387,445		Pers.(4.8) DNV OS F-101(2013)
Parameter				
β	=	0,623		Pers.(5.24) DNV OS F-101(2013)
αc	=	1,173		Pers.(5.22) DNV OS F-101(2013)
System Collapse Calculation				
Pel	=	13,950	MPa	Pers.(5.12) DNV OS F-101(2013)
Pp	=	20,958	MPa	Pers.(5.13) DNV OS F-101(2013)
b	=	-13,950	MPa	
c	=	-532,642	MPa^2	
d	=	6127,127	MPa^3	
u	=	-199,168	MPa^2	
v	=	1832,421	MPa^3	
ϕ	=	2,281		
y	=	6,619	MPa	
Maka,				
Pc	=	11,269	MPa	Pers.(13.13) DNV OS F-101(2013)
Pe	=	0,201	MPa	

$$\left\{\gamma_m \cdot \gamma_{SC} \cdot \frac{|M_{Sd}|}{\alpha_c \cdot M_p(t_2)} + \left\{\frac{\gamma_m \cdot \gamma_{SC} \cdot S_{Sd}}{\alpha_c \cdot S_p(t_2)}\right\}^2\right\}^2 + \left(\gamma_m \cdot \gamma_{SC} \cdot \frac{p_e - p_{min}}{p_c(t_2)}\right)^2 \leq 1$$

Local Buckling Check =		**1,382**	<	**1**

LOCAL BUCKLING CALCULATION

Stinger Stern Depth = 5m - *"SAGBEND"*

Data				
OD	=	0,508	m	
ID	=	0,4762	m	
t	=	0,0159	m	
E	=	207000	Mpa	
v	=	0,3		
SMYS	=	360	Mpa	
SMTS	=	460	MPa	
$f_{y,temp}$	=	0	Mpa	
$f_{u,temp}$	=	0	Mpa	
ρwater	=	1025	Kg/m³	
g	=	9,81	m/s²	
Wd	=	20	m	
fo	=	0,01		Ovalisation
αu	=	1		Tabel 5-4 DNV OS F-101(2013)
γSC	=	1,26		Tabel 5-3 DNV OS F-101(2013)
γm	=	1,15		Tabel 5-2 DNV OS F-101(2013)
αfab	=	0,93		Tabel 5-5 DNV OS F-101(2013)
fy	=	360	Mpa	Pers.(5.4) DNV OS F-101(2013)
fu	=	460	Mpa	Pers.(5.5) DNV OS F-101(2013)
Design Load Factor				
γc	=	1,07		Tabel 4-5 DNV OS F-101(2013)
γF	=	1,1		Tabel 4-4 DNV OS F-101(2013)
Bending Moment and Axial Force				
Mf	=	824,30	kNm	OFFPIPE Output
Sf	=	174,83	kN	OFFPIPE Output
Mp	=	1386,138	kNm	Pers.(5.21) DNV OS F-101(2013)
Sp	=	8849,177	kN	Pers.(5.20) DNV OS F-101(2013)
Msd	=	970,201		Pers.(4.6) DNV OS F-101(2013)
Ssd	=	205,775		Pers.(4.8) DNV OS F-101(2013)
Parameter				
β	=	0,623		Pers.(5.24) DNV OS F-101(2013)
αc	=	1,173		Pers.(5.22) DNV OS F-101(2013)
System Collapse Calculation				
Pel	=	13,950	MPa	Pers.(5.12) DNV OS F-101(2013)
Pp	=	20,958	MPa	Pers.(5.13) DNV OS F-101(2013)
b	=	-13,950	MPa	
c	=	-532,642	MPa^2	
d	=	6127,127	MPa^3	
u	=	-199,168	MPa^2	
v	=	1832,421	MPa^3	
ϕ	=	2,281		
y	=	6,619	MPa	
Maka,				
Pc	=	11,269	MPa	Pers.(13.13) DNV OS F-101(2013)
Pe	=	0,201	MPa	

$$\left\{\gamma_m \cdot \gamma_{SC} \cdot \frac{|M_{Sd}|}{\alpha_c \cdot M_p(t_2)} + \left\{\frac{\gamma_m \cdot \gamma_{SC} \cdot S_{Sd}}{\alpha_c \cdot S_p(t_2)}\right\}^2\right\}^2 + \left(\gamma_m \cdot \gamma_{SC} \cdot \frac{p_e - p_{min}}{p_c(t_2)}\right)^2 \leq 1$$

Local Buckling Check =	**0,749**	<	**1**	

BIODATA PENULIS

Moch. Ardiansyah lahir di Surabaya pada tanggal 30 Januari 1994. Penulis merupakan anak pertama dari dua bersaudara. Penulis mempunyai orang tua yang bernama Moch. Nuh Effendi dan Aris Hidayati. Selain itu, penulis mempunyai adik yang bernama Figo Arfiansyah. Selama ini penulis bertempat tinggal di jl. Kedung Sroko 16 A Surabaya. Pada waktu jenjang taman kanak-kanak, penulis bersekolah di TK Diponegoro Surabaya. Kemudian penulis melanjutkan pendidikan jenjang sekolah dasar di SDN Pacarkeling VI Surabaya. Setelah itu, penulis melanjutkan pendidikan jenjang menengah pertama dan menengah atas di SMPN 3 Surabaya dan SMAN 6 Surabaya. Selama di SMAN 6 Surabaya, penulis aktif dalam kegiatan ekstrakurikuler futsal. Selama 3 tahun, penulis aktif dalam ektrakurikuler futsal tersebut. Penulis juga beberapa mengikuti lomba futsal di tingkat regional dan kota untuk mewaakili SMAN 6 Surabaya. Setelah lulus, penulis diterima di Jurusan Teknik Kelautan Institut Teknologi Sepuluh Nopember Surabaya. Penulis diterima melalui jalur Seleksi Nasional Masuk Perguruan Tinggi Negeri (SNMPTN) tahun 2012. Selama mahasiswa, penulis aktif dalam berbagai kepanitian dan organisasi mahasiswa. Salah satunya, penulis pernah mengikuti kepanitian ITS EXPO tahun 2012. Pada tahun kedua, penulis terdaftar sebagai staff BEM ITS dan staff di Himpunan Mahasiswa Teknik Kelautan FTK ITS. Pada saat di BEM ITS, penulis pernah menjadi *Steering Committe* (SC) untuk kegiatan *Surabaya Education Great Event*. Pada tahun ketiga, penulis menjadi ketua Himpunan Mahasiswa Teknik Kelautan FTK ITS periode 2014-2015. Selain aktif dalam berbagai kegiatan kemahasiswaan penulis juga aktif dalam tim kepemanduan FTK ITS pada tahun 2014 dan 2015. Penulis juga pernah mengikuti Latihan Keterampilan Manajemen Mahasiswa Tingkat Pra-Dasar (LKMM Pra TD) dan Tingkat Dasar (LKMM TD). Penulis juga pernah menjalani kerja praktek kurang lebih selama 2 bulan di PT. Dwisatu Mustika Bumi pada tahun 2015. Pada tahun keempat, penulis mengambil tugas akhir dalam bidang perencanaan dan perancangan pipa bawah laut. Judul tugas akhir penulis adalah Analisis *Buckling* selama Proses *Abandonment and Recovery* pada *Pipeline* 20" di Sangatta, Kalimantan Timur. Selama pengerjaan tugas akhir tersebut, penulis dibimbing oleh Bapak Ir. Imam Rochani, M.Sc. dan Bapak Ir. Handayanu, M.Sc., Ph.D.