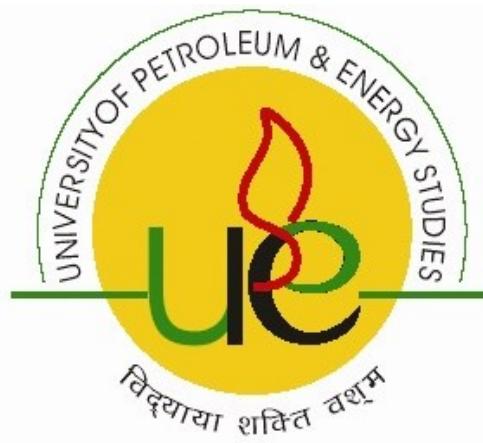# SUBSEA PIPELINE INSTALLATION ANALYSIS

By

K.V.Santosh Karun Das

M.Tech-Pipeline Engineering (2013-2015)

Enrolment No: R150213015

SAP ID: 500026389

College of Engineering

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Dehradun

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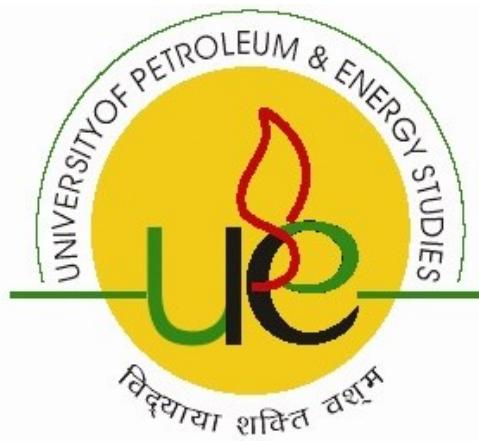
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SUBSEA PIPELINE INSTALLATION ANALYSIS

A thesis submitted in partial fulfilment of the requirements for the Degree of

Master of Technology

(Pipeline Engineering)

By

K.V.Santosh Karun Das

Under the guidance of

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April, 2015

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INTERNSHIP COMPLETION CERTIFICATE

This is to certify that Mr. K.V.Santosh Karun Das (Enrollment No.R150213015, M.Tech in Pipeline Engineering, University of Petroleum and Energy Studies, Dehradun), has successfully completed his internship with OCS Designs from the period January 2015 to April 2015. He worked on several pipeline related engineering topics such as wall thickness calculation, installation analysis and assisted in live projects during his tenure. Karun is distinguished as a diligent person fulfilling all the tasks assigned to him at expected levels.

Yours Sincerely,
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Udayasarathy Arcot V
Resident Director

CERTIFICATE

This is to certify that the work contained in this thesis titled "**Subsea Pipeline Installation Analysis**" has been carried out by **K.V.Santosh Karun Das** under my supervision and has not been submitted elsewhere for a degree.

Submitted for the University Exam held on: _____

Signature of guide
Shri. M.Ramesh
Assistant Professor,
Department of Mechanical Engineering.
University of Petroleum and Energy Studies.

Internal Examiner   External Examiner

ABSTRACT

Sub-Sea pipelines represent the most cost effective way of transporting oil and gas from the sub-sea field to the market. Pipelines, which are major components of these developments, will experience challenges both in terms of design and installation. The installation processes require special focus, as heavy pipelines may exceed the lay vessels' tension capacities in the water depths. Lay-barge construction is by far the most frequently used technique for marine pipeline construction

S-lay is the dominant installation method due to the horizontal firing line enabling several welding stations and efficient pipe string production. In the S-lay method, tensioners on the vessel/barge pull on the pipeline, keeping the whole section to the seabed in tension.

A subsea pipeline is exposed to different loads during installation from a laying vessel depending on the installation methods. The loads include hydrostatic pressure, axial tension, and bending. This project mainly deals with the analyzing the stresses, deformations and percentage yielding which pipe may undergo while it is being installed and the analysis is carried out using OFFPIPE software.

The main focus during the installation analysis is to maintain the stress, deformations as well as percentage yielding within the allowable limits (DNV RP F101) and to ensure that the whole operation is carried out in the most possible economical way. This thesis comprises development of 10 inch, steel pipelines for installation at shallow water. Static analysis studies and Dynamic studies are in addition made on the feasibility of installing these pipelines in shallow waters, and to investigate limiting factors in the installation processes.

This thesis will focus on the Static Analysis, Dynamic Analysis, Local Buckling check and concrete crushing check for safe laying of subsea pipeline.

ACKNOWLEDGEMENT

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CHAPTER-1

1. Introduction

The first pipeline was built in the United States in 1859 to transport crude oil (Wolbert, 1952). Through the one-and-a-half century of pipeline operating practice, the petroleum industry has proven that pipelines are by far the most economical means of large scale overland transportation for crude oil, natural gas, and their products, clearly superior to rail and truck transportation over competing routes, given large quantities to be moved on a regular basis. Transporting petroleum fluids with pipelines is a continuous and reliable operation. Pipelines have demonstrated an ability to adapt to a wide variety of environments including remote areas and hostile environments. Because of their superior flexibility to the alternatives, with very minor exceptions, largely due to local peculiarities, most refineries are served by one or more pipelines.

Man's inexorable demand for petroleum products intensified the search for oil in the offshore regions of the world as early as 1897, when the offshore oil exploration and production started from the Summerland, California. The first offshore pipeline was born in the Summerland, an idyllic-sounding spot just southeast of Santa Barbara. Since then the offshore pipeline has become the unique means of efficiently transporting offshore fluids, i.e. oil, gas, and water. Offshore pipelines can be classified as follows:

- Flowlines transporting oil and/or gas from satellite subsea wells to subsea manifolds;
- Flowlines transporting oil and/or gas from subsea manifolds to production facility platforms;
- Infield flowlines transporting oil and/or gas between production facility platforms;
- Export pipelines transporting oil and/or gas from production facility platforms to shore; and

• Flowlines transporting water or chemicals from production facility platforms, through subsea injection manifolds, to injection wellheads.

Use of Offshore Pipelines

Figure-1

The further downstream from the subsea wellhead, as more streams commingle, the larger the diameter of the pipelines. Of course, the pipelines are sized to handle the expected pressure and fluid flow. To ensure desired flow rate of product, pipeline size varies significantly from project to project. To contain the pressures, wall thicknesses of the pipelines range from 3/8 inch to 1 1⁄2 inch.

1.1 Design Stages of Subsea Pipelines

There are typically three phases in offshore pipeline designs:

1. **Conceptual Study or (Pre-FEED: Front End Engineering & Design):** The primary objectives are normally defines technical feasibility, system constraints, required information for design and construction, rough schedule and cost estimate.
2. **Preliminary Design or (FEED):** The primary objectives are normally defines pipe size and grade to order pipes, verifying the pipeline against design and code requirements for installation commissioning and operation, and prepares permit applications.
3. **Detail Engineering:** The detailed engineering phase is, as the description suggests, the development of the design to a point where the technical input for all procurement and construction tendering can be defined in sufficient detail
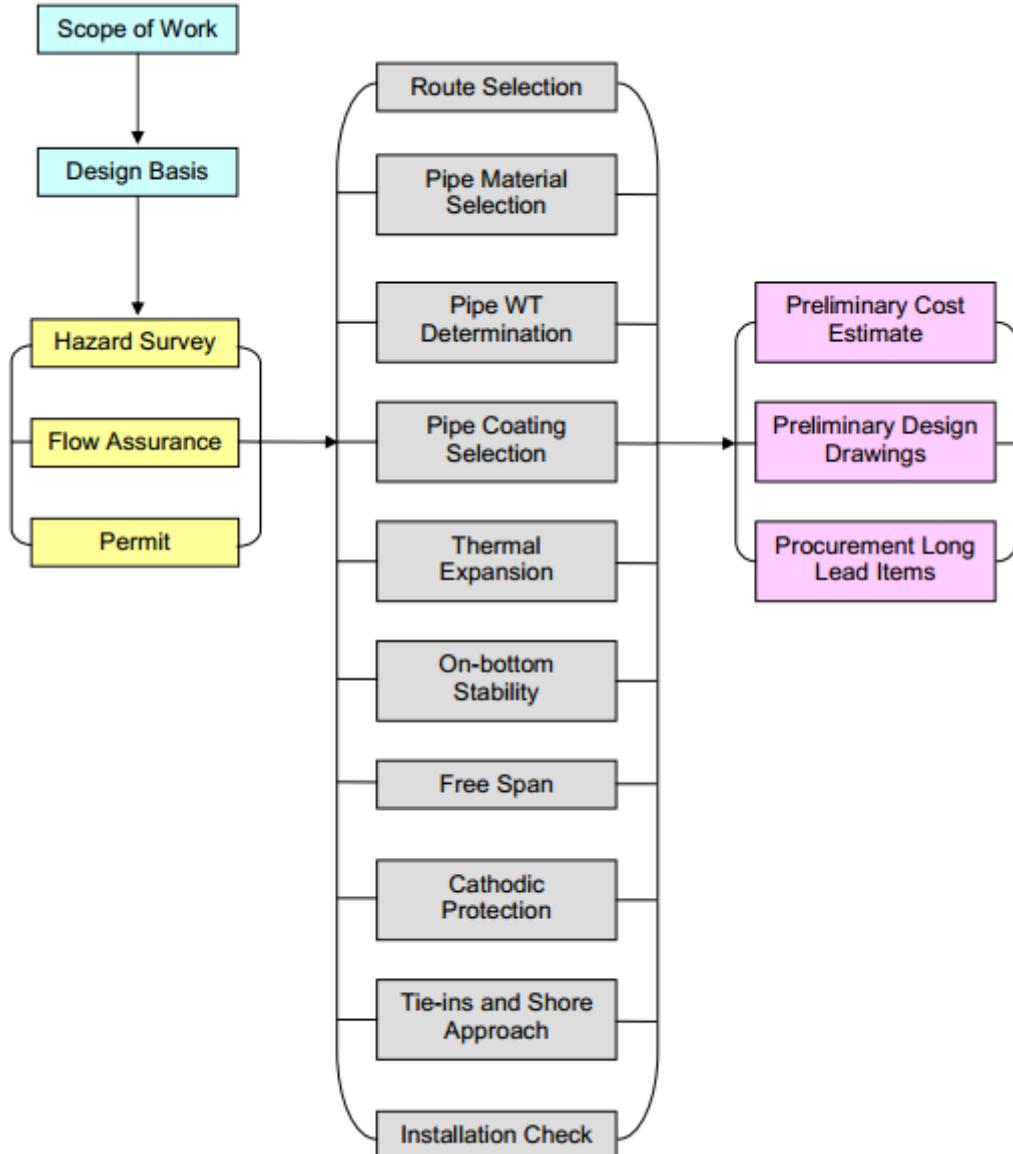
Design basis is an on-going document to be updated as needed as the project proceeds, especially in conceptual and preliminary design phases. The design basis should contain:
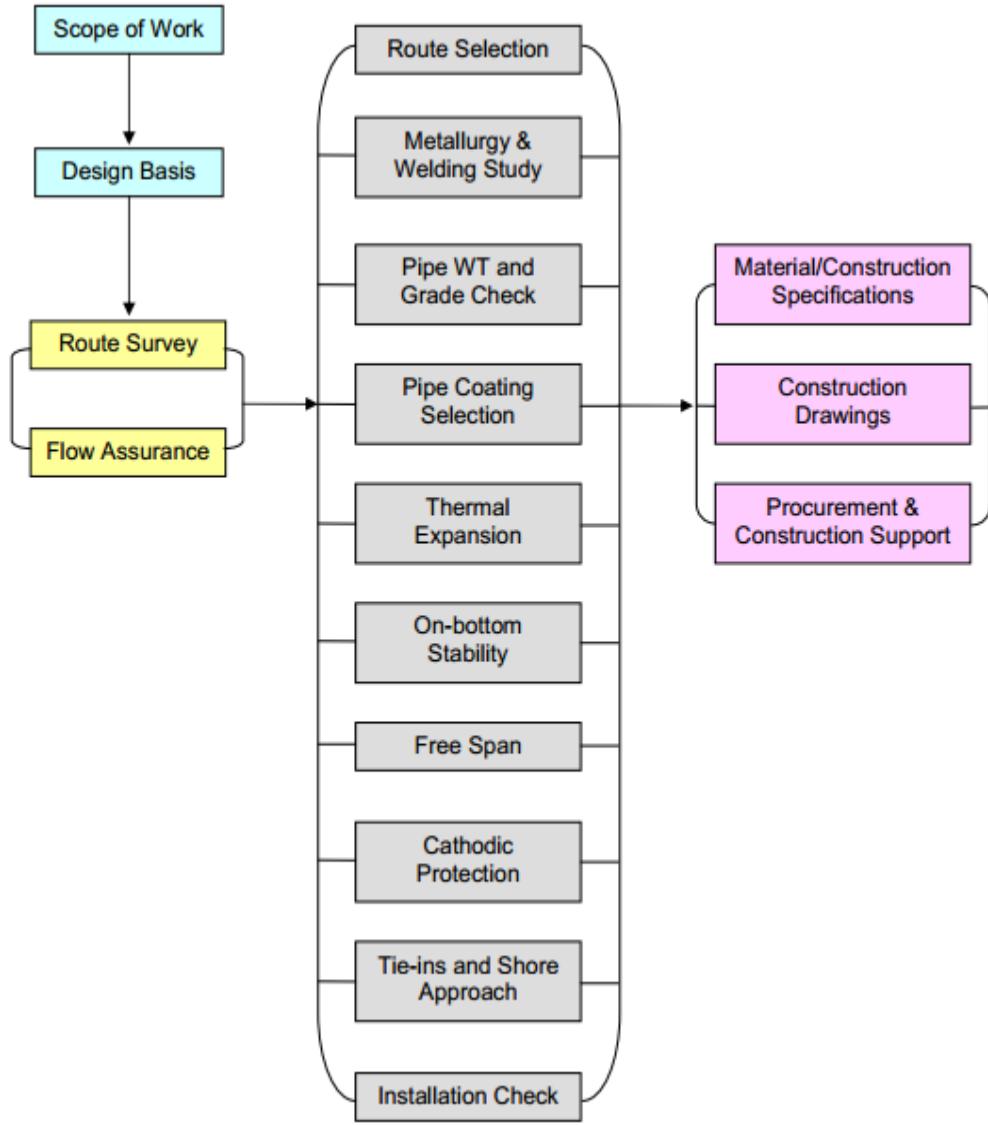
- Pipe Size
- Design Pressure (wellhead or platform deck)
- Design Temperature
- Pressure and Temperature Profile
- Max and Min Water Depth
- Corrosion Allowance
- Required overall heat transfer coefficient (OHTC) Value
- Design Code (ASME, API, or DNV)
- Installation Method (S, J, Reel, or Tow Lay)
- Metaocean Data
- Soil Data
- Design Life
- Fluid property (sweet or sour)

The pipeline design procedures may vary depending on the design phases above. Below tables show a flowchart for preliminary design phase and detail engineering phase, respectively.

Scope of Work → Design Basis → Hazard Survey / Flow Assurance / Permit → Route Selection → Pipe Material Selection → Pipe WT Determination → Pipe Coating Selection → Thermal Expansion → On-bottom Stability → Free Span → Cathodic Protection → Tie-ins and Shore Approach → Installation Check → Preliminary Cost Estimate → Preliminary Design Drawings → Procurement Long Lead Items

Preliminary Design (FEED) Flowchart

Figure-2

Detail Engineering Flowchart

Figure-3

CHAPTER-2

2. Literature Review

A detailed study was done on codes and standards and work procedures to have a clear understanding about Subsea Pipeline Installation.

1. DNV-OS-F101- Submarine Pipeline Systems (October 2010)

- The DNV-OS-F101 is a strain based code for subsea pipelines. This code is largest code which is being followed by many clients. The main advantage of this code is that the allowable limits are high when compared to DNV 1981 and factor of safety is low.
- This standard gives criteria and recommendations on concept development, design, construction, operation and abandonment of Submarine Pipeline Systems.
- This standard is based on limit state design. This implies that that the same design criteria apply to both installation and operation.
- This code contains material engineering and includes material selection, material specification (including required supplementary requirement to the linepipe specification), welding and corrosion control.
- This code contains requirement to pipeline layout, system test and mill test. It contains description of the Load and Resistance Factor Design (LRFD) format and characterization of material strength for straight pipes and supports. Design criteria for the different limit states for all phases, installation, commissioning and operation.
- It proven an internationally acceptable standard of safety for submarine pipeline systems by defining minimum requirement for concept development, design, construction, operation and abandonment.
- It serve as a technical reference document in contractual matters between purchaser and contractor.
- It serve as a guideline for designers, purchasers and contractors.

2. **API RP 1111 (American Petroleum Institute)**

- Design, Construction, Operation, and Maintenance of Offshore Hydrocarbon Pipelines (Limit State Design).

- This recommended practice sets out criteria for the design, construction, testing, operation, and maintenance of offshore steel pipelines utilized in the production, production support, or transportation of hydrocarbons; that is, the movement by pipeline of hydrocarbon liquids, gases, and mixtures of these hydrocarbons with water.

3. **ASME B31.4 Pipeline Transportation Systems for Liquid Hydrocarbons and Other Liquids.**
4. **ASME B31.8-Gas Transmission and Distribution Systems.**
5. **Offshore Pipelines by Dr. Boyun Guo**
6. **Introduction to Offshore Pipelines and Risers by Jaeyoung Lee, P.E.**
7. **Pipelines and Risers by Yong Bai**
8. **Subsea Pipeline Engineering by Andrew C. Palmer and Roger A. King**

These books covers all Installation method aspects of subsea pipelines with deep theoretical on it.

CHAPTER-3

3. Pipeline Installation

With the discovery of offshore oil fields in the shallow waters of the Gulf of Mexico during the late 1940s, offshore pipe line installation was invented. The first "offshore" pipeline in the Gulf of Mexico was constructed in 1954. Now, offshore fields are being discovered in water depth s of 10,000 feet and the pipeline installation technology is keeping up. The most common methods of pipeline lay installation methods are:

- S-lay (Shallow to Deep)
- J-lay (Intermediate to Deep)
- Reel lay (Intermediate to Deep

Shallow water depth ranges from shore to 500 feet. Intermediate water depth is assumed to be 500 feet to 1000 feet. Deepwater is water depths greater than 1000 feet. Offshore magazine produces a survey of most of the pipeline lay barges that work in the US every year. This survey does not cover all the lay barges of all the countries that do offshore work, but it does cover the bigger international ones Heerema, Saipem, Stolt, Technip, Allseas, McDermott, Global, and Subsea 7.
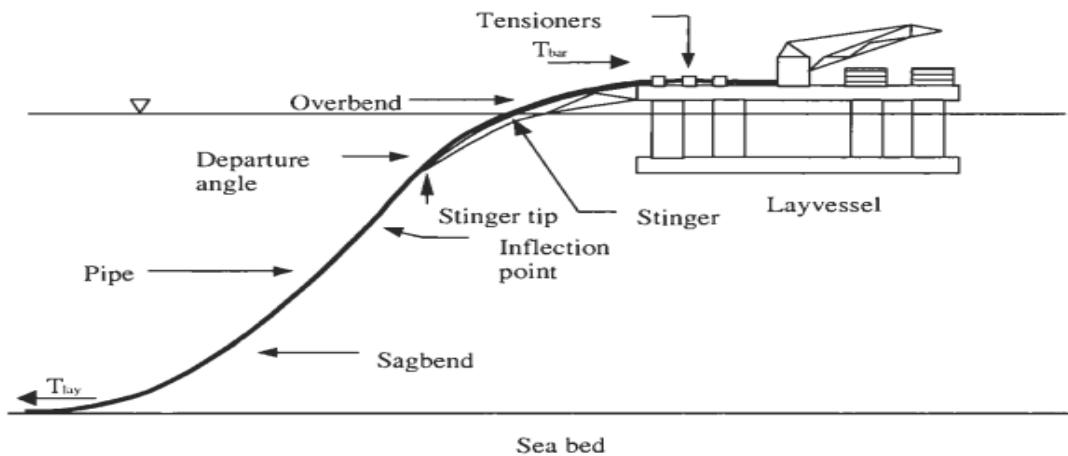
Depending on the method, a marine pipeline is exposed to different loads during installation from a lay-vessel. These loads are hydrostatic pressure, tension and bending. An installation analysis is conducted to estimate the minimum lay-tension for the pipeline for a given radius of curvature to ensure that the load effects on the pipeline is within the strength design criteria.

3.1 S-Lay Installation Method

The most common method of pipeline installation in shallow water is the S-lay method. The lay-vessel can be either a normal vessel or a semi-submersible vessel. What makes the lay-vessel special is that it has a long ramp extension or

"stinger" at the stem. At the vessel there is a near horizontal ramp. This ramp includes equipment like welding stations and tension machines. When the pipeline is welded the pipeline is fed into the sea by moving the vessel forward on its anchors. A number of rollers are placed at the stinger and vessel. These rollers support the pipeline when it moves from the vessel and into the sea. The rollers placed on the stinger and the vessel, together with the tension machines, create a curved support for the pipeline. The pipeline is bend over the curved support on its way into the sea and this part of the pipeline is named "overbend". The stinger radius controls the overbend curvature.

Number of tension machines, the positions of them and the capacity is different for each vessel. The last tension machine is normally placed at the stem of the vessel, close to the stinger. The first tension machine is placed somewhere further forward on the horizontal ramp. The purpose of applying tension to the pipeline through these tension machines is to control the curvature of the sagbend and the moment at the stinger tip through supporting the submerged weight of the suspended part of the pipeline. The tension capacity for the vessel depends on the capacity of each tension machine and the number of tension machines.
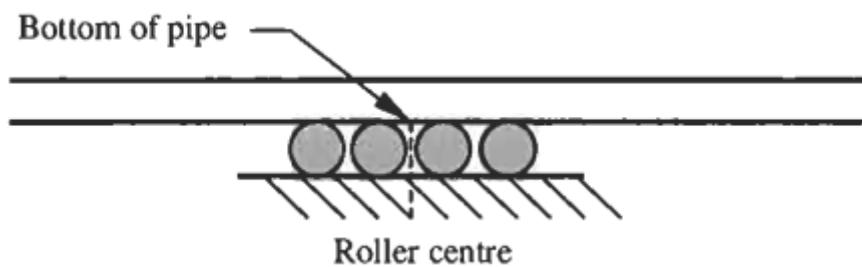
S-Lay Configuration

Figure-4

The required tension depends on the water depth, the submerged weight of the pipeline, the allowable radius of curvature at overbend, departure angle and the

allowable curvature at the sagbend. The stinger is normally made up of more than one section. Different set-ups can be made through moving the sections relative to the vessel and each other. The position of the rollers relative to the section they belong to can also be changed. This means that a vessel can be configured for a number of different radiuses of curvature. The stinger on a lay-vessel has limitations both for minimum and maximum radius of curvature. These limits are different for each lay-vessel. Because of this, each lay-vessel also have an upper and lower limit for the angle the pipelines can departure from the stinger. Through trim of the vessel, small changes can be made to the departure angle for a specific radius of curvature. The necessary lay-tension is very influenced by the departure angle from the stinger.
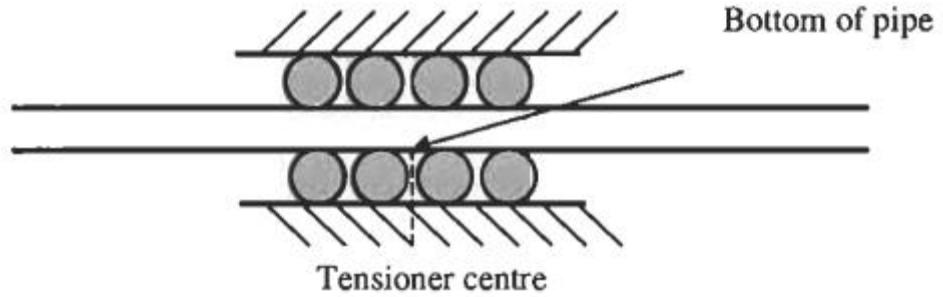
The curvature of the support for the pipeline is very often referred to as stinger radius. This doesn't mean that the stinger has a constant radius equal to this value. It is more like an average value for the radius of curvature that are made of the rollers at the stinger and vessel. A roller/support is normally buildup of some wheels.

Typical roller/support for pipeline

Figure-5

The tensioners normally consist of an upper and lower track loops. Wheels within the track loops apply squeeze forces to the tracks, which in turn grip the pipeline.

Bottom of pipe

Tensioner centre

Typical tensioner support

Figure-6

One of the main roles of the lay-vessel is to provide the tension that holds the suspended line and controls its shape. In older lay barges, the tension is reacted by several long mooring lines connected to anchors. The mooring lines are attached to winches, and the barge moves forward by winding in the mooring lines. This is a delicate operation essential to keeping the position and direction of the lay barge in accordance with the planned route. The loss of a mooring anchor during such an operation can cause sudden yawing or drifting of the barge, which in turn can result in buckling of the pipe at the end of the stinger due to excessive bending. More modern S-lay vessels used in deeper waters use dynamic positioning to control their position. This is achieved by thrusters (shrouded propellers that can be freely directed) that are computer-controlled using GPS. Dynamic positioning requires significantly more power but it increases the efficiency of the lay operation (laying speed is as high as 4 mi/d for pipe of diameters up to 30 in).

Advantages

- No limitations to pipeline diameter and -length. The vessels can install varying pipeline diameters in different projects, making them feasible for many S-lay installation projects.
- Requires minimal on-shore support ones the installation has started.
- Numerous pipeline tasks can be performed at the same time, including welding, inspections and field joint applications, due to the horizontal transportation across the vessel.

- Several contractors with S-lay experience, which gives advantages due to technical and economical competition.
- Laying speed is quite high, even for large diameter pipelines, and is typically between 2 and 6 km/day (Iorio, Bruschi and Donati, 2000). This is dependent on seabed topography and water depth, among other factors.

Disadvantages
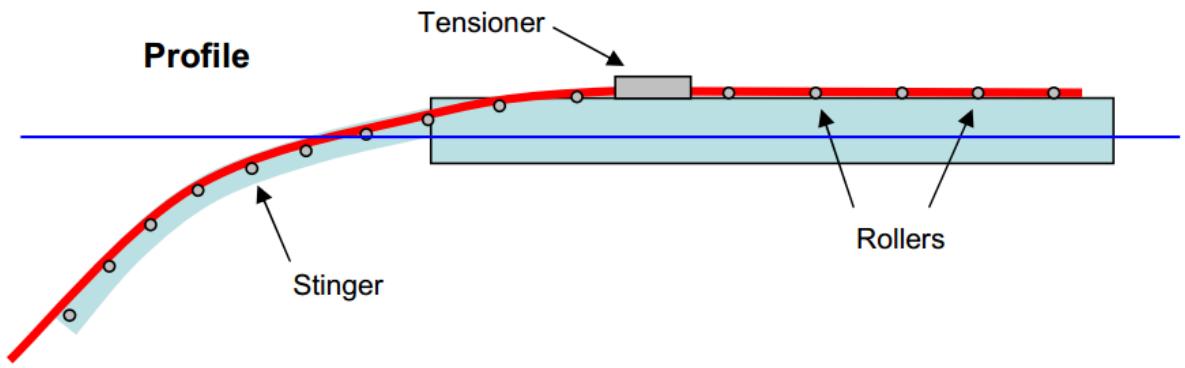
- Limited installation depth. Tension capacities at the vessels are likely to be exceeded at ultradeep waters for large diameter thick walled pipelines.
- Long stingers are vulnerable to wave and current forces, which is typical for S-lay vessels in deep waters.
- High tension is undesirable as the tensioners can damage the pipeline coating, as well as having to be balanced by the mooring or dynamic positioning system of the vessel.
- High strains in the overbend are common for deep water installations, with a high probability of exceeding the given strain criteria.

3.2 S-Lay Main Installation Equipment

The pipeline installation procedure for S-lay vessels is done by the following main equipment:

3.2.1 Tensioners

Tensioners are normally located near the stern of the ramp. Typically rubber pads put a pressure at the top and bottom of the pipe surface. These apply a tension to the pipe, controlling the curvature during installation. Their function is to give sufficient tension in order to secure the integrity of the pipe. The required tension depends on factors such as water depth, length of stinger, stinger radius, pipe diameter and -weight. For deep waters the required tension is higher than for more shallow waters, as the total pipeline segment has a higher weight. The S-lay vessel Solitaire (Allseas Group) has a total tension capacity of 1050t, allowing pipeline installation down to approximately 3000m.

Barge with Tensioner and Stinger

Figure-7

3.2.2 Stinger

The stinger is an open frame structure with rollers to support the pipeline during installation, and gives the pipe its curvature in the overbend region. It will often be constructed by several hinged sections, giving the possibility to adjust the stinger curvature and shape. Stinger lengths are depending on the lay vessel, but normally the lengths are above 100m for vessels installing pipelines in deep waters.

3.3 Dynamic positioning

During pipeline installation processes, the control of lay vessels motions and positioning are essential to avoid damages to both pipes and vessels. Positioning of the lay vessels is done either by mooring to anchors or by dynamic positioning (DP) systems with use of thrusters. These systems shall keep the vessel from drifting sideways or yaw away from the pipeline, as this may cause buckling or kinking of the pipe at the end of the stinger (Palmer and King, 2008).

The force by the positioning system has to be adequate in order to ensure a sufficient tension and hereby curvature of the pipe. This tension will react on the lay vessel, resulting in a force that the vessel has to be held in position against. Vessel size and dynamic factors, such as waves, currents and wind affect the force required to hold it in position.
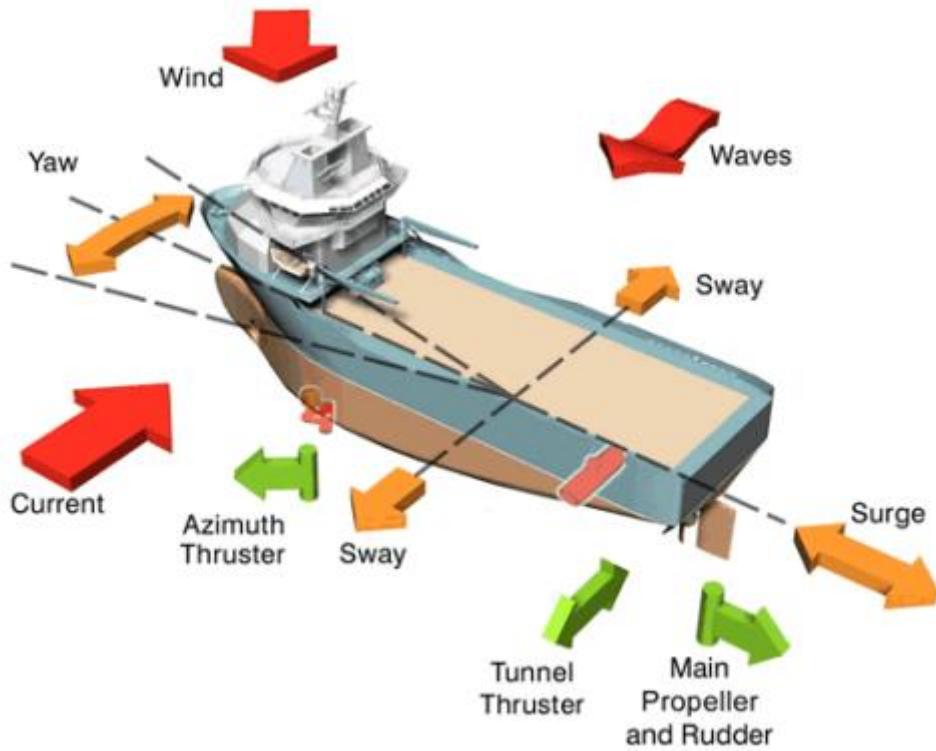
Positioning by anchors has been the common system for lay vessels constructed up until the later years. Anchors controlled by anchor handling tugs are spread

around the barges, and winches control the movement. Benefits such as no need for complex computer systems controlling propellers and thrusters, and independency of power supply are advantages for this type of systems. Still, several disadvantages are present. Difficulties of placing anchors without interfering with existing subsea structures and pipelines, is a problem. Continuous relocation of anchors is both time consuming and sensitive to sea conditions and weather.

One of the main issues is the limitation for use in deep waters. The water depth is limited to approximately 800m for use of mooring-anchor systems, depending on the pipeline diameter (Palmer and King, 2008). DP systems using thrusters to position the lay vessels give several advantages for pipelaying operations. Their precision in positioning are maintained by use of thrusters, GPS (Global Positioning System) or acoustic positioning systems, and sensors which measure vessel heading, motion, wind direction and speed. A control system also controls the configuration of the pipeline relative to the vessel. Only surge, sway and yaw can be controlled by the DP system, and a specific heading must be held, even though this might not be the optimal position regarding interaction of environmental loads.Below Figure shows the forces and motions acting on the vessel which the DP system has to withstand during operation.

Advantages

- Using of DP systems include faster abandonment and recovery of pipelines, quicker startup, independency to water depth, no interference with subsea structures such as pipelines, faster pipeline lay-rate, and higher maneuverability and flexibility for use in bad weather conditions. For water depths beyond approximately 800m vessels controlled by DP system is the only realistic option for pipeline installations.
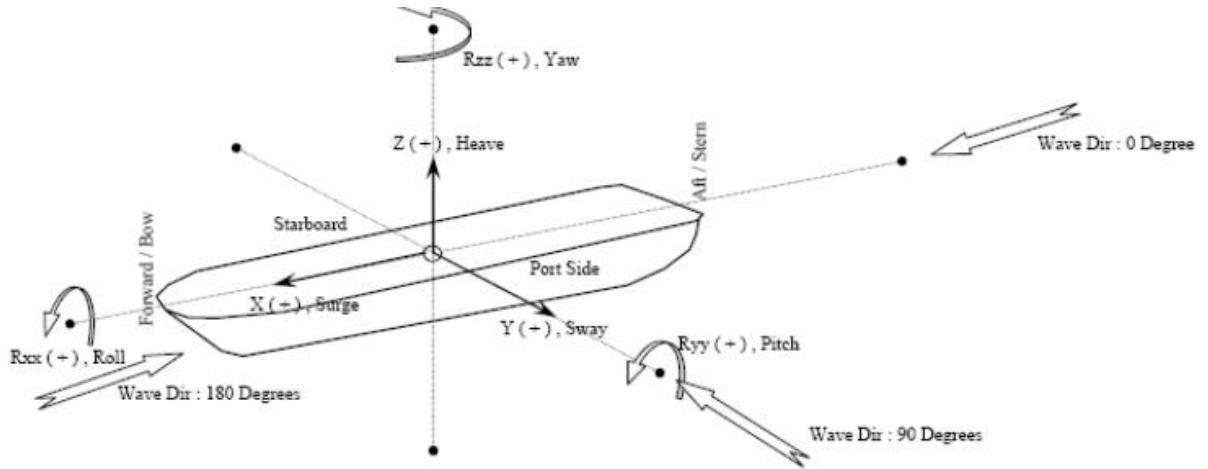
DP Vessel Affected by Forces and Motions

Figure-8

- Two of the negative factors by using DP systems are system reliability and power required to balance the applied tension from the pipe. The first factor can result in barge damage and buckling of the pipe, while the second factor require powerful thrusters which results in high fuel costs. DP systems normally include full redundancy in all components, to cope with the reliability issues, according to Jensen (2010). Other disadvantages by the DP systems are vulnerability to thrusters, -electronics and -power supply, and higher day-rates and fuel consumptions than for the anchored vessels.

3.4 Response amplitude operator (RAO)

RAO is used to represent the vessel or floating structure's six degree movements due to waves and wind, as below.

Response Amplitude Operator for a Barge

Figure-9

RAO is an important input for dynamic analysis for floating structure including pipelay barge. The main concern on the conventional lay barge, the mooring patterns and vessel position against its anchor and also the water depth are changed all the time during pipe lay process.

3.5 Pipelay Static Analyze

During installation, the pipeline will experience a combination of loads. These loads are tension, bending, pressure and contact forces perpendicular to the pipe axis at the supports on the stinger and at the seabed.

The static configuration of the pipeline is governed by following parameters:

- Tension at the lay-vessel
- Radius of curvature for the stinger
- Roller positions
- Departure angle from stinger
- Pipe weight pipe bending stiffness
- Water depth

3.6 Pipelay Dynamic Analyze

Pipelay Dynamic analyze is used to define the weather limitations during pipeline installation. The dynamic analysis can be run regular wave or irregular wave. When a regular wave is specified, the RAO, is based on single frequency and wave heading. When irregular wave is used, the RAO is inputted on the range of frequency to cover all the wave spectrum. In the past we used regular wave to speed up the calculation process. But now a day's computer time is not a problem any longer, so running on an irregular wave is a better approach to choose.

3.7 Allowable Stress/Strain Design Approach

Load Condition	Overbend Stress/ Strain (Von Mises) %SMYS	Stress at Sagbend (Von Mises) %SMYS
1. Functional (Static)	85	72
2. Functional + Environmental (Dynamic)	0.305	87

Table-1

Note:

1) The allowable of overbend and sagbend/stinger tip are based on strain and stress criteria respectively, refer to DNV-OS-F101.

3.8 Software OFFPIPE

For pipeline installation analysis the fit-for-purpose computer program OFFPIPE may be used. OFFPIPE is a finite element method program specifically developed for the modeling and analysis of non-linear structural problems encountered in the installation of offshore pipelines.

The static analysis carried out in this thesis considers the following 2-dimensional functional external loads:

- Tension at lay barge tensioners;
- Buoyancy uniformly distributed;
- External hydrostatic pressure;
- Reaction forces from the lay barge rollers;
- Vertical seabed reaction (assumed continuous elastic) foundation

The material modeling used by the OFFPIPE computer program is a Ramberg-Osgood material model. This Ramberg-Osgood material model used in OFFPIPE is expressed as follows:

$$\frac{K}{K_{y.}} = \frac{M}{M_y} + \left(\frac{M}{M_y}\right)^B A$$

$$K_y = \frac{2*\sigma_y}{E*D}$$

$$M_y = \frac{2 \cdot I_c \cdot \sigma_y}{D}$$

Where

     K= Pipeline Curvature

     M= Pipeline Bending Moment

     E = Modulus Elasticity of pipe steel

     D = Diameter of the steel Pipe

     I_C= Cross Sectional moment of a steel pipe

     σ_y =Nominal yield stress of a pipe steel

     A= Ramberg-Osgood equation coefficient

     B= Ramberg-Osgood equation exponent

The method described above is for typical standard S-lay, J-lay or reeling method installation of an offshore pipeline. The analysis can be carried out both by static analysis or dynamic in order to determine the effect of the weather conditions. For special consideration of local constraints on the pipeline in terms of structures or similar other simulation tools may be used in terms of more generalized computer programs (ANSYS, ABAQUS). More generalized computer software tolls may also be used if special installation methods should be used, where OFFPIPE not is found to be applicable.

3.9 Purpose of OFFPIPE Software

A commonly used FEM computer program for installation analysis is OFFPIPE. This program can give indicative global results for most situations but not the effects of stressed strain concentration and point loads due to change in stiffeners.

This thesis describes a finite element model for pipeline installation analysis. The model should be able to compute static load effects on a pipeline during installation, based on the lay ramp geometry, pipeline design data and water depth for the pipeline to be installed.

The established model should be a tool for analyzing the static configuration of a pipeline during installation. The static configuration of the pipeline is the

shape of the pipeline from the lay-vessel to the seabed when it is in static equilibrium. The model should also be capable of analyzing the load effects on the pipeline when a section like a valve is installed. The model should also be capable of letting the pipeline slide over the stinger. A pipeline cross section will then move from the lay-vessel, over the stinger and through the sagbend to the seabed.

The purpose of developing this finite element model for pipeline installation is to calculate the load effects on a pipeline during the installation of an in-line valve. These analyses also involve the response due to environmental loads.

CHAPTER-4

4. Installation Analysis

In this project, to lay a 10.75" Gas Pipeline without failing due to stresses and analysis should be done using OFFPIPE software.

4.1 Scope and Objectives

Major offshore facilities in the Scope of Work pipelines installation of concrete coated steel subsea pipeline i.e.:

(1) 10.75-inch x 7.3 km.

The objective of this document is to establish engineering parameters for Pipelay analysis of the 10" gas pipeline which includes:

- Static Laying Analysis
- Dynamic Laying Analysis
- Local Buckling check
- Concrete Crushing check

4.2 Executive Summary and Recommendation

- DLB-01 with two section articulated stinger is found suitable to install the pipeline from depth 21.34m).
- DLB-01 working draft 4.1m and trim 0.5m
- The maximum nominal lay tension for pipelay installation of 10.75" Pipeline is 25MT. This is well within the rated capacity of the tensioner system i.e. 113MT.
- Limiting sea state for dynamic pipelay was considered;
  Hs = 1 .1 m
  Tp = 7.36s for all directions.
- The local buckling check ratio on the barge, stinger and sagbend are 0.843 within the permissible limits.
- Max concrete crushing is‑0.194% within the permissible limits.

4.3 Design Data

This section presents the data and design parameters used for pipeline installation engineering analyses

4.3.1 Pipeline Data

The following pipeline data 10.75 inch gas export pipeline are used for the pipe lay analysis.

Parameter	Unit	Value
Start KP*	km	0.0
End KP*	km	7.197
Length	km	7.197
Pipe OD	in	10.75
	mm	273.1
Wall Thickness	mm	15.9
Material	-	API 5L X65
Cor. Coating Thk	mm	2.8
Cor. Coating Material	-	3LPE
Cor. Coating Density	Kg/m3	940
Concrete Coating	mm	40
Concrete Coating Density	Kg/m3	3040

Pipe Data

Table-2

4.4 Lay Barge and Stinger Data

The proposed barge for the Pipelay is DLB-01 and designated stinger is 2 sections articulated stinger. The details of the barge and the stinger are given below in Table,

Description	Barge Parameters
Maximum Pipe Tension Available	113 MT
No. of Tensioners Available on the Barge	2
No. of Rollers on the Barge	7
Barge Roller Bed Length	3.0
Length of Tensioner	6.4m
Hitch X-Location (w.r.t stern)	1.818 m
Hitch Y-Location (w.r.t main deck)	-3.712 m
Barge Moulded Dimensions	Length = 121.92 m Breadth = 32.3 m Depth = 8.6868 m
Barge Midship Draft	4.1 m
Barge Trim	0.5 deg

Lay Barge Data

Table-3

Description	Stinger Parameters
Stinger Type	Articulated Floating Stinger
No. of Stinger Sections	2
No. of Rollers on Stinger	5
Total Stinger Length	38.156 m

Stringer Parameters

Table-4

Rollers/Tensioners	R1	R2	R3	T1	R4	T2	R5	R6	R7
Distance from stern (m)	96.368	84.332	73.503	60.152	46.492	35.401	23.381	8.913	3.123
Bottom of Pipe Elevation	2.489	2.305	2.131	1.754	1.532	1.040	0.480	-0.940	-1.920
Separation (m)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Table-5

Configuration of the Rollers on Barge

Notes

1. Barge trim angle is set at 0.5 degrees.
2. The barge B.O.P elevations are measured from the main deck level (no barge ramp considered) to the bottom of pipe.
3. "R" refers to barge rollers, whilst "T" refers to the barge tensioners.
4. R7- refers to the barge roller nearest to the stern of the barge.
5. The separation is based on static analysis.

Stinger Section	Hitch Section		Sled Section		
Rollers	S1	S2	S7	S8	S9
Distance from Hitch (m)	5.593	14.737	24.592	35.400	38.518
Bottom of Pipe Elevation B.O.P (m)	1.106	1.089	1.085	1.085	0.638
Separation (m)	0.00	0.00	0.00	0.00	0.366

Table-6

Configuration of the Rollers on Stinger

Notes

1. S1 refers to the first stinger roller nearest to the hitch of the stinger.

2. Location of the stinger hitch is -1.855m in X-direction and -3.712m in Y-direction (elevation) from the stern of the barge with respect to main deck level.

3. The stinger B.O.P elevations are measured from the imaginary line drawn from hitch parallel to water surface.

4. The separation is based on static analysis.

Stinger section	Ballast Capacity	Ballast Schedule	
	(kN)	(kN)	(%)
Hitch Section	0	0	0%
	0	0	0%
	334	190	57%
	170	10	6%
Sled Section	0	0	0
	702	250	36%
	109	40	37%

Table-7

Stinger Ballast Schedule

4.5 Environmental Parameters

The environmental data below are the basis for determining sea state limit for pipeline installation operations. Conservatively, wave and associated wind and current are considered collinear.

4.5.1 Water Depth and Tidal data

Tidal levels relative to MSL is used for analysis. For the analysis envisaged tide (HAT) of 0.66m and Storm Surge of 0.04m (1year) will be added to the maximum water depth.

Description	Units	Value
Min. Depth (below LAT)	m	21.34
Max. Depth (below LAT)	m	22.23
Highest Water Level (Above MSL)	m	0.66
Mean Sea Level (MSL)	m	0.00
Lowest Water Level (Below MSL)	m	-0.66
Positive Surge (1 year RP)	m	+0.04
Negative Surge (1 year RP)	m	-0.04

Table-8

Tidal data

Min design water depth = Min Water Depth + Negative Surge

= 21.34m + (-0.04m) = 21.30m

Max design water depth = Max Water Depth + LWL + MSL + HWL + Positive Surge

= 22.23 + 0.66 + 0 + 0.66 + 0.04= 23.59m

No.	Heading	Allowable Hs (m) Water Depth 21.34m	Period
1.	Stern/Bow (0 and 180 Deg)	1.1	4.05
2.	Quarter (45,135,225 and 315 Deg)	1.1	4.05
3.	Beam (90 and 270 Deg)	1.1	4.05

Table-9

Wave data

4.6 Pipeline Installation Analysis

The profile control information has been developed from pipelay stress analyses based on three-dimensional (3-D) static, large deflection slender rod mechanics. The analysis is performed using the commercially available computer program OFFPIPE, version 3.01BP. A nonlinear moment curvature relationship is used to model the plastic deformations of the pipeline (large strain). The water depth considered for pipelay analysis is LAT + maximum astronomical tide +Storm Surge. Lay particulars (profile and tension) is determined and tabulated for all critical depths and pipe property changes. A finite element model of the pipeline up to touch down at sea bed will be checked. Load controlled condition will be considered for the analysis. The maximum combined stress and strain is to be kept within the allowable limits as shown in Table.

Allowable Stress/Strain Design Approach

Load Condition	Overbend Stress/ Strain (Von Mises) %SMYS	Stress at Sagbend (Von Mises) %SMYS
4. Functional (Static)	85	72
5. Functional + Environmental (Dynamic)	0.305	87

Table -10

Note

1. The allowable of overbend and sagbend/stinger tip are based on strain and stress criteria respectively, refer to DNV-OS-F101.

4.7 Modeling Procedure

The general procedure used to establish the nominal pipe lay tension and deriving resultant pipe profiles stresses is as follows.

- The barge and stinger over bend roller profile is established based on pipe properties and water depth.
- The barge tension in the model is varied until the desired installation profile with acceptable stresses at all locations is achieved.
- The truss is modeled with the roller supports. The stinger is connected to the barge by a hinge which permits rotation about the horizontal axis to simulate the floating stinger condition.
- Subsequent sections of the stinger are also attached to the previous by means of hinge which permits rotation about horizontal axis to simulate articulated stinger.

- The articulated floating stinger is ballasted to achieve the required inclination for individual stinger sections, thus attaining desired pipeline profile.

4.7.1 Computer Output

In OFFPIPE two-dimensional static pipelay analysis, the computer printed output comprises the following format:

- Input echo- the input data listed in a report format with a description and units for each variable.
- Static output table- The static pipe node coordinates from bow to touchdown at seabed, respective internal axial tension and bending forces stresses, support reactions at barge and stinger rollers.
- Static solution and input summary – a summary of the input data and static solution.

Default origin of co-ordinate axes in offpipe
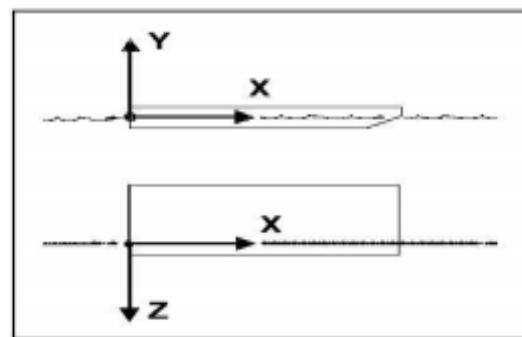
Figure-10

Offpipe finite element modeling for pipelay
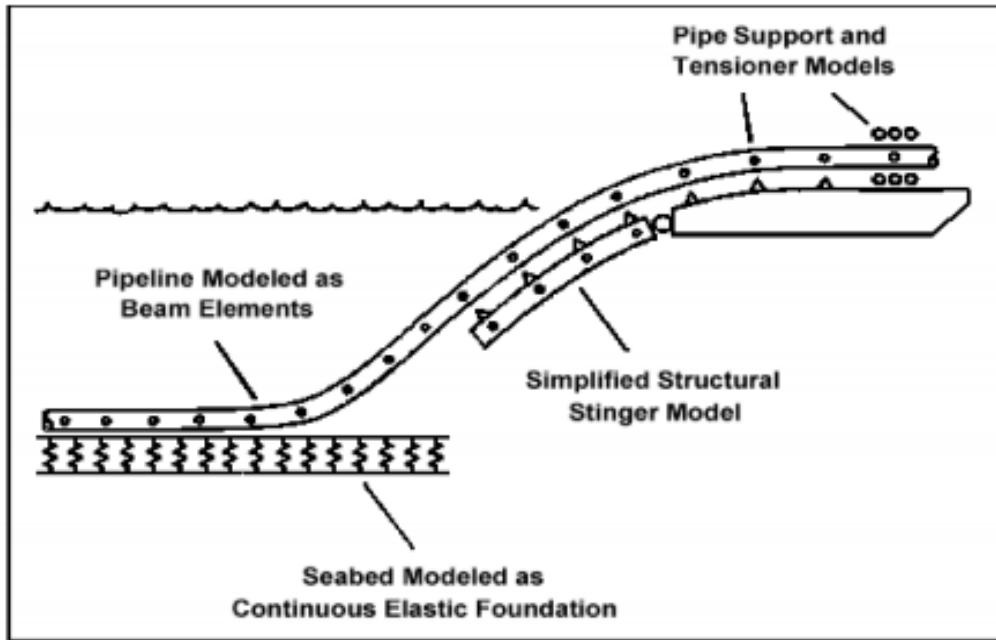
Figure-11

4.7.2 Normal Lay Analysis Result

The total combined pipe stress is calculated from the given tensile, hoop and bending stress using the Von Misses criteria and compared against the allowable stresses as mentioned in table 10. The results of the pipelay analysis and profile control data are shown in Table. Detail output refers to Appendix 3.

4.7.3 Dynamic Lay Analysis

The dynamic response and stresses of the pipeline is calculated in frequency domain. The current and wave direction is collinear for worst scenario and is checked for every 45 degree from 0 deg to 180 deg. Response Amplitude Operators (RAO's) of the barge has been generated using MOSES software and the output is presented in Appendix 2. These RAO's is used to model response of the barge during pipelay analysis. Dynamic analysis is performed using the pipe lay analysis computer program OFFPIPE. The following figure explains different sign conventions used in MOSES and OFFPIPE, which would help to interpret heading conventions between the two software outputs.
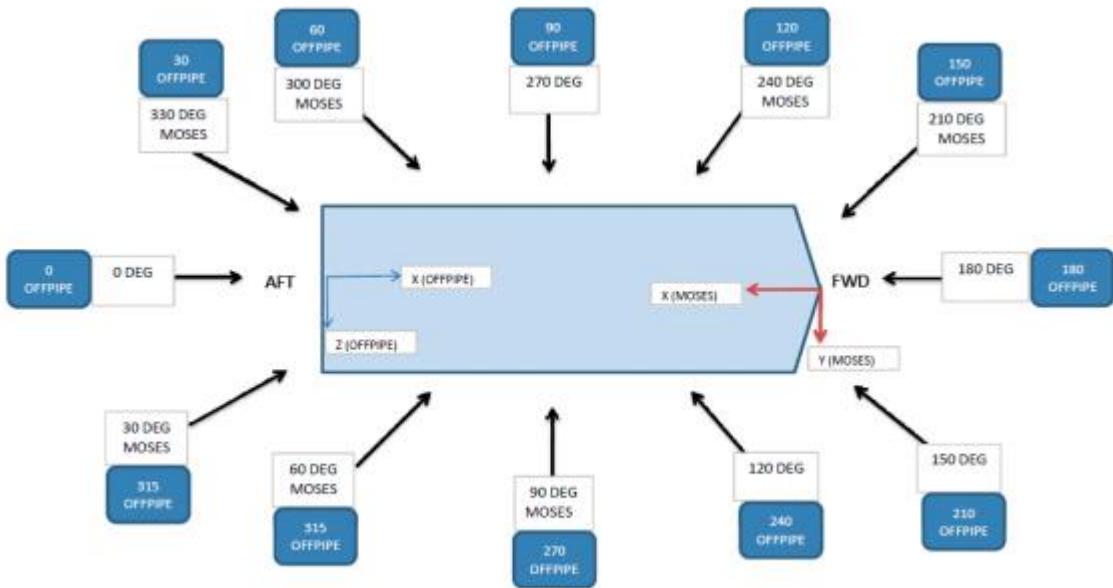
Figure-12

Wave Directions

The resulting loads from the dynamic lay analysis are checked against the requirements of DNV-OS-F101. The maximum allowable stress for dynamic analysis is as described in Section. The summary of results of the dynamic pipelay analysis is shown in through the most critical cases for the worst response is presented here in and thus defined in the limiting sea state. The analysis has been carried out for water depth 21.34m.

OFFPIPE outputs for the summarized results are included in Appendix 4.

Static Analysis Result Normal Laying Pipeline 10.75"

NO	Water Depth	Wall Thk	Corr Coat. Thk	Concrete Coat. Thk	Barge Trim	Lay Tension	Touch Down Tension	Max. Barge Roller Loads	Max. Stinger Roller Loads	Elevation of B.O.P at Last Stinger Roller	Touch down Distance from Stern	Gain	Overbend Stress at Stinger (%SMYS)		Max. Stress at Stinger Tip (%SMYS)		Max. Stress at Sagbend (%SMYS)	
													Actual	Allow	Actual	Allow	Actual	Allow
	(m)	(mm)	(mm)	(mm)	(deg)	(kN)	(kN)	(kN)	(kN)	(m)	(m)	(m)	Actual	Allow	Actual	Allow	Actual	Allow
1.	21.34	15.90	2.80	40	0.50	250	210.20	62.56	36.92	-7.96	116.17	2.9	62.1	85	20.7	85	41.5	72

Table-11

31

Note;

(1) Maximum water depth in the analysis include the (LAT+HAT).

(2) Negative sign indicates depth below water surface.

(3) Maximum allowable static stress is 85% (Stinger/Overbend); 72% (Sagbend and Stinger Tip).

Dynamic Analysis Result Normal Laying Pipeline 10.75", Water Depth 21.34m

Water Depth	Direction	Wall Thk	Corr Coat. Thk	Concrete Coat. Thk	Barge Trim	Lay Tension	Max. Barge Roller Loads	Max. Stinger Roller Loads	Elevation of B.O.P at Last Stinger Roller	Touch down Distance from Stern	Gain	Stress and Strain Output					
												Overbend total (%strain)		Max. Stress at Stinger Tip (%SMYS)		Max. Stress at Sagbend (%SMYS)	
(m)	(Deg)	(mm)	(mm)	(mm)	(deg)	(kN)	(kN)	(kN)	(m)	(m)	(m)	Actual	Allow	Actual	Allow	Actual	Allow
21.34	0	15.90	2.80	40	0.50	250	82.01	83.73	-8.20	113.21	2.92	0.1768	0.305	49.20	87	54.06	87
	45						72.92	66.39	-8.33	112.74	2.9	0.169		51.0		53.7	
	90						72.93	62.94	-8.02	113.79	2.9	0.151		45.8		49.4	
	135						75.33	73.91	-7.68	114.88	2.9	0.184		58.9		56.7	
	180						75.61	76.46	-7.48	114.37	2.9	0.194		60.5		54.8	
	225						75.61	76.92	-7.68	114.89	2.9	0.185		60.3		52.8	
	270						71.11	60.26	-8.02	113.79	2.9	0.148		42.0		48.7	
	315						72.62	67.44	-8.33	112.74	2.9	0.172		46.9		52.9	

Table-12

Note; (1) Maximum water depth in the analysis include the (LAT+HAT).

(2) Negative sign indicates depth below water surface.

(3) Maximum allowable static stress is 0.305 (Stinger/Overbend); 87% (Sagbend and Stinger Tip). *"Based on DNV-OS-F101"*

CHAPTER-5

5. Concrete Crushing and Local Buckling Check

5.1 Local Buckling Check

Local Buckling Check has been carried out in accordance with the DNV 2000 for the worst case combination of depth and bending moment. Refer Appendix 5 for detailed calculation. It is found that the pipeline stress is still within limit; with maximum stress ratio of 0.99.

5.2 Concrete Crushing Check

A check for concrete crushing is done as per Section 13 H200 of DNV OS F101 -2007 where following criterion should be used:

The mean overbend strain calculated as follow:

$$\xi_{mean} := \frac{-D}{2R} + \xi_{axial}$$

and should satisfy:

$$\gamma_{cc} \cdot \xi_{mean} \geq \xi_{cc}$$

Where

R = stinger radius

$\xi.mean$ = calculated mean overbend strain

$\xi.axial$ = Axial strain contribution

$\gamma.cc$ = 1.05 safety factor for concrete crushing

$\xi.cc$ = limit mean strain giving crushing of the concrete.

The calculation on Appendix 6 shows that the mean overbend strain is 0.12% which is less than limit mean strain that giving crushing for concrete crushing (0.20%).

5.3 Pipeline Route and Alignment Sheets

Figure-13

Figure-14

Figure-15

5.4 Barge Drawings

PROFILE
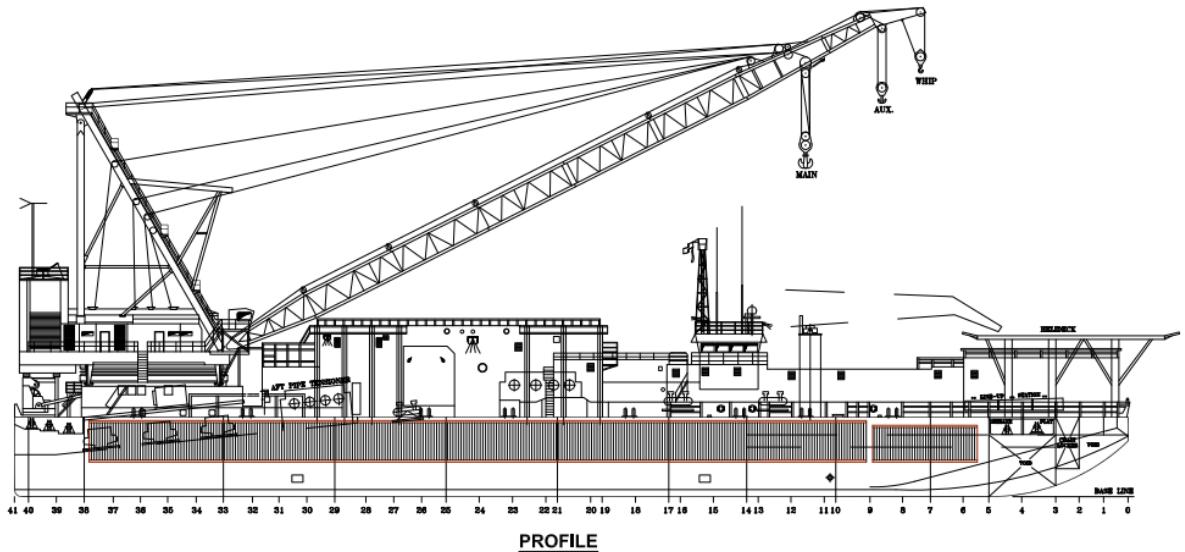
Figure-16

DLB - 01 BARGE ROLLER HEIGHT AND LOCATION
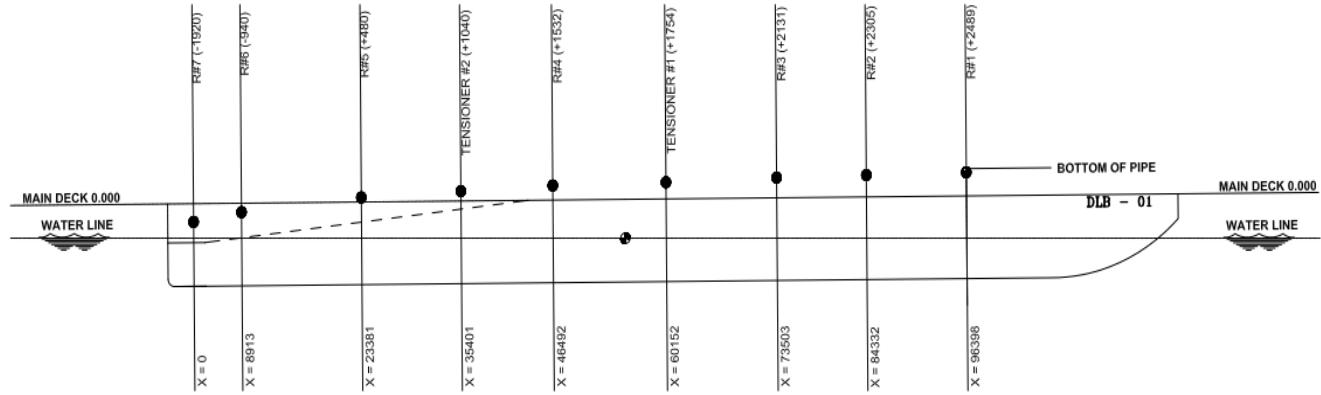
Figure-17

5.5 Environmental Data

5.5.1 Metaocean Data
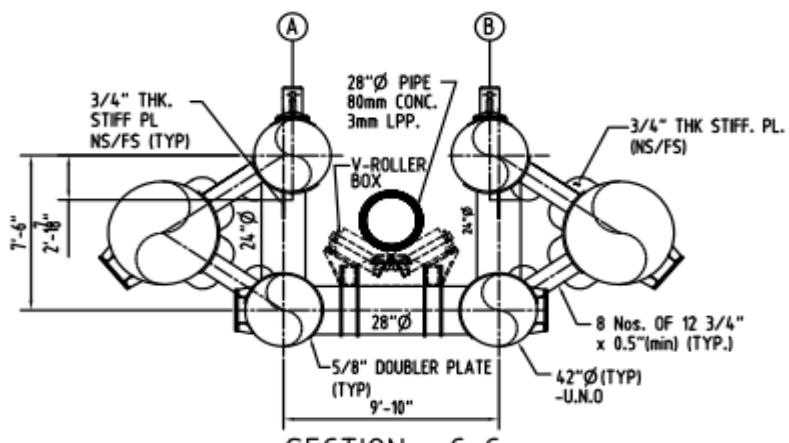
The metaocean data to be used for the detailed design for 10.75in gas export pipeline is presented in the table

PARAMETER	SYMBOL	UNIT	RETURN PERIOD		
			1 YEAR	10 YEARS	100 YEARS
Maximum Individual Wave					
Height	H_{max}	M	3.46	7.23	9.04
Period	T_{max}	S	7.49	9.43	10.11
Length	L_{max}	M	83.53	119.94	132.35
Steepness	$(H/L)_{max}$	-	0.04	0.06	0.07
Significant Wave					
Height	H_{max}	M	1.88	3.93	4.91
Period	T_{max}	S	4.98	6.84	7.52
Length	L_{max}	M	38.73	71.20	84.18
Steepness	$(H/L)_{max}$	-	0.05	0.06	0.06

Astronomical Tide					
Highest Water Level (above MSL)	HHWL	m	0.66		
Mean Sea Level	MSL	M	0.00		
Chart Datum	CD	M	-0.6		
Lowest Water Level (below MSL)	LLWL	m	-0.68		
Storm Surge	η	M	0.04	0.13	0.24
Current Speed					
Surface 0% Depth	V_0	m/s	1.03	1.49	1.84
10%	V_{10}	m/s	0.87	1.20	1.46
20%	V_{20}	m/s	0.74	0.99	1.18
30%	V_{30}	m/s	0.65	0.83	0.97
40%	V_{40}	m/s	0.59	0.72	0.82
50%	V_{50}	m/s	0.54	0.64	0.71
60%	V_{60}	m/s	0.51	0.58	0.63
70%	V_{70}	m/s	0.48	0.53	0.57
80%	V_{80}	m/s	0.46	0.50	0.53
90%	V_{90}	m/s	0.45	0.48	0.50
Seabed 100%	V_{100}	m/s	0.44	0.46	0.48

Table-13

5.6 Stinger Details

ELEVATION STINGER SLED UNIT

Figure-18

PLAN BOTTOM CHORD STINGER SLED UNIT

Figure-19

ELEVATION STINGER HITCH UNIT
LADDER ROW-A NOT SHOWN FOR CLARITY
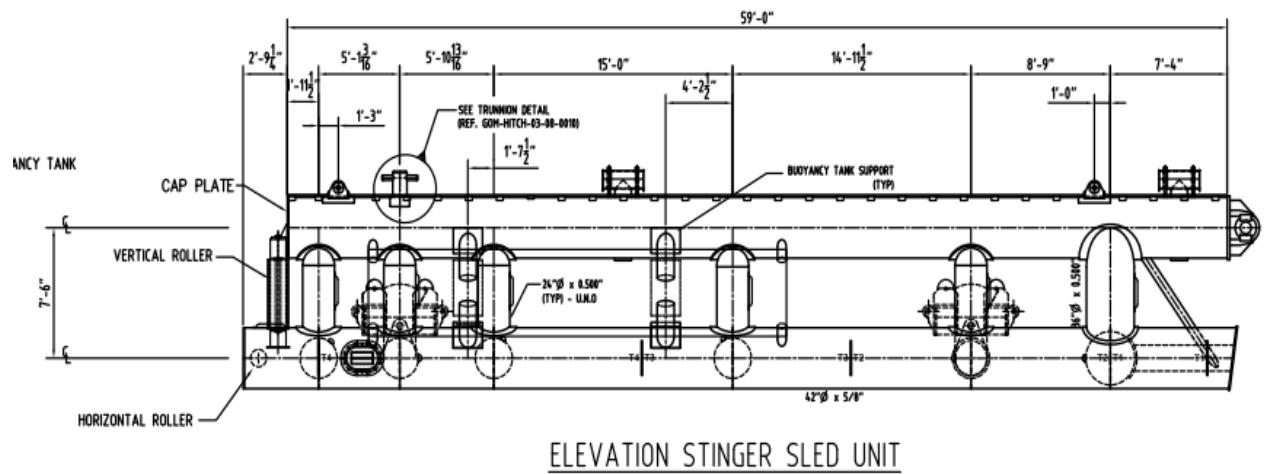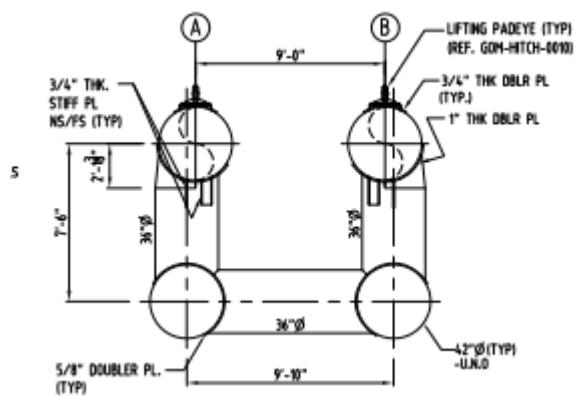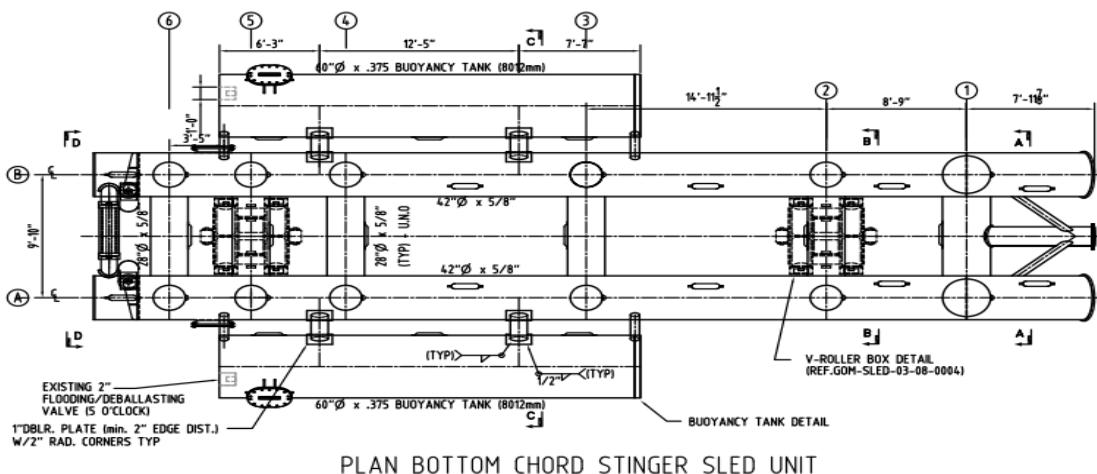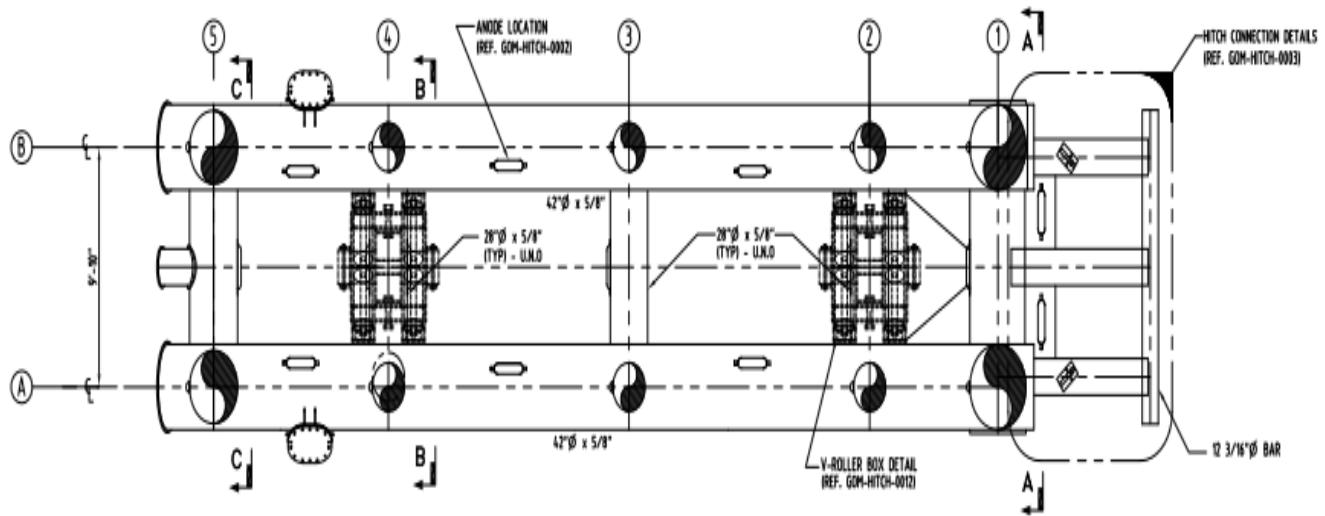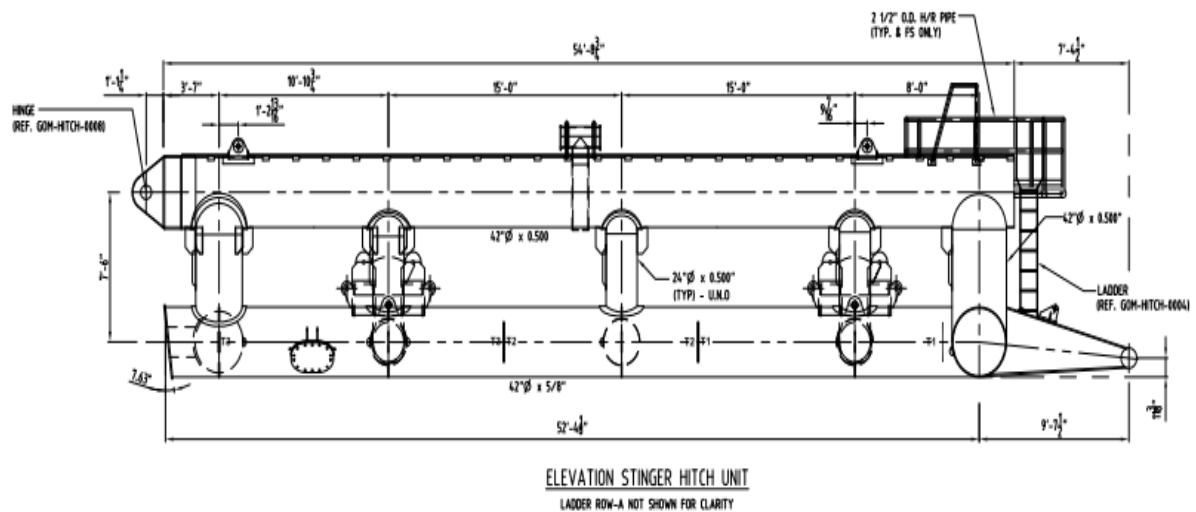
5.7 Stinger Ballast (Sled and Hitch Section)

Stinger Ballast Sled Section	
Element	**Ballast Capacity (kN)**
1	0.00
2	702.20
3	109.67

Table-14

Stinger Ballast Hitch Section	
Element	Ballast Capacity (kN)
1	0.00
2	0.00
3	334.83
4	170.70

Table-15

CHAPTER-6

6.0 OFFPIPE INPUT

6.1 Static Analysis Input

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    ORDL='Total Stress Von Mises', ABSL='Pipe Horizantal X-Coordinate',
    ORDI=14, ABSC=1

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    ORDL='Vertical Bending Moment', ABSL='Pipe Horizantal X-Coordinate',
    ORDI=10, ABSC=1

*PROF ROW=4, NUMB=2, TYPE=1,
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    ORDL='Vertical Pipe Support Reaction',
    ABSL='Pipe Horizantal X-Coordinate', ORDI=7, ABSC=1

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    73.503, 2.131,   1,
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    51.139, 1.956, 100,
    46.492, 1.532,   1,
    39.452, 1.586, 100,
    35.401, 1.040,   2,
    26.141, 0.824, 100,

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         3.123, -1.920,  11,


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*SUPP ROW=23, TYPE=1, ANGL=30
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    -14.737, 0.000  23, 10,  9.144
    -19.487, 0.000, 300,  4,  4.750
    -24.592, 0.000,  22, 13,  5.105
    -35.400, 0.000,  21, 11, 10.808
    -38.518, 0.000,   1,  4,  3.118
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     142.262, 130.680
     271.728, 368.710
     170.075, 189.690
     180.490, 222.830
     428.110, 807.400
     130.070, 122.200
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*GEOM DEPT=21.34, END=0, LENG=6
*SOIL CFX=0.5
*RUN
*END
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6.2 Dynamic Analysis Input

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    ORDL='Y COORD. OF PIPE AT STERN SHOE', ABSL='SOLUTION TIME', ORDI=2

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    ORDL='VERTICAL PIPE BENDING STRESS', ABSL='SOLUTION TIME', ORDI=13

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    ORDL='Y COORD. OF PIPE AT STINGER TIP', ABSL='SOLUTION TIME', ORDI=2

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    ORDL='VERTICAL PIPE BENDING STRESS', ABSL='SOLUTION TIME', ORDI=13

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    ABSL='PIPE HORIZONTAL X COORDINATE', ORDI=2, ABSC=1

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      73.503,  2.131,   1,

      60.152,  1.754,   2,

      51.139,  1.956,  100,

      46.492,  1.532,   1,

      39.452,  1.586,  100,

      35.401,  1.040,   2,

      26.141,  0.824,  100,

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       8.913, -0.940,   10,

       3.123, -1.920,   11,
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*SUPP ROW=11, TYPE=1, ANGL=30

*SUPP ROW=21, TYPE=1, ANGL=30

*SUPP ROW=22, TYPE=1, ANGL=30

*SUPP ROW=23, TYPE=1, ANGL=30

*STIN NUMB=7, GEOM=1, TYPE=6, RADI=200, XHIT=-1.855, YHIT=-3.712, XORG=-1.855,

    YORG=-3.712, XTAN=3.123, YTAN=-1.850, TABL=(X,Y,SUPP,SECT,LENG)

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     -5.593, 1.106,  22, 10,  2.699

    -14.737, 1.089,  23, 10,  9.144

    -19.487, 0.000, 300,  4,  4.750

    -24.592, 1.085,  22, 13,  5.105

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    -38.518, 0.638,   1,  4,  3.11
*SECT ROW=4, DISP=3.6, VARE=4.30, TYPE=1, HARE=4.3

*SECT ROW=6, DISP=3.6, VANG=20, VARE=4.3, TYPE=2, HARE=4.30

*SECT ROW=10, DISP=3.60, VARE=4.30, TYPE=1, HARE=4.30

*SECT ROW=11, DISP=5.4, VARE=5.40, TYPE=1, HARE=5.40

*SECT ROW=13, DISP=3.6, VANG=11, VARE=4.30, TYPE=2, HARE=4.3

*WEIG NUMB=7, TABL=(WEIG,DISP)

      65.584,  67.840

     142.262, 130.680

     271.728, 368.710

     170.075, 189.690

     180.490, 222.830

     428.110, 807.400

     130.070, 122.200
*BALL NUMB=7, LIST=0, 0, 0,000, 0, 0, 0, 0

*GEOM DEPT=21.34, END=0, LENG=6

*SOIL CFX=0.5
```

*CURR NUMB=3, TABL=(DEPT,VELO,DIRE)

  0,   1.030,

  10.000, 0.540,

  21.340, 0.440,

*TIME STEP=0.2, STOP=360, DAMP=0.2, SAMP=0.4, STAR=60

*SPEC SEAS=1, TYPE=7, DIRE=0, FMIN=0.2094, FMAX=2.0944, NUMB=30, FPEA=0.8537,

  JON1=0.0021, JON2=1.0000

*RAOS NUMB=30, SEAS=1, SIGN=1, TABL=(FREQ,SRGM,SRGA,SWYM,SWYA,HEAM,HEAA)

  0.2513, 1.9170, 122, 0.0010, 54.00, 1.0770, 25.00

  0.3142, 1.4330, 132, 0.0010, 37.00, 1.0490, 38.00

  0.3307, 1.3560, 136, 0.0010, 29.00, 1.0380, 42.00

  0.3491, 1.2830, 141, 0.0010, 31.00, 1.0220, 47.00

  0.3696, 1.2120, 147, 0.0010, 34.00, 1.0000, 52.00

  0.3927, 1.1380, 154, 0.0000, 0.00, 0.9710, 59.00

  0.4189, 1.0620, 162, 0.0000, 0.00, 0.9300, 67.00

  0.4333, 1.0180, 167, 0.0000, 0.00, 0.9030, 71.00

  0.4488, 0.9710, 173, 0.0000, 0.00, 0.8720, 77.00

  0.4654, 0.9200, 179, 0.0000, 0.00, 0.8360, 83.00

  0.4833, 0.8620, -174, 0.0000, 0.00, 0.7930, 89.00

  0.5027, 0.7960, -166, 0.0000, 0.00, 0.7420, 97.00

  0.5236, 0.7210, -158, 0.0000, 0.00, 0.6840, 106.00

  0.5464, 0.6330, -148, 0.0000, 0.00, 0.6180, 117.00

  0.5712, 0.5330, -137, 0.0000, 0.00, 0.5440, 130.00

  0.5984, 0.4200, -123, 0.0000, 0.00, 0.4650, 145.00

  0.6283, 0.2960, -106, 0.0000, 0.00, 0.3810, 165.00

  0.6614, 0.1710, -80, 0.0000, 0.00, 0.3000, -168.00

  0.6981, 0.0700, -22, 0.0000, 0.00, 0.2330, -132.00

  0.7392, 0.0890, 84, 0.0000, 0.00, 0.2000, -84.00

  0.7854, 0.1490, 137, 0.0000, 0.00, 0.2030, -34.00

  0.8378, 0.1740, -173, 0.0000, 0.00, 0.2060, 12.00

  0.8976, 0.1590, -110, 0.0000, 0.00, 0.1620, 62.00

  0.9666, 0.1310, -19, 0.0000, 0.00, 0.0870, 143.00

  1.0472, 0.1240, 97, 0.0000, 0.00, 0.0590, -87.00

  1.1424, 0.1190, -119, 0.0000, 0.00, 0.0400, 45.00

  1.2566, 0.0900, 64, 0.0000, 0.00, 0.0320, -116.00

  1.3963, 0.0630, -35, 0.0000, 0.00, 0.0170, 112.00

  1.5708, 0.0520, -14, 0.0000, 0.00, 0.0050, 37.00

  2.0944, 0.0100, -92, 0.0000, 0.00, 0.0060, 83.00

  TABL=(FREQ,ROLM,ROLA,PITM,PITA,YAWM,YAWA)

  0.2513, 0.0010, -53.00, 0.3790, -66.00, 0.0070, 157.00

  0.3142, 0.0000, 0.00, 0.5960, -54.00, 0.0030, 149.00

```
0.3307, 0.0000,   0.00, 0.6580,  -50.00, 0.0030, 150.00
0.3491, 0.0000,   0.00, 0.7290,  -46.00, 0.0020, 153.00
0.3696, 0.0000,   0.00, 0.8120,  -40.00, 0.0020, 157.00
0.3927, 0.0000,   0.00, 0.9060,  -34.00, 0.0020, 162.00
0.4189, 0.0000,   0.00, 1.0170,  -27.00, 0.0010, 170.00
0.4333, 0.0000,   0.00, 1.0760,  -23.00, 0.0010, 174.00
0.4488, 0.0000,   0.00, 1.1390,  -18.00, 0.0010, 178.00
0.4654, 0.0000,   0.00, 1.2040,  -13.00, 0.0010, -176.00
0.4833, 0.0000,   0.00, 1.2710,   -8.00, 0.0010, -170.00
0.5027, 0.0010, 137.00, 1.3340,   -2.00, 0.0010, -164.00
0.5236, 0.0010, 131.00, 1.3940,    4.00, 0.0010, -157.00
0.5464, 0.0010, 103.00, 1.4400,   11.00, 0.0010, 149.00
0.5712, 0.0010,  61.00, 1.4680,   20.00, 0.0000,   0.00
0.5984, 0.0010,  47.00, 1.4660,   30.00, 0.0000,   0.00
0.6283, 0.0010,  50.00, 1.4140,   41.00, 0.0000,   0.00
0.6614, 0.0000,   0.00, 1.3060,   54.00, 0.0000,   0.00
0.6981, 0.0000,   0.00, 1.1290,   71.00, 0.0000,   0.00
0.7392, 0.0000,   0.00, 0.8820,   92.00, 0.0000,   0.00
0.7854, 0.0000,   0.00, 0.5830,  123.00, 0.0000,   0.00
0.8378, 0.0000,   0.00, 0.3020,  177.00, 0.0000,   0.00
0.8976, 0.0000,   0.00, 0.2510,  -87.00, 0.0000,   0.00
0.9666, 0.0000,   0.00, 0.2530,  -14.00, 0.0000,   0.00
1.0472, 0.0000,   0.00, 0.1410,   74.00, 0.0000,   0.00
1.1424, 0.0000,   0.00, 0.0870, -112.00, 0.0000,   0.00
1.2566, 0.0000,   0.00, 0.0320,   44.00, 0.0000,   0.00
1.3963, 0.0000,   0.00, 0.0250,   21.00, 0.0000,   0.00
1.5708, 0.0000,   0.00, 0.0330,    8.00, 0.0000,   0.00
2.0944, 0.0000,   0.00, 0.0100,   21.00, 0.0000,   0.00
*RUN
*CURR NUMB=3, TABL=(DEPT,VELO,DIRE)
    0,    1.030, 45
   10.000, 0.540, 45
   21.340, 0.440, 45
*TIME STEP=0.2, STOP=360, DAMP=0.2, SAMP=0.4, STAR=60
*SPEC SEAS=1, TYPE=7, DIRE=45, FMIN=0.2094, FMAX=2.0944, NUMB=30, FPEA=0.8537,
   JON1=0.0021, JON2=1.0000
*RAOS NUMB=30, SEAS=1, SIGN=1, TABL=(FREQ,SRGM,SRGA,SWYM,SWYA,HEAM,HEAA)
   0.2513, 1.3840, 115.00, 0.5050, -34.00, 1.0870,  17.00
   0.3142, 1.0390, 121.00, 0.5970, -34.00, 1.0780,  27.00
   0.3307, 0.9890, 123.00, 0.6000, -34.00, 1.0730,  29.00
   0.3491, 0.9440, 127.00, 0.6000, -34.00, 1.0660,  33.00
```

0.3696, 0.9010, 131.00, 0.5910, -32.00, 1.0560, 36.00

0.3927, 0.8590, 136.00, 0.5760, -29.00, 1.0420, 41.00

0.4189, 0.8150, 141.00, 0.5540, -25.00, 1.0220, 47.00

0.4333, 0.7930, 145.00, 0.5410, -23.00, 1.0090, 50.00

0.4488, 0.7690, 148.00, 0.5250, -19.00, 0.9940, 53.00

0.4654, 0.7430, 153.00, 0.5070, -15.00, 0.9750, 57.00

0.4833, 0.7140, 157.00, 0.4890, -10.00, 0.9540, 62.00

0.5027, 0.6820, 162.00, 0.4730, -3.00, 0.9280, 67.00

0.5236, 0.6450, 168.00, 0.4750, 3.00, 0.8960, 73.00

0.5464, 0.6040, 175.00, 0.4860, 9.00, 0.8540, 79.00

0.5712, 0.5580, -176.00, 0.4770, 11.00, 0.8160, 88.00

0.5984, 0.5010, -168.00, 0.4270, 16.00, 0.7770, 97.00

0.6283, 0.4360, -157.00, 0.3640, 24.00, 0.7270, 108.00

0.6614, 0.3620, -144.00, 0.3020, 36.00, 0.6660, 119.00

0.6981, 0.2830, -128.00, 0.2380, 51.00, 0.5890, 133.00

0.7392, 0.2000, -107.00, 0.1710, 68.00, 0.4900, 148.00

0.7854, 0.1130, -80.00, 0.1000, 91.00, 0.3590, 166.00

0.8378, 0.0300, -8.00, 0.0310, 132.00, 0.2100, -163.00

0.8976, 0.0750, 115.00, 0.0340, -65.00, 0.1160, -100.00

0.9666, 0.1120, 165.00, 0.0690, -13.00, 0.1140, -30.00

1.0472, 0.1080, -132.00, 0.0720, 39.00, 0.0820, 33.00

1.1424, 0.0850, -38.00, 0.0410, 110.00, 0.0380, 123.00

1.2566, 0.0500, 96.00, 0.0100, -39.00, 0.0260, -82.00

1.3963, 0.0260, -72.00, 0.0200, 113.00, 0.0080, 90.00

1.5708, 0.0050, -150.00, 0.0050, 98.00, 0.0010, 55.00

2.0944, 0.0210, 51.00, 0.0020, 46.00, 0.0640, 83.00

TABL=(FREQ,ROLM,ROLA,PITM,PITA,YAWM,YAWA)

0.2513, 0.3290, -86.00, 0.2710, -73.00, 0.3030, -26.00

0.3142, 0.4910, -81.00, 0.4300, -64.00, 0.2430, 0.00

0.3307, 0.5440, -78.00, 0.4770, -62.00, 0.2550, 8.00

0.3491, 0.6050, -75.00, 0.5320, -59.00, 0.2770, 16.00

0.3696, 0.6910, -72.00, 0.5950, -55.00, 0.3040, 24.00

0.3927, 0.8090, -68.00, 0.6700, -51.00, 0.3370, 31.00

0.4189, 0.9800, -64.00, 0.7590, -46.00, 0.3750, 39.00

0.4333, 1.0920, -61.00, 0.8090, -43.00, 0.3980, 43.00

0.4488, 1.2470, -59.00, 0.8640, -40.00, 0.4190, 47.00

0.4654, 1.4560, -58.00, 0.9220, -37.00, 0.4410, 52.00

0.4833, 1.7510, -59.00, 0.9850, -33.00, 0.4640, 57.00

0.5027, 2.1650, -64.00, 1.0490, -28.00, 0.4870, 63.00

0.5236, 2.6090, -78.00, 1.1130, -24.00, 0.5100, 69.00

0.5464, 2.8450, -99.00, 1.1840, -18.00, 0.5360, 77.00

0.5712, 2.5740, -126.00, 1.2690, -12.00, 0.5630,   86.00

0.5984, 1.8260, -149.00, 1.3510, -6.00, 0.5870,   94.00

0.6283, 1.1010, -158.00, 1.4140,   1.00, 0.6010, 105.00

0.6614, 0.6310, -159.00, 1.4520,   9.00, 0.6050, 117.00

0.6981, 0.3360, -158.00, 1.4570, 19.00, 0.5970, 131.00

0.7392, 0.1570, -168.00, 1.4200, 31.00, 0.5720, 148.00

0.7854, 0.0920, 153.00, 1.3180, 44.00, 0.5220, 168.00

0.8378, 0.1000, 133.00, 1.0940, 58.00, 0.4400, -166.00

0.8976, 0.0870, 145.00, 0.6920, 74.00, 0.3150, -136.00

0.9666, 0.0490, 178.00, 0.2590, 110.00, 0.1590, -96.00

1.0472, 0.0080, -62.00, 0.1010, -133.00, 0.0200,   23.00

1.1424, 0.0350,   84.00, 0.1160, -22.00, 0.0990, 179.00

1.2566, 0.0220, 171.00, 0.0240, 76.00, 0.0960, -95.00

1.3963, 0.0160,   86.00, 0.0130, -20.00, 0.0080,   43.00

1.5708, 0.0060, 121.00, 0.0040, -86.00, 0.0270, -36.00

2.0944, 0.0580, -121.00, 0.1670, 74.00, 0.0090,   78.00

*RUN

*CURR NUMB=3, TABL=(DEPT,VELO,DIRE)

    0,   1.030, 90

    10.000, 0.540, 90

    21.340, 0.440, 90

*TIME STEP=0.2, STOP=360, DAMP=0.2, SAMP=0.4, STAR=60

*SPEC SEAS=1, TYPE=7, DIRE=90, FMIN=0.2094, FMAX=2.0944, NUMB=30, FPEA=0.8537,

    JON1=0.0021, JON2=1.0000

*RAOS NUMB=30, SEAS=1, SIGN=1, TABL=(FREQ,SRGM,SRGA,SWYM,SWYA,HEAM,HEAA)

    0.2513, 0.0330, 104.00, 0.8160, -55.00, 1.1000,   0.00

    0.3142, 0.0140, 148.00, 0.8750, -64.00, 1.1070,   0.00

    0.3307, 0.0150, 158.00, 0.8790, -67.00, 1.1090,   0.00

    0.3491, 0.0160, 160.00, 0.8790, -70.00, 1.1110,   -1.00

    0.3696, 0.0170, 162.00, 0.8670, -72.00, 1.1140,   -1.00

    0.3927, 0.0180, 163.00, 0.8500, -74.00, 1.1160,   -1.00

    0.4189, 0.0190, 163.00, 0.8280, -75.00, 1.1200,   -2.00

    0.4333, 0.0190, 163.00, 0.8140, -76.00, 1.1220,   -2.00

    0.4488, 0.0190, 163.00, 0.8000, -76.00, 1.1250,   -2.00

    0.4654, 0.0200, 162.00, 0.7840, -76.00, 1.1280,   -2.00

    0.4833, 0.0200, 164.00, 0.7720, -75.00, 1.1330,   -3.00

    0.5027, 0.0210, 160.00, 0.7720, -73.00, 1.1360,   -3.00

    0.5236, 0.0210, 154.00, 0.7930, -72.00, 1.1340,   -4.00

    0.5464, 0.0210, 150.00, 0.8260, -73.00, 1.1280,   -5.00

    0.5712, 0.0210, 144.00, 0.8400, -76.00, 1.1190,   -6.00

    0.5984, 0.0200, 158.00, 0.8210, -80.00, 1.1500,   -6.00

0.6283, 0.0230, 165.00, 0.7760, -82.00, 1.1880,   -7.00

0.6614, 0.0270, 169.00, 0.7260, -83.00, 1.2330,   -9.00

0.6981, 0.0330, 166.00, 0.6750, -82.00, 1.2700, -13.00

0.7392, 0.0410, 157.00, 0.6220, -80.00, 1.2840, -20.00

0.7854, 0.0490, 143.00, 0.5720, -78.00, 1.2500, -29.00

0.8378, 0.0570, 123.00, 0.5170, -74.00, 1.1160, -41.00

0.8976, 0.0570, 96.00, 0.4570, -70.00, 0.8800, -53.00

0.9666, 0.0470, 69.00, 0.3950, -62.00, 0.6020, -63.00

1.0472, 0.0330, 50.00, 0.3340, -52.00, 0.3630, -66.00

1.1424, 0.0200, 21.00, 0.2770, -37.00, 0.1860, -61.00

1.2566, 0.0090, 13.00, 0.2270, -17.00, 0.0730, -50.00

1.3963, 0.0010, 168.00, 0.1770,   9.00, 0.0090, 162.00

1.5708, 0.0110, 78.00, 0.1220, 47.00, 0.0330, -133.00

2.0944, 0.0110,-149.00, 0.0470,-131.00, 0.1930, -174.00

TABL=(FREQ,ROLM,ROLA,PITM,PITA,YAWM,YAWA)

0.2513, 0.4530, -102.00, 0.0010, 153.00, 0.2430, -118.00

0.3142, 0.7000, -104.00, 0.0020, 160.00, 0.1460, -142.00

0.3307, 0.7760, -105.00, 0.0030, 147.00, 0.1250, -145.00

0.3491, 0.8670, -104.00, 0.0040, 140.00, 0.1040, -146.00

0.3696, 1.0110, -105.00, 0.0040, 147.00, 0.0920, -146.00

0.3927, 1.2130, -105.00, 0.0050, 153.00, 0.0820, -145.00

0.4189, 1.5160, -106.00, 0.0070, 157.00, 0.0740, -143.00

0.4333, 1.7320, -107.00, 0.0080, 158.00, 0.0710, -142.00

0.4488, 2.0160, -109.00, 0.0100, 158.00, 0.0680, -141.00

0.4654, 2.4010, -113.00, 0.0120, 157.00, 0.0670, -140.00

0.4833, 2.9000, -121.00, 0.0140, 153.00, 0.0680, -142.00

0.5027, 3.5130, -132.00, 0.0180, 147.00, 0.0670, -144.00

0.5236, 4.0970, -149.00, 0.0220, 138.00, 0.0620, -150.00

0.5464, 4.4130, -171.00, 0.0260, 129.00, 0.0520, -157.00

0.5712, 4.1600, 163.00, 0.0290, 122.00, 0.0360, -160.00

0.5984, 3.5500, 140.00, 0.0370, 131.00, 0.0250, -159.00

0.6283, 2.7700, 123.00, 0.0530, 130.00, 0.0190, -146.00

0.6614, 2.0850, 114.00, 0.0770, 124.00, 0.0170, -133.00

0.6981, 1.5420, 111.00, 0.1080, 111.00, 0.0160, -126.00

0.7392, 1.1380, 113.00, 0.1480,   92.00, 0.0150, -123.00

0.7854, 0.8780, 118.00, 0.2000,   68.00, 0.0130, -120.00

0.8378, 0.6940, 123.00, 0.2480,   37.00, 0.0090, -121.00

0.8976, 0.5510, 127.00, 0.2490,   3.00, 0.0040, -139.00

0.9666, 0.4090, 129.00, 0.1850, -27.00, 0.0030, 133.00

1.0472, 0.2780, 134.00, 0.1180, -48.00, 0.0080, 109.00

1.1424, 0.1720, 141.00, 0.0590, -57.00, 0.0110,   97.00

1.2566, 0.0830, 139.00, 0.0240, -70.00, 0.0150, 102.00

1.3963, 0.0470, 74.00, 0.0020, 149.00, 0.0150, 94.00

1.5708, 0.1310, 60.00, 0.0660, 42.00, 0.0070, 84.00

2.0944, 0.1550, 57.00, 0.0720, -146.00, 0.0010, 10.00

*RUN

*CURR NUMB=3, TABL=(DEPT,VELO,DIRE)

    0.000, 1.030, 135

    10.000, 0.540, 135

    21.340, 0.440, 135

*TIME STEP=0.2, STOP=360, DAMP=0.2, SAMP=0.4, STAR=60

*SPEC SEAS=1, TYPE=7, DIRE=135, FMIN=0.2094, FMAX=2.0944, NUMB=30, FPEA=0.8537,

    JON1=0.0021, JON2=1.0000

*RAOS NUMB=30, SEAS=1, SIGN=1, TABL=(FREQ,SRGM,SRGA,SWYM,SWYA,HEAM,HEAA)

    0.2513, 1.3120, -101.00, 0.4760, -69.00, 1.0880, -18.00

    0.3142, 1.0030, -116.00, 0.6000, -93.00, 1.0770, -28.00

    0.3307, 0.9560, -119.00, 0.5980, -99.00, 1.0720, -31.00

    0.3491, 0.9130, -123.00, 0.5920, -104.00, 1.0650, -35.00

    0.3696, 0.8710, -128.00, 0.5790, -111.00, 1.0550, -40.00

    0.3927, 0.8290, -133.00, 0.5610, -118.00, 1.0410, -45.00

    0.4189, 0.7870, -139.00, 0.5370, -125.00, 1.0200, -51.00

    0.4333, 0.7640, -143.00, 0.5220, -129.00, 1.0070, -55.00

    0.4488, 0.7410, -147.00, 0.5040, -134.00, 0.9910, -59.00

    0.4654, 0.7160, -151.00, 0.4830, -138.00, 0.9710, -63.00

    0.4833, 0.6890, -156.00, 0.4590, -143.00, 0.9470, -69.00

    0.5027, 0.6580, -162.00, 0.4370, -146.00, 0.9180, -74.00

    0.5236, 0.6240, -169.00, 0.4280, -149.00, 0.8810, -81.00

    0.5464, 0.5850, -176.00, 0.4390, -155.00, 0.8330, -89.00

    0.5712, 0.5480, 174.00, 0.4390, -166.00, 0.7820, -97.00

    0.5984, 0.5070, 164.00, 0.4110, 179.00, 0.7270, -106.00

    0.6283, 0.4520, 152.00, 0.3560, 166.00, 0.6530, -117.00

    0.6614, 0.3910, 138.00, 0.2970, 153.00, 0.5640, -131.00

    0.6981, 0.3230, 121.00, 0.2360, 137.00, 0.4540, -148.00

    0.7392, 0.2540, 100.00, 0.1710, 118.00, 0.3150, -170.00

    0.7854, 0.1890, 71.00, 0.1030, 92.00, 0.1450, 159.00

    0.8378, 0.1320, 28.00, 0.0420, 42.00, 0.0290, -42.00

    0.8976, 0.0950, -32.00, 0.0390, -78.00, 0.1320, -92.00

    0.9666, 0.0780, -100.00, 0.0690, -134.00, 0.1340, -128.00

    1.0472, 0.0520, -172.00, 0.0710, 178.00, 0.0920, -149.00

    1.1424, 0.0060, -125.00, 0.0390, 122.00, 0.0500, -169.00

    1.2566, 0.0180, -111.00, 0.0110, -80.00, 0.0290, -157.00

    1.3963, 0.0110, -139.00, 0.0210, 163.00, 0.0150, -163.00

50

1.5708, 0.0030, -117.00, 0.0090, -108.00, 0.0040, -171.00

2.0944, 0.0160, 71.00, 0.0020, -157.00, 0.0160, 119.00

TABL=(FREQ,ROLM,ROLA,PITM,PITA,YAWM,YAWA)

0.2513, 0.3360, -116.00, 0.2760, 74.00, 0.3850, 174.00

0.3142, 0.4690, -128.00, 0.4360, 65.00, 0.3730, 153.00

0.3307, 0.5200, -130.00, 0.4830, 62.00, 0.3780, 150.00

0.3491, 0.5860, -133.00, 0.5390, 59.00, 0.3870, 147.00

0.3696, 0.6720, -136.00, 0.6040, 55.00, 0.4010, 143.00

0.3927, 0.7920, -140.00, 0.6820, 50.00, 0.4200, 138.00

0.4189, 0.9670, -146.00, 0.7750, 45.00, 0.4450, 132.00

0.4333, 1.0890, -149.00, 0.8280, 42.00, 0.4600, 129.00

0.4488, 1.2500, -154.00, 0.8870, 38.00, 0.4760, 125.00

0.4654, 1.4690, -160.00, 0.9520, 34.00, 0.4940, 121.00

0.4833, 1.7830, -168.00, 1.0230, 29.00, 0.5140, 117.00

0.5027, 2.2160, 175.00, 1.0970, 24.00, 0.5410, 111.00

0.5236, 2.6950, 152.00, 1.1760, 18.00, 0.5660, 105.00

0.5464, 2.9100, 119.00, 1.2620, 11.00, 0.5870, 98.00

0.5712, 2.6370, 83.00, 1.3660,   3.00, 0.6000, 90.00

0.5984, 1.9710, 48.00, 1.4800, -5.00, 0.6060, 81.00

0.6283, 1.1660, 24.00, 1.5650, -17.00, 0.6110, 72.00

0.6614, 0.6780,   9.00, 1.6360, -30.00, 0.6100, 61.00

0.6981, 0.3560, -1.00, 1.6650, -45.00, 0.5960, 48.00

0.7392, 0.1480, -3.00, 1.6470, -64.00, 0.5660, 33.00

0.7854, 0.0610, 53.00, 1.5370, -86.00, 0.5120, 15.00

0.8378, 0.1010, 83.00, 1.2640, -114.00, 0.4280, -6.00

0.8976, 0.1040, 76.00, 0.8130, -143.00, 0.3050, -33.00

0.9666, 0.0800, 75.00, 0.3820, -159.00, 0.1520, -69.00

1.0472, 0.0700, 87.00, 0.2160, -145.00, 0.0190, 169.00

1.1424, 0.0710, 82.00, 0.1850, -144.00, 0.1040, 40.00

1.2566, 0.0380, 80.00, 0.1140, -160.00, 0.0960, -29.00

1.3963, 0.0490, 105.00, 0.0510, -153.00, 0.0170, 105.00

1.5708, 0.0310, 86.00, 0.0090, -167.00, 0.0270, -62.00

2.0944, 0.0090, 78.00, 0.0430, 71.00, 0.0040, 114.00

*RUN

*CURR NUMB=3, TABL=(DEPT,VELO,DIRE)

    0.000, 1.030, 180

    10.000, 0.540, 180

    21.340, 0.440, 180

*TIME STEP=0.2, STOP=360, DAMP=0.2, SAMP=0.4, STAR=60

*SPEC SEAS=1, TYPE=7, DIRE=180, FMIN=0.2094, FMAX=2.0944, NUMB=30, FPEA=0.8537,

    JON1=0.0021, JON2=1.0000

51

*RAOS NUMB=30, SEAS=1, SIGN=1, TABL=(FREQ,SRGM,SRGA,SWYM,SWYA,HEAM,HEAA)

0.2513, 1.8220, -108.00, 0.0010, 151.00, 1.0760 -25.00

0.3142, 1.3750, -127.00, 0.0000,   0.00, 1.0490 -40.00

0.3307, 1.3020, -132.00, 0.0000,   0.00, 1.0370 -44.00

0.3491, 1.2310, -137.00, 0.0000,   0.00, 1.0210 -49.00

0.3696, 1.1600, -143.00, 0.0000,   0.00, 1.0000 -55.00

0.3927, 1.0860, -150.00, 0.0000,   0.00, 0.9700 -63.00

0.4189, 1.0060, -159.00, 0.0000,   0.00, 0.9280 -72.00

0.4333, 0.9630, -164.00, 0.0000,   0.00, 0.9000 -77.00

0.4488, 0.9170, -170.00, 0.0000,   0.00, 0.8680 -83.00

0.4654, 0.8670, -176.00, 0.0000,   0.00, 0.8280 -89.00

0.4833, 0.8120, 176.00, 0.0000,   0.00, 0.7810 -97.00

0.5027, 0.7520, 168.00, 0.0000,   0.00, 0.7250 -105.00

0.5236, 0.6850, 159.00, 0.0000,   0.00, 0.6580 -114.00

0.5464, 0.6080, 148.00, 0.0000,   0.00, 0.5770 -125.00

0.5712, 0.5210, 135.00, 0.0000,   0.00, 0.4830 -137.00

0.5984, 0.4270, 120.00, 0.0000,   0.00, 0.3770 -151.00

0.6283, 0.3230, 102.00, 0.0000,   0.00, 0.2600 -167.00

0.6614, 0.2170,   79.00, 0.0000,   0.00, 0.1350 174.00

0.6981, 0.1170,   48.00, 0.0000,   0.00, 0.0100 175.00

0.7392, 0.0450, -17.00, 0.0000,   0.00, 0.1040 -56.00

0.7854, 0.0530, -122.00, 0.0000,   0.00, 0.1790 -85.00

0.8378, 0.0680, -175.00, 0.0000,   0.00, 0.1880 -117.00

0.8976, 0.0440, 135.00, 0.0000,   0.00, 0.1330 -141.00

0.9666, 0.0110, -58.00, 0.0000,   0.00, 0.0880 -144.00

1.0472, 0.0450, -147.00, 0.0000,   0.00, 0.0740 -142.00

1.1424, 0.0270, -155.00, 0.0000,   0.00, 0.0580 -164.00

1.2566, 0.0250, -166.00, 0.0000,   0.00, 0.0440 -164.00

1.3963, 0.0280, -147.00, 0.0000,   0.00, 0.0260 170.00

1.5708, 0.0070, -128.00, 0.0000,   0.00, 0.0310 160.00

2.0944, 0.0080, 162.00, 0.0000,   0.00, 0.0100 -116.00

TABL=(FREQ,ROLM,ROLA,PITM,PITA,YAWM,YAWA)

0.2513, 0.0000,   0.00, 0.3880, 68.00, 0.0050, -73.00

0.3142, 0.0000,   0.00, 0.6090, 55.00, 0.0020, -111.00

0.3307, 0.0000,   0.00, 0.6740, 51.00, 0.0020, -118.00

0.3491, 0.0000,   0.00, 0.7480, 46.00, 0.0020, -125.00

0.3696, 0.0000,   0.00, 0.8350, 41.00, 0.0010, -132.00

0.3927, 0.0000,   0.00, 0.9350, 35.00, 0.0010, -141.00

0.4189, 0.0000,   0.00, 1.0520, 27.00, 0.0010, -150.00

0.4333, 0.0010, -124.00, 1.1170, 22.00, 0.0010, -156.00

0.4488, 0.0010, -134.00, 1.1870, 17.00, 0.0010, -161.00

0.4654, 0.0010, -146.00, 1.2610,   11.00, 0.0010, -168.00

    0.4833, 0.0010, -159.00, 1.3380,   5.00, 0.0000,   0.00

    0.5027, 0.0010, -176.00, 1.4170,   -1.00, 0.0000,   0.00

    0.5236, 0.0020, 158.00, 1.4940, -10.00, 0.0000,   0.00

    0.5464, 0.0020, 108.00, 1.5540, -20.00, 0.0000,   0.00

    0.5712, 0.0020,   41.00, 1.5960, -32.00, 0.0000,   0.00

    0.5984, 0.0010,   -1.00, 1.6080, -45.00, 0.0000,   0.00

    0.6283, 0.0010, -30.00, 1.5660, -60.00, 0.0000,   0.00

    0.6614, 0.0000,   0.00, 1.4470, -77.00, 0.0000,   0.00

    0.6981, 0.0000,   0.00, 1.2430, -95.00, 0.0000,   0.00

    0.7392, 0.0000,   0.00, 0.9510, -114.00, 0.0000,   0.00

    0.7854, 0.0000,   0.00, 0.6150, -126.00, 0.0000,   0.00

    0.8378 0.0000,   0.00, 0.4150, -116.00, 0.0000,   0.00

    0.8976, 0.0000,   0.00, 0.4760, -115.00, 0.0000,   0.00

    0.9666, 0.0000,   0.00, 0.4370, -138.00, 0.0000,   0.00

    1.0472, 0.0000,   0.00, 0.2760, -158.00, 0.0000,   0.00

    1.1424, 0.0000,   0.00, 0.1900, -152.00, 0.0000,   0.00

    1.2566, 0.0000,   0.00, 0.1460, -170.00, 0.0000,   0.00

    1.3963, 0.0000,   0.00, 0.1090, -179.00, 0.0000,   0.00

    1.5708, 0.0000,   0.00, 0.0700, 157.00, 0.0000,   0.00

    2.0944, 0.0000,   0.00, 0.0270, -127.00, 0.0000,   0.00

*RUN

*CURR NUMB=3, TABL=(DEPT,VELO,DIRE)

    0.000, 1.030, 225

    10.000, 0.540, 225

    21.340, 0.440, 225

*TIME STEP=0.2, STOP=360, DAMP=0.2, SAMP=0.4, STAR=60

*SPEC SEAS=1, TYPE=7, DIRE=225, FMIN=0.2094, FMAX=2.0944, NUMB=30, FPEA=0.8537,

    JON1=0.0021, JON2=1.0000

*RAOS NUMB=30, SEAS=1, SIGN=1, TABL=(FREQ,SRGM,SRGA,SWYM,SWYA,HEAM,HEAA)

    0.2513, 1.3160, -102.00, 0.4790, 110.00, 1.0880, -18.00

    0.3142, 1.0040, -116.00, 0.6020,   86.00, 1.0770, -28.00

    0.3307, 0.9580, -119.00, 0.6000,   81.00, 1.0720, -31.00

    0.3491, 0.9140, -123.00, 0.5930,   75.00, 1.0650, -35.00

    0.3696, 0.8720, -128.00, 0.5800,   68.00, 1.0550, -39.00

    0.3921, 0.8300, -133.00, 0.5620,   62.00, 1.0410, -45.00

    0.4189, 0.7870, -139.00, 0.5380,   54.00, 1.0200, -51.00

    0.4333, 0.7650, -143.00, 0.5220,   50.00, 1.0070, -55.00

    0.4488, 0.7420, -147.00, 0.5050,   45.00, 0.9910, -59.00

    0.4654, 0.7170, -151.00, 0.4840,   41.00, 0.9710, -63.00

    0.4833, 0.6900, -156.00, 0.4600,   36.00, 0.9470, -68.00

0.5027, 0.6590, -162.00, 0.4380, 34.00, 0.9180, -74.00

0.5236, 0.6240, -169.00, 0.4290, 30.00, 0.8810, -81.00

0.5464, 0.5850, -176.00, 0.4390, 25.00, 0.8320, -88.00

0.5712, 0.5480, 174.00, 0.4400, 13.00, 0.7820, -97.00

0.5984, 0.5080, 164.00, 0.4110, 0.00, 0.7270, -106.00

0.6283, 0.4520, 152.00, 0.3560, -13.00, 0.6530, -117.00

0.6614, 0.3910, 138.00, 0.2980, -26.00, 0.5640, -131.00

0.6981, 0.3230, 121.00, 0.2360, -41.00, 0.4540, -148.00

0.7392, 0.2550, 100.00, 0.1710, -60.00, 0.3150, -170.00

0.7854, 0.1890, 71.00, 0.1040, -87.00, 0.1450, 159.00

0.8378, 0.1330, 29.00, 0.0420, -137.00, 0.0290, -41.00

0.8976, 0.0950, -31.00, 0.0390, 102.00, 0.1320, -91.00

0.9666, 0.0780, -99.00, 0.0690, 46.00, 0.1340, -127.00

1.0472, 0.0520, -171.00, 0.0710, 0.00, 0.0920, -148.00

1.1424, 0.0060, -123.00, 0.0390, -55.00, 0.0500, -168.00

1.2566, 0.0180, -109.00, 0.0110, 101.00, 0.0290, -155.00

1.3963, 0.0110, -137.00, 0.0210, -13.00, 0.0150, -160.00

1.5708, 0.0030, -114.00, 0.0090, 74.00, 0.0040, -168.00

2.0944, 0.0160, 76.00, 0.0020, 27.00, 0.0160, 124.00

TABL=(FREQ,ROLM,ROLA,PITM,PITA,YAWM,YAWA)

0.2513, 0.3350, 63.00, 0.2760, 74.00, 0.3640,   1.00

0.3142, 0.4690, 51.00, 0.4360, 65.00, 0.3660, -22.00

0.3307, 0.5200, 49.00, 0.4830, 62.00, 0.3730, -26.00

0.3491, 0.5850, 46.00, 0.5390, 59.00, 0.3830, -30.00

0.3696, 0.6720, 43.00, 0.6040, 55.00, 0.3980, -34.00

0.3921, 0.7910, 39.00, 0.6820, 50.00, 0.4180, -39.00

0.4189, 0.9660, 33.00, 0.7750, 45.00, 0.4440, -45.00

0.4333, 1.0880, 30.00, 0.8280, 42.00, 0.4590, -49.00

0.4488, 1.2480, 25.00, 0.8870, 38.00, 0.4750, -53.00

0.4654, 1.4670, 19.00, 0.9520, 34.00, 0.4930, -57.00

0.4833, 1.7800, 11.00, 1.0230, 30.00, 0.5130, -61.00

0.5027, 2.2120, -4.00, 1.0970, 24.00, 0.5400, -67.00

0.5236, 2.6920, -27.00, 1.1760, 18.00, 0.5650, -73.00

0.5464, 2.9060, -60.00, 1.2620, 11.00, 0.5860, -80.00

0.5712, 2.6330, -96.00, 1.3660, 3.00, 0.5990, -88.00

0.5984, 1.9680, -131.00, 1.4800, -5.00, 0.6050, -97.00

0.6283, 1.1630, -155.00, 1.5650, -16.00, 0.6110, -106.00

0.6614, 0.6760, -170.00, 1.6360, -29.00, 0.6100, -117.00

0.6981, 0.3540, 178.00, 1.6650, -45.00, 0.5960, -130.00

0.7392, 0.1470, 177.00, 1.6470, -63.00, 0.5660, -145.00

0.7854, 0.0620, -125.00, 1.5370, -86.00, 0.5120, -163.00

0.8378, 0.1020, -95.00, 1.2640, -113.00, 0.4280, 174.00

0.8976, 0.1040, -102.00, 0.8130, -142.00, 0.3050, 147.00

0.9666, 0.0800, -103.00, 0.3820, -158.00, 0.1520, 111.00

1.0472, 0.0700, -91.00, 0.2160, -144.00, 0.0190, -9.00

1.1424, 0.0710, -95.00, 0.1850, -142.00, 0.1040, -137.00

1.2566, 0.0380, -97.00, 0.1140, -158.00, 0.0960, 152.00

1.3963, 0.0490, -72.00, 0.0510, -151.00, 0.0170, -72.00

1.5708, 0.0310, -90.00, 0.0090, -164.00, 0.0270, 120.00

2.0944, 0.0090, -96.00, 0.0430, 76.00, 0.0040, -60.00

*RUN

*CURR NUMB=3, TABL=(DEPT,VELO,DIRE)

   0.000, 1.030, 270

   10.000, 0.540, 270

   21.340, 0.440, 270

*TIME STEP=0.2, STOP=360, DAMP=0.2, SAMP=0.4, STAR=60

*SPEC SEAS=1, TYPE=7, DIRE=270, FMIN=0.2094, FMAX=2.0944, NUMB=30, FPEA=0.8537,

   JON1=0.0021, JON2=1.0000

*RAOS NUMB=30, SEAS=1, SIGN=1, TABL=(FREQ,SRGM,SRGA,SWYM,SWYA,HEAM,HEAA)

   0.2513, 0.0310, 101.00, 0.8190, 124.00, 1.1000, 0.00

   0.3142, 0.0120, 153.00, 0.8760, 115.00, 1.1070, 0.00

   0.3307, 0.0130, 164.00, 0.8790, 112.00, 1.1090, -1.00

   0.3491, 0.0150, 166.00, 0.8790, 109.00, 1.1110, -1.00

   0.3696, 0.0160, 167.00, 0.8670, 107.00, 1.1130, -1.00

   0.3927, 0.0170, 167.00, 0.8500, 105.00, 1.1160, -1.00

   0.4189, 0.0180, 166.00, 0.8280, 104.00, 1.1200, -2.00

   0.4333, 0.0190, 166.00, 0.8140, 103.00, 1.1220, -2.00

   0.4488, 0.0190, 165.00, 0.7990, 103.00, 1.1250, -2.00

   0.4654, 0.0190, 165.00, 0.7840, 103.00, 1.1280, -2.00

   0.4833, 0.0190, 166.00, 0.7720, 104.00, 1.1330, -3.00

   0.5027, 0.0200, 162.00, 0.7720, 106.00, 1.1360, -3.00

   0.5236, 0.0210, 156.00, 0.7930, 107.00, 1.1340, -4.00

   0.5464, 0.0200, 151.00, 0.8260, 106.00, 1.1280, -5.00

   0.5712, 0.0200, 146.00, 0.8400, 102.00, 1.1190, -6.00

   0.5984, 0.0200, 159.00, 0.8210, 99.00, 1.1500, -6.00

   0.6283, 0.0230, 166.00, 0.7760, 96.00, 1.1880, -7.00

   0.6614, 0.0270, 170.00, 0.7260, 96.00, 1.2330, -9.00

   0.6981, 0.0330, 167.00, 0.6750, 96.00, 1.2700, -13.00

   0.7392, 0.0410, 157.00, 0.6220, 99.00, 1.2830, -20.00

   0.7854, 0.0490, 143.00, 0.5720, 101.00, 1.2500, -29.00

   0.8378, 0.0560, 122.00, 0.5170, 104.00, 1.1150, -41.00

   0.8976, 0.0570, 96.00, 0.4570, 109.00, 0.8800, -54.00

0.9666, 0.0470,   69.00, 0.3950, 116.00, 0.6020, -63.00

1.0472, 0.0330,   49.00, 0.3340, 126.00, 0.3630, -66.00

1.1424, 0.0200,   20.00, 0.2770, 142.00, 0.1860, -61.00

1.2566, 0.0090,   12.00, 0.2270, 162.00, 0.0730, -51.00

1.3963, 0.0010, 167.00, 0.1770, -171.00, 0.0090, 161.00

1.5708, 0.0110,   77.00, 0.1220, -133.00, 0.0330, -134.00

2.0944, 0.0110, -151.00, 0.0470,   46.00, 0.1930, -176.00

TABL=(FREQ,ROLM,ROLA,PITM,PITA,YAWM,YAWA)

0.2513, 0.4530,   77.00, 0.0010, 143.00, 0.2470, 68.00

0.3142, 0.6990,   74.00, 0.0020, 158.00, 0.1480, 44.00

0.3307, 0.7750,   74.00, 0.0030, 145.00, 0.1270, 41.00

0.3491, 0.8670,   75.00, 0.0040, 139.00, 0.1060, 40.00

0.3696, 1.0100,   74.00, 0.0040, 147.00, 0.0950, 40.00

0.3927, 1.2120,   74.00, 0.0050, 153.00, 0.0850, 40.00

0.4189, 1.5150,   73.00, 0.0070, 157.00, 0.0770, 42.00

0.4333, 1.7310,   71.00, 0.0080, 158.00, 0.0740, 42.00

0.4488, 2.0150,   69.00, 0.0090, 158.00, 0.0710, 43.00

0.4654, 2.3990,   66.00, 0.0110, 157.00, 0.0690, 43.00

0.4833, 2.8980,   58.00, 0.0140, 153.00, 0.0700, 41.00

0.5027, 3.5110,   47.00, 0.0170, 147.00, 0.0680, 39.00

0.5236, 4.0950,   30.00, 0.0210, 138.00, 0.0630, 34.00

0.5464, 4.4100,   8.00, 0.0250, 129.00, 0.0520, 27.00

0.5712, 4.1580, -16.00, 0.0280, 122.00, 0.0360, 25.00

0.5984, 3.5460, -39.00, 0.0360, 130.00, 0.0250, 28.00

0.6283, 2.7670, -56.00, 0.0520, 130.00, 0.0200, 41.00

0.6614, 2.0820, -65.00, 0.0760, 123.00, 0.0180, 53.00

0.6981, 1.5400, -68.00, 0.1070, 111.00, 0.0170, 58.00

0.7392, 1.1360, -66.00, 0.1470, 91.00, 0.0170, 61.00

0.7854, 0.8770, -62.00, 0.2000, 67.00, 0.0140, 64.00

0.8378, 0.6930, -56.00, 0.2470, 37.00, 0.0090, 65.00

0.8976, 0.5500, -52.00, 0.2480,   2.00, 0.0040, 54.00

0.9666, 0.4090, -50.00, 0.1850, -28.00, 0.0030, -46.00

1.0472, 0.2780, -45.00, 0.1180, -48.00, 0.0080, -72.00

1.1424, 0.1720, -38.00, 0.0590, -57.00, 0.0110, -84.00

1.2566, 0.0830, -40.00, 0.0240, -71.00, 0.0150, -79.00

1.3963, 0.0460, -106.00, 0.0020, 148.00, 0.0150, -86.00

1.5708, 0.1310, -120.00, 0.0660, 41.00, 0.0070, -97.00

2.0944, 0.1550, -124.00, 0.0720, -148.00, 0.0010, -172.00

*RUN

*CURR NUMB=3, TABL=(DEPT,VELO,DIRE)

0.000, 1.030, 315

10.000, 0.540, 315

21.340, 0.440, 315

*TIME STEP=0.2, STOP=360, DAMP=0.2, SAMP=0.4, STAR=60

*SPEC SEAS=1, TYPE=7, DIRE=315, FMIN=0.2094, FMAX=2.0944, NUMB=30, FPEA=0.8537,

JON1=0.0021, JON2=1.0000

*RAOS NUMB=30, SEAS=1, SIGN=1, TABL=(FREQ,SRGM,SRGA,SWYM,SWYA,HEAM,HEAA)

0.2513, 1.3890, 115.00, 0.5060, 144.00, 1.0870, 17.00

0.3142, 1.0390, 121.00, 0.5950, 144.00, 1.0780, 26.00

0.3307, 0.9890, 123.00, 0.5980, 145.00, 1.0730, 29.00

0.3491, 0.9430, 127.00, 0.5980, 145.00, 1.0660, 32.00

0.3696, 0.9000, 131.00, 0.5890, 147.00, 1.0560, 36.00

0.3927, 0.8580, 135.00, 0.5740, 150.00, 1.0420, 41.00

0.4189, 0.8150, 141.00, 0.5530, 154.00, 1.0220, 46.00

0.4333, 0.7920, 145.00, 0.5400, 156.00, 1.0090, 49.00

0.4488, 0.7680, 148.00, 0.5240, 159.00, 0.9940, 53.00

0.4654, 0.7420, 152.00, 0.5060, 163.00, 0.9750, 57.00

0.4833, 0.7140, 157.00, 0.4880, 169.00, 0.9540, 62.00

0.5027, 0.6820, 162.00, 0.4720, 175.00, 0.9280, 67.00

0.5236, 0.6450, 168.00, 0.4740, -176.00, 0.8960, 72.00

0.5464, 0.6040, 175.00, 0.4850, -171.00, 0.8540, 79.00

0.5712, 0.5570, -177.00, 0.4760, -168.00, 0.8160, 87.00

0.5984, 0.5010, -168.00, 0.4260, -164.00, 0.7760, 96.00

0.6283, 0.4360, -157.00, 0.3630, -155.00, 0.7270, 107.00

0.6614, 0.3620, -145.00, 0.3010, -143.00, 0.6650, 119.00

0.6981, 0.2830, -128.00, 0.2380, -129.00, 0.5890, 132.00

0.7392, 0.2000, -108.00, 0.1710, -112.00, 0.4890, 147.00

0.7854, 0.1130, -81.00, 0.1000, -89.00, 0.3590, 165.00

0.8378, 0.0310, -8.00, 0.0310, -48.00, 0.2100, -164.00

0.8976, 0.0760, 114.00, 0.0340, 113.00, 0.1160, -101.00

0.9666, 0.1120, 163.00, 0.0680, 164.00, 0.1140, -32.00

1.0472, 0.1080, -134.00, 0.0720, -141.00, 0.0820, 32.00

1.1424, 0.0850, -40.00, 0.0410, -71.00, 0.0380, 121.00

1.2566, 0.0500, 93.00, 0.0100, 137.00, 0.0260, -85.00

1.3963, 0.0260, -75.00, 0.0200, -69.00, 0.0080, 87.00

1.5708, 0.0050, -154.00, 0.0050, -85.00, 0.0010, 51.00

2.0944, 0.0210, 44.00, 0.0020, -140.00, 0.0640, 76.00

TABL=(FREQ,ROLM,ROLA,PITM,PITA,YAWM,YAWA)

0.2513, 0.3270, 93.00, 0.2710, -73.00, 0.3770, 153.00

0.3142, 0.4900, 98.00, 0.4300, -65.00, 0.2700, 174.00

0.3307, 0.5420, 101.00, 0.4770, -62.00, 0.2760, -176.00

0.3491, 0.6040, 104.00, 0.5320, -59.00, 0.2910, -167.00

57

```
0.3696, 0.6900, 107.00, 0.5950,  -56.00, 0.3140, -159.00
0.3927, 0.8080, 111.00, 0.6700,  -51.00, 0.3440, -151.00
0.4189, 0.9790, 115.00, 0.7590,  -46.00, 0.3800, -143.00
0.4333, 1.0910, 118.00, 0.8090,  -43.00, 0.4010, -138.00
0.4488, 1.2460, 120.00, 0.8640,  -40.00, 0.4220, -134.00
0.4654, 1.4560, 121.00, 0.9220,  -37.00, 0.4440, -129.00
0.4833, 1.7500, 120.00, 0.9850,  -33.00, 0.4660, -124.00
0.5027, 2.1650, 115.00, 1.0490,  -29.00, 0.4890, -118.00
0.5236, 2.6080, 101.00, 1.1120,  -24.00, 0.5110, -111.00
0.5464, 2.8450,  79.00, 1.1830,  -19.00, 0.5360, -103.00
0.5712, 2.5730,  52.00, 1.2690,  -13.00, 0.5640,  -95.00
0.5984, 1.8250,  30.00, 1.3500,   -6.00, 0.5870,  -86.00
0.6283, 1.1000,  20.00, 1.4140,    0.00, 0.6010,  -75.00
0.6614, 0.6310,  20.00, 1.4510,    9.00, 0.6050,  -63.00
0.6981, 0.3370,  20.00, 1.4560,   19.00, 0.5970,  -49.00
0.7392, 0.1570,  10.00, 1.4190,   30.00, 0.5710,  -32.00
0.7854, 0.0920, -27.00, 1.3170,   43.00, 0.5220,  -12.00
0.8378, 0.1000, -47.00, 1.0930,   57.00, 0.4390,   12.00
0.8976, 0.0870, -35.00, 0.6910,   73.00, 0.3150,   42.00
0.9666, 0.0490,  -2.00, 0.2590,  108.00, 0.1590,   82.00
1.0472, 0.0080, 116.00, 0.1010, -134.00, 0.0200, -157.00
1.1424, 0.0350, -97.00, 0.1160,  -25.00, 0.0990,   -2.00
1.2566, 0.0220, -10.00, 0.0240,   73.00, 0.0960,   82.00
1.3963, 0.0160, -96.00, 0.0130,  -23.00, 0.0080, -139.00
1.5708, 0.0060, -62.00, 0.0040,  -90.00, 0.0270,  139.00
2.0944, 0.0580,  51.00, 0.1670,   67.00, 0.0090, -108.00
```
*TENS TENS=250, TMAX=275, TMIN=225

*GEOM DEPT=21.34, END=0, LENG=6

*SOIL CFX=0.5

*RUN

*END

APPENDIX-1

Pipeline Properties

PIPE PROPERTIES (CONCRETE COATED PIPELINE)

10" Gas Pipeline

1.0 SCOPE

This worksheet calculates pipe properties for concrete coated pipeline.
Design curve for computing the influence of the field joint is extracted from ASME paper: Effective Stiffnes of Concrete Coated Pipeline by Nathan C. Mogbo, James O. Jirsa and J.C Wlhoit.

Unit Conversions

$MPa = 1000000\,Pa \qquad kN = 1000\,N \qquad kPa = 1000\,Pa$

2.0 INPUT PARTICULAR

$D_s := 273.1 \cdot mm$	steel outer pipe diameter
$t_s := 15.9 \cdot mm$	steel pipe of thickness
$E := 2.07 \cdot 10^5 \cdot MPa$	modulus of elasticity
$\rho_{st} := 7850 \cdot \dfrac{kg}{m^3}$	density of steel
$t_{conc} := 40 \cdot mm$	concrete coat thickness
$\rho_{conc} := 3040 \cdot \dfrac{kg}{m^3}$	density of concrete
$t_{cc} := 2.8 \cdot mm$	corrosion coating thickness
$\rho_{cc} := 940 \cdot \dfrac{kg}{m^3}$	density of corrosion coating
$\xi := 5$	percentage of water absorption
$\rho_w := 1025 \cdot \dfrac{kg}{m^3}$	density of water
$F_{cc} := 40 \cdot MPa$	28days concrete compressive strength
$U := 80 \cdot kPa$	bond stress
$L_{cb} := 350 \cdot mm$	cutback
$C_b := 0$	concrete bevel 1 in.
$\rho_{fj} := 1025 \cdot \dfrac{kg}{m^3}$	density of field joint material
$L_j := 12.2 \cdot m$	joint length
$t_{fj} := 40 \cdot mm$	field joint thickness

_____ END OF INPUT _____

3.0 CALCULATIONS
3.1 Pipe Diameters

$D_i := D_s - 2 \cdot t_s$ 　　　　　　　 $D_i = 0.241\ m$ 　　　　 internal pipe diameter

$D_{cc} := D_s + 2 \cdot t_{cc}$ 　　　　　　 $D_{cc} = 0.279\ m$ 　　　 outside diameter of corrosion coat

$D_{conc} := D_{cc} + 2 \cdot t_{conc}$ 　　　　 $D_{conc} = 0.359\ m$ 　　 outside diameter of concrete coat

$D_{fj} := D_s + 2t_{cc} + 2 \cdot t_{fj}$ 　　　　 $D_{fj} = 0.359\ m$ 　　　 outside diameter of field joint coat

3.2 Weight Calculations

$W_{st} := \dfrac{\pi}{4} \cdot \left(D_s^{\,2} - D_i^{\,2} \right) \rho_{st}$ 　　　 $W_{st} = 100.853\ \dfrac{kg}{m}$ 　　 weight of steel

$W_{cc} := \dfrac{\pi}{4} \cdot \left(D_{cc}^{\,2} - D_s^{\,2} \right) \rho_{cc}$ 　　 $W_{cc} = 2.281\ \dfrac{kg}{m}$ 　　 weight of corrosion coat

$V_{conc} := \dfrac{\pi}{4} \cdot \left(D_{conc}^{\,2} - D_{cc}^{\,2} \right)$ 　　 $V_{conc} = 0.04\ m^2$ 　　 volume of concrete per unit length

$W_{conc} := V_{conc} \cdot \rho_{conc}$ 　　　　 $W_{conc} = 121.749\ \dfrac{kg}{m}$ 　 weight of concrete coating

$W_a := W_{st} + W_{cc} + W_{conc}$ 　　 $W_a = 224.883\ \dfrac{kg}{m}$ 　 weight in air

$B := \dfrac{\pi}{4} D_{conc}^{\,2} \rho_w$ 　　　　　 $B = 103.58\ \dfrac{kg}{m}$ 　　 buoyancy

$W_1 := W_{st} \cdot L_j + \left(W_{cc} + W_{conc} \right)\left(L_j - 2L_{cb} \right)$ 　　 weight of pipe excluding field joint

$W_2 := \rho_{fj} \cdot \left[\pi \cdot L_{cb} \cdot \dfrac{\left(D_{fj}^{\,2} - D_s^{\,2} \right)}{2} + 2\pi \cdot C_b \cdot \left(t_{fj} \right)^2 \left[\dfrac{D_s}{2} + \left(t_{fj} \right) \cdot \dfrac{2}{3} \right] \right]$ 　　 weight of field joint

$W_3 := -2 \cdot \pi \cdot \rho_{conc} \cdot C_b \cdot t_{conc}^{\,2} \cdot \left(\dfrac{D_{cc}}{2} + \dfrac{t_{conc}}{2} \right)$ 　　 effect of concrete bevel

$W_{sa} := \dfrac{\left(W_1 + W_2 + W_3 \right)}{L_j} + \dfrac{\xi}{100} \cdot V_{conc} \cdot \rho_w - B$ 　　 submerged weight (adjusted)

$W_{sa} = 118.737\ \dfrac{kg}{m}$

$W_w := W_{sa} + \dfrac{\pi}{4} D_i^{\,2} \cdot \rho_w$ 　　　　 $W_w = 165.611\ \dfrac{kg}{m}$ 　　 flooded weight

3.3 Cross Sectional Properties

3.3.1 Steel Pipe

$$A_{st} := \frac{\pi}{4} \cdot \left(D_s^{\ 2} - D_i^{\ 2} \right)$$
$\qquad A_{st} = 0.013 \, m^2 \qquad$ steel c/s area

$$I_{st} := \frac{\pi}{64} \cdot \left(D_s^{\ 4} - D_i^{\ 4} \right)$$
$\qquad I_{st} = 0 \, m^4 \qquad$ steel moment of inertia

$$Z_{st} := I_{st} \cdot \frac{2}{D_s}$$
$\qquad Z_{st} = 0.781 \, L \qquad$ steel section modulus

3.3.2 Composite Moment of Inertia

$$R_s := \frac{D_i + 2 \cdot t_s}{2} \qquad R_{cc} := R_s + t_{cc} \qquad R_{conc} := R_{cc} + t_{conc}$$

$$E_c := 33 \cdot psi \cdot \left(\frac{\rho_{conc}}{lb \cdot ft^{-3}} \right)^{1.5} \cdot \sqrt{\frac{F_{cc}}{psi}} = 45308796191.017 \, Pa$$
$\qquad$ concrete modulus of elasticity (ref. handbook of concrete: Mark Fintel)

$$N := if\left(\frac{E}{E_c} < 6.0, 6.0, \frac{E}{E_c} \right)$$
$\qquad N = 6 \qquad$ modular ratio

$$y_s := 45 \cdot mm$$
$\qquad$ shift in thre neutral axis (initial guess value)
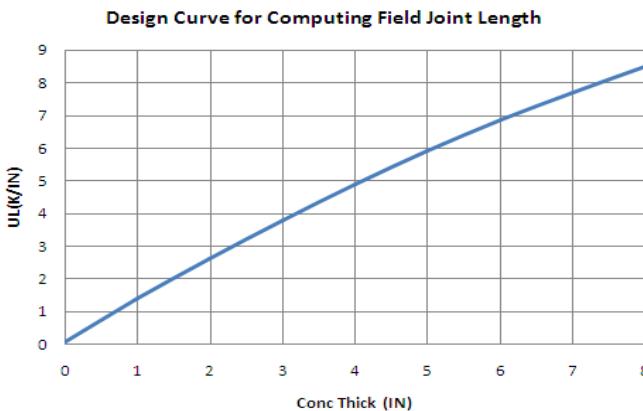
Given

$$y_s := \frac{\dfrac{2}{N} \cdot \displaystyle\int_{R_{cc}}^{R_{conc}} \int_{asin\left(\frac{y_s}{R_{conc}}\right)}^{\frac{\pi}{2}} r^2 \cdot sin(\theta) \; d\theta \; dr}{A_{st} + \dfrac{2}{N} \cdot \displaystyle\int_{R_{cc}}^{R_{conc}} \int_{asin\left(\frac{y_s}{R_{conc}}\right)}^{\frac{\pi}{2}} r \; d\theta \; dr}$$
$\qquad y_s = 45 \cdot mm \quad$ shift in the neutral axis

$$I_{comp} := I_{st} + A_{st} \cdot y_s^{\ 2} + \frac{2}{N} \cdot \int_{R_{cc}}^{R_{conc}} \int_{asin\left(\frac{y_s}{R_{conc}}\right)}^{\frac{\pi}{2}} r \cdot \left(r \cdot sin(\theta) - y_s \right)^2 \; d\theta \; dr$$

$$I_{comp} = 14248.331 \cdot cm^4$$

3.3.3 Effective Moment of Inertia

Design Curve for Computing Field Joint Length

$$u1\,(t) := \left(-0.0383 \cdot t^2 + 1.3613 \cdot t + 0.0643\right) \cdot 1000 \cdot \frac{lbf}{in}$$

product of bond stress and field joint length for concrete of 5000 psi compressive strength

$$UL_{sj} := u1\left(\frac{t_{conc}}{in}\right) \qquad UL_{sj} = 370.06 \cdot \frac{kN}{m}$$

product of bond stress and field joint length for specified concrete compressive strength

$$UL_{sj} := UL_{sj} \cdot \frac{F_{cc}}{5000.psi} \qquad UL_{sj} = 429.381 \cdot \frac{kN}{m}$$

$$L_{sj} := \frac{UL_{sj}}{U} \qquad L_{sj} = 5.367\,m$$

pipe length influenced by the field joint

$$I_{eff}\left(l_j\right) := \begin{vmatrix} \text{if} & l_j \le \dfrac{L_j}{2} \\ & \begin{vmatrix} l_j \leftarrow \dfrac{I_{st} + I_{comp}}{2} \\[2mm] I_e \leftarrow \dfrac{l_j \cdot 2 \cdot l_j + \left(L_j - 2.l_j\right) \cdot I_{comp}}{L_j} \end{vmatrix} \\ \text{otherwise} \\ & \begin{vmatrix} I_{comp\_r} \leftarrow I_{st} + \dfrac{\left(I_{comp} - I_{st}\right)}{2 \cdot l_j} \cdot L_j \\[2mm] I_e \leftarrow \dfrac{I_{st} + I_{comp\_r}}{2} \end{vmatrix} \\ I_e \end{vmatrix}$$
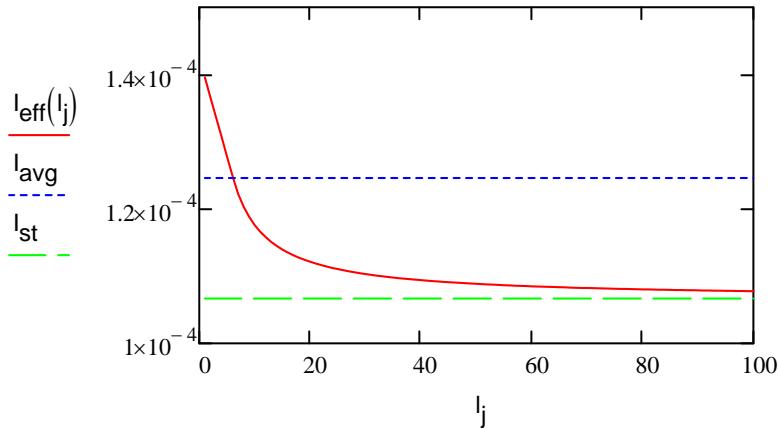
effective moment of inertia - based on ASME paper

$$I_{avg} := \frac{I_{st} + I_{comp}}{2} \qquad I_{avg} = 0\,m^4 \qquad \text{average moment of inertia\_effective}$$

$$I_{eff}(L_{sj}) = 0\,m^4 \qquad \text{moment of inertia of the pipeline}$$

$$I_j := 1 \cdot m, 2.0 \cdot m \ldots 100.0\,m$$

4.0 RESULTS

$$W_a = 0.225 \cdot \frac{tonne}{m} \qquad W_a \cdot g = 2.205 \cdot \frac{kN}{m} \qquad \text{weight in air}$$

$$W_{sa} = 118.737 \cdot \frac{kg}{m} \qquad W_{sa} \cdot g = 1.164 \cdot \frac{kN}{m} \qquad \text{submerged weight adjusted}$$

$$W_w = 0.166 \cdot \frac{tonne}{m} \qquad W_w \cdot g = 1.624 \cdot \frac{kN}{m} \qquad \text{flooded weight}$$

$$SG := \frac{W_a}{W_a - W_{sa}} \qquad SG = 2.119 \qquad \text{specific gravity-adjusted}$$

$$A_{st} = 128.475 \cdot cm^2 \qquad \text{area of steel pipe}$$

$$I_{eff}(L_{sj}) = 12671.511 \cdot cm^4 \qquad \text{effective moment of inertia of the pipeline}$$

APPENDIX-2

RAO Data from Moses

```
***********************************************************************************************************
*                                           ***  MOSES   ***                                            *
*                                           ----------------                     29 May, 2014            *
*         TIMAS DLB-01                                                                                   *
*         RAOs - DURING PIPELAYING CONDITION                                                             *
*                                                                                                        *
***********************************************************************************************************
```

                  +++ B U O Y A N C Y   A N D   W E I G H T   F O R   D L B 0 1 +++
                  ==

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

                            Results Are Reported In Body System

                 Draft =   3.57   Roll Angle =   0.00   Pitch Angle =   0.50

                            Wet Radii Of Gyration About CG

                    K-X =   19.25   K-Y =   35.96   K-Z =   40.25

                       GMT =   15.64   GML = 288.64

                                   /-- Center of Gravity ---/ Sounding   % Full
                   Name   Weight   ---X--- ---Y--- ---Z--- -------- --------

                   ---------------- Part ACCOMODA   ------------
                   ---------------- Part DLB01   ------------
                   LOAD_GRO 14395.1   66.68   0.00   8.28
                   ======== ======== ======= ======= =======
                   Total   14395.1   66.68   0.00   8.28
                   Buoyancy 14421.5   66.73   0.00   2.10

```
***********************************************************************************************************
*                                           ***  MOSES   ***                                            *
*                                           ----------------                     29 May, 2014            *
*         TIMAS DLB-01                                                                                   *
*         RAOs - DURING PIPELAYING CONDITION                                                             *
*                                                                                                        *
***********************************************************************************************************
```

                  +++ C U R R E N T   S Y S T E M   C O N F I G U R A T I O N +++
                  ==

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

                            Location and Net Force at Body Origin

                   Body   X   Y   Z   RX   RY   RZ
                   --------   --------- --------- --------- --------- --------- ---------

                   DLB01   Location   0.00   -0.01   -3.57   0.00   0.50   0.01
                            N Force   0.00   0.00   0.00   0.   0.   0.

```
***********************************************************************************************************
*                                           ***  MOSES   ***                                            *
*                                           ----------------                     29 May, 2014            *
*         TIMAS DLB-01                                                                                   *
*         RAOs - DURING PIPELAYING CONDITION                                                             *
*                                                                                                        *
***********************************************************************************************************
```

                       +++ D R A F T   M A R K   R E A D I N G S +++
                       ==

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

         Name   Draft   Name   Draft   Name   Draft   Name   Draft   Name   Draft   Name   Draft
       -------- -------- -------- -------- -------- -------- -------- -------- -------- -------- -------- --------

       AFTPORT   4.63 AFTSTBD   4.63 FOREPORT   3.57 FORESTBD   3.57 MEANPORT   4.10 MEANSTBD   4.10

```
***************************************************************************************************************
*                                                   ***  MOSES   ***                                        *
*                                                   ---------------                         29 May, 2014     *
*           TIMAS DLB-01                                                                                     *
*           RAOs - DURING PIPELAYING CONDITION                                                              *
*      Draft =   3.6 Meters                  Trim Angle =   0.50 Deg.            GMT = 15.64 Meters          *
*      Roll Gy. Radius = 19.2 Meters         Pitch Gy. Radius = 36.0 Meters    Yaw Gy. Radius =  40.3 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 DLB01 At X =   66.7 Y =   0.0 Z =   8.3

Process is 0: Units Are Degrees, Meters, and M-Tons Unless Specified

E N C O U N T E R		Surge / Wave Ampl.		Sway / Wave Ampl.		Heave / Wave Ampl.		Roll / Wave Ampl.		Pitch / Wave Ampl.		Yaw / Wave Ampl.	
Frequency -(Rad/Sec)-	Period -(Sec)-	Ampl.	Phase	Ampl.	Phase	Ampl.	Phase	Ampl.	Phase	Ampl.	Phase	Ampl.	Phase
0.2513	25.00	1.917	122	0.001	54	1.077	25	0.001	-53	0.379	-66	0.007	157
0.3142	20.00	1.433	132	0.001	37	1.049	38	0.000	0	0.596	-54	0.003	149
0.3307	19.00	1.356	136	0.001	29	1.038	42	0.000	0	0.658	-50	0.003	150
0.3491	18.00	1.283	141	0.001	31	1.022	47	0.000	0	0.729	-46	0.002	153
0.3696	17.00	1.212	147	0.001	34	1.000	52	0.000	0	0.812	-40	0.002	157
0.3927	16.00	1.138	154	0.000	0	0.971	59	0.000	0	0.906	-34	0.002	162
0.4189	15.00	1.062	162	0.000	0	0.930	67	0.000	0	1.017	-27	0.001	170
0.4333	14.50	1.018	167	0.000	0	0.903	71	0.000	0	1.076	-23	0.001	174
0.4488	14.00	0.971	173	0.000	0	0.872	77	0.000	0	1.139	-18	0.001	178
0.4654	13.50	0.920	179	0.000	0	0.836	83	0.000	0	1.204	-13	0.001	-176
0.4833	13.00	0.862	-174	0.000	0	0.793	89	0.000	0	1.271	-8	0.001	-170
0.5027	12.50	0.796	-166	0.000	0	0.742	97	0.001	137	1.334	-2	0.001	-164
0.5236	12.00	0.721	-158	0.000	0	0.684	106	0.001	131	1.394	4	0.001	-157
0.5464	11.50	0.633	-148	0.000	0	0.618	117	0.001	103	1.440	11	0.001	-149
0.5712	11.00	0.533	-137	0.000	0	0.544	130	0.001	61	1.468	20	0.000	0
0.5984	10.50	0.420	-123	0.000	0	0.465	145	0.001	47	1.466	30	0.000	0
0.6283	10.00	0.296	-106	0.000	0	0.381	165	0.001	50	1.414	41	0.000	0
0.6614	9.50	0.171	-80	0.000	0	0.300	-168	0.000	0	1.306	54	0.000	0
0.6981	9.00	0.070	-22	0.000	0	0.233	-132	0.000	0	1.129	71	0.000	0
0.7392	8.50	0.089	84	0.000	0	0.200	-84	0.000	0	0.882	92	0.000	0
0.7854	8.00	0.149	137	0.000	0	0.203	-34	0.000	0	0.583	123	0.000	0
0.8378	7.50	0.174	-173	0.000	0	0.206	12	0.000	0	0.302	177	0.000	0
0.8976	7.00	0.159	-110	0.000	0	0.162	62	0.000	0	0.251	-87	0.000	0
0.9666	6.50	0.131	-19	0.000	0	0.087	143	0.000	0	0.253	-14	0.000	0
1.0472	6.00	0.124	97	0.000	0	0.059	-87	0.000	0	0.141	74	0.000	0
1.1424	5.50	0.119	-119	0.000	0	0.040	45	0.000	0	0.087	-112	0.000	0
1.2566	5.00	0.090	64	0.000	0	0.032	-116	0.000	0	0.032	44	0.000	0
1.3963	4.50	0.063	-35	0.000	0	0.017	112	0.000	0	0.025	21	0.000	0
1.5708	4.00	0.052	-14	0.000	0	0.005	37	0.000	0	0.033	8	0.000	0
2.0944	3.00	0.010	-92	0.000	0	0.006	83	0.000	0	0.010	21	0.000	0

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***************************************************************************************************************
*                                                   ***  MOSES   ***                                        *
*                                                   ---------------                         29 May, 2014     *
*           TIMAS DLB-01                                                                                     *
*           RAOs - DURING PIPELAYING CONDITION                                                              *
*      Draft =   3.6 Meters                  Trim Angle =   0.50 Deg.            GMT = 15.64 Meters          *
*      Roll Gy. Radius = 19.2 Meters         Pitch Gy. Radius = 36.0 Meters    Yaw Gy. Radius =  40.3 Meters *
*      Heading =  45.00 Deg.                 Forward Speed =  0.00 Knots        Linearization Based on 1/ 20 *
*                                                                                                           *
***************************************************************************************************************
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+++ 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 DLB01 At X =   66.7 Y =   0.0 Z =   8.3

Process is 45: Units Are Degrees, Meters, and M-Tons Unless Specified

E N C O U N T E R		Surge / Wave Ampl.		Sway / Wave Ampl.		Heave / Wave Ampl.		Roll / Wave Ampl.		Pitch / Wave Ampl.		Yaw / Wave Ampl.	
Frequency -(Rad/Sec)-	Period -(Sec)-	Ampl.	Phase	Ampl.	Phase	Ampl.	Phase	Ampl.	Phase	Ampl.	Phase	Ampl.	Phase
0.2513	25.00	1.389	115	0.506	144	1.087	17	0.327	93	0.271	-73	0.377	153
0.3142	20.00	1.039	121	0.595	144	1.078	26	0.490	98	0.430	-65	0.270	174
0.3307	19.00	0.989	123	0.598	145	1.073	29	0.542	101	0.477	-62	0.276	-176
0.3491	18.00	0.943	127	0.598	145	1.066	32	0.604	104	0.532	-59	0.291	-167
0.3696	17.00	0.900	131	0.589	147	1.056	36	0.690	107	0.595	-56	0.314	-159
0.3927	16.00	0.858	135	0.574	150	1.042	41	0.808	111	0.670	-51	0.344	-151
0.4189	15.00	0.815	141	0.553	154	1.022	46	0.979	115	0.759	-46	0.380	-143
0.4333	14.50	0.792	145	0.540	156	1.009	49	1.091	118	0.809	-43	0.401	-138
0.4488	14.00	0.768	148	0.524	159	0.994	53	1.246	120	0.864	-40	0.422	-134
0.4654	13.50	0.742	152	0.506	163	0.975	57	1.456	121	0.922	-37	0.444	-129
0.4833	13.00	0.714	157	0.488	169	0.954	62	1.750	120	0.985	-33	0.466	-124
0.5027	12.50	0.682	162	0.472	175	0.928	67	2.165	115	1.049	-29	0.489	-118
0.5236	12.00	0.645	168	0.474	-176	0.896	72	2.608	101	1.112	-24	0.511	-111
0.5464	11.50	0.604	175	0.485	-171	0.854	79	2.845	79	1.183	-19	0.536	-103
0.5712	11.00	0.557	-177	0.476	-168	0.816	87	2.573	52	1.269	-13	0.564	-95
0.5984	10.50	0.501	-168	0.426	-164	0.776	96	1.825	30	1.350	-6	0.587	-86
0.6283	10.00	0.436	-157	0.363	-155	0.727	107	1.100	20	1.414	0	0.601	-75
0.6614	9.50	0.362	-145	0.301	-143	0.665	119	0.631	20	1.451	9	0.605	-63
0.6981	9.00	0.283	-128	0.238	-129	0.589	132	0.337	20	1.456	19	0.597	-49
0.7392	8.50	0.200	-108	0.171	-112	0.489	147	0.157	10	1.419	30	0.571	-32
0.7854	8.00	0.113	-81	0.100	-89	0.359	165	0.092	-27	1.317	43	0.522	-12
0.8378	7.50	0.031	-8	0.031	-48	0.210	-164	0.100	-47	1.093	57	0.439	12
0.8976	7.00	0.076	114	0.034	113	0.116	-101	0.087	-35	0.691	73	0.315	42
0.9666	6.50	0.112	163	0.068	164	0.114	-32	0.049	-2	0.259	108	0.159	82
1.0472	6.00	0.108	-134	0.072	-141	0.082	32	0.008	116	0.101	-134	0.020	-157
1.1424	5.50	0.085	-40	0.041	-71	0.038	121	0.035	-97	0.116	-25	0.099	-2
1.2566	5.00	0.050	93	0.010	137	0.026	-85	0.022	-10	0.024	73	0.096	82
1.3963	4.50	0.026	-75	0.020	-69	0.008	87	0.016	-96	0.013	-23	0.008	-139
1.5708	4.00	0.005	-154	0.005	-85	0.001	51	0.006	-62	0.004	-90	0.027	139
2.0944	3.00	0.021	44	0.002	-140	0.064	76	0.058	51	0.167	67	0.009	-108

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     ****************************************************************************************************************************
     *                                              ***  MOSES   ***                                                          *
     *                                              ---------------                              29 May, 2014         *
     *          TIMAS DLB-01                                                                                                  *
     *          RAOs - DURING PIPELAYING CONDITION                                                                           *
     *     Draft =   3.6 Meters                   Trim Angle =   0.50 Deg.              GMT = 15.64 Meters                    *
     *     Roll Gy. Radius = 19.2 Meters          Pitch Gy. Radius = 36.0 Meters       Yaw Gy. Radius =  40.3 Meters   *
     *     Heading = 90.00 Deg.                   Forward Speed =  0.00 Knots           Linearization Based on 1/ 20       *
     *                                                                                                                        *
     ****************************************************************************************************************************
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+++ M O T I O N   R E S P O N S E   O P E R A T O R S +++
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Of Point On Body DLB01 At X =   66.7 Y =   0.0 Z =   8.3

Process is 90: 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	Period												
-(Rad/Sec)-	-(Sec)-	Ampl.	Phase	Ampl.	Phase	Ampl.	Phase	Ampl.	Phase	Ampl.	Phase	Ampl.	Phase
0.2513	25.00	0.031	101	0.819	124	1.100	0	0.453	77	0.001	143	0.247	68
0.3142	20.00	0.012	153	0.876	115	1.107	0	0.699	74	0.002	158	0.148	44
0.3307	19.00	0.013	164	0.879	112	1.109	-1	0.775	74	0.003	145	0.127	41
0.3491	18.00	0.015	166	0.879	109	1.111	-1	0.867	75	0.004	139	0.106	40
0.3696	17.00	0.016	167	0.867	107	1.113	-1	1.010	74	0.004	147	0.095	40
0.3927	16.00	0.017	167	0.850	105	1.116	-1	1.212	74	0.005	153	0.085	40
0.4189	15.00	0.018	166	0.828	104	1.120	-2	1.515	73	0.007	157	0.077	42
0.4333	14.50	0.019	166	0.814	103	1.122	-2	1.731	71	0.008	158	0.074	42
0.4488	14.00	0.019	165	0.799	103	1.125	-2	2.015	69	0.009	158	0.071	43
0.4654	13.50	0.019	165	0.784	103	1.128	-2	2.399	66	0.011	157	0.069	43
0.4833	13.00	0.019	166	0.772	104	1.133	-3	2.898	58	0.014	153	0.070	41
0.5027	12.50	0.020	162	0.772	106	1.136	-3	3.511	47	0.017	147	0.068	39
0.5236	12.00	0.021	156	0.793	107	1.134	-4	4.095	30	0.021	138	0.063	34
0.5464	11.50	0.020	151	0.826	106	1.128	-5	4.410	8	0.025	129	0.052	27
0.5712	11.00	0.020	146	0.840	102	1.119	-6	4.158	-16	0.028	122	0.036	25
0.5984	10.50	0.020	159	0.821	99	1.150	-6	3.546	-39	0.036	130	0.025	28
0.6283	10.00	0.023	166	0.776	96	1.188	-7	2.767	-56	0.052	130	0.020	41
0.6614	9.50	0.027	170	0.726	96	1.233	-9	2.082	-65	0.076	123	0.018	53
0.6981	9.00	0.033	167	0.675	96	1.270	-13	1.540	-68	0.107	111	0.017	58
0.7392	8.50	0.041	157	0.622	99	1.283	-20	1.136	-66	0.147	91	0.017	61
0.7854	8.00	0.049	143	0.572	101	1.250	-29	0.877	-62	0.200	67	0.014	64
0.8378	7.50	0.056	122	0.517	104	1.115	-41	0.693	-56	0.247	37	0.009	65
0.8976	7.00	0.057	96	0.457	109	0.880	-54	0.550	-52	0.248	2	0.004	54
0.9666	6.50	0.047	69	0.395	116	0.602	-63	0.409	-50	0.185	-28	0.003	-46
1.0472	6.00	0.033	49	0.334	126	0.363	-66	0.278	-45	0.118	-48	0.008	-72
1.1424	5.50	0.020	20	0.277	142	0.186	-61	0.172	-38	0.059	-57	0.011	-84
1.2566	5.00	0.009	12	0.227	162	0.073	-51	0.083	-40	0.024	-71	0.015	-79
1.3963	4.50	0.001	167	0.177	-171	0.009	161	0.046	-106	0.002	148	0.015	-86
1.5708	4.00	0.011	77	0.122	-133	0.033	-134	0.131	-120	0.066	41	0.007	-97
2.0944	3.00	0.011	-151	0.047	46	0.193	-176	0.155	-124	0.072	-148	0.001	-172

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     ****************************************************************************************************************************
     *                                              ***  MOSES   ***                                                          *
     *                                              ---------------                              29 May, 2014         *
     *          TIMAS DLB-01                                                                                                  *
     *          RAOs - DURING PIPELAYING CONDITION                                                                           *
     *     Draft =   3.6 Meters                   Trim Angle =   0.50 Deg.              GMT = 15.64 Meters                    *
     *     Roll Gy. Radius = 19.2 Meters          Pitch Gy. Radius = 36.0 Meters       Yaw Gy. Radius =  40.3 Meters   *
     *     Heading = 135.00 Deg.                  Forward Speed =  0.00 Knots           Linearization Based on 1/ 20       *
     *                                                                                                                        *
     ****************************************************************************************************************************
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+++ 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 DLB01 At X =   66.7 Y =   0.0 Z =   8.3

Process is 135: 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	Period												
-(Rad/Sec)-	-(Sec)-	Ampl.	Phase	Ampl.	Phase	Ampl.	Phase	Ampl.	Phase	Ampl.	Phase	Ampl.	Phase
0.2513	25.00	1.316	-102	0.479	110	1.088	-18	0.335	63	0.276	74	0.364	1
0.3142	20.00	1.004	-116	0.602	86	1.077	-28	0.469	51	0.436	65	0.366	-22
0.3307	19.00	0.958	-119	0.600	81	1.072	-31	0.520	49	0.483	62	0.373	-26
0.3491	18.00	0.914	-123	0.593	75	1.065	-35	0.585	46	0.539	59	0.383	-30
0.3696	17.00	0.872	-128	0.580	68	1.055	-39	0.672	43	0.604	55	0.398	-34
0.3927	16.00	0.830	-133	0.562	62	1.041	-45	0.791	39	0.682	50	0.418	-39
0.4189	15.00	0.787	-139	0.538	54	1.020	-51	0.966	33	0.775	45	0.444	-45
0.4333	14.50	0.765	-143	0.522	50	1.007	-55	1.088	30	0.828	42	0.459	-49
0.4488	14.00	0.742	-147	0.505	45	0.991	-59	1.248	25	0.887	38	0.475	-53
0.4654	13.50	0.717	-151	0.484	41	0.971	-63	1.467	19	0.952	34	0.493	-57
0.4833	13.00	0.690	-156	0.460	36	0.947	-68	1.780	11	1.023	30	0.513	-61
0.5027	12.50	0.659	-162	0.438	34	0.918	-74	2.212	-4	1.097	24	0.540	-67
0.5236	12.00	0.624	-169	0.429	30	0.881	-81	2.692	-27	1.176	18	0.565	-73
0.5464	11.50	0.585	-176	0.439	25	0.832	-88	2.906	-60	1.262	11	0.586	-80
0.5712	11.00	0.548	174	0.440	13	0.782	-97	2.633	-96	1.366	3	0.599	-88
0.5984	10.50	0.508	164	0.411	0	0.727	-106	1.968	-131	1.480	-5	0.605	-97
0.6283	10.00	0.452	152	0.356	-13	0.653	-117	1.163	-155	1.565	-16	0.611	-106
0.6614	9.50	0.391	138	0.298	-26	0.564	-131	0.676	-170	1.636	-29	0.610	-117
0.6981	9.00	0.323	121	0.236	-41	0.454	-148	0.354	178	1.665	-45	0.596	-130
0.7392	8.50	0.255	100	0.171	-60	0.315	-170	0.147	177	1.647	-63	0.566	-145
0.7854	8.00	0.189	71	0.104	-87	0.145	159	0.062	-125	1.537	-86	0.512	-163
0.8378	7.50	0.133	29	0.042	-137	0.029	-41	0.102	-95	1.264	-113	0.428	174
0.8976	7.00	0.095	-31	0.039	102	0.132	-91	0.104	-102	0.813	-142	0.305	147
0.9666	6.50	0.078	-99	0.069	46	0.134	-127	0.080	-103	0.382	-158	0.152	111
1.0472	6.00	0.052	-171	0.071	0	0.092	-148	0.070	-91	0.216	-144	0.019	-9
1.1424	5.50	0.006	-123	0.039	-55	0.050	-168	0.071	-95	0.185	-142	0.104	-137
1.2566	5.00	0.018	-109	0.011	101	0.029	-155	0.038	-97	0.114	-142	0.096	152
1.3963	4.50	0.011	-137	0.021	-13	0.015	-160	0.049	-72	0.051	-151	0.017	-72
1.5708	4.00	0.003	-114	0.009	74	0.004	-168	0.031	-90	0.009	-164	0.027	120
2.0944	3.00	0.016	76	0.002	27	0.016	124	0.009	-96	0.043	76	0.004	-60

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*********************************************************************************************************
*                                       ***  MOSES  ***                                                *
*                                       ---------------                              29 May, 2014       *
*           TIMAS DLB-01                                                                                *
*           RAOs - DURING PIPELAYING CONDITION                                                          *
*     Draft =   3.6 Meters                  Trim Angle =   0.50 Deg.        GMT = 15.64 Meters          *
*     Roll Gy. Radius = 19.2 Meters         Pitch Gy. Radius = 36.0 Meters  Yaw Gy. Radius =  40.3 Meters *
*     Heading = 180.00 Deg.                 Forward Speed =  0.00 Knots     Linearization Based on 1/ 20 *
*                                                                                                       *
*********************************************************************************************************
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+++ M O T I O N   R E S P O N S E   O P E R A T O R S +++
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Of Point On Body DLB01 At X =   66.7 Y =   0.0 Z =   8.3

Process is 180: 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	Period												
-(Rad/Sec)-	-(Sec)-	Ampl.	Phase	Ampl.	Phase	Ampl.	Phase	Ampl.	Phase	Ampl.	Phase	Ampl.	Phase
0.2513	25.00	1.822	-108	0.001	151	1.076	-25	0.000	0	0.388	68	0.005	-73
0.3142	20.00	1.375	-127	0.000	0	1.049	-40	0.000	0	0.609	55	0.002	-111
0.3307	19.00	1.302	-132	0.000	0	1.037	-44	0.000	0	0.674	51	0.002	-118
0.3491	18.00	1.231	-137	0.000	0	1.021	-49	0.000	0	0.748	46	0.002	-125
0.3696	17.00	1.160	-143	0.000	0	1.000	-55	0.000	0	0.835	41	0.001	-132
0.3927	16.00	1.086	-150	0.000	0	0.970	-63	0.000	0	0.935	35	0.001	-141
0.4189	15.00	1.006	-159	0.000	0	0.928	-72	0.000	0	1.052	27	0.001	-150
0.4333	14.50	0.963	-164	0.000	0	0.900	-77	0.001	-124	1.117	22	0.001	-156
0.4488	14.00	0.917	-170	0.000	0	0.868	-83	0.001	-134	1.187	17	0.001	-161
0.4654	13.50	0.867	-176	0.000	0	0.828	-89	0.001	-146	1.261	11	0.001	-168
0.4833	13.00	0.812	176	0.000	0	0.781	-97	0.001	-159	1.338	5	0.000	0
0.5027	12.50	0.752	168	0.000	0	0.725	-105	0.001	-176	1.417	-1	0.000	0
0.5236	12.00	0.685	159	0.000	0	0.658	-114	0.002	158	1.494	-10	0.000	0
0.5464	11.50	0.608	148	0.000	0	0.577	-125	0.002	108	1.554	-20	0.000	0
0.5712	11.00	0.521	135	0.000	0	0.483	-137	0.002	41	1.596	-32	0.000	0
0.5984	10.50	0.427	120	0.000	0	0.377	-151	0.001	-1	1.608	-45	0.000	0
0.6283	10.00	0.323	102	0.000	0	0.260	-167	0.001	-30	1.566	-60	0.000	0
0.6614	9.50	0.217	79	0.000	0	0.135	174	0.000	0	1.447	-77	0.000	0
0.6981	9.00	0.117	48	0.000	0	0.010	175	0.000	0	1.243	-95	0.000	0
0.7392	8.50	0.045	-17	0.000	0	0.104	-56	0.000	0	0.951	-114	0.000	0
0.7854	8.00	0.053	-122	0.000	0	0.179	-85	0.000	0	0.615	-126	0.000	0
0.8378	7.50	0.068	-175	0.000	0	0.188	-117	0.000	0	0.415	-116	0.000	0
0.8976	7.00	0.044	135	0.000	0	0.133	-141	0.000	0	0.476	-115	0.000	0
0.9666	6.50	0.011	-58	0.000	0	0.088	-144	0.000	0	0.437	-138	0.000	0
1.0472	6.00	0.045	-147	0.000	0	0.074	-142	0.000	0	0.276	-158	0.000	0
1.1424	5.50	0.027	-155	0.000	0	0.058	-164	0.000	0	0.190	-152	0.000	0
1.2566	5.00	0.025	-166	0.000	0	0.044	-164	0.000	0	0.146	-170	0.000	0
1.3963	4.50	0.028	-147	0.000	0	0.026	170	0.000	0	0.109	-179	0.000	0
1.5708	4.00	0.007	-128	0.000	0	0.031	160	0.000	0	0.070	157	0.000	0
2.0944	3.00	0.008	162	0.000	0	0.010	-116	0.000	0	0.027	-127	0.000	0

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*********************************************************************************************************
*                                       ***  MOSES  ***                                                *
*                                       ---------------                              29 May, 2014       *
*           TIMAS DLB-01                                                                                *
*           RAOs - DURING PIPELAYING CONDITION                                                          *
*     Draft =   3.6 Meters                  Trim Angle =   0.50 Deg.        GMT = 15.64 Meters          *
*     Roll Gy. Radius = 19.2 Meters         Pitch Gy. Radius = 36.0 Meters  Yaw Gy. Radius =  40.3 Meters *
*     Heading = 225.00 Deg.                 Forward Speed =  0.00 Knots     Linearization Based on 1/ 20 *
*                                                                                                       *
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+++ 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 DLB01 At X =   66.7 Y =   0.0 Z =   8.3

Process is 225: 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	Period												
-(Rad/Sec)-	-(Sec)-	Ampl.	Phase	Ampl.	Phase	Ampl.	Phase	Ampl.	Phase	Ampl.	Phase	Ampl.	Phase
0.2513	25.00	1.312	-101	0.476	-69	1.088	-18	0.336	-116	0.276	74	0.385	174
0.3142	20.00	1.003	-116	0.600	-93	1.077	-28	0.469	-128	0.436	65	0.373	153
0.3307	19.00	0.956	-119	0.598	-99	1.072	-31	0.520	-130	0.483	62	0.378	150
0.3491	18.00	0.913	-123	0.592	-104	1.065	-35	0.586	-133	0.539	59	0.387	147
0.3696	17.00	0.871	-128	0.579	-111	1.055	-40	0.672	-136	0.604	55	0.401	143
0.3927	16.00	0.829	-133	0.561	-118	1.041	-45	0.792	-140	0.682	50	0.420	138
0.4189	15.00	0.787	-139	0.537	-125	1.020	-51	0.967	-146	0.775	45	0.445	132
0.4333	14.50	0.764	-143	0.522	-129	1.007	-55	1.089	-149	0.828	42	0.460	129
0.4488	14.00	0.741	-147	0.504	-134	0.991	-59	1.250	-154	0.887	38	0.476	125
0.4654	13.50	0.716	-151	0.483	-138	0.971	-63	1.469	-160	0.952	34	0.494	121
0.4833	13.00	0.689	-156	0.459	-143	0.947	-69	1.783	-168	1.023	29	0.514	117
0.5027	12.50	0.658	-162	0.437	-146	0.918	-74	2.216	175	1.097	24	0.541	111
0.5236	12.00	0.624	-169	0.428	-149	0.881	-81	2.695	152	1.176	18	0.566	105
0.5464	11.50	0.585	-176	0.439	-155	0.833	-89	2.910	119	1.262	11	0.587	98
0.5712	11.00	0.548	174	0.439	-166	0.782	-97	2.637	83	1.366	3	0.600	90
0.5984	10.50	0.507	164	0.411	179	0.727	-106	1.971	48	1.480	-5	0.606	81
0.6283	10.00	0.452	152	0.356	166	0.653	-117	1.166	24	1.565	-17	0.611	72
0.6614	9.50	0.391	138	0.297	153	0.564	-131	0.678	9	1.636	-30	0.610	61
0.6981	9.00	0.323	121	0.236	137	0.454	-148	0.356	-1	1.665	-45	0.596	48
0.7392	8.50	0.254	100	0.171	118	0.315	-170	0.148	-3	1.647	-64	0.566	33
0.7854	8.00	0.189	71	0.103	92	0.145	159	0.061	53	1.537	-86	0.512	15
0.8378	7.50	0.132	28	0.042	42	0.029	-42	0.101	83	1.264	-114	0.428	-6
0.8976	7.00	0.095	-32	0.039	-78	0.132	-92	0.104	76	0.813	-143	0.305	-33
0.9666	6.50	0.078	-100	0.069	-134	0.134	-128	0.080	75	0.382	-159	0.152	-69
1.0472	6.00	0.052	-172	0.071	178	0.092	-149	0.070	87	0.216	-145	0.019	169
1.1424	5.50	0.006	-125	0.039	122	0.050	-169	0.071	82	0.185	-144	0.104	40
1.2566	5.00	0.018	-111	0.011	-80	0.029	-157	0.038	80	0.114	-160	0.096	-29
1.3963	4.50	0.011	-139	0.021	163	0.015	-163	0.049	105	0.051	-153	0.017	105
1.5708	4.00	0.003	-117	0.009	-108	0.004	-171	0.031	86	0.009	-167	0.027	-62
2.0944	3.00	0.016	71	0.002	-157	0.016	119	0.009	78	0.043	71	0.004	114

```
*****************************************************************************************************************
*                                              ***  MOSES   ***                                                *
*                                              ---------------                                                 *
*                                                                                    29 May, 2014              *
*            TIMAS DLB-01                                                                                       *
*            RAOs - DURING PIPELAYING CONDITION                                                                *
*      Draft =   3.6 Meters                 Trim Angle =   0.50 Deg.          GMT = 15.64 Meters               *
*      Roll Gy. Radius = 19.2 Meters        Pitch Gy. Radius = 36.0 Meters    Yaw Gy. Radius =  40.3 Meters    *
*      Heading = 270.00 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 DLB01 At X = 66.7 Y =   0.0 Z =   8.3

Process is 270: Units Are Degrees, Meters, and M-Tons Unless Specified

E N C O U N T E R		Surge / Wave Ampl.		Sway / Wave Ampl.		Heave / Wave Ampl.		Roll / Wave Ampl.		Pitch / Wave Ampl.		Yaw / Wave Ampl.	
Frequency	Period	Ampl.	Phase	Ampl.	Phase	Ampl.	Phase	Ampl.	Phase	Ampl.	Phase	Ampl.	Phase
-(Rad/Sec)-	-(Sec)-												
0.2513	25.00	0.033	104	0.816	-55	1.100	0	0.453	-102	0.001	153	0.243	-118
0.3142	20.00	0.014	148	0.875	-64	1.107	0	0.700	-104	0.002	160	0.146	-142
0.3307	19.00	0.015	158	0.879	-67	1.109	0	0.776	-105	0.003	147	0.125	-145
0.3491	18.00	0.016	160	0.879	-70	1.111	-1	0.867	-104	0.004	140	0.104	-146
0.3696	17.00	0.017	162	0.867	-72	1.114	-1	1.011	-105	0.004	147	0.092	-146
0.3927	16.00	0.018	163	0.850	-74	1.116	-1	1.213	-105	0.005	153	0.082	-145
0.4189	15.00	0.019	163	0.828	-75	1.120	-2	1.516	-106	0.007	157	0.074	-143
0.4333	14.50	0.019	163	0.814	-76	1.122	-2	1.732	-107	0.008	158	0.071	-142
0.4488	14.00	0.019	163	0.800	-76	1.125	-2	2.016	-109	0.010	158	0.068	-141
0.4654	13.50	0.020	162	0.784	-76	1.128	-2	2.401	-113	0.012	157	0.067	-140
0.4833	13.00	0.020	164	0.772	-75	1.133	-3	2.900	-121	0.014	153	0.068	-142
0.5027	12.50	0.021	160	0.772	-73	1.136	-3	3.513	-132	0.018	147	0.067	-144
0.5236	12.00	0.021	154	0.793	-72	1.134	-4	4.097	-149	0.022	138	0.062	-150
0.5464	11.50	0.021	150	0.826	-73	1.128	-5	4.413	-171	0.026	129	0.052	-157
0.5712	11.00	0.021	144	0.840	-76	1.119	-6	4.160	163	0.029	122	0.036	-160
0.5984	10.50	0.020	158	0.821	-80	1.150	-6	3.550	140	0.037	131	0.025	-159
0.6283	10.00	0.023	165	0.776	-82	1.188	-7	2.770	123	0.053	130	0.019	-146
0.6614	9.50	0.027	169	0.726	-83	1.233	-9	2.085	114	0.077	124	0.017	-133
0.6981	9.00	0.033	166	0.675	-82	1.270	-13	1.542	111	0.108	111	0.016	-126
0.7392	8.50	0.041	157	0.622	-80	1.284	-20	1.138	113	0.148	92	0.015	-123
0.7854	8.00	0.049	143	0.572	-78	1.250	-29	0.878	118	0.200	68	0.013	-120
0.8378	7.50	0.057	123	0.517	-74	1.116	-41	0.694	123	0.248	37	0.009	-121
0.8976	7.00	0.057	96	0.457	-70	0.880	-53	0.551	127	0.249	3	0.004	-139
0.9666	6.50	0.047	69	0.395	-62	0.602	-63	0.409	129	0.185	-27	0.003	133
1.0472	6.00	0.033	50	0.334	-52	0.363	-66	0.278	134	0.118	-48	0.008	109
1.1424	5.50	0.020	21	0.277	-37	0.186	-61	0.172	141	0.059	-57	0.011	97
1.2566	5.00	0.009	13	0.227	-17	0.073	-50	0.083	139	0.024	-70	0.015	102
1.3963	4.50	0.001	168	0.177	9	0.009	162	0.047	74	0.002	149	0.015	94
1.5708	4.00	0.011	78	0.122	47	0.033	-133	0.131	60	0.066	42	0.007	84
2.0944	3.00	0.011	-149	0.047	-131	0.193	-174	0.155	57	0.072	-146	0.001	10

```
*****************************************************************************************************************
*                                              ***  MOSES   ***                                                *
*                                              ---------------                                                 *
*                                                                                    29 May, 2014              *
*            TIMAS DLB-01                                                                                       *
*            RAOs - DURING PIPELAYING CONDITION                                                                *
*      Draft =   3.6 Meters                 Trim Angle =   0.50 Deg.          GMT = 15.64 Meters               *
*      Roll Gy. Radius = 19.2 Meters        Pitch Gy. Radius = 36.0 Meters    Yaw Gy. Radius =  40.3 Meters    *
*      Heading = 315.00 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 DLB01 At X = 66.7 Y =   0.0 Z =   8.3

Process is 315: Units Are Degrees, Meters, and M-Tons Unless Specified

E N C O U N T E R		Surge / Wave Ampl.		Sway / Wave Ampl.		Heave / Wave Ampl.		Roll / Wave Ampl.		Pitch / Wave Ampl.		Yaw / Wave Ampl.	
Frequency	Period	Ampl.	Phase	Ampl.	Phase	Ampl.	Phase	Ampl.	Phase	Ampl.	Phase	Ampl.	Phase
-(Rad/Sec)-	-(Sec)-												
0.2513	25.00	1.384	115	0.505	-34	1.087	17	0.329	-86	0.271	-73	0.303	-26
0.3142	20.00	1.039	121	0.597	-34	1.078	27	0.491	-81	0.430	-64	0.243	0
0.3307	19.00	0.989	123	0.600	-34	1.073	29	0.544	-78	0.477	-62	0.255	8
0.3491	18.00	0.944	127	0.600	-34	1.066	33	0.605	-75	0.532	-59	0.277	16
0.3696	17.00	0.901	131	0.591	-32	1.056	36	0.691	-72	0.595	-55	0.304	24
0.3927	16.00	0.859	136	0.576	-29	1.042	41	0.809	-68	0.670	-51	0.337	31
0.4189	15.00	0.815	141	0.554	-25	1.022	47	0.980	-64	0.759	-46	0.375	39
0.4333	14.50	0.793	145	0.541	-23	1.009	50	1.092	-61	0.809	-43	0.398	43
0.4488	14.00	0.769	148	0.525	-19	0.994	53	1.247	-59	0.864	-40	0.419	47
0.4654	13.50	0.743	153	0.507	-15	0.975	57	1.456	-58	0.922	-37	0.441	52
0.4833	13.00	0.714	157	0.489	-10	0.954	62	1.751	-59	0.985	-33	0.464	57
0.5027	12.50	0.682	162	0.473	-3	0.928	67	2.165	-64	1.049	-28	0.487	63
0.5236	12.00	0.645	168	0.475	3	0.896	73	2.609	-78	1.113	-24	0.510	69
0.5464	11.50	0.604	175	0.486	9	0.854	79	2.845	-99	1.184	-18	0.536	77
0.5712	11.00	0.558	-176	0.477	11	0.816	88	2.574	-126	1.269	-12	0.563	86
0.5984	10.50	0.501	-168	0.427	16	0.777	97	1.826	-149	1.351	-6	0.587	94
0.6283	10.00	0.436	-157	0.364	24	0.727	108	1.101	-158	1.414	1	0.601	105
0.6614	9.50	0.362	-144	0.302	36	0.666	119	0.631	-159	1.452	9	0.605	117
0.6981	9.00	0.283	-128	0.238	51	0.589	133	0.336	-158	1.457	19	0.597	131
0.7392	8.50	0.200	-107	0.171	68	0.490	148	0.157	-168	1.420	31	0.572	148
0.7854	8.00	0.113	-80	0.100	91	0.359	166	0.092	153	1.318	44	0.522	168
0.8378	7.50	0.030	-8	0.031	132	0.210	-163	0.100	133	1.094	58	0.440	-166
0.8976	7.00	0.075	115	0.034	-65	0.116	-100	0.087	145	0.692	74	0.315	-136
0.9666	6.50	0.112	165	0.069	-13	0.114	-30	0.049	178	0.259	110	0.159	-96
1.0472	6.00	0.108	-132	0.072	39	0.082	33	0.008	-62	0.101	-133	0.020	23
1.1424	5.50	0.085	-38	0.041	110	0.038	123	0.035	84	0.116	-22	0.099	179
1.2566	5.00	0.050	96	0.010	-39	0.026	-82	0.022	171	0.024	76	0.096	-95
1.3963	4.50	0.026	-72	0.020	113	0.008	90	0.016	86	0.013	-20	0.008	43
1.5708	4.00	0.005	-150	0.005	98	0.001	55	0.006	121	0.004	-86	0.027	-36
2.0944	3.00	0.021	51	0.002	46	0.064	83	0.058	-121	0.167	74	0.009	78

```
*************************************************************************************************************
*                                                    ***  MOSES   ***                                     *
*                                                    ----------------                      29 May, 2014    *
*              MOORING ANALYSIS OF BARGE "DLB01"                                                           *
*              Bow View                                                                                   *
*                                                                                                         *
*************************************************************************************************************
```

                    +++ I N D E X   O F   O U T P U T +++
                    ======================================

APPENDIX-3

Static Pipelay Analysis Output

```
    MMMMMM        MMMMMMMMMMM    MMMMMMMMMMM    MMMMMMMMM      MMMMMMMMM      MMMMMMMMM      MMMMMMMMMMM    MMMMMMMM
   MMMMMMMMMM      MMMMMMMMMMMM   MMMMMMMMMMMM   MMMMMMMMMM     MMMMMMMMMM     MMMMMMMMMM     MMMMMMMMMMMM   MMMMMMMMMM
  MMM    MMM      MMM            MMM            MMM    MMMM    MMM    MMMM    MMM            MMM            M       MMM
  MMM    MMM      MMM            MMM            MMM     MMM    MMM     MMM    MMM     MMMM   MMM                    MMM
  MMM    MMM      MMM            MMM            MMM     MMM    MMM     MMM    MMM    MMMM    MMM                    MMM
  MMM    MMM      MMMMMMMM       MMMMMMMM       MMMMMMMMMMM    MMM            MMMMMMMMM      MMMMMMMM              MMMM
  MMM    MMM      MMMMMMMM       MMMMMMMM       MMMMMMMM       MMM            MMMMMMMM       MMMMMMMM             MMMM
  MMM    MMM      MMM            MMM            MMM            MMM            MMM            MMM                   MMM
  MMM    MMM      MMM            MMM            MMM            MMM            MMM            MMM                   MMM
   MMM  MMM       MMM            MMM            MMM            MMM            MMM            MMM            M      MMM
   MMMMMMMMM      MMM            MMM            MMM            MMMMMMMM       MMM            MMMMMMMMMMM    MMMMMMMMMM
    MMMMM         MMM            MMM            MMM            MMMMMMMM       MMM            MMMMMMMMMMM    MMMMMMM
```

```
==============================================================================
OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP          PAGE   3
Pipelay Analysis
JOB NO. - Static Analysis       LICENSED TO - OFFSHORE CONSTR. SPECIALISTS
USER ID - Karun                 DATE - 3/25/2015  TIME - 11:31:22   CASE   1
==============================================================================
```

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

PRINTED OUTPUT SELECTED
=======================
     STATIC PIPE FORCES AND STRESSES ...   YES
     STATIC SOLUTION SUMMARY ....   YES
     DYNAMIC PIPE FORCES AND STRESSES ..   NO
     DYNAMIC RANGE OF PIPE DATA ....   NO
     DYNAMIC TRACKING OF PIPE DATA .....   NO
     OVERBEND PIPE SUPPORT GEOMETRY ....   NO
     STINGER BALLAST SCHEDULE DATA .....   NO
     SUPPORT REACTIONS IN BARGE COORDS .   NO

     INTERNAL FORCES IN PIPE & CABLE ...   NO
     INTERNAL FORCES IN STINGER ....   NO
     PRINT PIPE STRAINS IN OUTPUT ......   NO
     DNV OS-F101 COMPLIANCE REPORT .....   NO
     API RP-1111 COMPLIANCE REPORT .....   NO
     PRINT DNV/API FACTORS & PARAMETERS   NO
     USE THICK WALL HOOP STRESS EQN. ...   NO
     USE DNV 1981 FOR TOTAL PIPE STRESS   NO

     ENABLE/DISABLE WARNING MESSAGES ...   ENABLE
     GENERATE SPREAD SHEET PLOT FILE ...   NO
     GENERATE ASCII PLOT DATA FILES ....   NO

PROFILE PLOT TABLE ENTRIES
==========================
     PLOT TABLE INDEX   1
     PLOT NUMBER   1
     PLOT TYPE OPTION NUMBER   1
     DYNAMIC PROFILE TIME POINT 0.000
     DYNAMIC PROFILE TIME INCREMENT 0.000
     ORDINATE PARAMETER CODE NUMBER   2
     AXIS LABEL FOR ORDINATE .... "Pipe Elevation Y-Coordinate   "
     ABSCISSA PARAMETER CODE NUMBER   1
     AXIS LABEL FOR ABSCISSA .... "Pipe Horizal X-Coordinate   "

```
       PLOT TITLE ...................... "Pipe Elevation and Total Pipe Stress              "
    MINIMUM VERTICAL AXIS RANGE .......     0.000
    MAXIMUM VERTICAL AXIS RANGE .......     0.000
    MINIMUM HORIZONTAL AXIS RANGE .....     0.000
    MAXIMUM HORIZONTAL AXIS RANGE .....     0.000

==============================================================================
OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP          PAGE   4
Pipelay Analysis
JOB NO. - Static Analysis        LICENSED TO - OFFSHORE CONSTR. SPECIALISTS
USER ID - Karun                  DATE - 3/25/2015  TIME - 11:31:22   CASE   1
==============================================================================

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


    PROFILE PLOT TABLE ENTRIES
    ==========================
       PLOT TABLE INDEX ..................     2
       PLOT NUMBER ......................     1
       PLOT TYPE OPTION NUMBER ...........     1
       DYNAMIC PROFILE TIME POINT ........     0.000
       DYNAMIC PROFILE TIME INCREMENT ....     0.000
       ORDINATE PARAMETER CODE NUMBER ....     14
       AXIS LABEL FOR ORDINATE .......... "Total Stress Von Mises           "
       ABSCISSA PARAMETER CODE NUMBER ....     1
       AXIS LABEL FOR ABSCISSA .......... "Pipe Horizantal  X-Coordinate    "

       PLOT TITLE ...................... "Pipe Elevation and Total Pipe Stress              "
    MINIMUM VERTICAL AXIS RANGE .......     0.000
    MAXIMUM VERTICAL AXIS RANGE .......     0.000
    MINIMUM HORIZONTAL AXIS RANGE .....     0.000
    MAXIMUM HORIZONTAL AXIS RANGE .....     0.000

    PROFILE PLOT TABLE ENTRIES
    ==========================
       PLOT TABLE INDEX ..................     3
       PLOT NUMBER ......................     2
       PLOT TYPE OPTION NUMBER ...........     1
       DYNAMIC PROFILE TIME POINT ........     0.000
       DYNAMIC PROFILE TIME INCREMENT ....     0.000
       ORDINATE PARAMETER CODE NUMBER ....     10
       AXIS LABEL FOR ORDINATE .......... "Vertical Bending Moment          "
       ABSCISSA PARAMETER CODE NUMBER ....     1
       AXIS LABEL FOR ABSCISSA .......... "Pipe Horizantal X-Coordinate     "

       PLOT TITLE ...................... "Vertical Bending Moment and Pipe Support Reactions    "
    MINIMUM VERTICAL AXIS RANGE .......     0.000
    MAXIMUM VERTICAL AXIS RANGE .......     0.000
    MINIMUM HORIZONTAL AXIS RANGE .....     0.000
    MAXIMUM HORIZONTAL AXIS RANGE .....     0.000

==============================================================================
OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP          PAGE   5
Pipelay Analysis
JOB NO. - Static Analysis        LICENSED TO - OFFSHORE CONSTR. SPECIALISTS
USER ID - Karun                  DATE - 3/25/2015  TIME - 11:31:22   CASE   1
==============================================================================

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


    PROFILE PLOT TABLE ENTRIES
    ==========================
       PLOT TABLE INDEX ..................     4
       PLOT NUMBER ......................     2
       PLOT TYPE OPTION NUMBER ...........     1
       DYNAMIC PROFILE TIME POINT ........     0.000
       DYNAMIC PROFILE TIME INCREMENT ....     0.000
       ORDINATE PARAMETER CODE NUMBER ....     7
       AXIS LABEL FOR ORDINATE .......... "Vertical Pipe Support Reaction  "
       ABSCISSA PARAMETER CODE NUMBER ....     1
       AXIS LABEL FOR ABSCISSA .......... "Pipe Horizantal  X-Coordinate    "

       PLOT TITLE ...................... "Vertical Bending Moment and Pipe Support Reaction      "
    MINIMUM VERTICAL AXIS RANGE .......     0.000
    MAXIMUM VERTICAL AXIS RANGE .......     0.000
    MINIMUM HORIZONTAL AXIS RANGE .....     0.000
    MAXIMUM HORIZONTAL AXIS RANGE .....     0.000

    PIPE PROPERTIES
    ===============
       PIPE PROPERTY TABLE ROW ...........     1
       PIPE SECTION LENGTH ...............     0.000 METERS
       STEEL MODULUS OF ELASTICITY .......  207000. M-PASCAL
       STEEL CROSS SECTIONAL AREA ........  128.475 CM^2
       COATED PIPE AVG MOMENT OF INERTIA . 12671.51 CM^4
       WEIGHT PER-UNIT-LENGTH IN AIR .....  2205.00 N/M
       WEIGHT PER-UNIT-LENGTH SUBMERGED ..  1164.00 N/M
       MAXIMUM ALLOWABLE PIPE STRAIN .....  0.000000 PERCENT

       STEEL OUTSIDE DIAMETER ............  27.3100 CM
       STEEL WALL THICKNESS ..............   1.5900 CM
       YIELD STRESS ......................   450.00 M-PASCAL
       STRESS/STRAIN INTENSE FACTOR ......   0.0000
       HYDRODYNAMIC OUTSIDE DIAMETER .....    0.000 CM
       DRAG COEFFICIENT ..................   0.0000
       HYDRODYNAMIC TOTAL AREA ...........    0.000 CM^2
       ADDED MASS COEFFICIENT ............   0.0000
       POISSON'S RATIO FOR STEEL PIPE ....   0.0000
       COEFFICIENT OF THERMAL EXPANSION ..0.00000000 1/DEG C
```

```
================================================================================
OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP          PAGE   6
Pipelay Analysis
JOB NO. - Static Analysis         LICENSED TO - OFFSHORE CONSTR. SPECIALISTS
USER ID - Karun                   DATE -  3/25/2015   TIME - 11:31:22   CASE   1
================================================================================

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


    PIPE COATING PROPERTIES
    =======================
       PIPE PROPERTY TABLE INDEX .........      1
       CORROSION COATING THICKNESS .......    0.230 CM
       CORROSION COATING WEIGHT DENSITY ..   9218.0 N/M^3
       CORROSION COATING ELASTIC MODULUS .    0.000 M-PASCAL
       CONCRETE COATING THICKNESS ........    4.000 CM
       CONCRETE COATING WEIGHT DENSITY ...   29846. N/M^3
       CONCRETE COATING ELASTIC MODULUS ..    0.000 M-PASCAL
       DESIRED PIPE SPECIFIC GRAVITY .....    0.0000
       CONCRETE STIFFENING EFFECTIVENESS .    0.000
       NO NOT CALC. STRESS FOR BARE PIPE .      NO

       AVERAGE LENGTH OF PIPE JOINT ......   12.200 METERS
       EFFECTIVE FIELD JOINT LENGTH ......    0.700 METERS
       FIELD JOINT FILL WEIGHT DENSITY ...   2177.0 N/M^3
       FIELD JOINT FILL ELASTIC MODULUS...    0.000 M-PASCAL
       FIELD JOINT STIFFENING EFFECT. ....    0.000
       FIELD JOINT BENDING MODEL .........        0 IGNORE COATING STIFFNESS
       WEIGHT DENSITY OF STEEL ...........   76982. N/M^3
       WEIGHT DENSITY OF PIPE CONTENTS ...      0.0 N/M^3
       REF. ELEVATION FOR STATIC HEAD ....     0.00 METERS
       FREE FLOOD PIPE DURING PIPELAY ....      NO


================================================================================
OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP          PAGE   7
Pipelay Analysis
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                    I N P U T   D A T A   E C H O


    LAYBARGE DESCRIPTION
    ====================
       NUMBER OF PIPE NODES ..............     12
       BARGE GEOMETRY SPECIFIED BY .......      1 X-Y COORDINATES
       OVERBEND PIPE SUPPORT RADIUS ......    0.000 METERS
       ADJUST Y COORDINATES MANUALLY .....      NO
       TANGENT POINT X-COORDINATE ........    0.000 METERS
       TANGENT POINT Y-COORDINATE ........    0.000 METERS
       PIPE ANGLE RELATIVE TO DECK .......   0.0000 DEGREES
       HEIGHT OF DECK ABOVE WATER ........    4.000 METERS
       LAYBARGE FORWARD (X) OFFSET .......    0.000 METERS
       BARGE TRIM ANGLE ..................   0.5000 DEGREES

       STERN SHOE X COORDINATE ..........     0.000 METERS
       STERN SHOE Y COORDINATE ..........     0.000 METERS
       ROTATION CENTER X COORDINATE ......   55.000 METERS
       ROTATION CENTER Y COORDINATE ......   -4.000 METERS
       ROTATION CENTER Z COORDINATE ......    0.000 METERS
       BARGE HEADING .....................   0.0000 DEGREES
       BARGE OFFSET FROM RIGHT-OF-WAY ....    0.000 METERS
       PIPE RAMP PIVOT X COORDINATE ......    0.000 METERS
       PIPE RAMP PIVOT Y COORDINATE ......    0.000 METERS
       PIPE RAMP PIVOT VERTICAL ANGLE ....    0.000 DEGREES
       PIPE RAMP PIVOT Z COORDINATE ......    0.000 METERS
       PIPE RAMP HEADING ON BARGE DECK ...    0.000 DEGREES

       NODE X    NODE Y        SUPPORT          DAVIT
        COORD    COORD           TYPE          SPACING
        (M  )    (M  )                          (M  )
       =======  =======   ====================  =======
        96.368    2.489     1  SIMPLE SUPPORT     0.000
        84.332    2.305     1  SIMPLE SUPPORT     0.000
        73.503    2.131     1  SIMPLE SUPPORT     0.000
        60.152    1.754     2  PIPE TENSIONER     0.000
        51.139    1.956   100  UNSUPPORTED NODE   0.000
        46.492    1.532     1  SIMPLE SUPPORT     0.000
        39.452    1.586   100  UNSUPPORTED NODE   0.000
        35.401    1.040     2  PIPE TENSIONER     0.000
        26.141    0.824   100  UNSUPPORTED NODE   0.000
        23.381    0.480    10  USER DEFINED SPT   0.000
         8.913   -0.940    10  USER DEFINED SPT   0.000
         3.123   -1.920    11  USER DEFINED SPT   0.000


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OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP          PAGE   8
Pipelay Analysis
JOB NO. - Static Analysis         LICENSED TO - OFFSHORE CONSTR. SPECIALISTS
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                    I N P U T   D A T A   E C H O


    SUPPORT ELEMENT PROPERTIES
    ==========================
       SUPPORT PROPERTY TABLE INDEX ......       10
       SUPPORT ELEMENT TYPE ..............        1 SIMPLE SUPPORT
```

```
     SUPPORT INITIAL STATE FLAG ........        0
     TENSIONER AXIAL STIFFNESS (F/L) ...   0.000E+00 KN/M
     VERTICAL STIFFNESS (F/L) ..........   0.000E+00 KN/M
     STATIC VERTICAL DEFLECTION ........     0.0000 CM
     LATERAL STIFFNESS (F/L) ...........   0.000E+00 KN/M

     BOTTOM ROLLER ANGLE TO HORIZONTAL .    30.000 DEGREES
     SIDE ROLLER ANGLE TO VERTICAL .....     0.000 DEGREES
     SIDE ROLLER OFFSET FROM C.L. ......     0.000 METERS
     BED ROLLER LENGTH .................     0.000 METERS
     HEIGHT OF TOP ROLLER ABOVE BED ....     0.000 METERS
     TENSIONER X-AXIS ROTATIONAL STIF. .     0.000 KN/DEG
     TENSIONER Y-AXIS ROTATIONAL STIF. .     0.000 KN/DEG
     TENSIONER Y-AXIS ROTATIONAL STIF. .     0.000 KN/DEG

  SUPPORT ELEMENT PROPERTIES
  ==========================
     SUPPORT PROPERTY TABLE INDEX ......       11
     SUPPORT ELEMENT TYPE ..............        1 SIMPLE SUPPORT
     SUPPORT INITIAL STATE FLAG ........        0
     TENSIONER AXIAL STIFFNESS (F/L) ...   0.000E+00 KN/M
     VERTICAL STIFFNESS (F/L) ..........   0.000E+00 KN/M
     STATIC VERTICAL DEFLECTION ........     0.0000 CM
     LATERAL STIFFNESS (F/L) ...........   0.000E+00 KN/M

     BOTTOM ROLLER ANGLE TO HORIZONTAL .    30.000 DEGREES
     SIDE ROLLER ANGLE TO VERTICAL .....     0.000 DEGREES
     SIDE ROLLER OFFSET FROM C.L. ......     0.000 METERS
     BED ROLLER LENGTH .................     0.000 METERS
     HEIGHT OF TOP ROLLER ABOVE BED ....     0.000 METERS
     TENSIONER X-AXIS ROTATIONAL STIF. .     0.000 KN/DEG
     TENSIONER Y-AXIS ROTATIONAL STIF. .     0.000 KN/DEG
     TENSIONER Y-AXIS ROTATIONAL STIF. .     0.000 KN/DEG
```

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OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP         PAGE   9
Pipelay Analysis
JOB NO. - Static Analysis         LICENSED TO - OFFSHORE CONSTR. SPECIALISTS
USER ID - Karun                   DATE - 3/25/2015   TIME - 11:31:22   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 ......       21
     SUPPORT ELEMENT TYPE ..............        1 SIMPLE SUPPORT
     SUPPORT INITIAL STATE FLAG ........        0
     TENSIONER AXIAL STIFFNESS (F/L) ...   0.000E+00 KN/M
     VERTICAL STIFFNESS (F/L) ..........   0.000E+00 KN/M
     STATIC VERTICAL DEFLECTION ........     0.0000 CM
     LATERAL STIFFNESS (F/L) ...........   0.000E+00 KN/M

     BOTTOM ROLLER ANGLE TO HORIZONTAL .    30.000 DEGREES
     SIDE ROLLER ANGLE TO VERTICAL .....     0.000 DEGREES
     SIDE ROLLER OFFSET FROM C.L. ......     0.000 METERS
     BED ROLLER LENGTH .................     0.000 METERS
     HEIGHT OF TOP ROLLER ABOVE BED ....     0.000 METERS
     TENSIONER X-AXIS ROTATIONAL STIF. .     0.000 KN/DEG
     TENSIONER Y-AXIS ROTATIONAL STIF. .     0.000 KN/DEG
     TENSIONER Y-AXIS ROTATIONAL STIF. .     0.000 KN/DEG

  SUPPORT ELEMENT PROPERTIES
  ==========================
     SUPPORT PROPERTY TABLE INDEX ......       22
     SUPPORT ELEMENT TYPE ..............        1 SIMPLE SUPPORT
     SUPPORT INITIAL STATE FLAG ........        0
     TENSIONER AXIAL STIFFNESS (F/L) ...   0.000E+00 KN/M
     VERTICAL STIFFNESS (F/L) ..........   0.000E+00 KN/M
     STATIC VERTICAL DEFLECTION ........     0.0000 CM
     LATERAL STIFFNESS (F/L) ...........   0.000E+00 KN/M

     BOTTOM ROLLER ANGLE TO HORIZONTAL .    30.000 DEGREES
     SIDE ROLLER ANGLE TO VERTICAL .....     0.000 DEGREES
     SIDE ROLLER OFFSET FROM C.L. ......     0.000 METERS
     BED ROLLER LENGTH .................     0.000 METERS
     HEIGHT OF TOP ROLLER ABOVE BED ....     0.000 METERS
     TENSIONER X-AXIS ROTATIONAL STIF. .     0.000 KN/DEG
     TENSIONER Y-AXIS ROTATIONAL STIF. .     0.000 KN/DEG
     TENSIONER Y-AXIS ROTATIONAL STIF. .     0.000 KN/DEG
```

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OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP         PAGE  10
Pipelay Analysis
JOB NO. - Static Analysis         LICENSED TO - OFFSHORE CONSTR. SPECIALISTS
USER ID - Karun                   DATE - 3/25/2015   TIME - 11:31:22   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 ......       23
     SUPPORT ELEMENT TYPE ..............        1 SIMPLE SUPPORT
     SUPPORT INITIAL STATE FLAG ........        0
     TENSIONER AXIAL STIFFNESS (F/L) ...   0.000E+00 KN/M
     VERTICAL STIFFNESS (F/L) ..........   0.000E+00 KN/M
     STATIC VERTICAL DEFLECTION ........     0.0000 CM
     LATERAL STIFFNESS (F/L) ...........   0.000E+00 KN/M
```

```
      BOTTOM ROLLER ANGLE TO HORIZONTAL .    30.000 DEGREES
      SIDE ROLLER ANGLE TO VERTICAL .....     0.000 DEGREES
      SIDE ROLLER OFFSET FROM C.L. ......     0.000 METERS
      BED ROLLER LENGTH ................     0.000 METERS
      HEIGHT OF TOP ROLLER ABOVE BED ....     0.000 METERS
      TENSIONER X-AXIS ROTATIONAL STIF. .     0.000 KN/DEG
      TENSIONER Y-AXIS ROTATIONAL STIF. .     0.000 KN/DEG
      TENSIONER Y-AXIS ROTATIONAL STIF. .     0.000 KN/DEG

   STINGER DESCRIPTION
   ===================
      NUMBER OF PIPE/STINGER NODES ......         7
      STINGER GEOMETRY SPECIFIED BY .....         1 X-Y COORD AND TANGENT PT
      STINGER TYPE ......................         6 ARTICULATED
      OVERBEND PIPE SUPPORT RADIUS ......    200.00 METERS
      HITCH X-COORDINATE ................    -1.855 METERS
      HITCH Y-COORDINATE ................    -3.712 METERS
      HITCH ANGULAR ORIENTATION .........     0.000 DEGREES

      X COORDINATE OF LOCAL ORIGIN ......    -1.855 METERS
      Y COORDINATE OF LOCAL ORIGIN ......    -3.712 METERS
      ROTATION ABOUT STINGER HITCH ......     0.000 DEGREES
      TANGENT POINT X-COORDINATE ........     3.123 METERS
      TANGENT POINT Y-COORDINATE ........    -1.850 METERS
      TANGENT POINT ANGLE ...............     0.000 DEGREES

       NODE X     NODE Y        SUPPORT                ELEMENT          ELEMENT
        COORD      COORD          TYPE                   TYPE           LENGTH
        (M  )      (M  )                                                (M  )
       ========   ========   ====================   ====================   =======
        -2.894      0.000    300 NO PIPE NODE          6  USER DEFINED       2.894
        -5.593      1.106     22 USER DEFINED          10 USER DEFINED       2.699
       -14.737      1.089     23 USER DEFINED          10 USER DEFINED       9.144
       -19.487      0.000    300 NO PIPE NODE          4  USER DEFINED       4.750
       -24.592      1.085     22 USER DEFINED          13 USER DEFINED       5.105
       -35.400      1.085     21 USER DEFINED          11 USER DEFINED      10.808
       -38.518      0.638      1 SIMPLE SUPPORT        4  USER DEFINED       3.118
```

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OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP   PAGE 11
Pipelay Analysis
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               I N P U T   D A T A   E C H O

   STINGER SECTION PROPERTIES
   ==========================
      STINGER PROPERTY TABLE INDEX   4
      STINGER ELEMENT TYPE ....   1 FIXED END
      AXIAL STIFFNESS (EA) .... 0.000E+00 K-NEWTON
      VERTICAL BENDING STIFFNESS (EI) ... 0.000E+00 KN-M^2
      VERTICAL HINGE STOP STIFFNESS ..... 0.000E+00 N-M
      VERTICAL ANGLE OF FREE ROTATION ...   0.000 DEGREES
      VERTICAL PROJECTED AREA/LENGTH ....   4.30 METERS

      DISPLACED VOLUME PER-UNIT-LENGTH ..   3.600 M^2
      DRAG COEFFICIENT 0.0000
      ADDED MASS COEFFICIENT 0.0000
      HORIZONTAL BENDING STIFFNESS ...... 0.000E+00 KN-M^2
      HORIZONTAL HINGE STOP STIFFNESS ... 0.000E+00 N-M
      HORIZONTAL ANGLE OF ROTATION ......   0.0000 DEGREES
      HORIZONTAL PROJECTED AREA/LENGTH ..   4.300 METERS

   STINGER SECTION PROPERTIES
   ==========================
      STINGER PROPERTY TABLE INDEX   6
      STINGER ELEMENT TYPE ....   2 HINGED END
      AXIAL STIFFNESS (EA) .... 0.000E+00 K-NEWTON
      VERTICAL BENDING STIFFNESS (EI) ... 0.000E+00 KN-M^2
      VERTICAL HINGE STOP STIFFNESS ..... 0.000E+00 N-M
      VERTICAL ANGLE OF FREE ROTATION ...   20.000 DEGREES
      VERTICAL PROJECTED AREA/LENGTH ....   4.30 METERS

      DISPLACED VOLUME PER-UNIT-LENGTH ..   3.600 M^2
      DRAG COEFFICIENT 0.0000
      ADDED MASS COEFFICIENT 0.0000
      HORIZONTAL BENDING STIFFNESS ...... 0.000E+00 KN-M^2
      HORIZONTAL HINGE STOP STIFFNESS ... 0.000E+00 N-M
      HORIZONTAL ANGLE OF ROTATION ......   0.0000 DEGREES
      HORIZONTAL PROJECTED AREA/LENGTH ..   4.300 METERS

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OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP   PAGE 12
Pipelay Analysis
JOB NO. - Static Analysis   LICENSED TO - OFFSHORE CONSTR. SPECIALISTS
USER ID - Karun   DATE - 3/25/2015 TIME - 11:31:22 CASE   1
===

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

   STINGER SECTION PROPERTIES
   ==========================
      STINGER PROPERTY TABLE INDEX   10
      STINGER ELEMENT TYPE ....   1 FIXED END
      AXIAL STIFFNESS (EA) .... 0.000E+00 K-NEWTON
      VERTICAL BENDING STIFFNESS (EI) ... 0.000E+00 KN-M^2
      VERTICAL HINGE STOP STIFFNESS ..... 0.000E+00 N-M
      VERTICAL ANGLE OF FREE ROTATION ...   0.000 DEGREES

```
        VERTICAL PROJECTED AREA/LENGTH ....       4.30 METERS

        DISPLACED VOLUME PER-UNIT-LENGTH ..       3.600 M^2
        DRAG COEFFICIENT ..................       0.0000
        ADDED MASS COEFFICIENT ............       0.0000
        HORIZONTAL BENDING STIFFNESS ......   0.000E+00 KN-M^2
        HORIZONTAL HINGE STOP STIFFNESS ...   0.000E+00 N-M
        HORIZONTAL ANGLE OF ROTATION ......       0.0000 DEGREES
        HORIZONTAL PROJECTED AREA/LENGTH ..       4.300 METERS

    STINGER SECTION PROPERTIES
    ==========================
        STINGER PROPERTY TABLE INDEX ......          11
        STINGER ELEMENT TYPE ..............           1 FIXED END
        AXIAL STIFFNESS (EA) ..............   0.000E+00 K-NEWTON
        VERTICAL BENDING STIFFNESS (EI) ...   0.000E+00 KN-M^2
        VERTICAL HINGE STOP STIFFNESS .....   0.000E+00 N-M
        VERTICAL ANGLE OF FREE ROTATION ...       0.000 DEGREES
        VERTICAL PROJECTED AREA/LENGTH ....       5.40 METERS

        DISPLACED VOLUME PER-UNIT-LENGTH ..       5.400 M^2
        DRAG COEFFICIENT ..................       0.0000
        ADDED MASS COEFFICIENT ............       0.0000
        HORIZONTAL BENDING STIFFNESS ......   0.000E+00 KN-M^2
        HORIZONTAL HINGE STOP STIFFNESS ...   0.000E+00 N-M
        HORIZONTAL ANGLE OF ROTATION ......       0.0000 DEGREES
        HORIZONTAL PROJECTED AREA/LENGTH ..       5.400 METERS
```

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OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP        PAGE  13
Pipelay Analysis
JOB NO. - Static Analysis       LICENSED TO - OFFSHORE CONSTR. SPECIALISTS
USER ID - Karun                 DATE - 3/25/2015   TIME - 11:31:22   CASE   1
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                     I N P U T   D A T A   E C H O


    STINGER SECTION PROPERTIES
    ==========================
        STINGER PROPERTY TABLE INDEX ......          13
        STINGER ELEMENT TYPE ..............           2 HINGED END
        AXIAL STIFFNESS (EA) ..............   0.000E+00 K-NEWTON
        VERTICAL BENDING STIFFNESS (EI) ...   0.000E+00 KN-M^2
        VERTICAL HINGE STOP STIFFNESS .....   0.000E+00 N-M
        VERTICAL ANGLE OF FREE ROTATION ...      11.000 DEGREES
        VERTICAL PROJECTED AREA/LENGTH ....       4.30 METERS

        DISPLACED VOLUME PER-UNIT-LENGTH ..       3.600 M^2
        DRAG COEFFICIENT ..................       0.0000
        ADDED MASS COEFFICIENT ............       0.0000
        HORIZONTAL BENDING STIFFNESS ......   0.000E+00 KN-M^2
        HORIZONTAL HINGE STOP STIFFNESS ...   0.000E+00 N-M
        HORIZONTAL ANGLE OF ROTATION ......       0.0000 DEGREES
        HORIZONTAL PROJECTED AREA/LENGTH ..       4.300 METERS

    STINGER SECTION BALLAST SCHEDULE
    ================================
        SECTION      BALLAST
        NUMBER       CONTENTS
                     (KN  )
        =======      ========
           1          0.000
           2          0.000
           3        190.000
           4         10.000
           5          0.000
           6        250.000
           7         40.000

    STINGER SECTION WEIGHTS AND DISPLACEMENTS
    =========================================
        SECTION     SECTION     DISPLACE
        NUMBER      WEIGHT       -MENT
                    (KN  )       (KN  )
        ======      ======      ======
           1        65.584      67.840
           2       142.262     130.680
           3       271.728     368.710
           4       170.075     189.690
           5       180.490     222.830
           6       428.110     807.400
           7       130.070     122.200
```

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================================================================================
OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP        PAGE  14
Pipelay Analysis
JOB NO. - Static Analysis       LICENSED TO - OFFSHORE CONSTR. SPECIALISTS
USER ID - Karun                 DATE - 3/25/2015   TIME - 11:31:22   CASE   1
================================================================================
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                     I N P U T   D A T A   E C H O


    PIPE TENSION DATA
    =================
        STATIC PIPE TENSION ON LAY VESSEL .   250.000 K-NEWTON
        MINIMUM DYNAMIC PIPE TENSION ......   225.000 K-NEWTON
        MAXIMUM DYNAMIC PIPE TENSION ......   275.000 K-NEWTON
        STATIC HORIZONTAL BOTTOM TENSION ..     0.000 K-NEWTON
        NO. OF VALUES FOR TENSION PROFILE .        0
        VALUES ARE FOR PIPE SPAN ANALYSIS .       NO
```

```
     MAXIMUM PIPE PAYOUT SPEED .........     0.000 M/SEC
     MAXIMUM PIPE TAKEUP SPEED .........     0.000 M/SEC

  SAGBEND GEOMETRY
  ================
     SAGBEND PIPE ELEMENT LENGTH .......     6.000 METERS
     WATER DEPTH ......................     21.34 METERS
     X-COORDINATE AT SPECIFIED DEPTH . .     0.00 METERS
     ESTIMATED SAGBEND X LENGTH ........     0.00 METERS
     ESTIMATED PIPE LENGTH ON SEABED ...     0.00 METERS
     X-COORD OF PIPE FREE END ON SEABED      0.00 METERS
     X-COORD POINT OF FIXITY ON SEABED .     0.00 METERS
     MAXIMUM SLOPE (ANGLE) OF SEABED ...     0.000 DEGREES
     DIRECTION OF MAXIMUM SLOPE ........     0.000 DEGREES

     PIPE/CABLE SPAN END CONDITION .....        0 PIPE/CABLE RESTING ON SEABED
     PIPE/CABLE SPAN LENGTH GIVEN BY ...        0 SPECIFIED PIPE/CABLE TENSION
     ESTIMATED SPAN DEPTH AT FREE END ..     0.00 METERS
     PIPE VERTICAL ANGLE AT FREE END ...     0.000 DEGREES
     BOTTOM HINGE OFFSET ...............     0.000 METERS
     BOTTOM HINGE MINIMUM ANGLE ........     0.000 DEGREES
     BOTTOM HINGE MAXIMUM ANGLE ........     0.000 DEGREES

  SOIL ELEMENT PROPERTIES
  =======================
     SOIL PROPERTY TABLE ROW INDEX .....        0
     SOIL ELEMENT TYPE (FUTURE USE) ....        0
     PIPE INDEX OR SEGMENT NUMBER ......        0
     LONGITUDINAL SOIL STIFFNESS .......     0.00 KN/M^2
     VERTICAL SOIL STIFFNESS ...........     0.00 KN/M^2
     LATERAL SOIL STIFFNESS ............     0.00 KN/M^2
     DEFLECTION UNDER REFERENCE LOAD ...   0.0000 CM

     LONGITUDINAL COEF. OF FRICTION ....     0.500
     LATERAL COEFFICIENT OF FRICTION ...     0.000
     NUMBER 0F INTEGRATION POINTS ......        0

  STATIC SOLUTION CONVERGED IN (      16 ) ITERATIONS


  END OF INPUT DATA

  ====================================================================================================================
     OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP          DATE - 3/25/2015    TIME - 11:31:22    PAGE   16
     PROJECT - Pipelay Analysis                                            JOB NO. - Static Analysis
     USER ID - Karun                                     LICENSED TO - OFFSHORE CONSTR. SPECIALISTS          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   PIPE        X        Y      VERT    PIPE    SUPPORT  SEPARA   AXIAL   BENDING  TENSILE  BENDING   TOTAL   PERCNT
  NO.    SECTION    COORD    COORD   ANGLE   LENGTH  REACTION -TION    TENSION  MOMENT   STRESS   STRESS   STRESS   YIELD
                    (M  )    (M  )   (DEG )  (M  )   (KN  )   (M  )    (KN  )   (KN-M)   (MPA )   (MPA )   (MPA )   (PCT )
  ====================================================================================================================
     1   LAYBARGE   96.31    6.85    1.65    0.00    11.793   0.000     0.00     0.00     0.00     0.00     0.00    0.00
     3   LAYBARGE   84.28    6.56    1.18   12.04    20.027   0.000    -0.64   -17.75    -0.05   -22.73    22.78    5.06
     5   LAYBARGE   73.45    6.29    1.94   22.87    43.428   0.000    -1.38   -89.78    -0.11  -114.96   115.06   25.57
     7   TENSIONR   60.10    5.80    1.63   36.22     4.501   0.000   122.64    45.65     9.55    58.45    68.00   15.11
     9   LAYBARGE   51.09    5.59    1.28   45.24     0.000   0.000   122.20   -38.81     9.51   -49.69    59.21   13.16
    10   LAYBARGE   46.44    5.46    2.22   49.89    62.537   0.000   121.47  -155.50     9.45  -199.11   208.57   46.35
    12   LAYBARGE   39.41    5.10    3.27   56.93     0.000   0.000   121.13    -1.95     9.43    -2.50    11.93    2.65
    13   TENSIONR   35.36    4.87    3.10   60.99    -8.575   0.000   245.61    34.57    19.12    44.27    63.38   14.09
    15   LAYBARGE   26.10    4.38    3.34   70.26     0.000   0.000   244.40   -91.72    19.02  -117.45   136.47   30.33
    16   LAYBARGE   23.34    4.20    4.13   73.02    57.026   0.000   243.59  -174.11    18.96  -222.94   241.90   53.75
    18   LAYBARGE    8.89    2.66    8.23   87.56    61.048   0.000   239.98  -202.97    18.68  -259.90   278.58   61.91
    20   LAYBARGE    3.09    1.72    9.81   93.44     0.000   0.096   238.62   -62.79    18.57   -80.40    98.75   21.99

    24   STINGER    -7.53   -0.19   10.50  104.23     6.423   0.000   234.65   -40.85    18.26   -52.30    70.56   15.68
    26   STINGER   -16.50   -1.95   12.13  113.37    36.421   0.000   232.21  -148.53    17.98  -190.19   208.26   46.28
    29   STINGER   -26.19   -4.26   14.48  123.33    13.843   0.000   229.75  -102.12    17.69  -130.76   148.63   33.03
    31   STINGER   -36.60   -7.16   16.68  134.14    35.819   0.000   226.29  -121.91    17.29  -156.11   173.70   38.60
    33   STINGER   -39.59   -8.07   17.29  137.27     0.000   0.366   225.44   -58.23    17.18   -74.56    92.08   20.46

    35   SAGBEND   -45.30   -9.87   17.47  143.25     0.000   0.000   223.41    22.59    16.94    28.92    46.29   10.29
    36   SAGBEND   -51.03  -11.64   16.84  149.25     0.000   0.000   221.26    69.84    16.69    89.43   106.63   23.69
    37   SAGBEND   -56.79  -13.33   15.72  155.25     0.000   0.000   219.21    97.70    16.45   125.10   142.13   31.58
    38   SAGBEND   -62.58  -14.88   14.32  161.25     0.000   0.000   217.33   114.32    16.23   146.39   163.27   36.28
    39   SAGBEND   -68.41  -16.29   12.76  167.25     0.000   0.000   215.65   124.29    16.04   159.14   175.89   39.09
    40   SAGBEND   -74.28  -17.53   11.09  173.25     0.000   0.000   214.18   130.06    15.87   166.54   183.17   40.70
    41   SAGBEND   -80.19  -18.59    9.36  179.25     0.000   0.000   212.92   132.89    15.72   170.15   186.68   41.49
    42   SAGBEND   -86.12  -19.48    7.61  185.25     0.000   0.000   211.89   133.14    15.60   170.48   186.93   41.54
    43   SAGBEND   -92.08  -20.18    5.88  191.25     0.000   0.000   211.08   130.52    15.50   167.12   183.50   40.78
    44   SAGBEND   -98.06  -20.71    4.21  197.25     0.000   0.000   210.50   123.94    15.44   158.69   175.03   38.90
    45   SAGBEND  -104.05  -21.07    2.66  203.25     0.000   0.000   210.14   111.23    15.39   142.43   158.74   35.27
    46   SAGBEND  -110.04  -21.28    1.34  209.25     0.084   0.000   209.99    88.52    15.37   113.35   129.65   28.81

    47   SEABED   -116.04  -21.36    0.41  215.25     5.071   0.000   210.00    50.04    15.37    64.07    80.38   17.86
    48   SEABED   -122.04  -21.38    0.01  221.25     9.758   0.000   210.05    14.53    15.37    18.60    34.93    7.76
    49   SEABED   -128.04  -21.38   -0.06  227.25     8.994   0.000   210.05    -0.16    15.37    -0.21    16.58    3.68
    50   SEABED   -134.04  -21.37   -0.04  233.25     7.666   0.000   210.05    -2.56    15.37    -3.28    19.63    4.36
    51   SEABED   -140.04  -21.37   -0.01  239.25     7.034   0.000   210.05    -1.44    15.37    -1.84    18.21    4.05
    52   SEABED   -146.04  -21.37    0.00  245.25     6.896   0.000   210.05    -0.39    15.37    -0.50    16.87    3.75
    53   SEABED   -152.04  -21.37    0.00  251.25     6.925   0.000   210.05     0.02    15.37     0.03    16.40    3.64
    54   SEABED   -158.04  -21.37    0.00  257.25     6.965   0.000   210.05     0.08    15.37     0.10    16.47    3.66
    55   SEABED   -164.04  -21.37    0.00  263.25     6.983   0.000   210.05     0.04    15.37     0.05    16.42    3.65
    56   SEABED   -170.04  -21.37    0.00  269.25     6.986   0.000   210.05     0.01    15.37     0.01    16.38    3.64
    57   SEABED   -176.04  -21.37    0.00  275.25     6.985   0.000   210.05     0.00    15.37     0.00    16.37    3.64
    58   SEABED   -182.04  -21.37    0.00  281.25     6.984   0.000   210.05     0.00    15.37     0.00    16.37    3.64
    59   SEABED   -188.04  -21.37    0.00  287.25     6.983   0.000   210.05     0.00    15.37     0.00    16.37    3.64

  ====================================================================================================================
```

```
    OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP          DATE - 3/25/2015   TIME - 11:31:22   PAGE   17
    PROJECT - Pipelay Analysis                                             JOB NO. - Static Analysis
    USER ID - Karun                                      LICENSED TO - OFFSHORE CONSTR. SPECIALISTS          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    PIPE       X        Y      VERT     PIPE    SUPPORT   SEPARA   AXIAL    BENDING  TENSILE  BENDING  TOTAL  PERCNT
    NO.   SECTION    COORD    COORD    ANGLE   LENGTH   REACTION   -TION   TENSION  MOMENT   STRESS   STRESS  STRESS  YIELD
                     (M  )    (M  )    (DEG )   (M  )    (KN  )    (M  )    (KN  )   (KN-M)   (MPA )   (MPA )  (MPA )  (PCT )
    ----------------------------------------------------------------------------------------------------------------------

     60   SEABED   -194.04   -21.37    0.00   293.25    6.983     0.000    210.05    0.00    15.37     0.00   16.37   3.64
     61   SEABED   -200.04   -21.37    0.00   299.25    6.983     0.000    210.05    0.00    15.37     0.00   16.37   3.64
     62   SEABED   -206.04   -21.37    0.00   305.25    0.000     0.000    210.05    0.00    15.37     0.00   16.37   3.64
```

```
    ================================================================================
    OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP          PAGE   18
    Pipelay Analysis
    JOB NO. - Static Analysis      LICENSED TO - OFFSHORE CONSTR. SPECIALISTS
    USER ID - Karun                DATE - 3/25/2015   TIME - 11:31:22   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 ( 1)
    ====================
      PIPE SECTION LENGTH ..     0.00 M     ELASTIC MODULUS ......   207000. MPA
      OUTSIDE DIAMETER .....    27.310 CM   CROSS SECTIONAL AREA .   128.48 CM^2
      WALL THICKNESS .......     1.590 CM   MOMENT OF INERTIA ....  12671.5 CM^4
      WEIGHT/LENGTH IN AIR .  2205.00 N/M   YIELD STRESS .........   450.00 MPA
      SUBMERGED WGHT/LENG ..  1164.00 N/M   STRESS INTENS FACTOR .    1.000
      SPECIFIC GRAVITY .....     2.118      STEEL DENSITY ........  76982.0 N/M3
      WRAP COAT THICKNESS ..     0.230 CM   WRAP COAT DENSITY ....   9218.0 N/M3
      CONCRETE THICKNESS ...     4.000 CM   CONCRETE DENSITY .....  29846.0 N/M3

    BARGE DATA
    ==========
      TOTAL PIPE TENSION ...   250.00 KN    RADIUS OF CURVATURE ..     0.00 M
      NUMBER OF TENSIONERS .        2       BARGE TRIM ANGLE .....    0.500 DEG
      NO. OF PIPE SUPPORTS .        7       PIPE ANGLE AT STERN ..    9.810 DEG

    STINGER DATA
    ============
      NO. OF PIPE SUPPORTS .        5       PIPE DEPTH AT STERN ..    -8.07 M
      NO. STINGER SECTIONS .        7       PIPE ANGLE AT STERN ..   17.286 DEG
      RADIUS OF CURVATURE ..   200.00 M     STINGER STERN DEPTH ..    -8.42 M
      STINGER LENGTH .......    39.00 M

    SAGBEND DATA
    ============
      WATER DEPTH ..........    21.34 M     TENSION AT TOUCHDOWN .   210.00 KN
      TOUCHDOWN X-COORD. ...  -113.68 M     BOTTOM SLOPE ANGLE ...    0.000 DEG
      PROJECTED SPAN LENGTH    74.09 M      PIPE LENGTH GAIN .....     2.89 M

    ========================= SOLUTION SUMMARY =============================
    NODE   PIPE      X       Y      VERT    REACT   BENDING  BENDING  TOTAL   PCT
    NO. SECTION    COORD   COORD   ANGLE    -ION    MOMENT   STRESS  STRESS   YLD
                   (M  )   (M  )   (DEG )   (KN  )  (KN-M)   (MPA )  (MPA )   (%)
    ----------------------------------------------------------------------------
      1  LAYBARGE   96.3    6.8     1.6     11.8      0.0      0.0     0.0     0.
      3  LAYBARGE   84.3    6.6     1.2     20.0    -17.8    -22.7    22.8     5.
      5  LAYBARGE   73.4    6.3     1.9     43.4    -89.8   -115.0   115.1    26.
      7  TENSIONR   60.1    5.8     1.6      4.5     45.6     58.5    68.0    15.
      9  LAYBARGE   51.1    5.6     1.3      0.0    -38.8    -49.7    59.2    13.
     10  LAYBARGE   46.4    5.5     2.2     62.5   -155.5   -199.1   208.6    46.
     12  LAYBARGE   39.4    5.1     3.3      0.0     -2.0     -2.5    11.9     3.
     13  TENSIONR   35.4    4.9     3.1     -8.6     34.6     44.3    63.4    14.
     15  LAYBARGE   26.1    4.4     3.3      0.0    -91.7   -117.4   136.5    30.
     16  LAYBARGE   23.3    4.2     4.1     57.0   -174.1   -222.9   241.9    54.
     18  LAYBARGE    8.9    2.7     8.2     61.0   -203.0   -259.9   278.6    62.
     20  LAYBARGE    3.1    1.7     9.8      0.0    -62.8    -80.4    99.0    22.
     24  STINGER    -7.5   -0.2    10.5      6.4    -40.8    -52.3    70.6    16.
```

```
    ================================================================================
    OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP          PAGE   19
    Pipelay Analysis
    JOB NO. - Static Analysis      LICENSED TO - OFFSHORE CONSTR. SPECIALISTS
    USER ID - Karun                DATE - 3/25/2015   TIME - 11:31:22   CASE    1
    ================================================================================
```

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


     26  STINGER   -16.5   -2.0    12.1     36.4   -148.5   -190.2   208.3    46.
     29  STINGER   -26.2   -4.3    14.5     13.8   -102.1   -130.8   148.6    33.
     31  STINGER   -36.6   -7.2    16.7     35.8   -121.9   -156.1   173.7    39.
     33  STINGER   -39.6   -8.1    17.3      0.0    -58.2    -74.6    92.1    20.
     42  SAGBEND   -86.1  -19.5     7.6      0.0    133.1    170.5   186.9    42.
     47  SEABED   -116.0  -21.4     0.4      5.1     50.0     64.1    80.4    18.
```

APPENDIX-4

Dynamic Pipelay Analysis Output

```
      MMMMMM        MMMMMMMMMMM    MMMMMMMMMMM    MMMMMMMMM      MMMMMMMMM      MMMMMMMMM      MMMMMMMMMMM    MMMMMMMM
    MMMMMMMMMMM      MMMMMMMMMMM    MMMMMMMMMMM    MMMMMMMMMM     MMMMMMMMM      MMMMMMMMMMM    MMMMMMMMMMM    MMMMMMMMMM
   MMM     MMM      MMM            MMM            MMM    MMMM    MMM            MMM     MMMM    MMM            M       MMM
   MMM     MMM      MMM            MMM            MMM     MMM    MMM            MMM      MMM    MMM                    MMM
   MMM     MMM      MMM            MMM            MMM     MMM    MMM            MMM     MMMM    MMM                    MMM
   MMM     MMM      MMMMMMMMM      MMMMMMMMM      MMMMMMMMMMM    MMM            MMMMMMMMMMM     MMMMMMMM             MMMMM
   MMM     MMM      MMMMMMMMM      MMMMMMMMM      MMMMMMMM       MMM            MMMMMMMM        MMMMMMMM            MMMMM
   MMM     MMM      MMM            MMM            MMM            MMM            MMM             MMM                    MMM
   MMM     MMM      MMM            MMM            MMM            MMM            MMM             MMM                    MMM
    MMM   MMM       MMM            MMM            MMM            MMM            MMM             MMM            M       MMM
    MMMMMMMMMM      MMM            MMM            MMM            MMMMMMMMM      MMM             MMMMMMMMMMM    MMMMMMMMMM
      MMMMM         MMM            MMM            MMM            MMMMMMMMM      MMM             MMMMMMMMMMM    MMMMMMMM
```

```
          ****************************************************************************************
          *                                                                                    *
          *               O F F P I P E - 3  --  OFFSHORE PIPELINE ANALYSIS SYSTEM              *
          *                                                                                    *
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          *                                                                                    *
          *                              VERSION NO. - 3.01BP                                   *
          *                              RELEASED ON - 01/25/2014                               *
          *                              LICENSED TO - OFFSHORE CONSTR. SPECIALISTS             *
          *                                                                                    *
          ****************************************************************************************
          *                                                                                    *
          *    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-   *
          *    OPERATIONS, DAVIT LIFTS, PIPELINES LYING ON AN UNEVEN SEABED, AND RISERS.           *
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          *                                                                                    *
          *                      ROBERT C. MALAHY               TELEPHONE: (713) 664-8635        *
          *                      6554 AUDEN                     FACSIMILE: (713) 664-0962        *
          *                      HOUSTON, TEXAS 77005                                            *
          *                      U.S.A.                         EMAIL: SUPPORT@OFFPIPE.COM       *
          *                                                                                    *
          ****************************************************************************************
```

```
===============================================================================
OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP        PAGE   3
Pipelay Analysis
JOB NO. - Dynamic Analysis     LICENSED TO - OFFSHORE CONSTR. SPECIALISTS
USER ID - Karun                DATE - 3/25/2015   TIME - 12:18:21   CASE   1
===============================================================================
                 I N P U T   D A T A   E C H O


TIME HISTORY PLOT TABLE ENTRIES
===============================
    PLOT TABLE INDEX ................        1
    PLOT NUMBER .....................        1
    NODE NUMBER OF PLOTTED PARAMETER ..     15
    PLOT PARAMETER CODE NUMBER ........      2
    AXIS LABEL FOR ORDINATE .......... "Y COORD. OF PIPE AT STERN SHOE "
    AXIS LABEL FOR ABSCISSA .......... "SOLUTION TIME                  "
    PLOT TITLE ....................... "TIME HISTORY OF VERT. BENDING STRESS - BARGE STERN      "

    TIME HISTORY PLOT START TIME ......    0.00 SECONDS
    TIME HISTORY PLOT END TIME ........    0.00 SECONDS
    MINIMUM RANGE OF PLOT PARAMETER ...   0.000
    MAXIMUM RANGE OF PLOT PARAMETER ...   0.000

TIME HISTORY PLOT TABLE ENTRIES
===============================
    PLOT TABLE INDEX ................        2
    PLOT NUMBER .....................        1
    NODE NUMBER OF PLOTTED PARAMETER ..     15
    PLOT PARAMETER CODE NUMBER ........     13
    AXIS LABEL FOR ORDINATE .......... "VERTICAL PIPE BENDING STRESS    "
    AXIS LABEL FOR ABSCISSA .......... "SOLUTION TIME                  "
    PLOT TITLE ....................... "TIME HISTORY OF VERT. BENDING STRESS - STERN SHOE       "

    TIME HISTORY PLOT START TIME ......    0.00 SECONDS
    TIME HISTORY PLOT END TIME ........    0.00 SECONDS
    MINIMUM RANGE OF PLOT PARAMETER ...   0.000
    MAXIMUM RANGE OF PLOT PARAMETER ...   0.000

TIME HISTORY PLOT TABLE ENTRIES
===============================
    PLOT TABLE INDEX ................        3
    PLOT NUMBER .....................        2
    NODE NUMBER OF PLOTTED PARAMETER ..     35
```

```
    PLOT PARAMETER CODE NUMBER ........      2
    AXIS LABEL FOR ORDINATE .......... "Y COORD. OF PIPE AT STINGER TIP "
    AXIS LABEL FOR ABSCISSA .......... "SOLUTION TIME                    "
    PLOT TITLE ....................... "TIME HISTORY OF VERT. BENDING STRESS - STINGER TIP      "

    TIME HISTORY PLOT START TIME ......      0.00 SECONDS
    TIME HISTORY PLOT END TIME ........      0.00 SECONDS
    MINIMUM RANGE OF PLOT PARAMETER ...      0.000
    MAXIMUM RANGE OF PLOT PARAMETER ...      0.000

================================================================================
OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP        PAGE   4
Pipelay Analysis
JOB NO. - Dynamic Analysis        LICENSED TO - OFFSHORE CONSTR. SPECIALISTS
USER ID - Karun                   DATE - 3/25/2015   TIME - 12:18:21   CASE   1
================================================================================

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


TIME HISTORY PLOT TABLE ENTRIES
===============================
    PLOT TABLE INDEX ..................      4
    PLOT NUMBER ......................       2
    NODE NUMBER OF PLOTTED PARAMETER ..     35
    PLOT PARAMETER CODE NUMBER .......     13
    AXIS LABEL FOR ORDINATE .......... "VERTICAL PIPE BENDING STRESS    "
    AXIS LABEL FOR ABSCISSA .......... "SOLUTION TIME                    "
    PLOT TITLE ....................... "TIME HISTORY OF VERT. BENDING STRESS - STINGER TIP      "

    TIME HISTORY PLOT START TIME ......      0.00 SECONDS
    TIME HISTORY PLOT END TIME ........      0.00 SECONDS
    MINIMUM RANGE OF PLOT PARAMETER ...      0.000
    MAXIMUM RANGE OF PLOT PARAMETER ...      0.000

TIME HISTORY PLOT TABLE ENTRIES
===============================
    PLOT TABLE INDEX ..................      5
    PLOT NUMBER ......................       3
    NODE NUMBER OF PLOTTED PARAMETER ..     35
    PLOT PARAMETER CODE NUMBER ........      3
    AXIS LABEL FOR ORDINATE .......... "Z COORD. OF PIPE AT STINGER TIP "
    AXIS LABEL FOR ABSCISSA .......... "SOLUTION TIME                    "
    PLOT TITLE ....................... "TIME HISTORY OF HORI. BENDING STRESS - STINGER TIP      "

    TIME HISTORY PLOT START TIME ......      0.00 SECONDS
    TIME HISTORY PLOT END TIME ........      0.00 SECONDS
    MINIMUM RANGE OF PLOT PARAMETER ...      0.000
    MAXIMUM RANGE OF PLOT PARAMETER ...      0.000

TIME HISTORY PLOT TABLE ENTRIES
===============================
    PLOT TABLE INDEX ..................      6
    PLOT NUMBER ......................       3
    NODE NUMBER OF PLOTTED PARAMETER ..     35
    PLOT PARAMETER CODE NUMBER ........     16
    AXIS LABEL FOR ORDINATE .......... "HORIZONTAL PIPE BENDING STRESS  "
    AXIS LABEL FOR ABSCISSA .......... "SOLUTION TIME                    "
    PLOT TITLE ....................... "TIME HISTORY OF HORI. BENDING STRESS - STINGER TIP      "

    TIME HISTORY PLOT START TIME ......      0.00 SECONDS
    TIME HISTORY PLOT END TIME ........      0.00 SECONDS
    MINIMUM RANGE OF PLOT PARAMETER ...      0.000
    MAXIMUM RANGE OF PLOT PARAMETER ...      0.000


================================================================================
OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP        PAGE   5
Pipelay Analysis
JOB NO. - Dynamic Analysis        LICENSED TO - OFFSHORE CONSTR. SPECIALISTS
USER ID - Karun                   DATE - 3/25/2015   TIME - 12:18:21   CASE   1
================================================================================

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


PROFILE PLOT TABLE ENTRIES
==========================
    PLOT TABLE INDEX ..................      7
    PLOT NUMBER ......................       5
    PLOT TYPE OPTION NUMBER ...........      1
    DYNAMIC PROFILE TIME POINT ........      0.000
    DYNAMIC PROFILE TIME INCREMENT ....      0.000
    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 ....................... "PIPE ELEVATION PROFILE AND DYNAMIC STRESS RANGE        "
    MINIMUM VERTICAL AXIS RANGE .......      0.000
    MAXIMUM VERTICAL AXIS RANGE .......      0.000
    MINIMUM HORIZONTAL AXIS RANGE .....      0.000
    MAXIMUM HORIZONTAL AXIS RANGE .....      0.000

PROFILE PLOT TABLE ENTRIES
==========================
    PLOT TABLE INDEX ..................      8
    PLOT NUMBER ......................       5
    PLOT TYPE OPTION NUMBER ...........      3
    DYNAMIC PROFILE TIME POINT ........      0.000
    DYNAMIC PROFILE TIME INCREMENT ....      0.000
    ORDINATE PARAMETER CODE NUMBER ....     14
    AXIS LABEL FOR ORDINATE .......... "TOTAL DYNAMIC PIPE STRESS RANGE "
```

```
      ABSCISSA PARAMETER CODE NUMBER ....        1
      AXIS LABEL FOR ABSCISSA .......... "PIPE HORIZONTAL X COORDINATE     "

      PLOT TITLE ...................... "PIPE ELEVATION PROFILE AND DYNAMIC STRESS RANGE         "
      MINIMUM VERTICAL AXIS RANGE .......     0.000
      MAXIMUM VERTICAL AXIS RANGE .......     0.000
      MINIMUM HORIZONTAL AXIS RANGE .....     0.000
      MAXIMUM HORIZONTAL AXIS RANGE .....     0.000
```

```
================================================================================
OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP          PAGE   6
Pipelay Analysis
JOB NO. - Dynamic Analysis      LICENSED TO - OFFSHORE CONSTR. SPECIALISTS
USER ID - Karun                 DATE - 3/25/2015   TIME - 12:18:21   CASE   1
================================================================================
```

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


```
PROFILE PLOT TABLE ENTRIES
==========================
      PLOT TABLE INDEX .................        9
      PLOT NUMBER .....................        5
      PLOT TYPE OPTION NUMBER ..........        4
      DYNAMIC PROFILE TIME POINT ........     0.000
      DYNAMIC PROFILE TIME INCREMENT ....     0.000
      ORDINATE PARAMETER CODE NUMBER ....       14
      AXIS LABEL FOR ORDINATE .......... "TOTAL DYNAMIC PIPE STRESS RANGE "
      ABSCISSA PARAMETER CODE NUMBER ....        1
      AXIS LABEL FOR ABSCISSA .......... "PIPE HORIZONTAL X COORDINATE     "

      PLOT TITLE ...................... "PIPE ELEVATION PROFILE AND DYNAMIC STRESS RANGE         "
      MINIMUM VERTICAL AXIS RANGE .......     0.000
      MAXIMUM VERTICAL AXIS RANGE .......     0.000
      MINIMUM HORIZONTAL AXIS RANGE .....     0.000
      MAXIMUM HORIZONTAL AXIS RANGE .....     0.000

PRINTED OUTPUT SELECTED
=======================
      STATIC PIPE FORCES AND STRESSES ...       NO
      STATIC SOLUTION SUMMARY ..........       YES
      DYNAMIC PIPE FORCES AND STRESSES ..      YES
      DYNAMIC RANGE OF PIPE DATA ........       NO
      DYNAMIC TRACKING OF PIPE DATA .....       NO
      OVERBEND PIPE SUPPORT GEOMETRY ....       NO
      STINGER BALLAST SCHEDULE DATA .....       NO
      SUPPORT REACTIONS IN BARGE COORDS .       NO

      INTERNAL FORCES IN PIPE & CABLE ...       NO
      INTERNAL FORCES IN STINGER  .......       NO
      PRINT PIPE STRAINS IN OUTPUT ......      YES
      DNV OS-F101 COMPLIANCE REPORT .....       NO
      API RP-1111 COMPLIANCE REPORT .....       NO
      PRINT DNV/API FACTORS & PARAMETERS        NO
      USE THICK WALL HOOP STRESS EQN. ...       NO
      USE DNV 1981 FOR TOTAL PIPE STRESS        NO

      ENABLE/DISABLE WARNING MESSAGES ...   ENABLE
      GENERATE SPREAD SHEET PLOT FILE ...       NO
      GENERATE ASCII PLOT DATA FILES ....       NO
```

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```
PIPE TENSION DATA
=================
      STATIC PIPE TENSION ON LAY VESSEL .   250.000 K-NEWTON
      MINIMUM DYNAMIC PIPE TENSION ......   225.000 K-NEWTON
      MAXIMUM DYNAMIC PIPE TENSION ......   275.000 K-NEWTON
      STATIC HORIZONTAL BOTTOM TENSION ..     0.000 K-NEWTON
      NO. OF VALUES FOR TENSION PROFILE .        0
      VALUES ARE FOR PIPE SPAN ANALYSIS .       NO
      MAXIMUM PIPE PAYOUT SPEED .........     0.000 M/SEC
      MAXIMUM PIPE TAKEUP SPEED .........     0.000 M/SEC

PIPE PROPERTIES
===============
      PIPE PROPERTY TABLE ROW ...........        1
      PIPE SECTION LENGTH ...............     0.000 METERS
      STEEL MODULUS OF ELASTICITY .......   207000. M-PASCAL
      STEEL CROSS SECTIONAL AREA ........   128.750 CM^2
      COATED PIPE AVG MOMENT OF INERTIA . 12671.51 CM^4
      WEIGHT PER-UNIT-LENGTH IN AIR .....   2205.00 N/M
      WEIGHT PER-UNIT-LENGTH SUBMERGED ..   1164.00 N/M
      MAXIMUM ALLOWABLE PIPE STRAIN ..... 0.000000 PERCENT

      STEEL OUTSIDE DIAMETER ............   27.3100 CM
      STEEL WALL THICKNESS ..............    1.5900 CM
      YIELD STRESS ......................   450.00 M-PASCAL
      STRESS/STRAIN INTENSE FACTOR ......    0.0000
      HYDRODYNAMIC OUTSIDE DIAMETER .....     0.000 CM
      DRAG COEFFICIENT ..................    0.0000
      HYDRODYNAMIC TOTAL AREA ...........     0.000 CM^2
      ADDED MASS COEFFICIENT ............    0.0000
      POISSON'S RATIO FOR STEEL PIPE ....    0.0000
```

COEFFICIENT OF THERMAL EXPANSION ..0.00000000 1/DEG C

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PIPE COATING PROPERTIES
=======================
   PIPE PROPERTY TABLE INDEX   1
   CORROSION COATING THICKNESS ....   0.280 CM
   CORROSION COATING WEIGHT DENSITY ..   9218.0 N/M^3
   CORROSION COATING ELASTIC MODULUS .   0.000 M-PASCAL
   CONCRETE COATING THICKNESS ....   4.000 CM
   CONCRETE COATING WEIGHT DENSITY ...   29846. N/M^3
   CONCRETE COATING ELASTIC MODULUS ..   0.000 M-PASCAL
   DESIRED PIPE SPECIFIC GRAVITY 0.0000
   CONCRETE STIFFENING EFFECTIVENESS .   0.000
   NO NOT CALC. STRESS FOR BARE PIPE .   NO

   AVERAGE LENGTH OF PIPE JOINT ......   12.200 METERS
   EFFECTIVE FIELD JOINT LENGTH ......   0.700 METERS
   FIELD JOINT FILL WEIGHT DENSITY ...   2177.0 N/M^3
   FIELD JOINT FILL ELASTIC MODULUS...   0.000 M-PASCAL
   FIELD JOINT STIFFENING EFFECT. 0.000
   FIELD JOINT BENDING MODEL ....   0 IGNORE COATING STIFFNESS
   WEIGHT DENSITY OF STEEL ....   76982. N/M^3
   WEIGHT DENSITY OF PIPE CONTENTS ...   0.0 N/M^3
   REF. ELEVATION FOR STATIC HEAD ....   0.00 METERS
   FREE FLOOD PIPE DURING PIPELAY ....   NO

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LAYBARGE DESCRIPTION
====================
   NUMBER OF PIPE NODES   12
   BARGE GEOMETRY SPECIFIED BY ....   1 X-Y COORDINATES
   OVERBEND PIPE SUPPORT RADIUS ......   0.000 METERS
   ADJUST Y COORDINATES MANUALLY .....   NO
   TANGENT POINT X-COORDINATE ....   0.000 METERS
   TANGENT POINT Y-COORDINATE ....   0.000 METERS
   PIPE ANGLE RELATIVE TO DECK ....   0.0000 DEGREES
   HEIGHT OF DECK ABOVE WATER ....   4.087 METERS
   LAYBARGE FORWARD (X) OFFSET ....   0.000 METERS
   BARGE TRIM ANGLE ....   0.5000 DEGREES

   STERN SHOE X COORDINATE ....   0.000 METERS
   STERN SHOE Y COORDINATE ....   0.000 METERS
   ROTATION CENTER X COORDINATE ......   55.200 METERS
   ROTATION CENTER Y COORDINATE ......   -4.087 METERS
   ROTATION CENTER Z COORDINATE ......   0.000 METERS
   BARGE HEADING ....   0.0000 DEGREES
   BARGE OFFSET FROM RIGHT-OF-WAY ....   0.000 METERS
   PIPE RAMP PIVOT X COORDINATE ......   0.000 METERS
   PIPE RAMP PIVOT Y COORDINATE ......   0.000 METERS
   PIPE RAMP PIVOT VERTICAL ANGLE ....   0.000 DEGREES
   PIPE RAMP PIVOT Z COORDINATE ......   0.000 METERS
   PIPE RAMP HEADING ON BARGE DECK ...   0.000 DEGREES

   NODE X   NODE Y   SUPPORT   DAVIT
   COORD   COORD   TYPE   SPACING
   (M)   (M)   (M)
   =======   =======   ==================== =======
    96.368   2.489   1 SIMPLE SUPPORT   0.000
    84.332   2.305   1 SIMPLE SUPPORT   0.000
    73.503   2.131   1 SIMPLE SUPPORT   0.000
    60.152   1.754   2 PIPE TENSIONER   0.000
    51.139   1.956   100 UNSUPPORTED NODE   0.000
    46.492   1.532   1 SIMPLE SUPPORT   0.000
    39.452   1.586   100 UNSUPPORTED NODE   0.000
    35.401   1.040   2 PIPE TENSIONER   0.000
    26.141   0.824   100 UNSUPPORTED NODE   0.000
    23.381   0.480   10 USER DEFINED SPT   0.000
     8.913   -0.940   10 USER DEFINED SPT   0.000
     3.123   -1.920   11 USER DEFINED SPT   0.000

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SUPPORT ELEMENT PROPERTIES
==========================
   SUPPORT PROPERTY TABLE INDEX   10

```
    SUPPORT ELEMENT TYPE .............       1 SIMPLE SUPPORT
    SUPPORT INITIAL STATE FLAG ........       0
    TENSIONER AXIAL STIFFNESS (F/L) ...   0.000E+00 KN/M
    VERTICAL STIFFNESS (F/L) ..........   0.000E+00 KN/M
    STATIC VERTICAL DEFLECTION ........      0.0000 CM
    LATERAL STIFFNESS (F/L) ...........   0.000E+00 KN/M

    BOTTOM ROLLER ANGLE TO HORIZONTAL .     30.000 DEGREES
    SIDE ROLLER ANGLE TO VERTICAL .....      0.000 DEGREES
    SIDE ROLLER OFFSET FROM C.L. ......      0.000 METERS
    BED ROLLER LENGTH .................      0.000 METERS
    HEIGHT OF TOP ROLLER ABOVE BED ....      0.000 METERS
    TENSIONER X-AXIS ROTATIONAL STIF. .      0.000 KN/DEG
    TENSIONER Y-AXIS ROTATIONAL STIF. .      0.000 KN/DEG
    TENSIONER Y-AXIS ROTATIONAL STIF. .      0.000 KN/DEG

 SUPPORT ELEMENT PROPERTIES
 ==========================
    SUPPORT PROPERTY TABLE INDEX ......      11
    SUPPORT ELEMENT TYPE .............       1 SIMPLE SUPPORT
    SUPPORT INITIAL STATE FLAG ........       0
    TENSIONER AXIAL STIFFNESS (F/L) ...   0.000E+00 KN/M
    VERTICAL STIFFNESS (F/L) ..........   0.000E+00 KN/M
    STATIC VERTICAL DEFLECTION ........      0.0000 CM
    LATERAL STIFFNESS (F/L) ...........   0.000E+00 KN/M

    BOTTOM ROLLER ANGLE TO HORIZONTAL .     30.000 DEGREES
    SIDE ROLLER ANGLE TO VERTICAL .....      0.000 DEGREES
    SIDE ROLLER OFFSET FROM C.L. ......      0.000 METERS
    BED ROLLER LENGTH .................      0.000 METERS
    HEIGHT OF TOP ROLLER ABOVE BED ....      0.000 METERS
    TENSIONER X-AXIS ROTATIONAL STIF. .      0.000 KN/DEG
    TENSIONER Y-AXIS ROTATIONAL STIF. .      0.000 KN/DEG
    TENSIONER Y-AXIS ROTATIONAL STIF. .      0.000 KN/DEG
```

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 SUPPORT ELEMENT PROPERTIES
 ==========================
    SUPPORT PROPERTY TABLE INDEX ......      21
    SUPPORT ELEMENT TYPE .............       1 SIMPLE SUPPORT
    SUPPORT INITIAL STATE FLAG ........       0
    TENSIONER AXIAL STIFFNESS (F/L) ...   0.000E+00 KN/M
    VERTICAL STIFFNESS (F/L) ..........   0.000E+00 KN/M
    STATIC VERTICAL DEFLECTION ........      0.0000 CM
    LATERAL STIFFNESS (F/L) ...........   0.000E+00 KN/M

    BOTTOM ROLLER ANGLE TO HORIZONTAL .     30.000 DEGREES
    SIDE ROLLER ANGLE TO VERTICAL .....      0.000 DEGREES
    SIDE ROLLER OFFSET FROM C.L. ......      0.000 METERS
    BED ROLLER LENGTH .................      0.000 METERS
    HEIGHT OF TOP ROLLER ABOVE BED ....      0.000 METERS
    TENSIONER X-AXIS ROTATIONAL STIF. .      0.000 KN/DEG
    TENSIONER Y-AXIS ROTATIONAL STIF. .      0.000 KN/DEG
    TENSIONER Y-AXIS ROTATIONAL STIF. .      0.000 KN/DEG

 SUPPORT ELEMENT PROPERTIES
 ==========================
    SUPPORT PROPERTY TABLE INDEX ......      22
    SUPPORT ELEMENT TYPE .............       1 SIMPLE SUPPORT
    SUPPORT INITIAL STATE FLAG ........       0
    TENSIONER AXIAL STIFFNESS (F/L) ...   0.000E+00 KN/M
    VERTICAL STIFFNESS (F/L) ..........   0.000E+00 KN/M
    STATIC VERTICAL DEFLECTION ........      0.0000 CM
    LATERAL STIFFNESS (F/L) ...........   0.000E+00 KN/M

    BOTTOM ROLLER ANGLE TO HORIZONTAL .     30.000 DEGREES
    SIDE ROLLER ANGLE TO VERTICAL .....      0.000 DEGREES
    SIDE ROLLER OFFSET FROM C.L. ......      0.000 METERS
    BED ROLLER LENGTH .................      0.000 METERS
    HEIGHT OF TOP ROLLER ABOVE BED ....      0.000 METERS
    TENSIONER X-AXIS ROTATIONAL STIF. .      0.000 KN/DEG
    TENSIONER Y-AXIS ROTATIONAL STIF. .      0.000 KN/DEG
    TENSIONER Y-AXIS ROTATIONAL STIF. .      0.000 KN/DEG
```

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OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP          PAGE  12
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 SUPPORT ELEMENT PROPERTIES
 ==========================
    SUPPORT PROPERTY TABLE INDEX ......      23
    SUPPORT ELEMENT TYPE .............       1 SIMPLE SUPPORT
    SUPPORT INITIAL STATE FLAG ........       0
    TENSIONER AXIAL STIFFNESS (F/L) ...   0.000E+00 KN/M
    VERTICAL STIFFNESS (F/L) ..........   0.000E+00 KN/M
    STATIC VERTICAL DEFLECTION ........      0.0000 CM
    LATERAL STIFFNESS (F/L) ...........   0.000E+00 KN/M
```

```
    BOTTOM ROLLER ANGLE TO HORIZONTAL .      30.000 DEGREES
    SIDE ROLLER ANGLE TO VERTICAL .....       0.000 DEGREES
    SIDE OFFSET FROM C.L. ......               0.000 METERS
    BED ROLLER LENGTH .................        0.000 METERS
    HEIGHT OF TOP ROLLER ABOVE BED ....        0.000 METERS
    TENSIONER X-AXIS ROTATIONAL STIF. .        0.000 KN/DEG
    TENSIONER Y-AXIS ROTATIONAL STIF. .        0.000 KN/DEG
    TENSIONER Y-AXIS ROTATIONAL STIF. .        0.000 KN/DEG

STINGER DESCRIPTION
===================
    NUMBER OF PIPE/STINGER NODES ......           7
    STINGER GEOMETRY SPECIFIED BY .....           1 X-Y COORD AND TANGENT PT
    STINGER TYPE ......................           6 ARTICULATED
    OVERBEND PIPE SUPPORT RADIUS ......      200.00 METERS
    HITCH X-COORDINATE ................       -1.855 METERS
    HITCH Y-COORDINATE ................       -3.712 METERS
    HITCH ANGULAR ORIENTATION .........        0.000 DEGREES

    X COORDINATE OF LOCAL ORIGIN ......       -1.855 METERS
    Y COORDINATE OF LOCAL ORIGIN ......       -3.712 METERS
    ROTATION ABOUT STINGER HITCH ......        0.000 DEGREES
    TANGENT POINT X-COORDINATE ........        3.123 METERS
    TANGENT POINT Y-COORDINATE ........       -1.850 METERS
    TANGENT POINT ANGLE ...............        0.000 DEGREES


    NODE X      NODE Y         SUPPORT                  ELEMENT          ELEMENT
     COORD       COORD          TYPE                     TYPE            LENGTH
     (M   )      (M   )                                                  (M   )
    ========    ========    ====================    ====================  =======
     -2.894       0.000    300  NO PIPE NODE          6  USER DEFINED     2.894
     -5.593       1.106     22  USER DEFINED         10  USER DEFINED     2.699
    -14.737       1.089     23  USER DEFINED         10  USER DEFINED     9.144
    -19.487       0.000    300  NO PIPE NODE          4  USER DEFINED     4.750
    -24.592       1.085     22  USER DEFINED         13  USER DEFINED     5.105
    -35.400       1.085     21  USER DEFINED         11  USER DEFINED    10.808
    -38.518       0.638      1  SIMPLE SUPPORT        4  USER DEFINED     3.118
```

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OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP        PAGE  13
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STINGER SECTION PROPERTIES
==========================
    STINGER PROPERTY TABLE INDEX ......           4
    STINGER ELEMENT TYPE ..............           1 FIXED END
    AXIAL STIFFNESS (EA) ..............  0.000E+00 K-NEWTON
    VERTICAL BENDING STIFFNESS (EI) ...  0.000E+00 KN-M^2
    VERTICAL HINGE STOP STIFFNESS .....  0.000E+00 N-M
    VERTICAL ANGLE OF FREE ROTATION ...      0.000 DEGREES
    VERTICAL PROJECTED AREA/LENGTH ....       4.30 METERS

    DISPLACED VOLUME PER-UNIT-LENGTH ..      3.600 M^2
    DRAG COEFFICIENT ..................      0.0000
    ADDED MASS COEFFICIENT ............      0.0000
    HORIZONTAL BENDING STIFFNESS ......  0.000E+00 KN-M^2
    HORIZONTAL HINGE STOP STIFFNESS ...  0.000E+00 N-M
    HORIZONTAL ANGLE OF ROTATION ......      0.0000 DEGREES
    HORIZONTAL PROJECTED AREA/LENGTH ..      4.300 METERS

STINGER SECTION PROPERTIES
==========================
    STINGER PROPERTY TABLE INDEX ......           6
    STINGER ELEMENT TYPE ..............           2 HINGED END
    AXIAL STIFFNESS (EA) ..............  0.000E+00 K-NEWTON
    VERTICAL BENDING STIFFNESS (EI) ...  0.000E+00 KN-M^2
    VERTICAL HINGE STOP STIFFNESS .....  0.000E+00 N-M
    VERTICAL ANGLE OF FREE ROTATION ...     20.000 DEGREES
    VERTICAL PROJECTED AREA/LENGTH ....       4.30 METERS

    DISPLACED VOLUME PER-UNIT-LENGTH ..      3.600 M^2
    DRAG COEFFICIENT ..................      0.0000
    ADDED MASS COEFFICIENT ............      0.0000
    HORIZONTAL BENDING STIFFNESS ......  0.000E+00 KN-M^2
    HORIZONTAL HINGE STOP STIFFNESS ...  0.000E+00 N-M
    HORIZONTAL ANGLE OF ROTATION ......      0.0000 DEGREES
    HORIZONTAL PROJECTED AREA/LENGTH ..      4.300 METERS
```

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OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP        PAGE  14
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STINGER SECTION PROPERTIES
==========================
    STINGER PROPERTY TABLE INDEX ......          10
    STINGER ELEMENT TYPE ..............           1 FIXED END
    AXIAL STIFFNESS (EA) ..............  0.000E+00 K-NEWTON
    VERTICAL BENDING STIFFNESS (EI) ...  0.000E+00 KN-M^2
    VERTICAL HINGE STOP STIFFNESS .....  0.000E+00 N-M
```

```
    VERTICAL ANGLE OF FREE ROTATION ...      0.000 DEGREES
    VERTICAL PROJECTED AREA/LENGTH ....      4.30 METERS

    DISPLACED VOLUME PER-UNIT-LENGTH ..      3.600 M^2
    DRAG COEFFICIENT .................      0.0000
    ADDED MASS COEFFICIENT ...........      0.0000
    HORIZONTAL BENDING STIFFNESS ......   0.000E+00 KN-M^2
    HORIZONTAL HINGE STOP STIFFNESS ...   0.000E+00 N-M
    HORIZONTAL ANGLE OF ROTATION ......      0.0000 DEGREES
    HORIZONTAL PROJECTED AREA/LENGTH ..      4.300 METERS

STINGER SECTION PROPERTIES
==========================
    STINGER PROPERTY TABLE INDEX ......        11
    STINGER ELEMENT TYPE ..............         1 FIXED END
    AXIAL STIFFNESS (EA) ..............   0.000E+00 K-NEWTON
    VERTICAL BENDING STIFFNESS (EI) ...   0.000E+00 KN-M^2
    VERTICAL HINGE STOP STIFFNESS .....   0.000E+00 N-M
    VERTICAL ANGLE OF FREE ROTATION ...      0.000 DEGREES
    VERTICAL PROJECTED AREA/LENGTH ....      5.40 METERS

    DISPLACED VOLUME PER-UNIT-LENGTH ..      5.400 M^2
    DRAG COEFFICIENT .................      0.0000
    ADDED MASS COEFFICIENT ...........      0.0000
    HORIZONTAL BENDING STIFFNESS ......   0.000E+00 KN-M^2
    HORIZONTAL HINGE STOP STIFFNESS ...   0.000E+00 N-M
    HORIZONTAL ANGLE OF ROTATION ......      0.0000 DEGREES
    HORIZONTAL PROJECTED AREA/LENGTH ..      5.400 METERS
```

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OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP          PAGE  15
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STINGER SECTION PROPERTIES
==========================
    STINGER PROPERTY TABLE INDEX ......        13
    STINGER ELEMENT TYPE ..............         2 HINGED END
    AXIAL STIFFNESS (EA) ..............   0.000E+00 K-NEWTON
    VERTICAL BENDING STIFFNESS (EI) ...   0.000E+00 KN-M^2
    VERTICAL HINGE STOP STIFFNESS .....   0.000E+00 N-M
    VERTICAL ANGLE OF FREE ROTATION ...     11.000 DEGREES
    VERTICAL PROJECTED AREA/LENGTH ....      4.30 METERS

    DISPLACED VOLUME PER-UNIT-LENGTH ..      3.600 M^2
    DRAG COEFFICIENT .................      0.0000
    ADDED MASS COEFFICIENT ...........      0.0000
    HORIZONTAL BENDING STIFFNESS ......   0.000E+00 KN-M^2
    HORIZONTAL HINGE STOP STIFFNESS ...   0.000E+00 N-M
    HORIZONTAL ANGLE OF ROTATION ......      0.0000 DEGREES
    HORIZONTAL PROJECTED AREA/LENGTH ..      4.300 METERS

STINGER SECTION WEIGHTS AND DISPLACEMENTS
=========================================
    SECTION     SECTION    DISPLACE
    NUMBER      WEIGHT      -MENT
                (KN  )      (KN  )
    ======      ======      ======
       1        65.584      67.840
       2       142.262     130.680
       3       271.728     368.710
       4       170.075     189.690
       5       180.490     222.830
       6       428.110     807.400
       7       130.070     122.200

STINGER SECTION BALLAST SCHEDULE
================================
    SECTION     BALLAST
    NUMBER      CONTENTS
                (KN  )
    =======     ========
       1         0.000
       2         0.000
       3       190.000
       4        10.000
       5         0.000
       6       250.000
       7        40.000
```

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OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP          PAGE  16
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SAGBEND GEOMETRY
================
    SAGBEND PIPE ELEMENT LENGTH .......      6.000 METERS
    WATER DEPTH ......................     21.34 METERS
    X-COORDINATE AT SPECIFIED DEPTH . .      0.00 METERS
    ESTIMATED SAGBEND X LENGTH ........      0.00 METERS
    ESTIMATED PIPE LENGTH ON SEABED ...      0.00 METERS
```

```
          X-COORD OF PIPE FREE END ON SEABED       0.00 METERS
          X-COORD POINT OF FIXITY ON SEABED .      0.00 METERS
          MAXIMUM SLOPE (ANGLE) OF SEABED ...      0.000 DEGREES
          DIRECTION OF MAXIMUM SLOPE ........      0.000 DEGREES

          PIPE/CABLE SPAN END CONDITION .....         0 PIPE/CABLE RESTING ON SEABED
          PIPE/CABLE SPAN LENGTH GIVEN BY ...         0 SPECIFIED PIPE/CABLE TENSION
          ESTIMATED SPAN DEPTH AT FREE END ..      0.00 METERS
          PIPE VERTICAL ANGLE AT FREE END ...      0.000 DEGREES
          BOTTOM HINGE OFFSET ...............      0.000 METERS
          BOTTOM HINGE MINIMUM ANGLE ........      0.000 DEGREES
          BOTTOM HINGE MAXIMUM ANGLE ........      0.000 DEGREES

     SOIL ELEMENT PROPERTIES
     =======================
          SOIL PROPERTY TABLE ROW INDEX .....         0
          SOIL ELEMENT TYPE (FUTURE USE) ....         0
          PIPE INDEX OR SEGMENT NUMBER ......         0
          LONGITUDINAL SOIL STIFFNESS .......      0.00 KN/M^2
          VERTICAL SOIL STIFFNESS ...........      0.00 KN/M^2
          LATERAL SOIL STIFFNESS ............      0.00 KN/M^2
          DEFLECTION UNDER REFERENCE LOAD ...    0.0000 CM

          LONGITUDINAL COEF. OF FRICTION ....      0.500
          LATERAL COEFFICIENT OF FRICTION ...      0.000
          NUMBER 0F INTEGRATION POINTS ......         0

     CURRENT VELOCITIES
     ==================
        WATER      CURRENT      DIRECTION
        DEPTH       SPEED       OF TRAVEL
        (M  )       (M/S )       (DEG )
        ======     =======     =========
        0.000       1.030        0.000
       10.000       0.540        0.000
       21.340       0.440        0.000


================================================================================
OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP          PAGE  17
Pipelay Analysis
JOB NO. - Dynamic Analysis       LICENSED TO - OFFSHORE CONSTR. SPECIALISTS
USER ID - Karun                  DATE - 3/25/2015   TIME - 12:18:21   CASE   1
================================================================================

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


     TIME INTEGRATION PARAMETERS
     ===========================
          TIME STEP LENGTH ..................    0.2000 SECONDS
          MAXIMUM TIME OF INTEGRATION .......  360.000 SECONDS
          SOLUTION SAMPLING TIME STEP........    0.400 SECONDS
          SOLUTION SAMPLING STARTS AT TIME ..   60.000 SECONDS
          DAMPING RATIO .....................    0.2000
          NUMBER OF VARIABLE TIME STEPS .....         0

     WAVE SPECTRUM EQUATION
     ======================
          SEA STATE ROW INDEX ...............         1
          WAVE SPECTRUM EQUATION TYPE .......         7 JONSWAP (CLASSIC)
          NUMBER OF WAVES IN SPECTRUM .......        30
          USE WAVE FREQUENCY OR PERIOD ...... FREQUENCY
          SEED FOR RANDOM WAVE PHASES .......         0
          MINIMUM FREQUENCY IN SPECTRUM .....    0.2094 RAD/SEC
          MAXIMUM FREQUENCY IN SPECTRUM .....    2.0944 RAD/SEC
          DIRECTION OF WAVE TRAVEL ..........    0.000 DEGREES
          1ST JONSWAP COEF. (ALPHA) ......... 0.0021000
          2ND JONSWAP COEF. (GAMMA) .........    1.000
          PEAK WAVE FREQUENCY ...............    0.8537 RAD/SEC

     BARGE MOTION RAO TABLE
     ======================
          SEA STATE NUMBER ..................         1
          USE PHASE LAG FOR RAOS ............         0
          VESSEL MOTIONS SIGN CONVENTION .... OFFPIPE
          USE WAVE FREQUENCY OR PERIOD ...... FREQUENCY
          RANDOM WAVE GENERATION SEED .......         0

        WAVE     /------ SURGE -----/  /------ SWAY ------/  /------ HEAVE -----/
      FREQUENCY  AMPLITUDE   PHASE     AMPLITUDE   PHASE     AMPLITUDE   PHASE
      (RAD/SEC)   (M/M  )    (DEG)      (M/M  )    (DEG)      (M/M  )    (DEG)
      =========  =======    =======    =======    =======    =======    =======
        0.2513    1.9170     122.00     0.0010      54.00     1.0770      25.00
        0.3142    1.4330     132.00     0.0010      37.00     1.0490      38.00
        0.3307    1.3560     136.00     0.0010      29.00     1.0380      42.00
        0.3491    1.2830     141.00     0.0010      31.00     1.0220      47.00
        0.3696    1.2120     147.00     0.0010      34.00     1.0000      52.00
        0.3927    1.1380     154.00     0.0000       0.00     0.9710      59.00
        0.4189    1.0620     162.00     0.0000       0.00     0.9300      67.00
        0.4333    1.0180     167.00     0.0000       0.00     0.9030      71.00
        0.4488    0.9710     173.00     0.0000       0.00     0.8720      77.00
        0.4654    0.9200     179.00     0.0000       0.00     0.8360      83.00
        0.4833    0.8620    -174.00     0.0000       0.00     0.7930      89.00
        0.5027    0.7960    -166.00     0.0000       0.00     0.7420      97.00
        0.5236    0.7210    -158.00     0.0000       0.00     0.6840     106.00


================================================================================
OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP          PAGE  18
Pipelay Analysis
JOB NO. - Dynamic Analysis       LICENSED TO - OFFSHORE CONSTR. SPECIALISTS
USER ID - Karun                  DATE - 3/25/2015   TIME - 12:18:21   CASE   1
================================================================================
```

```
     0.5464    0.6330   -148.00     0.0000      0.00     0.6180    117.00
     0.5712    0.5330   -137.00     0.0000      0.00     0.5440    130.00
     0.5984    0.4200   -123.00     0.0000      0.00     0.4650    145.00
     0.6283    0.2960   -106.00     0.0000      0.00     0.3810    165.00
     0.6614    0.1710    -80.00     0.0000      0.00     0.3000   -168.00
     0.6981    0.0700    -22.00     0.0000      0.00     0.2330   -132.00
     0.7392    0.0890     84.00     0.0000      0.00     0.2000    -84.00
     0.7854    0.1490    137.00     0.0000      0.00     0.2030    -34.00
     0.8378    0.1740   -173.00     0.0000      0.00     0.2060     12.00
     0.8976    0.1590   -110.00     0.0000      0.00     0.1620     62.00
     0.9666    0.1310    -19.00     0.0000      0.00     0.0870    143.00
     1.0472    0.1240     97.00     0.0000      0.00     0.0590    -87.00
     1.1424    0.1190   -119.00     0.0000      0.00     0.0400     45.00
     1.2566    0.0900     64.00     0.0000      0.00     0.0320   -116.00
     1.3963    0.0630    -35.00     0.0000      0.00     0.0170    112.00
     1.5708    0.0520    -14.00     0.0000      0.00     0.0050     37.00
     2.0944    0.0100    -92.00     0.0000      0.00     0.0060     83.00
```

```
      WAVE     /------ ROLL ------/  /------ PITCH -----/  /------- YAW ------/
   FREQUENCY   AMPLITUDE    PHASE    AMPLITUDE    PHASE    AMPLITUDE    PHASE
   (RAD/SEC)   (DEG/M )    (DEG)     (DEG/M )    (DEG)     (DEG/M )    (DEG)
   =========   ========   =======   ========   =======   ========   =======
     0.2513    0.0010    -53.00     0.3790    -66.00     0.0070    157.00
     0.3142    0.0000      0.00     0.5960    -54.00     0.0030    149.00
     0.3307    0.0000      0.00     0.6580    -50.00     0.0030    150.00
     0.3491    0.0000      0.00     0.7290    -46.00     0.0020    153.00
     0.3696    0.0000      0.00     0.8120    -40.00     0.0020    157.00
     0.3927    0.0000      0.00     0.9060    -34.00     0.0020    162.00
     0.4189    0.0000      0.00     1.0170    -27.00     0.0010    170.00
     0.4333    0.0000      0.00     1.0760    -23.00     0.0010    174.00
     0.4488    0.0000      0.00     1.1390    -18.00     0.0010    178.00
     0.4654    0.0000      0.00     1.2040    -13.00     0.0010   -176.00
     0.4833    0.0000      0.00     1.2710     -8.00     0.0010   -170.00
     0.5027    0.0010    137.00     1.3340     -2.00     0.0010   -164.00
     0.5236    0.0010    131.00     1.3940      4.00     0.0010   -157.00
     0.5464    0.0010    103.00     1.4400     11.00     0.0010    149.00
     0.5712    0.0010     61.00     1.4680     20.00     0.0000      0.00
     0.5984    0.0010     47.00     1.4660     30.00     0.0000      0.00
     0.6283    0.0010     50.00     1.4140     41.00     0.0000      0.00
     0.6614    0.0000      0.00     1.3060     54.00     0.0000      0.00
     0.6981    0.0000      0.00     1.1290     71.00     0.0000      0.00
     0.7392    0.0000      0.00     0.8820     92.00     0.0000      0.00
     0.7854    0.0000      0.00     0.5830    123.00     0.0000      0.00
     0.8378    0.0000      0.00     0.3020    177.00     0.0000      0.00
     0.8976    0.0000      0.00     0.2510    -87.00     0.0000      0.00
     0.9666    0.0000      0.00     0.2530    -14.00     0.0000      0.00
     1.0472    0.0000      0.00     0.1410     74.00     0.0000      0.00
     1.1424    0.0000      0.00     0.0870   -112.00     0.0000      0.00
     1.2566    0.0000      0.00     0.0320     44.00     0.0000      0.00
```

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OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP   PAGE 19
Pipelay Analysis
JOB NO. - Dynamic Analysis   LICENSED TO - OFFSHORE CONSTR. SPECIALISTS
USER ID - Karun   DATE - 3/25/2015   TIME - 12:18:21   CASE   1
==

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

```
     1.3963    0.0000      0.00     0.0250     21.00     0.0000      0.00
     1.5708    0.0000      0.00     0.0330      8.00     0.0000      0.00
     2.0944    0.0000      0.00     0.0100     21.00     0.0000      0.00
```

STATIC SOLUTION CONVERGED IN (22) ITERATIONS

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OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP   PAGE 20
Pipelay Analysis
JOB NO. - Dynamic Analysis   LICENSED TO - OFFSHORE CONSTR. SPECIALISTS
USER ID - Karun   DATE - 3/25/2015   TIME - 12:18:21   CASE   2
==

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

CURRENT VELOCITIES
===================
     WATER   CURRENT   DIRECTION
     DEPTH   SPEED   OF TRAVEL
     (M)   (M/S)   (DEG)
     ======   =======   =========
     0.000   1.030   45.000
    10.000   0.540   45.000
    21.340   0.440   45.000

TIME INTEGRATION PARAMETERS
============================
     TIME STEP LENGTH ....   0.2000 SECONDS
     MAXIMUM TIME OF INTEGRATION .... 360.000 SECONDS
     SOLUTION SAMPLING TIME STEP.......   0.400 SECONDS
     SOLUTION SAMPLING STARTS AT TIME ..   60.000 SECONDS
     DAMPING RATIO 0.2000
     NUMBER OF VARIABLE TIME STEPS   0

WAVE SPECTRUM EQUATION
=======================
     SEA STATE ROW INDEX   1
     WAVE SPECTRUM EQUATION TYPE ....   7 JONSWAP (CLASSIC)
     NUMBER OF WAVES IN SPECTRUM   30

```
   USE WAVE FREQUENCY OR PERIOD ...... FREQUENCY
   SEED FOR RANDOM WAVE PHASES .......          0
   MINIMUM FREQUENCY IN SPECTRUM .....    0.2094 RAD/SEC
   MAXIMUM FREQUENCY IN SPECTRUM .....    2.0944 RAD/SEC
   DIRECTION OF WAVE TRAVEL ..........   45.000 DEGREES
   1ST JONSWAP COEF. (ALPHA) ......... 0.0021000
   2ND JONSWAP COEF. (GAMMA) .........    1.000
   PEAK WAVE FREQUENCY ...............    0.8537 RAD/SEC
```

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================================================================================
OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP          PAGE  21
Pipelay Analysis
JOB NO. - Dynamic Analysis      LICENSED TO - OFFSHORE CONSTR. SPECIALISTS
USER ID - Karun                 DATE - 3/25/2015   TIME - 12:18:21   CASE   2
================================================================================
```

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

BARGE MOTION RAO TABLE
======================
     SEA STATE NUMBER   1
     USE PHASE LAG FOR RAOS   0
     VESSEL MOTIONS SIGN CONVENTION .... OFFPIPE
     USE WAVE FREQUENCY OR PERIOD ...... FREQUENCY
     RANDOM WAVE GENERATION SEED   0

WAVE FREQUENCY (RAD/SEC)	SURGE AMPLITUDE (M/M)	SURGE PHASE (DEG)	SWAY AMPLITUDE (M/M)	SWAY PHASE (DEG)	HEAVE AMPLITUDE (M/M)	HEAVE PHASE (DEG)
0.2513	1.3840	115.00	0.5050	-34.00	1.0870	17.00
0.3142	1.0390	121.00	0.5970	-34.00	1.0780	27.00
0.3307	0.9890	123.00	0.6000	-34.00	1.0730	29.00
0.3491	0.9440	127.00	0.6000	-34.00	1.0660	33.00
0.3696	0.9010	131.00	0.5910	-32.00	1.0560	36.00
0.3927	0.8590	136.00	0.5760	-29.00	1.0420	41.00
0.4189	0.8150	141.00	0.5540	-25.00	1.0220	47.00
0.4333	0.7930	145.00	0.5410	-23.00	1.0090	50.00
0.4488	0.7690	148.00	0.5250	-19.00	0.9940	53.00
0.4654	0.7430	153.00	0.5070	-15.00	0.9750	57.00
0.4833	0.7140	157.00	0.4890	-10.00	0.9540	62.00
0.5027	0.6820	162.00	0.4730	-3.00	0.9280	67.00
0.5236	0.6450	168.00	0.4750	3.00	0.8960	73.00
0.5464	0.6040	175.00	0.4860	9.00	0.8540	79.00
0.5712	0.5580	-176.00	0.4770	11.00	0.8160	88.00
0.5984	0.5010	-168.00	0.4270	16.00	0.7770	97.00
0.6283	0.4360	-157.00	0.3640	24.00	0.7270	108.00
0.6614	0.3620	-144.00	0.3020	36.00	0.6660	119.00
0.6981	0.2830	-128.00	0.2380	51.00	0.5890	133.00
0.7392	0.2000	-107.00	0.1710	68.00	0.4900	148.00
0.7854	0.1130	-80.00	0.1000	91.00	0.3590	166.00
0.8378	0.0300	-8.00	0.0310	132.00	0.2100	-163.00
0.8976	0.0750	115.00	0.0340	-65.00	0.1160	-100.00
0.9666	0.1120	165.00	0.0690	-13.00	0.1140	-30.00
1.0472	0.1080	-132.00	0.0720	39.00	0.0820	33.00
1.1424	0.0850	-38.00	0.0410	110.00	0.0380	123.00
1.2566	0.0500	96.00	0.0100	-39.00	0.0260	-82.00
1.3963	0.0260	-72.00	0.0200	113.00	0.0080	90.00
1.5708	0.0050	-150.00	0.0050	98.00	0.0010	55.00
2.0944	0.0210	51.00	0.0020	46.00	0.0640	83.00

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OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP          PAGE  22
Pipelay Analysis
JOB NO. - Dynamic Analysis      LICENSED TO - OFFSHORE CONSTR. SPECIALISTS
USER ID - Karun                 DATE - 3/25/2015   TIME - 12:18:21   CASE   2
================================================================================
```

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

WAVE FREQUENCY (RAD/SEC)	ROLL AMPLITUDE (DEG/M)	ROLL PHASE (DEG)	PITCH AMPLITUDE (DEG/M)	PITCH PHASE (DEG)	YAW AMPLITUDE (DEG/M)	YAW PHASE (DEG)
0.2513	0.3290	-86.00	0.2710	-73.00	0.3030	-26.00
0.3142	0.4910	-81.00	0.4300	-64.00	0.2430	0.00
0.3307	0.5440	-78.00	0.4770	-62.00	0.2550	8.00
0.3491	0.6050	-75.00	0.5320	-59.00	0.2770	16.00
0.3696	0.6910	-72.00	0.5950	-55.00	0.3040	24.00
0.3927	0.8090	-68.00	0.6700	-51.00	0.3370	31.00
0.4189	0.9800	-64.00	0.7590	-46.00	0.3750	39.00
0.4333	1.0920	-61.00	0.8090	-43.00	0.3980	43.00
0.4488	1.2470	-59.00	0.8640	-40.00	0.4190	47.00
0.4654	1.4560	-58.00	0.9220	-37.00	0.4410	52.00
0.4833	1.7510	-59.00	0.9850	-33.00	0.4640	57.00
0.5027	2.1650	-64.00	1.0490	-28.00	0.4870	63.00
0.5236	2.6090	-78.00	1.1130	-24.00	0.5100	69.00
0.5464	2.8450	-99.00	1.1840	-18.00	0.5360	77.00
0.5712	2.5740	-126.00	1.2690	-12.00	0.5630	86.00
0.5984	1.8260	-149.00	1.3510	-6.00	0.5870	94.00
0.6283	1.1010	-158.00	1.4140	1.00	0.6010	105.00
0.6614	0.6310	-159.00	1.4520	9.00	0.6050	117.00
0.6981	0.3360	-158.00	1.4570	19.00	0.5970	131.00
0.7392	0.1570	-168.00	1.4200	31.00	0.5720	148.00
0.7854	0.0920	153.00	1.3180	44.00	0.5220	168.00
0.8378	0.1000	133.00	1.0940	58.00	0.4400	-166.00
0.8976	0.0870	145.00	0.6920	74.00	0.3150	-136.00
0.9666	0.0490	178.00	0.2590	110.00	0.1590	-96.00
1.0472	0.0080	-62.00	0.1010	-133.00	0.0200	23.00
1.1424	0.0350	84.00	0.1160	-22.00	0.0990	179.00

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      1.2566     0.0220    171.00     0.0240     76.00     0.0960    -95.00
      1.3963     0.0160     86.00     0.0130    -20.00     0.0080     43.00
      1.5708     0.0060    121.00     0.0040    -86.00     0.0270    -36.00
      2.0944     0.0580   -121.00     0.1670     74.00     0.0090     78.00

STATIC SOLUTION CONVERGED IN (      22 ) ITERATIONS
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OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP   PAGE 23

Pipelay Analysis

JOB NO. - Dynamic Analysis   LICENSED TO - OFFSHORE CONSTR. SPECIALISTS

USER ID - Karun   DATE - 3/25/2015 TIME - 12:18:21 CASE   3

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

CURRENT VELOCITIES header

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===============================================================================
OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP          PAGE  23
Pipelay Analysis
JOB NO. - Dynamic Analysis      LICENSED TO - OFFSHORE CONSTR. SPECIALISTS
USER ID - Karun                 DATE - 3/25/2015  TIME - 12:18:21  CASE   3
===============================================================================

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


CURRENT VELOCITIES
==================
   WATER      CURRENT    DIRECTION
   DEPTH       SPEED     OF TRAVEL
   (M  )      (M/S )      (DEG )
   ======     =======    =========
    0.000      1.030       90.000
   10.000      0.540       90.000
   21.340      0.440       90.000

TIME INTEGRATION PARAMETERS
===========================
    TIME STEP LENGTH ..................   0.2000 SECONDS
    MAXIMUM TIME OF INTEGRATION .......  360.000 SECONDS
    SOLUTION SAMPLING TIME STEP........    0.400 SECONDS
    SOLUTION SAMPLING STARTS AT TIME ..   60.000 SECONDS
    DAMPING RATIO ....................    0.2000
    NUMBER OF VARIABLE TIME STEPS .....        0

WAVE SPECTRUM EQUATION
======================
    SEA STATE ROW INDEX ...............        1
    WAVE SPECTRUM EQUATION TYPE .......        7 JONSWAP (CLASSIC)
    NUMBER OF WAVES IN SPECTRUM .......       30
    USE WAVE FREQUENCY OR PERIOD ...... FREQUENCY
    SEED FOR RANDOM WAVE PHASES .......        0
    MINIMUM FREQUENCY IN SPECTRUM .....   0.2094 RAD/SEC
    MAXIMUM FREQUENCY IN SPECTRUM .....   2.0944 RAD/SEC
    DIRECTION OF WAVE TRAVEL ..........   90.000 DEGREES
    1ST JONSWAP COEF. (ALPHA) ......... 0.0021000
    2ND JONSWAP COEF. (GAMMA) .........    1.000
    PEAK WAVE FREQUENCY ...............   0.8537 RAD/SEC
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OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP          PAGE  24
Pipelay Analysis
JOB NO. - Dynamic Analysis      LICENSED TO - OFFSHORE CONSTR. SPECIALISTS
USER ID - Karun                 DATE - 3/25/2015  TIME - 12:18:21  CASE   3
===============================================================================

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


BARGE MOTION RAO TABLE
======================
    SEA STATE NUMBER ..................        1
    USE PHASE LAG FOR RAOS ............        0
    VESSEL MOTIONS SIGN CONVENTION .... OFFPIPE
    USE WAVE FREQUENCY OR PERIOD ...... FREQUENCY
    RANDOM WAVE GENERATION SEED .......        0

    WAVE     /------ SURGE -----/  /------ SWAY ------/  /------ HEAVE -----/
  FREQUENCY  AMPLITUDE    PHASE    AMPLITUDE    PHASE    AMPLITUDE    PHASE
  (RAD/SEC)   (M/M  )     (DEG)     (M/M  )     (DEG)     (M/M  )     (DEG)
  =========  =========   =======   =========   =======   =========   =======
    0.2513    0.0330     104.00     0.8160     -55.00     1.1000       0.00
    0.3142    0.0140     148.00     0.8750     -64.00     1.1070       0.00
    0.3307    0.0150     158.00     0.8790     -67.00     1.1090       0.00
    0.3491    0.0160     160.00     0.8790     -70.00     1.1110      -1.00
    0.3696    0.0170     162.00     0.8670     -72.00     1.1140      -1.00
    0.3927    0.0180     163.00     0.8500     -74.00     1.1160      -1.00
    0.4189    0.0190     163.00     0.8280     -75.00     1.1200      -2.00
    0.4333    0.0190     163.00     0.8140     -76.00     1.1220      -2.00
    0.4488    0.0190     163.00     0.8000     -76.00     1.1250      -2.00
    0.4654    0.0200     162.00     0.7840     -76.00     1.1280      -2.00
    0.4833    0.0200     164.00     0.7720     -75.00     1.1330      -3.00
    0.5027    0.0210     160.00     0.7720     -73.00     1.1360      -3.00
    0.5236    0.0210     154.00     0.7930     -72.00     1.1340      -4.00
    0.5464    0.0210     150.00     0.8260     -73.00     1.1280      -5.00
    0.5712    0.0210     144.00     0.8400     -76.00     1.1190      -6.00
    0.5984    0.0200     158.00     0.8210     -80.00     1.1500      -6.00
    0.6283    0.0230     165.00     0.7760     -82.00     1.1880      -7.00
    0.6614    0.0270     169.00     0.7260     -83.00     1.2330      -9.00
    0.6981    0.0330     166.00     0.6750     -82.00     1.2700     -13.00
    0.7392    0.0410     157.00     0.6220     -80.00     1.2840     -20.00
    0.7854    0.0490     143.00     0.5720     -78.00     1.2500     -29.00
    0.8378    0.0570     123.00     0.5170     -74.00     1.1160     -41.00
    0.8976    0.0570      96.00     0.4570     -70.00     0.8800     -53.00
    0.9666    0.0470      69.00     0.3950     -62.00     0.6020     -63.00
    1.0472    0.0330      50.00     0.3340     -52.00     0.3630     -66.00
    1.1424    0.0200      21.00     0.2770     -37.00     0.1860     -61.00
    1.2566    0.0090      13.00     0.2270     -17.00     0.0730     -50.00
    1.3963    0.0010     168.00     0.1770       9.00     0.0090     162.00
    1.5708    0.0110      78.00     0.1220      47.00     0.0330    -133.00
    2.0944    0.0110    -149.00     0.0470    -131.00     0.1930    -174.00
```

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OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP   PAGE 25
Pipelay Analysis
JOB NO. - Dynamic Analysis   LICENSED TO - OFFSHORE CONSTR. SPECIALISTS
USER ID - Karun   DATE - 3/25/2015   TIME - 12:18:21   CASE   3
==

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

     WAVE   /------ ROLL ------/ /------ PITCH -----/ /------- YAW ------/
  FREQUENCY   AMPLITUDE   PHASE   AMPLITUDE   PHASE   AMPLITUDE   PHASE
  (RAD/SEC)   (DEG/M)   (DEG)   (DEG/M)   (DEG)   (DEG/M)   (DEG)
  =========   ========   =======   ========   =======   ========   =======
     0.2513   0.4530   -102.00   0.0010   153.00   0.2430   -118.00
     0.3142   0.7000   -104.00   0.0020   160.00   0.1460   -142.00
     0.3307   0.7760   -105.00   0.0030   147.00   0.1250   -145.00
     0.3491   0.8670   -104.00   0.0040   140.00   0.1040   -146.00
     0.3696   1.0110   -105.00   0.0040   147.00   0.0920   -146.00
     0.3927   1.2130   -105.00   0.0050   153.00   0.0820   -145.00
     0.4189   1.5160   -106.00   0.0070   157.00   0.0740   -143.00
     0.4333   1.7320   -107.00   0.0080   158.00   0.0710   -142.00
     0.4488   2.0160   -109.00   0.0100   158.00   0.0680   -141.00
     0.4654   2.4010   -113.00   0.0120   157.00   0.0670   -140.00
     0.4833   2.9000   -121.00   0.0140   153.00   0.0680   -142.00
     0.5027   3.5130   -132.00   0.0180   147.00   0.0670   -144.00
     0.5236   4.0970   -149.00   0.0220   138.00   0.0620   -150.00
     0.5464   4.4130   -171.00   0.0260   129.00   0.0520   -157.00
     0.5712   4.1600   163.00   0.0290   122.00   0.0360   -160.00
     0.5984   3.5500   140.00   0.0370   131.00   0.0250   -159.00
     0.6283   2.7700   123.00   0.0530   130.00   0.0190   -146.00
     0.6614   2.0850   114.00   0.0770   124.00   0.0170   -133.00
     0.6981   1.5420   111.00   0.1080   111.00   0.0160   -126.00
     0.7392   1.1380   113.00   0.1480   92.00   0.0150   -123.00
     0.7854   0.8780   118.00   0.2000   68.00   0.0130   -120.00
     0.8378   0.6940   123.00   0.2480   37.00   0.0090   -121.00
     0.8976   0.5510   127.00   0.2490   3.00   0.0040   -139.00
     0.9666   0.4090   129.00   0.1850   -27.00   0.0030   133.00
     1.0472   0.2780   134.00   0.1180   -48.00   0.0080   109.00
     1.1424   0.1720   141.00   0.0590   -57.00   0.0110   97.00
     1.2566   0.0830   139.00   0.0240   -70.00   0.0150   102.00
     1.3963   0.0470   74.00   0.0020   149.00   0.0150   94.00
     1.5708   0.1310   60.00   0.0660   42.00   0.0070   84.00
     2.0944   0.1550   57.00   0.0720   -146.00   0.0010   10.00

STATIC SOLUTION CONVERGED IN (21) ITERATIONS

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OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP   PAGE 26
Pipelay Analysis
JOB NO. - Dynamic Analysis   LICENSED TO - OFFSHORE CONSTR. SPECIALISTS
USER ID - Karun   DATE - 3/25/2015   TIME - 12:18:21   CASE   4
==

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

CURRENT VELOCITIES
===================
    WATER   CURRENT   DIRECTION
    DEPTH   SPEED   OF TRAVEL
    (M)   (M/S)   (DEG)
    ======   =======   =========
     0.000   1.030   135.000
    10.000   0.540   135.000
    21.340   0.440   135.000

TIME INTEGRATION PARAMETERS
===========================
    TIME STEP LENGTH ....   0.2000 SECONDS
    MAXIMUM TIME OF INTEGRATION .... 360.000 SECONDS
    SOLUTION SAMPLING TIME STEP........   0.400 SECONDS
    SOLUTION SAMPLING STARTS AT TIME ..   60.000 SECONDS
    DAMPING RATIO 0.2000
    NUMBER OF VARIABLE TIME STEPS   0

WAVE SPECTRUM EQUATION
======================
    SEA STATE ROW INDEX   1
    WAVE SPECTRUM EQUATION TYPE ....   7 JONSWAP (CLASSIC)
    NUMBER OF WAVES IN SPECTRUM   30
    USE WAVE FREQUENCY OR PERIOD ...... FREQUENCY
    SEED FOR RANDOM WAVE PHASES   0
    MINIMUM FREQUENCY IN SPECTRUM .....   0.2094 RAD/SEC
    MAXIMUM FREQUENCY IN SPECTRUM .....   2.0944 RAD/SEC
    DIRECTION OF WAVE TRAVEL .... 135.000 DEGREES
    1ST JONSWAP COEF. (ALPHA) 0.0021000
    2ND JONSWAP COEF. (GAMMA) 1.000
    PEAK WAVE FREQUENCY ....   0.8537 RAD/SEC

==
OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP   PAGE 27
Pipelay Analysis
JOB NO. - Dynamic Analysis   LICENSED TO - OFFSHORE CONSTR. SPECIALISTS
USER ID - Karun   DATE - 3/25/2015   TIME - 12:18:21   CASE   4
==

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

BARGE MOTION RAO TABLE

```
        =========================
          SEA STATE NUMBER ..................      1
          USE PHASE LAG FOR RAOS ............      0
          VESSEL MOTIONS SIGN CONVENTION .... OFFPIPE
          USE WAVE FREQUENCY OR PERIOD ...... FREQUENCY
          RANDOM WAVE GENERATION SEED .......      0

           WAVE    /------ SURGE -----/  /------ SWAY ------/  /------ HEAVE -----/
        FREQUENCY  AMPLITUDE   PHASE    AMPLITUDE   PHASE    AMPLITUDE   PHASE
        (RAD/SEC)   (M/M  )    (DEG)     (M/M  )    (DEG)     (M/M  )    (DEG)
        =========  =======    =======   =======    =======   =======    =======
          0.2513    1.3120    -101.00    0.4760     -69.00    1.0880     -18.00
          0.3142    1.0030    -116.00    0.6000     -93.00    1.0770     -28.00
          0.3307    0.9560    -119.00    0.5980     -99.00    1.0720     -31.00
          0.3491    0.9130    -123.00    0.5920    -104.00    1.0650     -35.00
          0.3696    0.8710    -128.00    0.5790    -111.00    1.0550     -40.00
          0.3927    0.8290    -133.00    0.5610    -118.00    1.0410     -45.00
          0.4189    0.7870    -139.00    0.5370    -125.00    1.0200     -51.00
          0.4333    0.7640    -143.00    0.5220    -129.00    1.0070     -55.00
          0.4488    0.7410    -147.00    0.5040    -134.00    0.9910     -59.00
          0.4654    0.7160    -151.00    0.4830    -138.00    0.9710     -63.00
          0.4833    0.6890    -156.00    0.4590    -143.00    0.9470     -69.00
          0.5027    0.6580    -162.00    0.4370    -146.00    0.9180     -74.00
          0.5236    0.6240    -169.00    0.4280    -149.00    0.8810     -81.00
          0.5464    0.5850    -176.00    0.4390    -155.00    0.8330     -89.00
          0.5712    0.5480     174.00    0.4390    -166.00    0.7820     -97.00
          0.5984    0.5070     164.00    0.4110     179.00    0.7270    -106.00
          0.6283    0.4520     152.00    0.3560     166.00    0.6530    -117.00
          0.6614    0.3910     138.00    0.2970     153.00    0.5640    -131.00
          0.6981    0.3230     121.00    0.2360     137.00    0.4540    -148.00
          0.7392    0.2540     100.00    0.1710     118.00    0.3150    -170.00
          0.7854    0.1890      71.00    0.1030      92.00    0.1450     159.00
          0.8378    0.1320      28.00    0.0420      42.00    0.0290     -42.00
          0.8976    0.0950     -32.00    0.0390     -78.00    0.1320     -92.00
          0.9666    0.0780    -100.00    0.0690    -134.00    0.1340    -128.00
          1.0472    0.0520    -172.00    0.0710     178.00    0.0920    -149.00
          1.1424    0.0060    -125.00    0.0390     122.00    0.0500    -169.00
          1.2566    0.0180    -111.00    0.0110     -80.00    0.0290    -157.00
          1.3963    0.0110    -139.00    0.0210     163.00    0.0150    -163.00
          1.5708    0.0030    -117.00    0.0090    -108.00    0.0040    -171.00
          2.0944    0.0160      71.00    0.0020    -157.00    0.0160     119.00
```

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================================================================================
OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP        PAGE  28
Pipelay Analysis
JOB NO. - Dynamic Analysis        LICENSED TO - OFFSHORE CONSTR. SPECIALISTS
USER ID - Karun                   DATE - 3/25/2015  TIME - 12:18:21  CASE   4
================================================================================
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```
              I N P U T   D A T A   E C H O


           WAVE    /------ ROLL ------/  /------ PITCH -----/  /------- YAW ------/
        FREQUENCY  AMPLITUDE   PHASE    AMPLITUDE   PHASE    AMPLITUDE   PHASE
        (RAD/SEC)   (DEG/M )    (DEG)    (DEG/M )    (DEG)    (DEG/M )    (DEG)
        =========  =======    =======   ========   =======   ========   =======
          0.2513    0.3360    -116.00    0.2760      74.00    0.3850     174.00
          0.3142    0.4690    -128.00    0.4360      65.00    0.3730     153.00
          0.3307    0.5200    -130.00    0.4830      62.00    0.3780     150.00
          0.3491    0.5860    -133.00    0.5390      59.00    0.3870     147.00
          0.3696    0.6720    -136.00    0.6040      55.00    0.4010     143.00
          0.3927    0.7920    -140.00    0.6820      50.00    0.4200     138.00
          0.4189    0.9670    -146.00    0.7750      45.00    0.4450     132.00
          0.4333    1.0890    -149.00    0.8280      42.00    0.4600     129.00
          0.4488    1.2500    -154.00    0.8870      38.00    0.4760     125.00
          0.4654    1.4690    -160.00    0.9520      34.00    0.4940     121.00
          0.4833    1.7830    -168.00    1.0230      29.00    0.5140     117.00
          0.5027    2.2160     175.00    1.0970      24.00    0.5410     111.00
          0.5236    2.6950     152.00    1.1760      18.00    0.5660     105.00
          0.5464    2.9100     119.00    1.2620      11.00    0.5870      98.00
          0.5712    2.6370      83.00    1.3660       3.00    0.6000      90.00
          0.5984    1.9710      48.00    1.4800      -5.00    0.6060      81.00
          0.6283    1.1660      24.00    1.5650     -17.00    0.6110      72.00
          0.6614    0.6780       9.00    1.6360     -30.00    0.6100      61.00
          0.6981    0.3560      -1.00    1.6650     -45.00    0.5960      48.00
          0.7392    0.1480      -3.00    1.6470     -64.00    0.5660      33.00
          0.7854    0.0610      53.00    1.5370     -86.00    0.5120      15.00
          0.8378    0.1010      83.00    1.2640    -114.00    0.4280      -6.00
          0.8976    0.1040      76.00    0.8130    -143.00    0.3050     -33.00
          0.9666    0.0800      75.00    0.3820    -159.00    0.1520     -69.00
          1.0472    0.0700      87.00    0.2160    -145.00    0.0190     169.00
          1.1424    0.0710      82.00    0.1850    -144.00    0.1040      40.00
          1.2566    0.0380      80.00    0.1140    -160.00    0.0960     -29.00
          1.3963    0.0490     105.00    0.0510    -153.00    0.0170     105.00
          1.5708    0.0310      86.00    0.0090    -167.00    0.0270     -62.00
          2.0944    0.0090      78.00    0.0430      71.00    0.0040     114.00

        STATIC SOLUTION CONVERGED IN (      28 ) ITERATIONS
```

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OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP        PAGE  29
Pipelay Analysis
JOB NO. - Dynamic Analysis        LICENSED TO - OFFSHORE CONSTR. SPECIALISTS
USER ID - Karun                   DATE - 3/25/2015  TIME - 12:18:21  CASE   5
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```
              I N P U T   D A T A   E C H O


        CURRENT VELOCITIES
        ==================
           WATER    CURRENT    DIRECTION
```

```
         DEPTH        SPEED      OF TRAVEL
         (M   )       (M/S )       (DEG )
         ======      =======     =========
          0.000        1.030       180.000
         10.000        0.540       180.000
         21.340        0.440       180.000

TIME INTEGRATION PARAMETERS
===========================
     TIME STEP LENGTH .................     0.2000 SECONDS
     MAXIMUM TIME OF INTEGRATION .......   360.000 SECONDS
     SOLUTION SAMPLING TIME STEP........     0.400 SECONDS
     SOLUTION SAMPLING STARTS AT TIME ..    60.000 SECONDS
     DAMPING RATIO ....................      0.2000
     NUMBER OF VARIABLE TIME STEPS .....          0

WAVE SPECTRUM EQUATION
======================
     SEA STATE ROW INDEX ..............          1
     WAVE SPECTRUM EQUATION TYPE .......          7 JONSWAP (CLASSIC)
     NUMBER OF WAVES IN SPECTRUM .......         30
     USE WAVE FREQUENCY OR PERIOD ...... FREQUENCY
     SEED FOR RANDOM WAVE PHASES .......          0
     MINIMUM FREQUENCY IN SPECTRUM .....     0.2094 RAD/SEC
     MAXIMUM FREQUENCY IN SPECTRUM .....     2.0944 RAD/SEC
     DIRECTION OF WAVE TRAVEL ..........   180.000 DEGREES
     1ST JONSWAP COEF. (ALPHA) ......... 0.0021000
     2ND JONSWAP COEF. (GAMMA) .........     1.000
     PEAK WAVE FREQUENCY ...............     0.8537 RAD/SEC
```

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OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP          PAGE  30
Pipelay Analysis
JOB NO. - Dynamic Analysis        LICENSED TO - OFFSHORE CONSTR. SPECIALISTS
USER ID - Karun                   DATE - 3/25/2015   TIME - 12:18:21   CASE   5
===============================================================================
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                    I N P U T   D A T A   E C H O


BARGE MOTION RAO TABLE
======================
     SEA STATE NUMBER .................          1
     USE PHASE LAG FOR RAOS ............         0
     VESSEL MOTIONS SIGN CONVENTION .... OFFPIPE
     USE WAVE FREQUENCY OR PERIOD ...... FREQUENCY
     RANDOM WAVE GENERATION SEED .......         0
```

WAVE FREQUENCY (RAD/SEC)	/------ SURGE -----/ AMPLITUDE (M/M)	PHASE (DEG)	/------ SWAY ------/ AMPLITUDE (M/M)	PHASE (DEG)	/------ HEAVE -----/ AMPLITUDE (M/M)	PHASE (DEG)
0.2513	1.8220	-108.00	0.0010	151.00	1.0760	-25.00
0.3142	1.3750	-127.00	0.0000	0.00	1.0490	-40.00
0.3307	1.3020	-132.00	0.0000	0.00	1.0370	-44.00
0.3491	1.2310	-137.00	0.0000	0.00	1.0210	-49.00
0.3696	1.1600	-143.00	0.0000	0.00	1.0000	-55.00
0.3927	1.0860	-150.00	0.0000	0.00	0.9700	-63.00
0.4189	1.0060	-159.00	0.0000	0.00	0.9280	-72.00
0.4333	0.9630	-164.00	0.0000	0.00	0.9000	-77.00
0.4488	0.9170	-170.00	0.0000	0.00	0.8680	-83.00
0.4654	0.8670	-176.00	0.0000	0.00	0.8280	-89.00
0.4833	0.8120	176.00	0.0000	0.00	0.7810	-97.00
0.5027	0.7520	168.00	0.0000	0.00	0.7250	-105.00
0.5236	0.6850	159.00	0.0000	0.00	0.6580	-114.00
0.5464	0.6080	148.00	0.0000	0.00	0.5770	-125.00
0.5712	0.5210	135.00	0.0000	0.00	0.4830	-137.00
0.5984	0.4270	120.00	0.0000	0.00	0.3770	-151.00
0.6283	0.3230	102.00	0.0000	0.00	0.2600	-167.00
0.6614	0.2170	79.00	0.0000	0.00	0.1350	174.00
0.6981	0.1170	48.00	0.0000	0.00	0.0100	175.00
0.7392	0.0450	-17.00	0.0000	0.00	0.1040	-56.00
0.7854	0.0530	-122.00	0.0000	0.00	0.1790	-85.00
0.8378	0.0680	-175.00	0.0000	0.00	0.1880	-117.00
0.8976	0.0440	135.00	0.0000	0.00	0.1330	-141.00
0.9666	0.0110	-58.00	0.0000	0.00	0.0880	-144.00
1.0472	0.0450	-147.00	0.0000	0.00	0.0740	-142.00
1.1424	0.0270	-155.00	0.0000	0.00	0.0580	-164.00
1.2566	0.0250	-166.00	0.0000	0.00	0.0440	-164.00
1.3963	0.0280	-147.00	0.0000	0.00	0.0260	170.00
1.5708	0.0070	-128.00	0.0000	0.00	0.0310	160.00
2.0944	0.0080	162.00	0.0000	0.00	0.0100	-116.00

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OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP          PAGE  31
Pipelay Analysis
JOB NO. - Dynamic Analysis        LICENSED TO - OFFSHORE CONSTR. SPECIALISTS
USER ID - Karun                   DATE - 3/25/2015   TIME - 12:18:21   CASE   5
===============================================================================
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```
                    I N P U T   D A T A   E C H O
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WAVE FREQUENCY (RAD/SEC)	/------ ROLL ------/ AMPLITUDE (DEG/M)	PHASE (DEG)	/------ PITCH -----/ AMPLITUDE (DEG/M)	PHASE (DEG)	/------- YAW ------/ AMPLITUDE (DEG/M)	PHASE (DEG)
0.2513	0.0000	0.00	0.3880	68.00	0.0050	-73.00
0.3142	0.0000	0.00	0.6090	55.00	0.0020	-111.00
0.3307	0.0000	0.00	0.6740	51.00	0.0020	-118.00
0.3491	0.0000	0.00	0.7480	46.00	0.0020	-125.00
0.3696	0.0000	0.00	0.8350	41.00	0.0010	-132.00

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     0.3927     0.0000      0.00     0.9350      35.00     0.0010    -141.00
     0.4189     0.0000      0.00     1.0520      27.00     0.0010    -150.00
     0.4333     0.0010   -124.00     1.1170      22.00     0.0010    -156.00
     0.4488     0.0010   -134.00     1.1870      17.00     0.0010    -161.00
     0.4654     0.0010   -146.00     1.2610      11.00     0.0010    -168.00
     0.4833     0.0010   -159.00     1.3380       5.00     0.0000       0.00
     0.5027     0.0010   -176.00     1.4170      -1.00     0.0000       0.00
     0.5236     0.0020    158.00     1.4940     -10.00     0.0000       0.00
     0.5464     0.0020    108.00     1.5540     -20.00     0.0000       0.00
     0.5712     0.0020     41.00     1.5960     -32.00     0.0000       0.00
     0.5984     0.0010     -1.00     1.6080     -45.00     0.0000       0.00
     0.6283     0.0010    -30.00     1.5660     -60.00     0.0000       0.00
     0.6614     0.0000      0.00     1.4470     -77.00     0.0000       0.00
     0.6981     0.0000      0.00     1.2430     -95.00     0.0000       0.00
     0.7392     0.0000      0.00     0.9510    -114.00     0.0000       0.00
     0.7854     0.0000      0.00     0.6150    -126.00     0.0000       0.00
     0.8378     0.0000      0.00     0.4150    -116.00     0.0000       0.00
     0.8976     0.0000      0.00     0.4760    -115.00     0.0000       0.00
     0.9666     0.0000      0.00     0.4370    -138.00     0.0000       0.00
     1.0472     0.0000      0.00     0.2760    -158.00     0.0000       0.00
     1.1424     0.0000      0.00     0.1900    -152.00     0.0000       0.00
     1.2566     0.0000      0.00     0.1460    -170.00     0.0000       0.00
     1.3963     0.0000      0.00     0.1090    -179.00     0.0000       0.00
     1.5708     0.0000      0.00     0.0700     157.00     0.0000       0.00
     2.0944     0.0000      0.00     0.0270    -127.00     0.0000       0.00

STATIC SOLUTION CONVERGED IN (     21 ) ITERATIONS
```

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================================================================================
OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP          PAGE   32
Pipelay Analysis
JOB NO. - Dynamic Analysis        LICENSED TO - OFFSHORE CONSTR. SPECIALISTS
USER ID - Karun                   DATE - 3/25/2015   TIME - 12:18:21   CASE   6
================================================================================
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```
                   I N P U T   D A T A   E C H O


CURRENT VELOCITIES
==================
    WATER      CURRENT     DIRECTION
    DEPTH       SPEED      OF TRAVEL
    (M  )       (M/S )       (DEG )
    ======     =======     =========
    0.000       1.030       225.000
   10.000       0.540       225.000
   21.340       0.440       225.000

TIME INTEGRATION PARAMETERS
===========================
    TIME STEP LENGTH ..................     0.2000 SECONDS
    MAXIMUM TIME OF INTEGRATION .......   360.000 SECONDS
    SOLUTION SAMPLING TIME STEP........     0.400 SECONDS
    SOLUTION SAMPLING STARTS AT TIME ..    60.000 SECONDS
    DAMPING RATIO .....................     0.2000
    NUMBER OF VARIABLE TIME STEPS .....         0

WAVE SPECTRUM EQUATION
======================
    SEA STATE ROW INDEX ...............         1
    WAVE SPECTRUM EQUATION TYPE .......         7 JONSWAP (CLASSIC)
    NUMBER OF WAVES IN SPECTRUM .......        30
    USE WAVE FREQUENCY OR PERIOD ......   FREQUENCY
    SEED FOR RANDOM WAVE PHASES .......         0
    MINIMUM FREQUENCY IN SPECTRUM .....    0.2094 RAD/SEC
    MAXIMUM FREQUENCY IN SPECTRUM .....    2.0944 RAD/SEC
    DIRECTION OF WAVE TRAVEL ..........   225.000 DEGREES
    1ST JONSWAP COEF. (ALPHA) ......... 0.0021000
    2ND JONSWAP COEF. (GAMMA) .........     1.000
    PEAK WAVE FREQUENCY ...............    0.8537 RAD/SEC
```

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================================================================================
OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP          PAGE   33
Pipelay Analysis
JOB NO. - Dynamic Analysis        LICENSED TO - OFFSHORE CONSTR. SPECIALISTS
USER ID - Karun                   DATE - 3/25/2015   TIME - 12:18:21   CASE   6
================================================================================
```

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


BARGE MOTION RAO TABLE
======================
    SEA STATE NUMBER ..................         1
    USE PHASE LAG FOR RAOS ............         0
    VESSEL MOTIONS SIGN CONVENTION .... OFFPIPE
    USE WAVE FREQUENCY OR PERIOD ...... FREQUENCY
    RANDOM WAVE GENERATION SEED .......         0

     WAVE     /------ SURGE -----/  /------ SWAY ------/  /------ HEAVE -----/
   FREQUENCY  AMPLITUDE    PHASE    AMPLITUDE    PHASE    AMPLITUDE    PHASE
   (RAD/SEC)   (M/M )     (DEG)      (M/M )     (DEG)      (M/M )     (DEG)
   =========  =======    =======    =======    =======    =======    =======
     0.2513    1.3160    -102.00     0.4790     110.00     1.0880     -18.00
     0.3142    1.0040    -116.00     0.6020      86.00     1.0770     -28.00
     0.3307    0.9580    -119.00     0.6000      81.00     1.0720     -31.00
     0.3491    0.9140    -123.00     0.5930      75.00     1.0650     -35.00
     0.3696    0.8720    -128.00     0.5800      68.00     1.0550     -39.00
     0.3921    0.8300    -133.00     0.5620      62.00     1.0410     -45.00
     0.4189    0.7870    -139.00     0.5380      54.00     1.0200     -51.00
     0.4333    0.7650    -143.00     0.5220      50.00     1.0070     -55.00
     0.4488    0.7420    -147.00     0.5050      45.00     0.9910     -59.00
```

```
     0.4654    0.7170   -151.00    0.4840     41.00    0.9710    -63.00
     0.4833    0.6900   -156.00    0.4600     36.00    0.9470    -68.00
     0.5027    0.6590   -162.00    0.4380     34.00    0.9180    -74.00
     0.5236    0.6240   -169.00    0.4290     30.00    0.8810    -81.00
     0.5464    0.5850   -176.00    0.4390     25.00    0.8320    -88.00
     0.5712    0.5480    174.00    0.4400     13.00    0.7820    -97.00
     0.5984    0.5080    164.00    0.4110      0.00    0.7270   -106.00
     0.6283    0.4520    152.00    0.3560    -13.00    0.6530   -117.00
     0.6614    0.3910    138.00    0.2980    -26.00    0.5640   -131.00
     0.6981    0.3230    121.00    0.2360    -41.00    0.4540   -148.00
     0.7392    0.2550    100.00    0.1710    -60.00    0.3150   -170.00
     0.7854    0.1890     71.00    0.1040    -87.00    0.1450    159.00
     0.8378    0.1330     29.00    0.0420   -137.00    0.0290    -41.00
     0.8976    0.0950    -31.00    0.0390    102.00    0.1320    -91.00
     0.9666    0.0780    -99.00    0.0690     46.00    0.1340   -127.00
     1.0472    0.0520   -171.00    0.0710      0.00    0.0920   -148.00
     1.1424    0.0060   -123.00    0.0390    -55.00    0.0500   -168.00
     1.2566    0.0180   -109.00    0.0110    101.00    0.0290   -155.00
     1.3963    0.0110   -137.00    0.0210    -13.00    0.0150   -160.00
     1.5708    0.0030   -114.00    0.0090     74.00    0.0040   -168.00
     2.0944    0.0160     76.00    0.0020     27.00    0.0160    124.00
```

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OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP   PAGE 34
Pipelay Analysis
JOB NO. - Dynamic Analysis   LICENSED TO - OFFSHORE CONSTR. SPECIALISTS
USER ID - Karun   DATE - 3/25/2015   TIME - 12:18:21   CASE   6
==

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


     WAVE    /------ ROLL ------/  /------ PITCH -----/  /------- YAW ------/
   FREQUENCY AMPLITUDE   PHASE    AMPLITUDE   PHASE    AMPLITUDE    PHASE
   (RAD/SEC) (DEG/M )   (DEG)     (DEG/M )   (DEG)     (DEG/M )    (DEG)
   ========= ========  =======   ========  =======    ========   =======
     0.2513    0.3350     63.00    0.2760     74.00    0.3640      1.00
     0.3142    0.4690     51.00    0.4360     65.00    0.3660    -22.00
     0.3307    0.5200     49.00    0.4830     62.00    0.3730    -26.00
     0.3491    0.5850     46.00    0.5390     59.00    0.3830    -30.00
     0.3696    0.6720     43.00    0.6040     55.00    0.3980    -34.00
     0.3921    0.7910     39.00    0.6820     50.00    0.4180    -39.00
     0.4189    0.9660     33.00    0.7750     45.00    0.4440    -45.00
     0.4333    1.0880     30.00    0.8280     42.00    0.4590    -49.00
     0.4488    1.2480     25.00    0.8870     38.00    0.4750    -53.00
     0.4654    1.4670     19.00    0.9520     34.00    0.4930    -57.00
     0.4833    1.7800     11.00    1.0230     30.00    0.5130    -61.00
     0.5027    2.2120     -4.00    1.0970     24.00    0.5400    -67.00
     0.5236    2.6920    -27.00    1.1760     18.00    0.5650    -73.00
     0.5464    2.9060    -60.00    1.2620     11.00    0.5860    -80.00
     0.5712    2.6330    -96.00    1.3660      3.00    0.5990    -88.00
     0.5984    1.9680   -131.00    1.4800     -5.00    0.6050    -97.00
     0.6283    1.1630   -155.00    1.5650    -16.00    0.6110   -106.00
     0.6614    0.6760   -170.00    1.6360    -29.00    0.6100   -117.00
     0.6981    0.3540    178.00    1.6650    -45.00    0.5960   -130.00
     0.7392    0.1470    177.00    1.6470    -63.00    0.5660   -145.00
     0.7854    0.0620   -125.00    1.5370    -86.00    0.5120   -163.00
     0.8378    0.1020    -95.00    1.2640   -113.00    0.4280    174.00
     0.8976    0.1040   -102.00    0.8130   -142.00    0.3050    147.00
     0.9666    0.0800   -103.00    0.3820   -158.00    0.1520    111.00
     1.0472    0.0700    -91.00    0.2160   -144.00    0.0190     -9.00
     1.1424    0.0710    -95.00    0.1850   -142.00    0.1040   -137.00
     1.2566    0.0380    -97.00    0.1140   -158.00    0.0960    152.00
     1.3963    0.0490    -72.00    0.0510   -151.00    0.0170    -72.00
     1.5708    0.0310    -90.00    0.0090   -164.00    0.0270    120.00
     2.0944    0.0090    -96.00    0.0430     76.00    0.0040    -60.00

STATIC SOLUTION CONVERGED IN (     28 ) ITERATIONS
```

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OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP   PAGE 35
Pipelay Analysis
JOB NO. - Dynamic Analysis   LICENSED TO - OFFSHORE CONSTR. SPECIALISTS
USER ID - Karun   DATE - 3/25/2015   TIME - 12:18:21   CASE   7
==

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


CURRENT VELOCITIES
==================
    WATER     CURRENT    DIRECTION
    DEPTH      SPEED     OF TRAVEL
    (M  )     (M/S )      (DEG )
    ======    =======    =========
     0.000     1.030      270.000
    10.000     0.540      270.000
    21.340     0.440      270.000

TIME INTEGRATION PARAMETERS
===========================
    TIME STEP LENGTH .................    0.2000 SECONDS
    MAXIMUM TIME OF INTEGRATION .......  360.000 SECONDS
    SOLUTION SAMPLING TIME STEP........    0.4000 SECONDS
    SOLUTION SAMPLING STARTS AT TIME ..   60.000 SECONDS
    DAMPING RATIO .....................    0.2000
    NUMBER OF VARIABLE TIME STEPS .....        0

WAVE SPECTRUM EQUATION
======================
    SEA STATE ROW INDEX ...............        1
    WAVE SPECTRUM EQUATION TYPE .......        7 JONSWAP (CLASSIC)
```

```
    NUMBER OF WAVES IN SPECTRUM .......        30
    USE WAVE FREQUENCY OR PERIOD ...... FREQUENCY
    SEED FOR RANDOM WAVE PHASES .......         0
    MINIMUM FREQUENCY IN SPECTRUM .....    0.2094 RAD/SEC
    MAXIMUM FREQUENCY IN SPECTRUM .....    2.0944 RAD/SEC
    DIRECTION OF WAVE TRAVEL ..........  270.000 DEGREES
    1ST JONSWAP COEF. (ALPHA) ......... 0.0021000
    2ND JONSWAP COEF. (GAMMA) .........    1.000
    PEAK WAVE FREQUENCY ...............    0.8537 RAD/SEC
```

```
================================================================================
OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP          PAGE  36
Pipelay Analysis
JOB NO. - Dynamic Analysis        LICENSED TO - OFFSHORE CONSTR. SPECIALISTS
USER ID - Karun                   DATE - 3/25/2015  TIME - 12:18:21  CASE   7
================================================================================
```

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


BARGE MOTION RAO TABLE
======================
    SEA STATE NUMBER ..................        1
    USE PHASE LAG FOR RAOS ............        0
    VESSEL MOTIONS SIGN CONVENTION .... OFFPIPE
    USE WAVE FREQUENCY OR PERIOD ...... FREQUENCY
    RANDOM WAVE GENERATION SEED .......        0
```

WAVE FREQUENCY (RAD/SEC)	/------ SURGE -----/ AMPLITUDE (M/M)	PHASE (DEG)	/------ SWAY ------/ AMPLITUDE (M/M)	PHASE (DEG)	/------ HEAVE -----/ AMPLITUDE (M/M)	PHASE (DEG)
0.2513	0.0310	101.00	0.8190	124.00	1.1000	0.00
0.3142	0.0120	153.00	0.8760	115.00	1.1070	0.00
0.3307	0.0130	164.00	0.8790	112.00	1.1090	-1.00
0.3491	0.0150	166.00	0.8790	109.00	1.1110	-1.00
0.3696	0.0160	167.00	0.8670	107.00	1.1130	-1.00
0.3927	0.0170	167.00	0.8500	105.00	1.1160	-1.00
0.4189	0.0180	166.00	0.8280	104.00	1.1200	-2.00
0.4333	0.0190	166.00	0.8140	103.00	1.1220	-2.00
0.4488	0.0190	165.00	0.7990	103.00	1.1250	-2.00
0.4654	0.0190	165.00	0.7840	103.00	1.1280	-2.00
0.4833	0.0190	166.00	0.7720	104.00	1.1330	-3.00
0.5027	0.0200	162.00	0.7720	106.00	1.1360	-3.00
0.5236	0.0210	156.00	0.7930	107.00	1.1340	-4.00
0.5464	0.0200	151.00	0.8260	106.00	1.1280	-5.00
0.5712	0.0200	146.00	0.8400	102.00	1.1190	-6.00
0.5984	0.0200	159.00	0.8210	99.00	1.1500	-6.00
0.6283	0.0230	166.00	0.7760	96.00	1.1880	-7.00
0.6614	0.0270	170.00	0.7260	96.00	1.2330	-9.00
0.6981	0.0330	167.00	0.6750	96.00	1.2700	-13.00
0.7392	0.0410	157.00	0.6220	99.00	1.2830	-20.00
0.7854	0.0490	143.00	0.5720	101.00	1.2500	-29.00
0.8378	0.0560	122.00	0.5170	104.00	1.1150	-41.00
0.8976	0.0570	96.00	0.4570	109.00	0.8800	-54.00
0.9666	0.0470	69.00	0.3950	116.00	0.6020	-63.00
1.0472	0.0330	49.00	0.3340	126.00	0.3630	-66.00
1.1424	0.0200	20.00	0.2770	142.00	0.1860	-61.00
1.2566	0.0090	12.00	0.2270	162.00	0.0730	-51.00
1.3963	0.0010	167.00	0.1770	-171.00	0.0090	161.00
1.5708	0.0110	77.00	0.1220	-133.00	0.0330	-134.00
2.0944	0.0110	-151.00	0.0470	46.00	0.1930	-176.00

```
================================================================================
OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP          PAGE  37
Pipelay Analysis
JOB NO. - Dynamic Analysis        LICENSED TO - OFFSHORE CONSTR. SPECIALISTS
USER ID - Karun                   DATE - 3/25/2015  TIME - 12:18:21  CASE   7
================================================================================
```

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

WAVE FREQUENCY (RAD/SEC)	/------ ROLL ------/ AMPLITUDE (DEG/M)	PHASE (DEG)	/------ PITCH -----/ AMPLITUDE (DEG/M)	PHASE (DEG)	/------- YAW ------/ AMPLITUDE (DEG/M)	PHASE (DEG)
0.2513	0.4530	77.00	0.0010	143.00	0.2470	68.00
0.3142	0.6990	74.00	0.0020	158.00	0.1480	44.00
0.3307	0.7750	74.00	0.0030	145.00	0.1270	41.00
0.3491	0.8670	75.00	0.0040	139.00	0.1060	40.00
0.3696	1.0100	74.00	0.0040	147.00	0.0950	40.00
0.3927	1.2120	74.00	0.0050	153.00	0.0850	40.00
0.4189	1.5150	73.00	0.0070	157.00	0.0770	42.00
0.4333	1.7310	71.00	0.0080	158.00	0.0740	42.00
0.4488	2.0150	69.00	0.0090	158.00	0.0710	43.00
0.4654	2.3990	66.00	0.0110	157.00	0.0690	43.00
0.4833	2.8980	58.00	0.0140	153.00	0.0700	41.00
0.5027	3.5110	47.00	0.0170	147.00	0.0680	39.00
0.5236	4.0950	30.00	0.0210	138.00	0.0630	34.00
0.5464	4.4100	8.00	0.0250	129.00	0.0520	27.00
0.5712	4.1580	-16.00	0.0280	122.00	0.0360	25.00
0.5984	3.5460	-39.00	0.0360	130.00	0.0250	28.00
0.6283	2.7670	-56.00	0.0520	130.00	0.0200	41.00
0.6614	2.0820	-65.00	0.0760	123.00	0.0180	53.00
0.6981	1.5400	-68.00	0.1070	111.00	0.0170	58.00
0.7392	1.1360	-66.00	0.1470	91.00	0.0170	61.00
0.7854	0.8770	-62.00	0.2000	67.00	0.0140	64.00
0.8378	0.6930	-56.00	0.2470	37.00	0.0090	65.00
0.8976	0.5500	-52.00	0.2480	2.00	0.0040	54.00
0.9666	0.4090	-50.00	0.1850	-28.00	0.0030	-46.00
1.0472	0.2780	-45.00	0.1180	-48.00	0.0080	-72.00

```
     1.1424    0.1720    -38.00    0.0590    -57.00    0.0110    -84.00
     1.2566    0.0830    -40.00    0.0240    -71.00    0.0150    -79.00
     1.3963    0.0460   -106.00    0.0020    148.00    0.0150    -86.00
     1.5708    0.1310   -120.00    0.0660     41.00    0.0070    -97.00
     2.0944    0.1550   -124.00    0.0720   -148.00    0.0010   -172.00

STATIC SOLUTION CONVERGED IN (     21 ) ITERATIONS
```

```
================================================================================
OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP          PAGE  38
Pipelay Analysis
JOB NO. - Dynamic Analysis        LICENSED TO - OFFSHORE CONSTR. SPECIALISTS
USER ID - Karun                   DATE - 3/25/2015   TIME - 12:18:21   CASE   8
================================================================================
```

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

CURRENT VELOCITIES
==================
```
     WATER     CURRENT    DIRECTION
     DEPTH      SPEED     OF TRAVEL
     (M  )      (M/S )      (DEG )
     ======    =======    =========
     0.000      1.030      315.000
    10.000      0.540      315.000
    21.340      0.440      315.000
```

TIME INTEGRATION PARAMETERS
===========================
```
     TIME STEP LENGTH ..................    0.2000 SECONDS
     MAXIMUM TIME OF INTEGRATION .......  360.000 SECONDS
     SOLUTION SAMPLING TIME STEP........    0.400 SECONDS
     SOLUTION SAMPLING STARTS AT TIME ..   60.000 SECONDS
     DAMPING RATIO .....................    0.2000
     NUMBER OF VARIABLE TIME STEPS .....        0
```

WAVE SPECTRUM EQUATION
======================
```
     SEA STATE ROW INDEX ...............        1
     WAVE SPECTRUM EQUATION TYPE .......        7 JONSWAP (CLASSIC)
     NUMBER OF WAVES IN SPECTRUM .......       30
     USE WAVE FREQUENCY OR PERIOD ...... FREQUENCY
     SEED FOR RANDOM WAVE PHASES .......        0
     MINIMUM FREQUENCY IN SPECTRUM .....    0.2094 RAD/SEC
     MAXIMUM FREQUENCY IN SPECTRUM .....    2.0944 RAD/SEC
     DIRECTION OF WAVE TRAVEL ..........  315.000 DEGREES
     1ST JONSWAP COEF. (ALPHA) ......... 0.0021000
     2ND JONSWAP COEF. (GAMMA) .........    1.000
     PEAK WAVE FREQUENCY ...............    0.8537 RAD/SEC
```

```
================================================================================
OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP          PAGE  39
Pipelay Analysis
JOB NO. - Dynamic Analysis        LICENSED TO - OFFSHORE CONSTR. SPECIALISTS
USER ID - Karun                   DATE - 3/25/2015   TIME - 12:18:21   CASE   8
================================================================================
```

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

BARGE MOTION RAO TABLE
======================
```
     SEA STATE NUMBER ..................        1
     USE PHASE LAG FOR RAOS ............        0
     VESSEL MOTIONS SIGN CONVENTION .... OFFPIPE
     USE WAVE FREQUENCY OR PERIOD ...... FREQUENCY
     RANDOM WAVE GENERATION SEED .......        0
```

```
    WAVE     /------ SURGE -----/  /------ SWAY ------/  /------ HEAVE -----/
 FREQUENCY  AMPLITUDE    PHASE     AMPLITUDE    PHASE    AMPLITUDE    PHASE
 (RAD/SEC)   (M/M  )     (DEG)      (M/M  )     (DEG)     (M/M  )     (DEG)
 =========  =======     =======    =======     =======   =======    =======
    0.2513    1.3890     115.00     0.5060     144.00     1.0870      17.00
    0.3142    1.0390     121.00     0.5950     144.00     1.0780      26.00
    0.3307    0.9890     123.00     0.5980     145.00     1.0730      29.00
    0.3491    0.9430     127.00     0.5980     145.00     1.0660      32.00
    0.3696    0.9000     131.00     0.5890     147.00     1.0560      36.00
    0.3927    0.8580     135.00     0.5740     150.00     1.0420      41.00
    0.4189    0.8150     141.00     0.5530     154.00     1.0220      46.00
    0.4333    0.7920     145.00     0.5400     156.00     1.0090      49.00
    0.4488    0.7680     148.00     0.5240     159.00     0.9940      53.00
    0.4654    0.7420     152.00     0.5060     163.00     0.9750      57.00
    0.4833    0.7140     157.00     0.4880     169.00     0.9540      62.00
    0.5027    0.6820     162.00     0.4720     175.00     0.9280      67.00
    0.5236    0.6450     168.00     0.4740    -176.00     0.8960      72.00
    0.5464    0.6040     175.00     0.4850    -171.00     0.8540      79.00
    0.5712    0.5570    -177.00     0.4760    -168.00     0.8160      87.00
    0.5984    0.5010    -168.00     0.4260    -164.00     0.7760      96.00
    0.6283    0.4360    -157.00     0.3630    -155.00     0.7270     107.00
    0.6614    0.3620    -145.00     0.3010    -143.00     0.6650     119.00
    0.6981    0.2830    -128.00     0.2380    -129.00     0.5890     132.00
    0.7392    0.2000    -108.00     0.1710    -112.00     0.4890     147.00
    0.7854    0.1130     -81.00     0.1000     -89.00     0.3590     165.00
    0.8378    0.0310      -8.00     0.0310     -48.00     0.2100    -164.00
    0.8976    0.0760     114.00     0.0340     113.00     0.1160    -101.00
    0.9666    0.1120     163.00     0.0680     164.00     0.1140     -32.00
    1.0472    0.1080    -134.00     0.0720    -141.00     0.0820      32.00
    1.1424    0.0850     -40.00     0.0410     -71.00     0.0380     121.00
    1.2566    0.0500      93.00     0.0100     137.00     0.0260     -85.00
    1.3963    0.0260     -75.00     0.0200     -69.00     0.0080      87.00
    1.5708    0.0050    -154.00     0.0050     -85.00     0.0010      51.00
```

```
     2.0944    0.0210     44.00    0.0020    -140.00    0.0640     76.00
```

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OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP   PAGE 40
Pipelay Analysis
JOB NO. - Dynamic Analysis   LICENSED TO - OFFSHORE CONSTR. SPECIALISTS
USER ID - Karun   DATE - 3/25/2015   TIME - 12:18:21   CASE 8
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                    I N P U T   D A T A   E C H O

      WAVE   /------ ROLL ------/ /------ PITCH -----/ /------- YAW ------/
   FREQUENCY   AMPLITUDE   PHASE   AMPLITUDE   PHASE   AMPLITUDE   PHASE
   (RAD/SEC)   (DEG/M)   (DEG)   (DEG/M)   (DEG)   (DEG/M)   (DEG)
   =========   ========   ======   ========   =======   ========   =======
    0.2513   0.3270   93.00   0.2710   -73.00   0.3770   153.00
    0.3142   0.4900   98.00   0.4300   -65.00   0.2700   174.00
    0.3307   0.5420   101.00   0.4770   -62.00   0.2760   -176.00
    0.3491   0.6040   104.00   0.5320   -59.00   0.2910   -167.00
    0.3696   0.6900   107.00   0.5950   -56.00   0.3140   -159.00
    0.3927   0.8080   111.00   0.6700   -51.00   0.3440   -151.00
    0.4189   0.9790   115.00   0.7590   -46.00   0.3800   -143.00
    0.4333   1.0910   118.00   0.8090   -43.00   0.4010   -138.00
    0.4488   1.2460   120.00   0.8640   -40.00   0.4220   -134.00
    0.4654   1.4560   121.00   0.9220   -37.00   0.4440   -129.00
    0.4833   1.7500   120.00   0.9850   -33.00   0.4660   -124.00
    0.5027   2.1650   115.00   1.0490   -29.00   0.4890   -118.00
    0.5236   2.6080   101.00   1.1120   -24.00   0.5110   -111.00
    0.5464   2.8450   79.00   1.1830   -19.00   0.5360   -103.00
    0.5712   2.5730   52.00   1.2690   -13.00   0.5640   -95.00
    0.5984   1.8250   30.00   1.3500   -6.00   0.5870   -86.00
    0.6283   1.1000   20.00   1.4140   0.00   0.6010   -75.00
    0.6614   0.6310   20.00   1.4510   9.00   0.6050   -63.00
    0.6981   0.3370   20.00   1.4560   19.00   0.5970   -49.00
    0.7392   0.1570   10.00   1.4190   30.00   0.5710   -32.00
    0.7854   0.0920   -27.00   1.3170   43.00   0.5220   -12.00
    0.8378   0.1000   -47.00   1.0930   57.00   0.4390   12.00
    0.8976   0.0870   -35.00   0.6910   73.00   0.3150   42.00
    0.9666   0.0490   -2.00   0.2590   108.00   0.1590   82.00
    1.0472   0.0080   116.00   0.1010   -134.00   0.0200   -157.00
    1.1424   0.0350   -97.00   0.1160   -25.00   0.0990   -2.00
    1.2566   0.0220   -10.00   0.0240   73.00   0.0960   82.00
    1.3963   0.0160   -96.00   0.0130   -23.00   0.0080   -139.00
    1.5708   0.0060   -62.00   0.0040   -90.00   0.0270   139.00
    2.0944   0.0580   51.00   0.1670   67.00   0.0090   -108.00

PIPE TENSION DATA
=================
    STATIC PIPE TENSION ON LAY VESSEL .   250.000 K-NEWTON
    MINIMUM DYNAMIC PIPE TENSION ......   225.000 K-NEWTON
    MAXIMUM DYNAMIC PIPE TENSION ......   275.000 K-NEWTON
    STATIC HORIZONTAL BOTTOM TENSION ..   0.000 K-NEWTON
    NO. OF VALUES FOR TENSION PROFILE .   0
    VALUES ARE FOR PIPE SPAN ANALYSIS .   NO
    MAXIMUM PIPE PAYOUT SPEED ....   0.000 M/SEC
    MAXIMUM PIPE TAKEUP SPEED ....   0.000 M/SEC

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OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP   PAGE 41
Pipelay Analysis
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USER ID - Karun   DATE - 3/25/2015   TIME - 12:18:21   CASE 8
==

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

SAGBEND GEOMETRY
================
    SAGBEND PIPE ELEMENT LENGTH ....   6.000 METERS
    WATER DEPTH ....   21.34 METERS
    X-COORDINATE AT SPECIFIED DEPTH . .   0.00 METERS
    ESTIMATED SAGBEND X LENGTH ....   0.00 METERS
    ESTIMATED PIPE LENGTH ON SEABED ...   0.00 METERS
    X-COORD OF PIPE FREE END ON SEABED   0.00 METERS
    X-COORD POINT OF FIXITY ON SEABED .   0.00 METERS
    MAXIMUM SLOPE (ANGLE) OF SEABED ...   0.000 DEGREES
    DIRECTION OF MAXIMUM SLOPE ....   0.000 DEGREES

    PIPE/CABLE SPAN END CONDITION .....   0 PIPE/CABLE RESTING ON SEABED
    PIPE/CABLE SPAN LENGTH GIVEN BY ...   0 SPECIFIED PIPE/CABLE TENSION
    ESTIMATED SPAN DEPTH AT FREE END ..   0.00 METERS
    PIPE VERTICAL ANGLE AT FREE END ...   0.000 DEGREES
    BOTTOM HINGE OFFSET ....   0.000 METERS
    BOTTOM HINGE MINIMUM ANGLE ....   0.000 DEGREES
    BOTTOM HINGE MAXIMUM ANGLE ....   0.000 DEGREES

SOIL ELEMENT PROPERTIES
=======================
    SOIL PROPERTY TABLE ROW INDEX   0
    SOIL ELEMENT TYPE (FUTURE USE)   0
    PIPE INDEX OR SEGMENT NUMBER   0
    LONGITUDINAL SOIL STIFFNESS ....   0.00 KN/M^2
    VERTICAL SOIL STIFFNESS ....   0.00 KN/M^2
    LATERAL SOIL STIFFNESS ....   0.00 KN/M^2
    DEFLECTION UNDER REFERENCE LOAD ...   0.0000 CM

    LONGITUDINAL COEF. OF FRICTION 0.500
    LATERAL COEFFICIENT OF FRICTION ...   0.000
    NUMBER 0F INTEGRATION POINTS   0

STATIC SOLUTION CONVERGED IN (22) ITERATIONS

END OF INPUT DATA

===
OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP   PAGE 42
Pipelay Analysis
JOB NO. - Dynamic Analysis   LICENSED TO - OFFSHORE CONSTR. SPECIALISTS
USER ID - Karun   DATE - 3/25/2015 TIME - 12:18:21 CASE 1
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           S T A T I C   S O L U T I O N   S U M M A R Y

PIPE PROPERTIES (1)
=====================
  PIPE SECTION LENGTH ..   0.00 M   ELASTIC MODULUS ......   207000. MPA
  OUTSIDE DIAMETER .....   27.310 CM CROSS SECTIONAL AREA .   128.75 CM^2
  WALL THICKNESS ....   1.590 CM MOMENT OF INERTIA .... 12671.5 CM^4
  WEIGHT/LENGTH IN AIR . 2205.00 N/M YIELD STRESS ....   450.00 MPA
  SUBMERGED WGHT/LENG .. 1164.00 N/M STRESS INTENS FACTOR .   1.000
  SPECIFIC GRAVITY .....   2.118   STEEL DENSITY 76982.0 N/M3
  WRAP COAT THICKNESS ..   0.280 CM WRAP COAT DENSITY 9218.0 N/M3
  CONCRETE THICKNESS ...   4.000 CM CONCRETE DENSITY 29846.0 N/M3

BARGE DATA
==========
  TOTAL PIPE TENSION ...   250.00 KN RADIUS OF CURVATURE ..   0.00 M
  NUMBER OF TENSIONERS .   2   BARGE TRIM ANGLE .....   0.500 DEG
  NO. OF PIPE SUPPORTS .   7   PIPE ANGLE AT STERN ..   9.904 DEG
  BARGE HEADING ....   0.000 DEG OFFSET FROM R.O.W. ...   0.00 M

STINGER DATA
============
  NO. OF PIPE SUPPORTS .   5   PIPE DEPTH AT STERN ..   -8.20 M
  NO. STINGER SECTIONS .   7   PIPE ANGLE AT STERN ..   17.335 DEG
  RADIUS OF CURVATURE ..   200.00 M   STINGER STERN DEPTH ..   -8.55 M
  STINGER LENGTH ....   39.00 M

SAGBEND DATA
============
  WATER DEPTH ....   21.34 M   TENSION AT TOUCHDOWN .   209.82 KN
  TOUCHDOWN X-COORD. ... -113.21 M   BOTTOM SLOPE ANGLE ...   0.000 DEG
  PROJECTED SPAN LENGTH   73.65 M   PIPE LENGTH GAIN .....   2.92 M

============================= SOLUTION SUMMARY =============================
NODE   PIPE   X   Y   Z   SUPPORT REACT   TOTAL   TOTAL   PCT
NO. SECTION   COORD   COORD   COORD   VERT   HORIZ   MOMENT STRAIN   ALL
              (M)   (M)   (M)   (KN)   (KN)   (KN-M) (PCT)   (%)
===
  1 LAYBARGE   96.3   6.9   0.0   11.8   0.0   0.0   0.000   0.
  3 LAYBARGE   84.3   6.6   0.0   20.0   0.0   17.8   0.011   0.
  5 LAYBARGE   73.4   6.4   0.0   43.4   0.0   89.8   0.056   0.
  7 TENSIONR   60.1   5.9   0.0   4.5   0.0   45.6   0.033   0.
  9 LAYBARGE   51.1   5.7   0.0   0.0   0.0   38.8   0.029   0.
 10 LAYBARGE   46.4   5.5   0.0   62.5   0.0   155.5   0.101   0.
 12 LAYBARGE   39.4   5.2   0.0   0.0   0.0   2.1   0.006   0.
 13 TENSIONR   35.4   5.0   0.0   -8.5   0.0   34.4   0.030   0.
 15 LAYBARGE   26.1   4.5   0.0   0.0   0.0   91.1   0.066   0.
 16 LAYBARGE   23.3   4.3   0.0   56.6   0.0   173.2   0.116   0.
 18 LAYBARGE   8.9   2.7   0.0   61.1   0.0   206.5   0.137   0.
 20 LAYBARGE   3.1   1.8   0.0   0.0   0.0   69.5   0.052   0.

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OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP   PAGE 43
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           S T A T I C   S O L U T I O N   S U M M A R Y

 24 STINGER   -7.5   -0.2   0.0   12.9   0.0   61.6   0.047   0.
 26 STINGER   -16.5   -2.0   0.0   30.8   0.0   133.3   0.091   0.
 29 STINGER   -26.2   -4.3   0.0   14.7   0.0   97.6   0.069   0.
 31 STINGER   -36.6   -7.3   0.0   34.5   0.0   113.7   0.079   0.
 33 STINGER   -39.6   -8.2   0.0   0.0   0.0   51.9   0.041   0.
 41 SAGBEND   -80.2 -18.7   0.0   0.0   0.0   133.2   0.090   0.
 47 SEABED   -116.0 -21.4   0.0   5.7   0.0   46.8   0.037   0.

      M A X I M U M   D Y N A M I C   P I P E   F O R C E S   A N D   S T R A I N S

===
NODE   PIPE   X   Y   Z   HORIZ   VERT   PIPE   TENSILE   HOOP   BENDING STRAINS   TOTAL PERCNT
NO. SECTION   COORD   COORD   COORD   ANGLE   ANGLE   LENGTH   STRAIN   STRAIN   VERT   HORIZ   STRAIN ALLOW
               (M)   (M)   (M)   (DEG) (DEG)   (M)   (PCT)   (PCT)   (PCT)   (PCT)   (PCT) (PCT)
===
   1 LAYBARGE   96.29   6.92   0.00   0.000   1.641   0.00   0.0000   0.0000   0.0000   0.0000   0.0000   0.00
   3 LAYBARGE   84.26   6.64   0.00   0.000   1.171   12.04 -0.0001   0.0000 -0.0118   0.0000   0.0119   0.00
   5 LAYBARGE   73.43   6.38   0.00   0.000   1.934   22.87 -0.0001   0.0000 -0.0566   0.0000   0.0567   0.00
   7 TENSIONR   60.09   5.89   0.00   0.000   1.621   36.22   0.0056   0.0000   0.0288   0.0000   0.0341   0.00
   9 LAYBARGE   51.07   5.68   0.00   0.000   1.271   45.24   0.0056   0.0000 -0.0245   0.0000   0.0296   0.00
  10 LAYBARGE   46.43   5.54   0.00   0.000   2.207   49.89   0.0056   0.0000 -0.0968   0.0000   0.1024   0.00
  12 LAYBARGE   39.39   5.18   0.00   0.000   3.259   56.93   0.0056   0.0000 -0.0028   0.0000   0.0078   0.00
  13 TENSIONR   35.34   4.95   0.00   0.000   3.097   60.99   0.0105   0.0000   0.0228   0.0000   0.0328   0.00

NODE NO.	PIPE SECTION	X COORD (M)	Y COORD (M)	Z COORD (M)	HORIZ ANGLE (DEG)	VERT ANGLE (DEG)	PIPE LENGTH (M)	TENSILE STRAIN (PCT)	HOOP STRAIN (PCT)	BENDING STRAINS VERT (PCT)	HORIZ (PCT)	TOTAL STRAIN (PCT)	PERCNT ALLOW (PCT)
15	LAYBARGE	26.09	4.47	0.00	0.000	3.325	70.26	0.0105	0.0000	-0.0608	0.0000	0.0708	0.00
16	LAYBARGE	23.33	4.30	0.00	0.000	4.089	73.02	0.0104	0.0000	-0.1141	0.0000	0.1241	0.00
18	LAYBARGE	8.88	2.76	0.00	0.000	8.460	87.56	0.0104	0.0000	-0.1669	0.0000	0.1763	0.00
20	LAYBARGE	3.09	1.79	0.00	0.000	10.625	93.44	0.0103	0.0000	-0.2167	0.0000	0.2245	0.00
24	STINGER	-7.58	-0.46	0.00	0.000	12.744	104.24	0.0102	0.0000	-0.1556	0.0000	0.1654	0.00
26	STINGER	-16.46	-2.51	0.00	0.000	14.458	113.38	0.0101	-0.0001	-0.1568	0.0000	0.1663	0.00
29	STINGER	-25.90	-5.03	0.00	0.000	15.468	123.33	0.0100	-0.0003	-0.1331	0.0000	0.1427	0.00
31	STINGER	-36.33	-8.02	0.00	0.000	16.835	134.14	0.0098	-0.0004	-0.1694	0.0000	0.1768	0.00
33	STINGER	-39.32	-8.92	0.00	0.000	17.138	137.27	0.0098	-0.0004	-0.1075	0.0000	0.1148	0.00
35	SAGBEND	-45.18	-10.72	0.00	0.000	17.168	143.25	0.0097	-0.0005	0.0749	0.0000	0.0841	0.00
36	SAGBEND	-50.90	-12.44	0.00	0.000	16.598	149.25	0.0096	-0.0006	0.0808	0.0000	0.0898	0.00
37	SAGBEND	-56.67	-14.08	0.00	0.000	15.314	155.25	0.0095	-0.0006	0.0923	0.0000	0.1012	0.00
38	SAGBEND	-62.48	-15.57	0.00	0.000	13.704	161.25	0.0094	-0.0007	0.1015	0.0000	0.1103	0.00
39	SAGBEND	-68.33	-16.90	0.00	0.000	11.942	167.25	0.0093	-0.0007	0.1032	0.0000	0.1109	0.00
40	SAGBEND	-74.21	-18.04	0.00	0.000	10.159	173.25	0.0092	-0.0008	0.1068	0.0000	0.1136	0.00
41	SAGBEND	-80.13	-18.99	0.00	0.000	8.469	179.25	0.0092	-0.0008	0.1094	0.0000	0.1162	0.00
42	SAGBEND	-86.08	-19.77	0.00	0.000	6.752	185.25	0.0091	-0.0009	0.1076	0.0000	0.1142	0.00
43	SAGBEND	-92.05	-20.38	0.00	0.000	4.983	191.25	0.0091	-0.0009	0.1045	0.0000	0.1114	0.00
44	SAGBEND	-98.03	-20.81	0.00	0.000	3.309	197.25	0.0091	-0.0009	0.0947	0.0000	0.1014	0.00
45	SAGBEND	-104.02	-21.07	0.00	0.000	1.966	203.25	0.0091	-0.0009	0.0802	0.0000	0.0872	0.00
46	SAGBEND	-110.01	-21.23	0.00	0.000	1.134	209.25	0.0091	-0.0009	0.0624	0.0000	0.0713	0.00
47	SAGBEND	-116.01	-21.32	0.00	0.000	0.611	215.25	0.0091	-0.0009	0.0481	0.0000	0.0566	0.00
48	SEABED	-122.01	-21.37	0.00	0.000	0.212	221.25	0.0091	-0.0009	0.0309	0.0000	0.0399	0.00
49	SEABED	-128.01	-21.37	0.00	0.000	0.006	227.25	0.0091	-0.0009	0.0120	0.0000	0.0210	0.00
50	SEABED	-134.01	-21.37	0.00	0.000	-0.026	233.25	0.0091	-0.0009	-0.0019	0.0000	0.0109	0.00
51	SEABED	-140.01	-21.37	0.00	0.000	-0.016	239.25	0.0091	-0.0009	-0.0014	0.0000	0.0108	0.00
52	SEABED	-146.01	-21.37	0.00	0.000	-0.005	245.25	0.0091	-0.0009	-0.0009	0.0000	0.0102	0.00
53	SEABED	-152.01	-21.37	0.00	0.000	0.000	251.25	0.0091	-0.0009	-0.0003	0.0000	0.0097	0.00
54	SEABED	-158.01	-21.37	0.00	0.000	0.001	257.25	0.0091	-0.0009	0.0001	0.0000	0.0096	0.00
55	SEABED	-164.01	-21.37	0.00	0.000	0.000	263.25	0.0091	-0.0009	0.0001	0.0000	0.0096	0.00
56	SEABED	-170.01	-21.37	0.00	0.000	0.000	269.25	0.0091	-0.0009	0.0000	0.0000	0.0096	0.00
57	SEABED	-176.01	-21.37	0.00	0.000	0.000	275.25	0.0092	-0.0009	0.0000	0.0000	0.0096	0.00
58	SEABED	-182.01	-21.37	0.00	0.000	0.000	281.25	0.0092	-0.0009	0.0000	0.0000	0.0096	0.00
59	SEABED	-188.01	-21.37	0.00	0.000	0.000	287.25	0.0092	-0.0009	0.0000	0.0000	0.0096	0.00

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 OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP        DATE - 3/25/2015    TIME - 12:18:21    PAGE   45
 PROJECT - Pipelay Analysis                                                         JOB NO. - Dynamic Analysis
 USER ID - Karun                                     LICENSED TO - OFFSHORE CONSTR. SPECIALISTS        CASE   1
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M A X I M U M   D Y N A M I C   P I P E   F O R C E S   A N D   S T R A I N S

NODE NO.	PIPE SECTION	X COORD (M)	Y COORD (M)	Z COORD (M)	HORIZ ANGLE (DEG)	VERT ANGLE (DEG)	PIPE LENGTH (M)	TENSILE STRAIN (PCT)	HOOP STRAIN (PCT)	BENDING STRAINS VERT (PCT)	HORIZ (PCT)	TOTAL STRAIN (PCT)	PERCNT ALLOW (PCT)
60	SEABED	-194.01	-21.37	0.00	0.000	0.000	293.25	0.0092	-0.0009	0.0000	0.0000	0.0097	0.00
61	SEABED	-200.01	-21.37	0.00	0.000	0.000	299.25	0.0092	-0.0009	0.0000	0.0000	0.0097	0.00
62	SEABED	-206.01	-21.37	0.00	0.000	0.000	305.25	0.0092	-0.0009	0.0000	0.0000	0.0097	0.00

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 OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP        DATE - 3/25/2015    TIME - 12:18:21    PAGE   46
 PROJECT - Pipelay Analysis                                                         JOB NO. - Dynamic Analysis
 USER ID - Karun                                     LICENSED TO - OFFSHORE CONSTR. SPECIALISTS        CASE   1
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M A X I M U M   D Y N A M I C   P I P E   F O R C E S   A N D   S T R A I N S

NODE NO.	PIPE SECTION	X COORD (M)	Y COORD (M)	Z COORD (M)	SUPPORT REACTION VERT (KN)	HORIZ (KN)	SUPT SEPARATIONS VERT (M)	HORIZ (M)	PIPE TENSION (KN)	BENDING MOMENTS VERT (KN-M)	HORIZ (KN-M)	TOTAL (KN-M)
1	LAYBARGE	96.29	6.92	0.00	12.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	LAYBARGE	84.26	6.64	0.00	20.48	0.00	0.00	0.00	-2.00	-19.14	0.00	19.14
5	LAYBARGE	73.43	6.38	0.00	43.96	0.00	0.00	0.00	-3.96	-91.53	0.00	91.53
7	TENSIONR	60.09	5.89	0.00	4.85	0.00	0.00	0.00	149.75	46.52	0.00	46.52
9	LAYBARGE	51.07	5.68	0.00	0.00	0.00	0.00	0.00	149.94	-39.64	0.00	39.64
10	LAYBARGE	46.43	5.54	0.00	63.62	0.00	0.00	0.00	149.59	-156.44	0.00	156.44
12	LAYBARGE	39.39	5.18	0.00	0.00	0.00	0.00	0.00	149.91	-4.56	0.00	4.56
13	TENSIONR	35.34	4.95	0.00	-9.72	0.00	0.00	0.00	278.14	36.78	0.00	36.78
15	LAYBARGE	26.09	4.47	0.00	0.00	0.00	0.00	0.00	277.97	-98.34	0.00	98.34
16	LAYBARGE	23.33	4.30	0.00	62.17	0.00	0.00	0.00	277.46	-184.46	0.00	184.46
18	LAYBARGE	8.88	2.76	0.00	73.62	0.00	0.00	0.00	275.31	-269.87	0.00	269.87
20	LAYBARGE	3.09	1.79	0.00	82.01	0.00	0.14	0.00	274.59	-350.37	0.00	350.37
24	STINGER	-7.58	-0.46	0.00	64.48	0.00	0.09	0.00	271.39	-251.53	0.00	251.53
26	STINGER	-16.46	-2.51	0.00	64.19	0.00	0.91	0.00	269.47	-253.42	0.00	253.42
29	STINGER	-25.90	-5.03	0.00	61.74	0.00	0.93	0.00	267.62	-215.20	0.00	215.20
31	STINGER	-36.33	-8.02	0.00	83.73	0.00	0.54	0.00	265.41	-273.89	0.00	273.89
33	STINGER	-39.32	-8.92	0.00	0.00	0.00	1.18	0.00	264.53	-173.73	0.00	173.73
35	SAGBEND	-45.18	-10.72	0.00	0.00	0.00	0.00	0.00	262.82	121.07	0.00	121.07
36	SAGBEND	-50.90	-12.44	0.00	0.00	0.00	0.00	0.00	261.22	130.65	0.00	130.65
37	SAGBEND	-56.67	-14.08	0.00	0.00	0.00	0.00	0.00	259.75	149.22	0.00	149.22
38	SAGBEND	-62.48	-15.57	0.00	0.00	0.00	0.00	0.00	258.42	164.16	0.00	164.16
39	SAGBEND	-68.33	-16.90	0.00	0.00	0.00	0.00	0.00	257.20	166.91	0.00	166.91
40	SAGBEND	-74.21	-18.04	0.00	0.00	0.00	0.00	0.00	256.10	172.71	0.00	172.71
41	SAGBEND	-80.13	-18.99	0.00	0.00	0.00	0.00	0.00	255.15	176.86	0.00	176.86
42	SAGBEND	-86.08	-19.77	0.00	0.00	0.00	0.00	0.00	254.39	173.90	0.00	173.90
43	SAGBEND	-92.05	-20.38	0.00	0.00	0.00	0.00	0.00	253.83	168.95	0.00	168.95
44	SAGBEND	-98.03	-20.81	0.00	1.19	0.00	0.00	0.00	253.50	153.02	0.00	153.02
45	SAGBEND	-104.02	-21.07	0.00	11.62	0.00	0.00	0.00	253.37	129.73	0.00	129.73
46	SAGBEND	-110.01	-21.23	0.00	13.67	0.00	0.00	0.00	253.44	100.84	0.00	100.84
47	SAGBEND	-116.01	-21.32	0.00	11.89	0.00	0.00	0.00	253.67	77.71	0.00	77.71
48	SEABED	-122.01	-21.37	0.00	10.69	0.00	0.00	0.00	253.98	50.00	0.00	50.00

```
 49    SEABED    -128.01   -21.37     0.00      9.75     0.00      0.00      0.00    254.25    19.35     0.00     19.35
 50    SEABED    -134.01   -21.37     0.00      8.84     0.00      0.00      0.00    254.49    -3.07     0.00      3.07
 51    SEABED    -140.01   -21.37     0.00      7.85     0.00      0.00      0.00    254.73    -2.26     0.00      2.26
 52    SEABED    -146.01   -21.37     0.00      7.18     0.00      0.00      0.00    254.97    -1.39     0.00      1.39
 53    SEABED    -152.01   -21.37     0.00      6.99     0.00      0.00      0.00    255.19    -0.54     0.00      0.54
 54    SEABED    -158.01   -21.37     0.00      7.00     0.00      0.00      0.00    255.41     0.12     0.00      0.12
 55    SEABED    -164.01   -21.37     0.00      7.00     0.00      0.00      0.00    255.62     0.08     0.00      0.08
 56    SEABED    -170.01   -21.37     0.00      6.99     0.00      0.00      0.00    255.83     0.04     0.00      0.04
 57    SEABED    -176.01   -21.37     0.00      6.99     0.00      0.00      0.00    256.03     0.03     0.00      0.03
```

```
 ====================================================================================================================
   OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP              DATE -  3/25/2015    TIME - 12:18:21    PAGE    47
   PROJECT - Pipelay Analysis                                                          JOB NO. - Dynamic Analysis
   USER ID - Karun                                                  LICENSED TO - OFFSHORE CONSTR. SPECIALISTS        CASE    1
 ====================================================================================================================
```

          M A X I M U M   D Y N A M I C   P I P E   F O R C E S   A N D   S T R A I N S

```
====================================================================================================================
NODE    PIPE        X         Y         Z      SUPPORT REACTION    SUPT SEPARATIONS    PIPE           BENDING MOMENTS
NO.    SECTION    COORD     COORD     COORD    VERT      HORIZ     VERT      HORIZ    TENSION   VERT      HORIZ     TOTAL
                  (M  )     (M  )     (M  )    (KN )     (KN )     (M  )     (M  )    (KN  )   (KN-M)    (KN-M)    (KN-M)
====================================================================================================================

 58    SEABED    -182.01   -21.37     0.00      6.99     0.00      0.00      0.00    256.22    -0.03     0.00      0.03
 59    SEABED    -188.01   -21.37     0.00      6.99     0.00      0.00      0.00    256.40    -0.02     0.00      0.02
 60    SEABED    -194.01   -21.37     0.00      6.99     0.00      0.00      0.00    256.58    -0.02     0.00      0.02
 61    SEABED    -200.01   -21.37     0.00      6.99     0.00      0.00      0.00    256.76     0.01     0.00      0.01
 62    SEABED    -206.01   -21.37     0.00      0.00     0.00      0.00      0.00    256.92     0.00     0.00      0.00
```

```
====================================================================================================================
OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP              PAGE   48
Pipelay Analysis
JOB NO. - Dynamic Analysis          LICENSED TO - OFFSHORE CONSTR. SPECIALISTS
USER ID - Karun                          DATE -  3/25/2015   TIME - 12:18:21   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 (1)
====================
```
  PIPE SECTION LENGTH ..     0.00 M      ELASTIC MODULUS ......   207000. MPA
  OUTSIDE DIAMETER .....    27.310 CM    CROSS SECTIONAL AREA .   128.75 CM^2
  WALL THICKNESS .......     1.590 CM    MOMENT OF INERTIA ....  12671.5 CM^4
  WEIGHT/LENGTH IN AIR .  2205.00 N/M    YIELD STRESS .........   450.00 MPA
  SUBMERGED WGHT/LENG ..  1164.00 N/M    STRESS INTENS FACTOR .    1.000
  SPECIFIC GRAVITY .....     2.118       STEEL DENSITY ........  76982.0 N/M3
  WRAP COAT THICKNESS ..     0.280 CM    WRAP COAT DENSITY ....   9218.0 N/M3
  CONCRETE THICKNESS ...     4.000 CM    CONCRETE DENSITY .....  29846.0 N/M3
```

BARGE DATA
==========
```
  TOTAL PIPE TENSION ...   250.00 KN     RADIUS OF CURVATURE ..     0.00 M
  NUMBER OF TENSIONERS .        2        BARGE TRIM ANGLE .....     0.500 DEG
  NO. OF PIPE SUPPORTS .        7        PIPE ANGLE AT STERN ..     9.965 DEG
  BARGE HEADING ........     0.000 DEG   OFFSET FROM R.O.W. ...     0.00 M
```

STINGER DATA
============
```
  NO. OF PIPE SUPPORTS .        5        PIPE DEPTH AT STERN ..    -8.33 M
  NO. STINGER SECTIONS .        7        PIPE ANGLE AT STERN ..    17.336 DEG
  RADIUS OF CURVATURE ..   200.00 M      STINGER STERN DEPTH ..    -8.69 M
  STINGER LENGTH .......    39.00 M
```

SAGBEND DATA
============
```
  WATER DEPTH ..........    21.34 M      TENSION AT TOUCHDOWN .   209.82 KN
  TOUCHDOWN X-COORD. ...  -112.74 M      BOTTOM SLOPE ANGLE ...     0.000 DEG
  PROJECTED SPAN LENGTH    73.22 M       PIPE LENGTH GAIN .....     2.93 M
```

```
============================= SOLUTION SUMMARY =============================
NODE    PIPE       X        Y        Z     SUPPORT REACT   TOTAL    TOTAL   PCT
NO.   SECTION    COORD    COORD    COORD    VERT    HORIZ  MOMENT   STRAIN  ALL
                 (M  )    (M  )    (M  )    (KN )   (KN )  (KN-M)   (PCT )  (%)
===========================================================================
  1   LAYBARGE    96.3     6.9      0.0     11.8     0.0     0.0    0.000    0.
  3   LAYBARGE    84.3     6.6      0.0     20.0     0.0    17.8    0.011    0.
  5   LAYBARGE    73.4     6.4      0.0     43.4     0.0    89.8    0.056    0.
  7   TENSIONR    60.1     5.9      0.0      4.5     0.0    45.6    0.033    0.
  9   LAYBARGE    51.1     5.7      0.0      0.0     0.0    38.8    0.029    0.
 10   LAYBARGE    46.4     5.5      0.0     62.5     0.0   155.4    0.101    0.
 12   LAYBARGE    39.4     5.2      0.0      0.0     0.0     2.1    0.006    0.
 13   TENSIONR    35.4     5.0      0.0     -8.4     0.0    34.2    0.030    0.
 15   LAYBARGE    26.1     4.5      0.0      0.0     0.0    90.8    0.065    0.
 16   LAYBARGE    23.3     4.3      0.0     56.4     0.0   172.7    0.116    0.
 18   LAYBARGE     8.9     2.7      0.0     60.9     0.0   208.6    0.138    0.
 20   LAYBARGE     3.1     1.8      0.0      0.0     0.0    74.4    0.055    0.
```

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====================================================================================================================
OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP              PAGE   49
Pipelay Analysis
JOB NO. - Dynamic Analysis          LICENSED TO - OFFSHORE CONSTR. SPECIALISTS
USER ID - Karun                          DATE -  3/25/2015   TIME - 12:18:21   CASE    2
====================================================================================================================
```

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


```
 24   STINGER    -7.5    -0.2      0.0     17.1    -0.3    75.7    0.056    0.
 26   STINGER   -16.5    -2.1      0.0     26.9    -0.6   122.1    0.084    0.
 29   STINGER   -26.1    -4.5      0.0     15.3    -0.6    93.9    0.067    0.
 31   STINGER   -36.5    -7.4      0.0     33.5     1.6   107.7    0.075    0.
```

```
33  STINGER   -39.5   -8.3   0.0   0.0    -2.6   47.7   0.038   0.
41  SAGBEND   -80.1  -18.7   0.0   0.0     0.0  133.4   0.090   0.
47  SEABED   -116.0  -21.4   0.0   6.3    -0.5   43.6   0.035   0.
```

```
================================================================================================
  OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP          DATE - 3/25/2015    TIME - 12:18:21    PAGE   50
  PROJECT - Pipelay Analysis                                                        JOB NO. - Dynamic Analysis
  USER ID - Karun                                            LICENSED TO - OFFSHORE CONSTR. SPECIALISTS       CASE   2
================================================================================================
```

M A X I M U M   D Y N A M I C   P I P E   F O R C E S   A N D   S T R A I N S

NODE NO.	PIPE SECTION	X COORD (M)	Y COORD (M)	Z COORD (M)	HORIZ ANGLE (DEG)	VERT ANGLE (DEG)	PIPE LENGTH (M)	TENSILE STRAIN (PCT)	HOOP STRAIN (PCT)	BENDING STRAINS VERT (PCT)	HORIZ (PCT)	TOTAL STRAIN (PCT)	PERCNT ALLOW (PCT)
1	LAYBARGE	96.32	6.93	0.00	0.005	1.648	0.00	0.0000	0.0000	0.0000	0.0000	0.0000	0.00
3	LAYBARGE	84.28	6.65	-0.01	0.005	1.186	12.04	-0.0001	0.0000	-0.0119	0.0002	0.0119	0.00
5	LAYBARGE	73.46	6.37	0.00	0.006	1.948	22.87	-0.0002	0.0000	-0.0563	0.0002	0.0563	0.00
7	TENSIONR	60.11	5.88	-0.01	0.006	1.634	36.22	0.0056	0.0000	0.0288	-0.0001	0.0340	0.00
9	LAYBARGE	51.09	5.68	0.00	0.005	1.286	45.24	0.0056	0.0000	-0.0244	-0.0001	0.0297	0.00
10	LAYBARGE	46.45	5.55	0.00	0.006	2.223	49.89	0.0056	0.0000	-0.0969	0.0002	0.1023	0.00
12	LAYBARGE	39.42	5.18	0.00	0.007	3.275	56.93	0.0056	0.0000	-0.0028	0.0000	0.0077	0.00
13	TENSIONR	35.37	4.95	0.00	0.006	3.109	60.99	0.0104	0.0000	0.0237	0.0001	0.0332	0.00
15	LAYBARGE	26.11	4.46	0.00	0.007	3.338	70.26	0.0104	0.0000	-0.0627	-0.0001	0.0717	0.00
16	LAYBARGE	23.35	4.28	0.00	0.007	4.109	73.02	0.0104	0.0000	-0.1162	-0.0003	0.1258	0.00
18	LAYBARGE	8.90	2.72	0.00	0.009	8.439	87.56	0.0103	0.0000	-0.1645	-0.0004	0.1742	0.00
20	LAYBARGE	3.10	1.76	0.00	0.011	10.194	93.44	0.0103	0.0000	-0.1141	0.0004	0.1222	0.00
24	STINGER	-7.57	-0.31	0.00	0.010	11.542	104.24	0.0102	0.0000	-0.1275	-0.0007	0.1372	0.00
26	STINGER	-16.51	-2.37	0.00	0.010	13.774	113.39	0.0101	-0.0001	-0.1536	-0.0010	0.1616	0.00
29	STINGER	-26.08	-4.87	0.00	0.008	15.096	123.34	0.0099	-0.0002	-0.1609	-0.0014	0.1690	0.00
31	STINGER	-36.47	-7.91	-0.01	0.011	17.251	134.14	0.0098	-0.0004	-0.1529	0.0018	0.1603	0.00
33	STINGER	-39.47	-8.83	-0.01	0.000	17.607	137.27	0.0097	-0.0004	-0.0978	-0.0163	0.1052	0.00
35	SAGBEND	-45.19	-10.62	-0.01	-0.042	17.387	143.25	0.0096	-0.0005	0.0627	-0.0089	0.0716	0.00
36	SAGBEND	-50.91	-12.35	0.00	-0.067	16.635	149.25	0.0095	-0.0006	0.0787	-0.0055	0.0875	0.00
37	SAGBEND	-56.67	-13.96	0.00	-0.122	15.465	155.25	0.0094	-0.0006	0.0859	0.0067	0.0945	0.00
38	SAGBEND	-62.48	-15.41	0.01	-0.105	13.972	161.25	0.0093	-0.0007	0.0950	0.0079	0.1025	0.00
39	SAGBEND	-68.32	-16.67	0.02	-0.055	12.193	167.25	0.0092	-0.0007	0.1084	0.0080	0.1152	0.00
40	SAGBEND	-74.21	-17.80	0.02	-0.016	10.418	173.25	0.0092	-0.0008	0.1136	0.0077	0.1204	0.00
41	SAGBEND	-80.13	-18.80	0.02	0.007	8.588	179.25	0.0091	-0.0008	0.1098	0.0067	0.1164	0.00
42	SAGBEND	-86.08	-19.61	0.02	0.022	6.944	185.25	0.0091	-0.0008	0.1075	0.0053	0.1142	0.00
43	SAGBEND	-92.04	-20.25	0.02	0.034	5.304	191.25	0.0090	-0.0009	0.1017	0.0047	0.1085	0.00
44	SAGBEND	-98.02	-20.72	0.01	0.036	3.720	197.25	0.0090	-0.0009	0.0904	0.0040	0.0972	0.00
45	SAGBEND	-104.01	-21.04	0.01	0.040	2.344	203.25	0.0090	-0.0009	0.0756	-0.0065	0.0828	0.00
46	SAGBEND	-110.01	-21.22	0.01	0.037	1.295	209.25	0.0090	-0.0009	0.0616	-0.0115	0.0692	0.00
47	SAGBEND	-116.01	-21.32	0.01	0.019	0.633	215.25	0.0090	-0.0009	0.0488	-0.0134	0.0579	0.00
48	SEABED	-122.01	-21.37	0.01	0.052	0.208	221.25	0.0090	-0.0009	0.0313	-0.0083	0.0406	0.00
49	SEABED	-128.01	-21.37	0.00	0.038	-0.002	227.25	0.0090	-0.0009	0.0114	-0.0053	0.0214	0.00
50	SEABED	-134.01	-21.37	0.00	0.002	-0.029	233.25	0.0090	-0.0009	-0.0019	-0.0022	0.0114	0.00
51	SEABED	-140.01	-21.37	0.00	0.000	-0.017	239.25	0.0091	-0.0009	-0.0014	0.0004	0.0107	0.00
52	SEABED	-146.01	-21.37	0.00	-0.001	-0.006	245.25	0.0091	-0.0009	-0.0009	0.0003	0.0100	0.00
53	SEABED	-152.01	-21.37	0.00	0.000	0.000	251.25	0.0091	-0.0009	-0.0003	0.0002	0.0097	0.00
54	SEABED	-158.01	-21.37	0.00	0.000	0.001	257.25	0.0091	-0.0009	0.0001	0.0001	0.0096	0.00
55	SEABED	-164.01	-21.37	0.00	0.000	0.000	263.25	0.0091	-0.0009	0.0001	0.0001	0.0096	0.00
56	SEABED	-170.01	-21.37	0.00	0.000	0.000	269.25	0.0091	-0.0009	0.0000	0.0001	0.0096	0.00
57	SEABED	-176.01	-21.37	0.00	0.000	0.000	275.25	0.0091	-0.0009	0.0000	0.0001	0.0096	0.00
58	SEABED	-182.01	-21.37	0.00	0.000	0.000	281.25	0.0091	-0.0009	0.0000	0.0001	0.0096	0.00
59	SEABED	-188.01	-21.37	0.00	0.000	0.000	287.25	0.0091	-0.0009	0.0000	0.0001	0.0097	0.00

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  OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP          DATE - 3/25/2015    TIME - 12:18:21    PAGE   51
  PROJECT - Pipelay Analysis                                                        JOB NO. - Dynamic Analysis
  USER ID - Karun                                            LICENSED TO - OFFSHORE CONSTR. SPECIALISTS       CASE   2
================================================================================================
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M A X I M U M   D Y N A M I C   P I P E   F O R C E S   A N D   S T R A I N S

NODE NO.	PIPE SECTION	X COORD (M)	Y COORD (M)	Z COORD (M)	HORIZ ANGLE (DEG)	VERT ANGLE (DEG)	PIPE LENGTH (M)	TENSILE STRAIN (PCT)	HOOP STRAIN (PCT)	BENDING STRAINS VERT (PCT)	HORIZ (PCT)	TOTAL STRAIN (PCT)	PERCNT ALLOW (PCT)
60	SEABED	-194.01	-21.37	0.00	0.000	0.000	293.25	0.0091	-0.0009	0.0000	0.0002	0.0097	0.00
61	SEABED	-200.01	-21.37	0.00	0.000	0.000	299.25	0.0092	-0.0009	0.0000	0.0002	0.0097	0.00
62	SEABED	-206.01	-21.37	0.00	0.000	0.000	305.25	0.0092	-0.0009	0.0000	0.0000	0.0096	0.00

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================================================================================================
  OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP          DATE - 3/25/2015    TIME - 12:18:21    PAGE   52
  PROJECT - Pipelay Analysis                                                        JOB NO. - Dynamic Analysis
  USER ID - Karun                                            LICENSED TO - OFFSHORE CONSTR. SPECIALISTS       CASE   2
================================================================================================
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M A X I M U M   D Y N A M I C   P I P E   F O R C E S   A N D   S T R A I N S

NODE NO.	PIPE SECTION	X COORD (M)	Y COORD (M)	Z COORD (M)	SUPPORT REACTION VERT (KN)	HORIZ (KN)	SUPT SEPARATIONS VERT (M)	HORIZ (M)	PIPE TENSION (KN)	BENDING MOMENTS VERT (KN-M)	HORIZ (KN-M)	TOTAL (KN-M)
1	LAYBARGE	96.32	6.93	0.00	12.04	0.14	0.00	0.00	0.00	0.00	0.00	0.00
3	LAYBARGE	84.28	6.65	-0.01	20.71	0.31	0.00	0.00	-2.45	-19.24	0.35	19.24
5	LAYBARGE	73.46	6.37	0.00	43.99	0.20	0.00	0.00	-4.83	-91.03	0.29	91.03
7	TENSIONR	60.11	5.88	-0.01	5.01	0.15	0.00	0.00	148.78	46.48	-0.23	46.48
9	LAYBARGE	51.09	5.68	0.00	0.00	0.00	0.00	0.00	148.76	-39.38	-0.14	39.38
10	LAYBARGE	46.45	5.55	0.00	63.70	0.18	0.00	0.00	148.23	-156.62	0.37	156.62
12	LAYBARGE	39.42	5.18	0.00	0.00	0.00	0.00	0.00	148.18	-4.50	-0.05	4.50
13	TENSIONR	35.37	4.95	0.00	-10.32	0.16	0.00	0.00	277.58	38.29	0.19	38.29
15	LAYBARGE	26.11	4.46	0.00	0.00	0.00	0.00	0.00	277.36	-101.43	-0.24	101.43

16	LAYBARGE	23.35	4.28	0.00	63.38	-0.34	0.00	0.00	276.84	-187.91	-0.56	187.91
18	LAYBARGE	8.90	2.72	0.00	71.39	-0.36	0.00	0.00	274.53	-265.99	-0.63	265.99
20	LAYBARGE	3.10	1.76	0.00	25.10	0.43	0.18	0.00	273.77	-184.38	0.68	184.38
24	STINGER	-7.57	-0.31	0.00	56.56	-1.33	0.13	0.00	270.28	-206.10	-1.19	206.10
26	STINGER	-16.51	-2.37	0.00	58.00	-2.40	0.50	0.00	268.56	-248.27	-1.62	248.27
29	STINGER	-26.08	-4.87	0.00	54.46	-2.61	0.54	0.00	266.36	-260.14	-2.21	260.14
31	STINGER	-36.47	-7.91	-0.01	73.77	9.67	0.17	0.00	263.79	-247.16	2.99	247.16
33	STINGER	-39.47	-8.83	-0.01	-0.03	-12.69	0.66	0.00	263.11	-158.09	-26.43	158.10
35	SAGBEND	-45.19	-10.62	-0.01	0.00	0.00	0.00	0.00	261.50	101.33	-14.41	101.33
36	SAGBEND	-50.91	-12.35	0.00	0.00	0.00	0.00	0.00	259.82	127.30	-8.84	127.31
37	SAGBEND	-56.67	-13.96	0.00	0.00	0.00	0.00	0.00	258.21	138.84	10.85	138.85
38	SAGBEND	-62.48	-15.41	0.01	0.00	0.00	0.00	0.00	256.73	153.50	12.79	153.52
39	SAGBEND	-68.32	-16.67	0.02	0.00	0.00	0.00	0.00	255.39	175.25	13.00	175.31
40	SAGBEND	-74.21	-17.80	0.02	0.00	0.00	0.00	0.00	254.21	183.72	12.41	183.77
41	SAGBEND	-80.13	-18.80	0.02	0.00	0.00	0.00	0.00	253.21	177.44	10.82	177.47
42	SAGBEND	-86.08	-19.61	0.02	0.00	0.00	0.00	0.00	252.40	173.74	8.61	173.75
43	SAGBEND	-92.04	-20.25	0.02	0.00	0.00	0.00	0.00	251.80	164.44	7.56	164.44
44	SAGBEND	-98.02	-20.72	0.01	0.00	0.00	0.00	0.00	251.43	146.19	6.53	146.19
45	SAGBEND	-104.01	-21.04	0.01	2.52	-0.99	0.00	0.00	251.42	122.29	-10.43	122.29
46	SAGBEND	-110.01	-21.22	0.01	10.83	-3.53	0.00	0.00	251.64	99.52	-18.57	99.56
47	SAGBEND	-116.01	-21.32	0.01	11.34	-4.11	0.00	0.00	252.00	78.85	-21.60	78.96
48	SEABED	-122.01	-21.37	0.01	10.49	-2.67	0.00	0.00	252.37	50.64	-13.48	51.26
49	SEABED	-128.01	-21.37	0.00	9.62	-1.49	0.00	0.00	252.69	18.39	-8.54	20.25
50	SEABED	-134.01	-21.37	0.00	8.90	0.55	0.00	0.00	253.00	-3.04	-3.51	4.11
51	SEABED	-140.01	-21.37	0.00	7.81	0.35	0.00	0.00	253.31	-2.27	0.63	2.27
52	SEABED	-146.01	-21.37	0.00	7.13	0.20	0.00	0.00	253.61	-1.44	0.48	1.48
53	SEABED	-152.01	-21.37	0.00	6.98	-0.12	0.00	0.00	253.90	-0.53	0.34	0.62
54	SEABED	-158.01	-21.37	0.00	7.00	-0.12	0.00	0.00	254.19	0.10	0.18	0.19
55	SEABED	-164.01	-21.37	0.00	7.00	-0.12	0.00	0.00	254.46	0.08	0.18	0.18
56	SEABED	-170.01	-21.37	0.00	7.00	-0.12	0.00	0.00	254.73	0.05	0.18	0.18
57	SEABED	-176.01	-21.37	0.00	6.99	-0.12	0.00	0.00	254.99	0.03	0.18	0.18

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=============================================================================================================
 OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP          DATE - 3/25/2015   TIME - 12:18:21    PAGE   53
 PROJECT - Pipelay Analysis                                             JOB NO. - Dynamic Analysis
 USER ID - Karun                                       LICENSED TO - OFFSHORE CONSTR. SPECIALISTS      CASE    2
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M A X I M U M   D Y N A M I C   P I P E   F O R C E S   A N D   S T R A I N S

NODE NO.	PIPE SECTION	X COORD (M)	Y COORD (M)	Z COORD (M)	SUPPORT REACTION		SUPT SEPARATIONS		PIPE	BENDING MOMENTS		
					VERT (KN)	HORIZ (KN)	VERT (M)	HORIZ (M)	TENSION (KN)	VERT (KN-M)	HORIZ (KN-M)	TOTAL (KN-M)
58	SEABED	-182.01	-21.37	0.00	6.99	-0.12	0.00	0.00	255.24	-0.02	0.18	0.18
59	SEABED	-188.01	-21.37	0.00	6.99	-0.13	0.00	0.00	255.49	-0.02	0.20	0.20
60	SEABED	-194.01	-21.37	0.00	6.99	-0.12	0.00	0.00	255.73	-0.01	0.25	0.25
61	SEABED	-200.01	-21.37	0.00	6.99	-0.07	0.00	0.00	255.95	-0.01	0.28	0.28
62	SEABED	-206.01	-21.37	0.00	0.00	-0.01	0.00	0.00	256.18	0.00	0.00	0.00

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OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP          PAGE   54
Pipelay Analysis
JOB NO. - Dynamic Analysis      LICENSED TO - OFFSHORE CONSTR. SPECIALISTS
USER ID - Karun                 DATE - 3/25/2015   TIME - 12:18:21   CASE    3
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S T A T I C   S O L U T I O N   S U M M A R Y

PIPE PROPERTIES (1)
====================
PIPE SECTION LENGTH ..	0.00 M	ELASTIC MODULUS	207000. MPA
OUTSIDE DIAMETER	27.310 CM	CROSS SECTIONAL AREA .	128.75 CM^2
WALL THICKNESS	1.590 CM	MOMENT OF INERTIA	12671.5 CM^4
WEIGHT/LENGTH IN AIR .	2205.00 N/M	YIELD STRESS	450.00 MPA
SUBMERGED WGHT/LENG ..	1164.00 N/M	STRESS INTENS FACTOR .	1.000
SPECIFIC GRAVITY	2.118	STEEL DENSITY	76982.0 N/M3
WRAP COAT THICKNESS ..	0.280 CM	WRAP COAT DENSITY	9218.0 N/M3
CONCRETE THICKNESS ...	4.000 CM	CONCRETE DENSITY	29846.0 N/M3

BARGE DATA
==========
TOTAL PIPE TENSION ...	250.00 KN	RADIUS OF CURVATURE ..	0.00 M
NUMBER OF TENSIONERS .	2	BARGE TRIM ANGLE	0.500 DEG
NO. OF PIPE SUPPORTS .	7	PIPE ANGLE AT STERN ..	9.823 DEG
BARGE HEADING	0.000 DEG	OFFSET FROM R.O.W. ...	0.00 M

STINGER DATA
============
NO. OF PIPE SUPPORTS .	5	PIPE DEPTH AT STERN ..	-8.02 M
NO. STINGER SECTIONS .	7	PIPE ANGLE AT STERN ..	17.333 DEG
RADIUS OF CURVATURE ..	200.00 M	STINGER STERN DEPTH ..	-8.37 M
STINGER LENGTH	39.00 M		

SAGBEND DATA
============
WATER DEPTH	21.34 M	TENSION AT TOUCHDOWN .	209.81 KN
TOUCHDOWN X-COORD. ...	-113.79 M	BOTTOM SLOPE ANGLE ...	0.000 DEG
PROJECTED SPAN LENGTH	74.20 M	PIPE LENGTH GAIN	2.91 M

============================== SOLUTION SUMMARY ==============================
NODE NO.	PIPE SECTION	X COORD (M)	Y COORD (M)	Z COORD (M)	SUPPORT REACT		TOTAL MOMENT (KN-M)	TOTAL STRAIN (PCT)	PCT ALL (%)
					VERT (KN)	HORIZ (KN)			
1	LAYBARGE	96.3	6.9	0.0	11.8	0.0	0.0	0.000	0.
3	LAYBARGE	84.3	6.6	0.0	20.0	0.0	17.8	0.011	0.

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    5  LAYBARGE   73.4    6.4    0.0    43.4    0.0    89.8   0.056   0.
    7  TENSIONR   60.1    5.9    0.0     4.5    0.0    45.6   0.033   0.
    9  LAYBARGE   51.1    5.7    0.0     0.0    0.0    38.8   0.029   0.
   10  LAYBARGE   46.4    5.5    0.0    62.5    0.0   155.5   0.101   0.
   12  LAYBARGE   39.4    5.2    0.0     0.0    0.0     2.0   0.006   0.
   13  TENSIONR   35.4    5.0    0.0    -8.6    0.0    34.5   0.031   0.
   15  LAYBARGE   26.1    4.5    0.0     0.0    0.0    91.6   0.066   0.
   16  LAYBARGE   23.3    4.3    0.0    57.0    0.0   173.9   0.117   0.
   18  LAYBARGE    8.9    2.7    0.0    61.2    0.0   203.7   0.135   0.
   20  LAYBARGE    3.1    1.8    0.0     0.0    0.1    63.1   0.048   0.
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OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP   PAGE 55
Pipelay Analysis
JOB NO. - Dynamic Analysis   LICENSED TO - OFFSHORE CONSTR. SPECIALISTS
USER ID - Karun   DATE - 3/25/2015   TIME - 12:18:21   CASE   3
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       S T A T I C   S O L U T I O N   S U M M A R Y

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   24  STINGER    -7.5   -0.1    0.0     7.3   -0.7    43.4   0.036   0.
   26  STINGER   -16.5   -1.9    0.0    36.0   -1.2   148.0   0.100   0.
   29  STINGER   -26.2   -4.2    0.0    13.9   -1.2   102.2   0.072   0.
   31  STINGER   -36.6   -7.1    0.0    35.8    3.2   121.9   0.084   0.
   33  STINGER   -39.6   -8.0    0.0     0.0   -5.2    59.1   0.045   0.
   42  SAGBEND   -86.1  -19.5    0.1     0.0    0.0   133.3   0.090   0.
   47  SEABED   -116.0  -21.4    0.0     4.9   -0.9    51.2   0.040   0.
```

       M A X I M U M   D Y N A M I C   P I P E   F O R C E S   A N D   S T R A I N S

| NODE | PIPE | X | Y | Z | HORIZ | VERT | PIPE | TENSILE | HOOP | BENDING STRAINS | | TOTAL | PERCNT |
| NO. | SECTION | COORD | COORD | COORD | ANGLE | ANGLE | LENGTH | STRAIN | STRAIN | VERT | HORIZ | STRAIN | ALLOW |
		(M)	(M)	(M)	(DEG)	(DEG)	(M)	(PCT)	(PCT)	(PCT)	(PCT)	(PCT)	(PCT)
1	LAYBARGE	96.29	6.93	0.02	0.000	1.648	0.00	0.0000	0.0000	0.0000	0.0000	0.0000	0.00
3	LAYBARGE	84.26	6.64	0.02	-0.001	1.180	12.04	-0.0001	0.0000	-0.0122	0.0004	0.0122	0.00
5	LAYBARGE	73.43	6.37	0.02	0.001	1.944	22.87	-0.0001	0.0000	-0.0561	-0.0008	0.0562	0.00
7	TENSIONR	60.08	5.88	0.02	0.001	1.631	36.22	0.0055	0.0000	0.0292	0.0006	0.0343	0.00
9	LAYBARGE	51.07	5.67	0.02	-0.001	1.280	45.24	0.0055	0.0000	-0.0244	-0.0003	0.0296	0.00
10	LAYBARGE	46.43	5.53	0.02	0.002	2.217	49.89	0.0055	0.0000	-0.0973	-0.0013	0.1028	0.00
12	LAYBARGE	39.39	5.17	0.02	0.003	3.269	56.93	0.0055	0.0000	-0.0026	-0.0001	0.0074	0.00
13	TENSIONR	35.34	4.94	0.02	0.003	3.101	60.99	0.0104	0.0000	0.0225	0.0003	0.0326	0.00
15	LAYBARGE	26.08	4.45	0.02	0.004	3.338	70.26	0.0104	0.0000	-0.0608	0.0007	0.0709	0.00
16	LAYBARGE	23.33	4.27	0.02	0.005	4.122	73.02	0.0103	0.0000	-0.1149	0.0015	0.1249	0.00
18	LAYBARGE	8.87	2.72	0.02	0.005	8.333	87.56	0.0102	0.0000	-0.1594	-0.0019	0.1684	0.00
20	LAYBARGE	3.08	1.76	0.01	0.002	10.102	93.44	0.0102	0.0000	-0.0745	-0.0008	0.0844	0.00
24	STINGER	-7.55	-0.26	0.01	-0.015	11.627	104.23	0.0101	0.0000	-0.1194	-0.0022	0.1292	0.00
26	STINGER	-16.48	-2.06	0.02	-0.017	13.436	113.38	0.0099	-0.0001	-0.1346	-0.0028	0.1442	0.00
29	STINGER	-26.11	-4.47	0.02	-0.002	14.862	123.33	0.0098	-0.0002	-0.1426	-0.0026	0.1518	0.00
31	STINGER	-36.54	-7.44	0.02	0.014	16.884	134.14	0.0096	-0.0003	-0.1358	0.0026	0.1433	0.00
33	STINGER	-39.54	-8.36	0.02	0.005	17.227	137.27	0.0096	-0.0004	-0.0830	-0.0208	0.0905	0.00
35	SAGBEND	-45.25	-10.16	0.02	-0.129	17.166	143.25	0.0095	-0.0005	0.0531	-0.0105	0.0625	0.00
36	SAGBEND	-50.98	-11.92	0.02	-0.151	16.565	149.25	0.0094	-0.0005	0.0675	0.0048	0.0767	0.00
37	SAGBEND	-56.75	-13.60	0.02	-0.134	15.538	155.25	0.0093	-0.0006	0.0765	0.0055	0.0841	0.00
38	SAGBEND	-62.55	-15.15	0.03	-0.088	14.123	161.25	0.0092	-0.0007	0.0874	0.0071	0.0948	0.00
39	SAGBEND	-68.38	-16.55	0.04	-0.049	12.499	167.25	0.0091	-0.0007	0.0941	0.0084	0.1012	0.00
40	SAGBEND	-74.25	-17.77	0.05	-0.030	10.841	173.25	0.0090	-0.0008	0.0994	0.0089	0.1064	0.00
41	SAGBEND	-80.16	-18.80	0.06	-0.034	9.131	179.25	0.0090	-0.0008	0.1014	0.0087	0.1083	0.00
42	SAGBEND	-86.10	-19.65	0.07	-0.025	7.230	185.25	0.0089	-0.0008	0.0994	0.0082	0.1063	0.00
43	SAGBEND	-92.06	-20.30	0.07	0.022	5.418	191.25	0.0089	-0.0009	0.0941	0.0065	0.1010	0.00
44	SAGBEND	-98.04	-20.77	0.06	0.071	3.748	197.25	0.0089	-0.0009	0.0865	0.0045	0.0933	0.00
45	SAGBEND	-104.03	-21.08	0.05	0.118	2.285	203.25	0.0089	-0.0009	0.0761	0.0059	0.0829	0.00
46	SAGBEND	-110.03	-21.26	0.04	0.162	1.196	209.25	0.0089	-0.0009	0.0619	0.0103	0.0699	0.00
47	SEABED	-116.02	-21.34	0.02	0.170	0.493	215.25	0.0089	-0.0009	0.0459	-0.0140	0.0550	0.00
48	SEABED	-122.02	-21.37	0.01	0.107	0.109	221.25	0.0089	-0.0009	0.0237	-0.0121	0.0343	0.00
49	SEABED	-128.02	-21.37	0.00	0.038	-0.037	227.25	0.0089	-0.0009	0.0065	-0.0063	0.0177	0.00
50	SEABED	-134.02	-21.37	0.00	-0.004	-0.031	233.25	0.0089	-0.0009	-0.0018	-0.0020	0.0109	0.00
51	SEABED	-140.02	-21.37	0.00	-0.005	-0.014	239.25	0.0089	-0.0009	-0.0014	0.0004	0.0103	0.00
52	SEABED	-146.02	-21.37	0.00	-0.003	-0.003	245.25	0.0089	-0.0009	-0.0007	0.0003	0.0097	0.00
53	SEABED	-152.02	-21.37	0.00	-0.001	0.001	251.25	0.0089	-0.0009	-0.0002	0.0002	0.0094	0.00
54	SEABED	-158.02	-21.37	0.00	0.000	0.001	257.25	0.0089	-0.0009	0.0001	0.0002	0.0095	0.00
55	SEABED	-164.02	-21.37	0.00	0.000	0.000	263.25	0.0089	-0.0009	0.0000	0.0002	0.0094	0.00
56	SEABED	-170.02	-21.37	0.00	0.000	0.000	269.25	0.0090	-0.0009	0.0000	0.0001	0.0094	0.00
57	SEABED	-176.02	-21.37	0.00	0.000	0.000	275.25	0.0090	-0.0009	0.0000	0.0001	0.0094	0.00
58	SEABED	-182.02	-21.37	0.00	0.000	0.000	281.25	0.0090	-0.0009	0.0000	0.0001	0.0094	0.00
59	SEABED	-188.02	-21.37	0.00	0.000	0.000	287.25	0.0090	-0.0009	0.0000	0.0002	0.0095	0.00

       M A X I M U M   D Y N A M I C   P I P E   F O R C E S   A N D   S T R A I N S

| NODE | PIPE | X | Y | Z | HORIZ | VERT | PIPE | TENSILE | HOOP | BENDING STRAINS | | TOTAL | PERCNT |
| NO. | SECTION | COORD | COORD | COORD | ANGLE | ANGLE | LENGTH | STRAIN | STRAIN | VERT | HORIZ | STRAIN | ALLOW |
		(M)	(M)	(M)	(DEG)	(DEG)	(M)	(PCT)	(PCT)	(PCT)	(PCT)	(PCT)	(PCT)
60	SEABED	-194.02	-21.37	0.00	0.000	0.000	293.25	0.0090	-0.0009	0.0000	0.0003	0.0095	0.00

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  61   SEABED    -200.02    -21.37     0.00    0.000    0.000   299.25   0.0090  -0.0009   0.0000   0.0003   0.0095     0.00
  62   SEABED    -206.02    -21.37     0.00    0.000    0.000   305.25   0.0090  -0.0009   0.0000   0.0000   0.0095     0.00
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   OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP          DATE - 3/25/2015   TIME - 12:18:21    PAGE   58
   PROJECT - Pipelay Analysis                                             JOB NO. - Dynamic Analysis
   USER ID - Karun                                   LICENSED TO - OFFSHORE CONSTR. SPECIALISTS          CASE    3
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M A X I M U M   D Y N A M I C   P I P E   F O R C E S   A N D   S T R A I N 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	LAYBARGE	96.29	6.93	0.02	12.30	-0.28	0.00	0.00	0.00	0.00	0.00	0.00
3	LAYBARGE	84.26	6.64	0.02	21.55	0.65	0.00	0.00	-1.54	-19.71	0.67	19.71
5	LAYBARGE	73.43	6.37	0.02	44.54	-0.82	0.00	0.00	-3.09	-90.69	-1.29	90.70
7	TENSIONR	60.08	5.88	0.02	6.21	0.64	0.00	0.00	147.36	47.19	0.96	47.19
9	LAYBARGE	51.07	5.67	0.02	0.00	-1.05	0.00	0.00	147.31	-39.43	-0.48	39.43
10	LAYBARGE	46.43	5.53	0.02	64.39	-1.05	0.00	0.00	146.77	-157.35	-2.07	157.35
12	LAYBARGE	39.39	5.17	0.02	0.00	0.00	0.00	0.00	146.71	-4.25	-0.17	4.25
13	TENSIONR	35.34	4.94	0.02	-9.66	0.52	0.00	0.00	276.24	36.37	0.56	36.37
15	LAYBARGE	26.08	4.45	0.02	0.00	0.00	0.00	0.00	275.77	-98.31	1.19	98.31
16	LAYBARGE	23.33	4.27	0.02	63.27	-1.07	0.00	0.00	275.17	-185.69	2.37	185.70
18	LAYBARGE	8.87	2.72	0.02	69.62	-1.08	0.00	0.00	272.52	-257.69	-3.10	257.69
20	LAYBARGE	3.08	1.76	0.01	0.00	-0.51	0.14	0.00	271.58	-120.51	-1.33	120.52
24	STINGER	-7.55	-0.26	0.01	53.70	-3.01	0.07	0.00	267.90	-193.06	-3.52	193.09
26	STINGER	-16.48	-2.06	0.02	48.06	-3.78	0.28	0.00	265.82	-217.59	-4.57	217.59
29	STINGER	-26.11	-4.47	0.02	49.55	-2.89	0.30	0.00	263.69	-230.60	-4.21	230.60
31	STINGER	-36.54	-7.44	0.02	59.88	12.23	0.01	0.00	260.89	-219.61	4.24	219.62
33	STINGER	-39.54	-8.36	0.02	0.12	-15.63	0.43	0.00	260.07	-134.10	-33.59	134.23
35	SAGBEND	-45.25	-10.16	0.02	0.00	0.00	0.00	0.00	258.26	85.87	-17.03	86.00
36	SAGBEND	-50.98	-11.92	0.02	0.00	0.00	0.00	0.00	256.43	109.15	7.75	109.16
37	SAGBEND	-56.75	-13.60	0.02	0.00	0.00	0.00	0.00	254.72	123.67	8.92	123.89
38	SAGBEND	-62.55	-15.15	0.03	0.00	0.00	0.00	0.00	253.20	141.34	11.48	141.52
39	SAGBEND	-68.38	-16.55	0.04	0.00	0.00	0.00	0.00	251.86	152.16	13.65	152.18
40	SAGBEND	-74.25	-17.77	0.05	0.00	0.00	0.00	0.00	250.71	160.66	14.46	160.67
41	SAGBEND	-80.16	-18.80	0.06	0.00	0.00	0.00	0.00	249.76	163.88	13.99	163.88
42	SAGBEND	-86.10	-19.65	0.07	0.00	0.00	0.00	0.00	249.00	160.65	13.21	160.65
43	SAGBEND	-92.06	-20.30	0.07	0.00	0.00	0.00	0.00	248.44	152.10	10.51	152.22
44	SAGBEND	-98.04	-20.77	0.06	0.00	0.00	0.00	0.00	248.10	139.88	7.36	139.88
45	SAGBEND	-104.03	-21.08	0.05	0.74	0.37	0.00	0.00	247.99	123.04	9.53	123.07
46	SAGBEND	-110.03	-21.26	0.04	7.93	-2.50	0.00	0.00	248.10	100.09	16.63	100.13
47	SEABED	-116.02	-21.34	0.02	10.52	-3.71	0.00	0.00	248.39	74.14	-22.69	74.64
48	SEABED	-122.02	-21.37	0.01	10.31	-3.32	0.00	0.00	248.71	38.39	-19.62	41.21
49	SEABED	-128.02	-21.37	0.00	9.66	0.98	0.00	0.00	248.98	10.53	-10.25	14.34
50	SEABED	-134.02	-21.37	0.00	8.54	0.95	0.00	0.00	249.24	-2.94	-3.28	3.40
51	SEABED	-140.02	-21.37	0.00	7.50	0.58	0.00	0.00	249.49	-2.19	0.58	2.19
52	SEABED	-146.02	-21.37	0.00	7.02	0.34	0.00	0.00	249.73	-1.09	0.45	1.12
53	SEABED	-152.02	-21.37	0.00	6.97	-0.23	0.00	0.00	249.96	-0.29	0.25	0.30
54	SEABED	-158.02	-21.37	0.00	6.99	-0.24	0.00	0.00	250.19	0.09	0.25	0.26
55	SEABED	-164.02	-21.37	0.00	7.00	-0.24	0.00	0.00	250.41	0.06	0.25	0.25
56	SEABED	-170.02	-21.37	0.00	7.00	-0.24	0.00	0.00	250.62	0.03	0.24	0.24
57	SEABED	-176.02	-21.37	0.00	7.00	-0.24	0.00	0.00	250.83	0.01	0.23	0.23

```
================================================================================================================
   OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP          DATE - 3/25/2015   TIME - 12:18:21    PAGE   59
   PROJECT - Pipelay Analysis                                             JOB NO. - Dynamic Analysis
   USER ID - Karun                                   LICENSED TO - OFFSHORE CONSTR. SPECIALISTS          CASE    3
================================================================================================================
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M A X I M U M   D Y N A M I C   P I P E   F O R C E S   A N D   S T R A I N 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)
58	SEABED	-182.02	-21.37	0.00	7.00	-0.25	0.00	0.00	251.02	0.00	0.24	0.24
59	SEABED	-188.02	-21.37	0.00	7.00	-0.25	0.00	0.00	251.22	0.00	0.30	0.30
60	SEABED	-194.02	-21.37	0.00	7.00	-0.23	0.00	0.00	251.40	0.00	0.41	0.41
61	SEABED	-200.02	-21.37	0.00	7.00	-0.14	0.00	0.00	251.58	0.00	0.47	0.47
62	SEABED	-206.02	-21.37	0.00	0.00	-0.02	0.00	0.00	251.75	0.00	0.00	0.00

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================================================================================================================
OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP          PAGE   60
Pipelay Analysis
JOB NO. - Dynamic Analysis     LICENSED TO - OFFSHORE CONSTR. SPECIALISTS
USER ID - Karun                DATE - 3/25/2015   TIME - 12:18:21   CASE    4
================================================================================================================
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S T A T I C   S O L U T I O N   S U M M A R Y

PIPE PROPERTIES (1)
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 PIPE SECTION LENGTH ..      0.00 M    ELASTIC MODULUS ......   207000. MPA
 OUTSIDE DIAMETER .....     27.310 CM   CROSS SECTIONAL AREA .   128.75 CM^2
 WALL THICKNESS .......      1.590 CM   MOMENT OF INERTIA ....  12671.5 CM^4
 WEIGHT/LENGTH IN AIR .   2205.00 N/M   YIELD STRESS .........   450.00 MPA
 SUBMERGED WGHT/LENG ..   1164.00 N/M   STRESS INTENS FACTOR .    1.000
 SPECIFIC GRAVITY .....      2.118      STEEL DENSITY ........  76982.0 N/M3
 WRAP COAT THICKNESS ..      0.280 CM   WRAP COAT DENSITY ....   9218.0 N/M3
 CONCRETE THICKNESS ...      4.000 CM   CONCRETE DENSITY .....  29846.0 N/M3
```

BARGE DATA
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      TOTAL PIPE TENSION ...    250.00 KN     RADIUS OF CURVATURE ..     0.00 M
      NUMBER OF TENSIONERS .       2          BARGE TRIM ANGLE .....     0.500 DEG
      NO. OF PIPE SUPPORTS .       7          PIPE ANGLE AT STERN ..     9.594 DEG
      BARGE HEADING ........     0.000 DEG    OFFSET FROM R.O.W. ...     0.00 M

  STINGER DATA
  ============
      NO. OF PIPE SUPPORTS .       5          PIPE DEPTH AT STERN ..    -7.68 M
      NO. STINGER SECTIONS .       7          PIPE ANGLE AT STERN ..    17.345 DEG
      RADIUS OF CURVATURE ..    200.00 M      STINGER STERN DEPTH ..    -8.02 M
      STINGER LENGTH .......     39.00 M

  SAGBEND DATA
  ============
      WATER DEPTH ..........     21.34 M      TENSION AT TOUCHDOWN .    209.80 KN
      TOUCHDOWN X-COORD. ...   -114.88 M      BOTTOM SLOPE ANGLE ...     0.000 DEG
      PROJECTED SPAN LENGTH     75.25 M       PIPE LENGTH GAIN .....     2.90 M

  ============================== SOLUTION SUMMARY ==============================
  NODE  PIPE        X       Y       Z    SUPPORT REACT   TOTAL   TOTAL   PCT
  NO.  SECTION    COORD   COORD   COORD   VERT   HORIZ  MOMENT  STRAIN   ALL
                   (M  )   (M  )   (M  )  (KN )   (KN )  (KN-M)  (PCT )   (%)
  ============================================================================
    1  LAYBARGE   96.3    6.9     0.0    11.8     0.0    0.0    0.000    0.
    3  LAYBARGE   84.3    6.6     0.0    20.0     0.0   17.7    0.011    0.
    5  LAYBARGE   73.4    6.4     0.0    43.4     0.0   89.8    0.056    0.
    7  TENSIONR   60.1    5.9     0.0     4.5     0.0   45.7    0.033    0.
    9  LAYBARGE   51.1    5.7     0.0     0.0     0.0   38.9    0.029    0.
   10  LAYBARGE   46.4    5.5     0.0    62.6     0.0  155.7    0.101    0.
   12  LAYBARGE   39.4    5.2     0.0     0.0     0.0    1.6    0.006    0.
   13  TENSIONR   35.4    5.0     0.0    -8.9     0.0   35.2    0.031    0.
   15  LAYBARGE   26.1    4.5     0.0     0.0     0.0   93.4    0.067    0.
   16  LAYBARGE   23.3    4.3     0.0    58.1     0.0  176.6    0.118    0.
   18  LAYBARGE    8.9    2.7     0.0    60.1     0.0  193.4    0.129    0.
   20  LAYBARGE    3.1    1.8     0.0     0.0     0.1   50.5    0.040    0.

  ============================================================================
  OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP          PAGE  61
  Pipelay Analysis
  JOB NO. - Dynamic Analysis      LICENSED TO - OFFSHORE CONSTR. SPECIALISTS
  USER ID - Karun                 DATE - 3/25/2015   TIME - 12:18:21   CASE   4
  ============================================================================

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


   24  STINGER    -7.5    0.0     0.0     0.0    -0.3   18.1    0.020    0.
   26  STINGER   -16.5   -1.7     0.0    42.7    -0.6  168.5    0.113    0.
   29  STINGER   -26.2   -3.9     0.0    14.0    -0.7  114.7    0.080    0.
   31  STINGER   -36.7   -6.8     0.0    37.7     1.7  135.8    0.093    0.
   33  STINGER   -39.6   -7.7     0.0     0.0    -2.7   69.3    0.051    0.
   42  SAGBEND   -86.1  -19.3     0.0     0.0     0.0  133.3    0.090    0.
   47  SEABED   -116.0  -21.4     0.0     3.5    -0.5   58.9    0.044    0.
```

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  ================================================================================================
   OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP        DATE - 3/25/2015   TIME - 12:18:21   PAGE   62
   PROJECT - Pipelay Analysis                                                          JOB NO. - Dynamic Analysis
   USER ID - Karun                                    LICENSED TO - OFFSHORE CONSTR. SPECIALISTS        CASE   4
  ================================================================================================

       M A X I M U M   D Y N A M I C   P I P E   F O R C E S   A N D   S T R A I N S
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  ================================================================================================
  NODE  PIPE       X       Y       Z     HORIZ   VERT    PIPE   TENSILE  HOOP   BENDING STRAINS   TOTAL   PERCNT
  NO.  SECTION   COORD   COORD   COORD   ANGLE   ANGLE  LENGTH  STRAIN  STRAIN   VERT    HORIZ   STRAIN   ALLOW
                  (M  )   (M  )   (M  )  (DEG )  (DEG )   (M  )  (PCT )  (PCT )  (PCT )  (PCT )   (PCT )   (PCT )
  ================================================================================================
    1  LAYBARGE   96.28    6.94   -0.01  -0.001   1.630    0.00   0.0000  0.0000  0.0000  0.0000   0.0000   0.00
    3  LAYBARGE   84.24    6.65   -0.01  -0.001   1.169   12.04  -0.0001  0.0000 -0.0121  0.0003   0.0122   0.00
    5  LAYBARGE   73.41    6.38    0.00  -0.001   1.932   22.87  -0.0002  0.0000 -0.0564  0.0002   0.0565   0.00
    7  TENSIONR   60.07    5.88    0.00  -0.001   1.615   36.22   0.0056  0.0000  0.0288 -0.0002   0.0340   0.00
    9  LAYBARGE   51.05    5.67    0.00  -0.001   1.271   45.24   0.0056  0.0000 -0.0245 -0.0001   0.0297   0.00
   10  LAYBARGE   46.41    5.54    0.00  -0.001   2.210   49.89   0.0056  0.0000 -0.0970 -0.0003   0.1023   0.00
   12  LAYBARGE   39.37    5.18    0.00   0.000   3.259   56.93   0.0055  0.0000 -0.0029  0.0000   0.0079   0.00
   13  TENSIONR   35.32    4.96    0.00   0.000   3.083   60.99   0.0104  0.0000  0.0244 -0.0001   0.0339   0.00
   15  LAYBARGE   26.06    4.48   -0.01   0.000   3.339   70.26   0.0104  0.0000 -0.0647 -0.0002   0.0738   0.00
   16  LAYBARGE   23.30    4.31   -0.01   0.000   4.146   73.02   0.0104  0.0000 -0.1195  0.0004   0.1290   0.00
   18  LAYBARGE    8.85    2.76   -0.01   0.003   8.509   87.56   0.0103  0.0000 -0.1662  0.0005   0.1743   0.00
   20  LAYBARGE    3.06    1.80   -0.01   0.005  10.102   93.44   0.0103  0.0000 -0.1471 -0.0003   0.1552   0.00

   24  STINGER    -7.57   -0.32   -0.01   0.004  11.075  104.23   0.0102  0.0000 -0.1186 -0.0013   0.1267   0.00
   26  STINGER   -16.50   -2.28   -0.01   0.007  12.877  113.37   0.0101 -0.0001 -0.1416 -0.0015   0.1510   0.00
   29  STINGER   -26.06   -4.55   -0.01   0.000  14.035  123.32   0.0099 -0.0002 -0.1574 -0.0020   0.1665   0.00
   31  STINGER   -36.51   -7.33   -0.02   0.024  16.464  134.12   0.0098 -0.0004 -0.1767  0.0033   0.1841   0.00
   33  STINGER   -39.55   -8.24   -0.02  -0.033  17.131  137.25   0.0097 -0.0004 -0.1136 -0.0301   0.1212   0.00

   35  SAGBEND   -45.29  -10.03    0.00  -0.066  17.474  143.25   0.0096 -0.0005  0.0616 -0.0162   0.0708   0.00
   36  SAGBEND   -51.02  -11.78    0.02  -0.143  16.842  149.25   0.0095 -0.0005  0.0761 -0.0088   0.0852   0.00
   37  SAGBEND   -56.78  -13.41    0.04  -0.195  15.734  155.25   0.0094 -0.0006  0.0826  0.0077   0.0902   0.00
   38  SAGBEND   -62.57  -14.95    0.06  -0.207  14.241  161.25   0.0094 -0.0007  0.0938  0.0085   0.1008   0.00
   39  SAGBEND   -68.41  -16.35    0.07  -0.170  12.602  167.25   0.0093 -0.0007  0.1002  0.0084   0.1072   0.00
   40  SAGBEND   -74.29  -17.57    0.08  -0.077  10.881  173.25   0.0092 -0.0008  0.1050  0.0077   0.1119   0.00
   41  SAGBEND   -80.19  -18.60    0.08  -0.006   9.196  179.25   0.0092 -0.0008  0.1093  0.0070   0.1159   0.00
   42  SAGBEND   -86.13  -19.45    0.07   0.040   7.397  185.25   0.0091 -0.0008  0.1094  0.0068   0.1160   0.00
   43  SAGBEND   -92.09  -20.12    0.07   0.077   5.572  191.25   0.0091 -0.0009  0.1032  0.0060   0.1098   0.00
   44  SAGBEND   -98.06  -20.61    0.06   0.099   3.984  197.25   0.0090 -0.0009  0.0943  0.0047   0.1013   0.00
   45  SAGBEND  -104.05  -20.94    0.05   0.123   2.602  203.25   0.0090 -0.0009  0.0802  0.0054   0.0871   0.00
   46  SAGBEND  -110.04  -21.15    0.03   0.155   1.578  209.25   0.0090 -0.0009  0.0686 -0.0098   0.0766   0.00
   47  SAGBEND  -116.04  -21.28    0.02   0.145   0.891  215.25   0.0090 -0.0009  0.0550 -0.0138   0.0632   0.00

   48  SEABED   -122.04  -21.35    0.01   0.094   0.386  221.25   0.0090 -0.0009  0.0403 -0.0120   0.0493   0.00
   49  SEABED   -128.04  -21.38    0.00   0.041   0.069  227.25   0.0090 -0.0009  0.0196 -0.0064   0.0292   0.00
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50	SEABED	-134.04	-21.37	0.00	0.006	-0.035	233.25	0.0091	-0.0009	0.0046	-0.0024	0.0142	0.00
51	SEABED	-140.04	-21.37	0.00	-0.005	-0.023	239.25	0.0091	-0.0009	-0.0017	-0.0007	0.0108	0.00
52	SEABED	-146.04	-21.37	0.00	-0.003	-0.011	245.25	0.0091	-0.0009	-0.0011	0.0004	0.0103	0.00
53	SEABED	-152.04	-21.37	0.00	-0.001	-0.002	251.25	0.0091	-0.0009	-0.0005	0.0002	0.0097	0.00
54	SEABED	-158.04	-21.37	0.00	0.000	0.001	257.25	0.0091	-0.0009	-0.0001	-0.0002	0.0096	0.00
55	SEABED	-164.04	-21.37	0.00	0.000	0.001	263.25	0.0091	-0.0009	0.0001	0.0002	0.0096	0.00
56	SEABED	-170.04	-21.37	0.00	0.000	0.000	269.25	0.0091	-0.0009	0.0002	0.0002	0.0096	0.00
57	SEABED	-176.04	-21.37	0.00	0.000	0.000	275.25	0.0091	-0.0009	0.0000	0.0002	0.0096	0.00
58	SEABED	-182.04	-21.37	0.00	0.000	0.000	281.25	0.0091	-0.0009	0.0000	0.0002	0.0096	0.00
59	SEABED	-188.04	-21.37	0.00	0.000	0.000	287.25	0.0091	-0.0009	0.0000	0.0002	0.0096	0.00

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 OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP        DATE - 3/25/2015    TIME - 12:18:21    PAGE   63
 PROJECT - Pipelay Analysis                                           JOB NO. - Dynamic Analysis
 USER ID - Karun                                    LICENSED TO - OFFSHORE CONSTR. SPECIALISTS        CASE    4
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M A X I M U M   D Y N A M I C   P I P E   F O R C E S   A N D   S T R A I N S

NODE NO.	PIPE SECTION	X COORD (M)	Y COORD (M)	Z COORD (M)	HORIZ ANGLE (DEG)	VERT ANGLE (DEG)	PIPE LENGTH (M)	TENSILE STRAIN (PCT)	HOOP STRAIN (PCT)	BENDING STRAINS VERT (PCT)	HORIZ (PCT)	TOTAL STRAIN (PCT)	PERCNT ALLOW (PCT)
60	SEABED	-194.04	-21.37	0.00	0.000	0.000	293.25	0.0091	-0.0009	0.0000	0.0002	0.0097	0.00
61	SEABED	-200.04	-21.37	0.00	0.000	0.000	299.25	0.0091	-0.0009	0.0000	0.0002	0.0097	0.00
62	SEABED	-206.04	-21.37	0.00	0.000	0.000	305.25	0.0092	-0.0009	0.0000	0.0000	0.0096	0.00

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 OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP        DATE - 3/25/2015    TIME - 12:18:21    PAGE   64
 PROJECT - Pipelay Analysis                                           JOB NO. - Dynamic Analysis
 USER ID - Karun                                    LICENSED TO - OFFSHORE CONSTR. SPECIALISTS        CASE    4
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M A X I M U M   D Y N A M I C   P I P E   F O R C E S   A N D   S T R A I N S

NODE NO.	PIPE SECTION	X COORD (M)	Y COORD (M)	Z COORD (M)	SUPPORT REACTION VERT (KN)	HORIZ (KN)	SUPT SEPARATIONS VERT (M)	HORIZ (M)	PIPE TENSION (KN)	BENDING MOMENTS VERT (KN-M)	HORIZ (KN-M)	TOTAL (KN-M)
1	LAYBARGE	96.28	6.94	-0.01	12.15	0.16	0.00	0.00	0.00	0.00	0.00	0.00
3	LAYBARGE	84.24	6.65	-0.01	21.06	0.37	0.00	0.00	-2.36	-19.63	0.42	19.63
5	LAYBARGE	73.41	6.38	0.00	43.97	-0.22	0.00	0.00	-4.64	-91.20	0.26	91.20
7	TENSIONR	60.07	5.88	0.00	5.04	0.18	0.00	0.00	148.31	46.56	-0.29	46.56
9	LAYBARGE	51.05	5.67	0.00	0.00	0.00	0.00	0.00	148.19	-39.60	-0.14	39.60
10	LAYBARGE	46.41	5.54	0.00	63.67	0.19	0.00	0.00	147.63	-156.81	-0.42	156.81
12	LAYBARGE	39.37	5.18	0.00	0.00	0.00	0.00	0.00	147.56	-4.71	-0.04	4.71
13	TENSIONR	35.32	4.96	0.00	-10.85	-0.14	0.00	0.00	277.24	39.37	-0.16	39.37
15	LAYBARGE	26.06	4.48	-0.01	0.00	0.00	0.00	0.00	276.92	-104.53	-0.29	104.53
16	LAYBARGE	23.30	4.31	-0.01	65.93	0.38	0.00	0.00	276.34	-193.21	0.69	193.21
18	LAYBARGE	8.85	2.76	-0.01	73.13	0.42	0.00	0.00	274.19	-268.65	0.84	268.65
20	LAYBARGE	3.06	1.80	-0.01	48.78	-1.03	0.20	0.00	273.31	-237.74	-0.55	237.74
24	STINGER	-7.57	-0.32	-0.01	54.92	-1.78	0.16	0.00	270.64	-191.77	-2.04	191.77
26	STINGER	-16.50	-2.28	-0.01	54.67	-2.73	0.72	0.00	268.84	-228.87	-2.47	228.87
29	STINGER	-26.06	-4.55	-0.01	57.02	-2.68	0.81	0.00	267.05	-254.46	-3.25	254.46
31	STINGER	-36.51	-7.33	-0.02	72.15	17.70	0.10	0.00	264.74	-285.60	5.37	285.60
33	STINGER	-39.55	-8.24	-0.02	0.04	-22.40	0.55	0.00	263.90	-183.70	-48.62	183.77
35	SAGBEND	-45.29	-10.03	0.00	0.00	0.00	0.00	0.00	262.19	99.53	-26.13	99.70
36	SAGBEND	-51.02	-11.78	0.02	0.00	0.00	0.00	0.00	260.52	123.05	-14.17	123.12
37	SAGBEND	-56.78	-13.41	0.04	0.00	0.00	0.00	0.00	258.99	133.56	12.41	133.56
38	SAGBEND	-62.57	-14.95	0.06	0.00	0.00	0.00	0.00	257.63	151.65	13.81	151.70
39	SAGBEND	-68.41	-16.35	0.07	0.00	0.00	0.00	0.00	256.43	162.04	13.57	162.10
40	SAGBEND	-74.29	-17.57	0.08	0.00	0.00	0.00	0.00	255.36	169.67	12.45	169.68
41	SAGBEND	-80.19	-18.60	0.08	0.00	0.00	0.00	0.00	254.43	176.63	11.33	176.64
42	SAGBEND	-86.13	-19.45	0.07	0.00	0.00	0.00	0.00	253.64	176.79	10.92	176.79
43	SAGBEND	-92.09	-20.12	0.07	0.00	0.00	0.00	0.00	253.02	166.79	9.65	166.82
44	SAGBEND	-98.06	-20.61	0.06	0.00	0.00	0.00	0.00	252.60	152.44	7.52	152.47
45	SAGBEND	-104.05	-20.94	0.05	1.91	0.90	0.00	0.00	252.41	129.66	8.69	129.72
46	SAGBEND	-110.04	-21.15	0.03	9.47	-2.47	0.00	0.00	252.43	110.85	-15.92	110.89
47	SAGBEND	-116.04	-21.28	0.02	10.90	-4.00	0.00	0.00	252.64	88.90	-22.38	88.92
48	SEABED	-122.04	-21.35	0.01	10.65	-3.38	0.00	0.00	252.97	65.09	-19.42	65.25
49	SEABED	-128.04	-21.38	0.00	10.14	-1.54	0.00	0.00	253.25	31.76	-10.36	32.64
50	SEABED	-134.04	-21.37	0.00	9.31	0.75	0.00	0.00	253.51	7.48	-3.95	8.46
51	SEABED	-140.04	-21.37	0.00	8.30	0.47	0.00	0.00	253.76	-2.67	-1.07	2.67
52	SEABED	-146.04	-21.37	0.00	7.37	0.24	0.00	0.00	254.00	-1.84	0.57	1.84
53	SEABED	-152.04	-21.37	0.00	6.99	0.17	0.00	0.00	254.24	-0.89	0.31	0.90
54	SEABED	-158.04	-21.37	0.00	6.99	0.17	0.00	0.00	254.47	-0.21	-0.25	0.27
55	SEABED	-164.04	-21.37	0.00	7.00	0.17	0.00	0.00	254.69	0.09	0.25	0.25
56	SEABED	-170.04	-21.37	0.00	7.00	-0.17	0.00	0.00	254.90	0.06	0.25	0.25
57	SEABED	-176.04	-21.37	0.00	6.99	-0.17	0.00	0.00	255.11	0.03	0.25	0.25

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 OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP        DATE - 3/25/2015    TIME - 12:18:21    PAGE   65
 PROJECT - Pipelay Analysis                                           JOB NO. - Dynamic Analysis
 USER ID - Karun                                    LICENSED TO - OFFSHORE CONSTR. SPECIALISTS        CASE    4
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M A X I M U M   D Y N A M I C   P I P E   F O R C E S   A N D   S T R A I N S

NODE NO.	PIPE SECTION	X COORD (M)	Y COORD (M)	Z COORD (M)	SUPPORT REACTION VERT (KN)	HORIZ (KN)	SUPT SEPARATIONS VERT (M)	HORIZ (M)	PIPE TENSION (KN)	BENDING MOMENTS VERT (KN-M)	HORIZ (KN-M)	TOTAL (KN-M)
58	SEABED	-182.04	-21.37	0.00	6.99	-0.17	0.00	0.00	255.31	-0.02	0.25	0.25
59	SEABED	-188.04	-21.37	0.00	6.99	-0.17	0.00	0.00	255.51	-0.02	0.28	0.28
60	SEABED	-194.04	-21.37	0.00	6.99	-0.16	0.00	0.00	255.69	-0.01	0.36	0.36
61	SEABED	-200.04	-21.37	0.00	6.99	-0.11	0.00	0.00	255.88	-0.01	0.40	0.40

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 62   SEABED   -206.04   -21.37    0.00    0.00    -0.02    0.00    0.00   256.05    0.00    0.00    0.00
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OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP   PAGE 66
Pipelay Analysis
JOB NO. - Dynamic Analysis   LICENSED TO - OFFSHORE CONSTR. SPECIALISTS
USER ID - Karun   DATE - 3/25/2015   TIME - 12:18:21   CASE   5
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         S T A T I C   S O L U T I O N   S U M M A R Y

PIPE PROPERTIES (1)
====================
  PIPE SECTION LENGTH ..   0.00 M   ELASTIC MODULUS ......   207000. MPA
  OUTSIDE DIAMETER .....   27.310 CM   CROSS SECTIONAL AREA .   128.75 CM^2
  WALL THICKNESS ....   1.590 CM   MOMENT OF INERTIA .... 12671.5 CM^4
  WEIGHT/LENGTH IN AIR . 2205.00 N/M YIELD STRESS ....   450.00 MPA
  SUBMERGED WGHT/LENG .. 1164.00 N/M STRESS INTENS FACTOR .   1.000
  SPECIFIC GRAVITY .....   2.118   STEEL DENSITY 76982.0 N/M3
  WRAP COAT THICKNESS ..   0.280 CM   WRAP COAT DENSITY 9218.0 N/M3
  CONCRETE THICKNESS ...   4.000 CM   CONCRETE DENSITY 29846.0 N/M3

BARGE DATA
==========
  TOTAL PIPE TENSION ...   250.00 KN   RADIUS OF CURVATURE ..   0.00 M
  NUMBER OF TENSIONERS .   2   BARGE TRIM ANGLE .....   0.500 DEG
  NO. OF PIPE SUPPORTS .   7   PIPE ANGLE AT STERN ..   9.744 DEG
  BARGE HEADING ....   0.000 DEG OFFSET FROM R.O.W. ...   0.00 M

STINGER DATA
============
  NO. OF PIPE SUPPORTS .   5   PIPE DEPTH AT STERN ..   -7.84 M
  NO. STINGER SECTIONS .   7   PIPE ANGLE AT STERN ..   17.327 DEG
  RADIUS OF CURVATURE ..   200.00 M   STINGER STERN DEPTH ..   -8.19 M
  STINGER LENGTH ....   39.00 M

SAGBEND DATA
============
  WATER DEPTH ....   21.34 M   TENSION AT TOUCHDOWN .   209.80 KN
  TOUCHDOWN X-COORD. ... -114.36 M   BOTTOM SLOPE ANGLE ...   0.000 DEG
  PROJECTED SPAN LENGTH   74.74 M   PIPE LENGTH GAIN .....   2.90 M

============================== SOLUTION SUMMARY ==============================
NODE PIPE   X   Y   Z   SUPPORT REACT   TOTAL   TOTAL   PCT
NO. SECTION   COORD   COORD   COORD   VERT   HORIZ   MOMENT STRAIN ALL
              (M)   (M)   (M)   (KN)   (KN)   (KN-M) (PCT) (%)
===
  1 LAYBARGE   96.3   6.9   0.0   11.8   0.0   0.0   0.000   0.
  3 LAYBARGE   84.3   6.6   0.0   20.0   0.0   17.7   0.011   0.
  5 LAYBARGE   73.4   6.4   0.0   43.4   0.0   89.8   0.056   0.
  7 TENSIONR   60.1   5.9   0.0   4.5   0.0   45.7   0.033   0.
  9 LAYBARGE   51.1   5.7   0.0   0.0   0.0   38.8   0.029   0.
 10 LAYBARGE   46.4   5.5   0.0   62.6   0.0   155.5   0.101   0.
 12 LAYBARGE   39.4   5.2   0.0   0.0   0.0   1.9   0.006   0.
 13 TENSIONR   35.4   5.0   0.0   -8.6   0.0   34.7   0.031   0.
 15 LAYBARGE   26.1   4.5   0.0   0.0   0.0   92.1   0.066   0.
 16 LAYBARGE   23.3   4.3   0.0   57.3   0.0   174.7   0.117   0.
 18 LAYBARGE   8.9   2.7   0.0   61.4   0.0   201.0   0.133   0.
 20 LAYBARGE   3.1   1.8   0.0   0.0   0.0   56.9   0.044   0.

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OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP   PAGE 67
Pipelay Analysis
JOB NO. - Dynamic Analysis   LICENSED TO - OFFSHORE CONSTR. SPECIALISTS
USER ID - Karun   DATE - 3/25/2015   TIME - 12:18:21   CASE   5
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         S T A T I C   S O L U T I O N   S U M M A R Y

 24 STINGER   -7.5   -0.1   0.0   1.9   0.0   25.5   0.025   0.
 26 STINGER   -16.5   -1.8   0.0   41.1   0.0   162.1   0.109   0.
 29 STINGER   -26.2   -4.0   0.0   13.0   0.0   106.4   0.074   0.
 31 STINGER   -36.6   -6.9   0.0   37.2   0.0   130.1   0.089   0.
 33 STINGER   -39.6   -7.8   0.0   0.0   0.0   64.5   0.048   0.
 42 SAGBEND   -86.1 -19.4   0.0   0.0   0.0   133.3   0.090   0.
 47 SEABED   -116.0 -21.4   0.0   4.1   0.0   55.1   0.042   0.

       M A X I M U M   D Y N A M I C   P I P E   F O R C E S   A N D   S T R A I N S

===
NODE PIPE   X   Y   Z   HORIZ   VERT   PIPE   TENSILE   HOOP   BENDING STRAINS   TOTAL PERCNT
NO. SECTION   COORD   COORD   COORD ANGLE   ANGLE LENGTH STRAIN   STRAIN   VERT   HORIZ   STRAIN ALLOW
              (M)   (M)   (M) (DEG) (DEG) (M)   (PCT)   (PCT) (PCT) (PCT)   (PCT) (PCT)
===
  1 LAYBARGE   96.27   6.92   0.00   0.000   1.624   0.00   0.0000   0.0000   0.0000 0.0000   0.0000   0.00
  3 LAYBARGE   84.24   6.65   0.00   0.000   1.154   12.04 -0.0001   0.0000 -0.0122 0.0000   0.0122   0.00
  5 LAYBARGE   73.41   6.38   0.00   0.000   1.917   22.87 -0.0002   0.0000 -0.0566 0.0000   0.0566   0.00
  7 TENSIONR   60.07   5.89   0.00   0.000   1.605   36.22   0.0055   0.0000   0.0290 0.0000   0.0340   0.00
  9 LAYBARGE   51.05   5.68   0.00   0.000   1.253   45.24   0.0055   0.0000 -0.0248 0.0000   0.0298   0.00
 10 LAYBARGE   46.41   5.55   0.00   0.000   2.190   49.89   0.0055   0.0000 -0.0969 0.0000   0.1022   0.00
 12 LAYBARGE   39.37   5.18   0.00   0.000   3.241   56.93   0.0055   0.0000 -0.0030 0.0000   0.0076   0.00
 13 TENSIONR   35.32   4.96   0.00   0.000   3.076   60.99   0.0105   0.0000   0.0237 0.0000   0.0338   0.00
 15 LAYBARGE   26.07   4.47   0.00   0.000   3.311   70.26   0.0105   0.0000 -0.0634 0.0000   0.0734   0.00
 16 LAYBARGE   23.31   4.30   0.00   0.000   4.127   73.02   0.0105   0.0000 -0.1183 0.0000   0.1283   0.00
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| 18 | LAYBARGE | 8.86 | 2.76 | 0.00 | 0.000 | 8.356 | 87.56 | 0.0104 | 0.0000 | -0.1682 | 0.0000 | 0.1780 | 0.00 |
| 20 | LAYBARGE | 3.06 | 1.80 | 0.00 | 0.000 | 10.173 | 93.44 | 0.0104 | 0.0000 | -0.0912 | 0.0000 | 0.0993 | 0.00 |
| | | | | | | | | | | | | | |
| 24 | STINGER | -7.59 | -0.20 | 0.00 | 0.000 | 11.215 | 104.23 | 0.0103 | 0.0000 | -0.0974 | 0.0000 | 0.1073 | 0.00 |
| 26 | STINGER | -16.54 | -2.07 | 0.00 | 0.000 | 12.495 | 113.38 | 0.0102 | -0.0001 | -0.1635 | 0.0000 | 0.1731 | 0.00 |
| 29 | STINGER | -26.14 | -4.41 | 0.00 | 0.000 | 14.029 | 123.32 | 0.0101 | -0.0002 | -0.1542 | 0.0000 | 0.1635 | 0.00 |
| 31 | STINGER | -36.58 | -7.15 | 0.00 | 0.000 | 16.458 | 134.13 | 0.0099 | -0.0003 | -0.1872 | 0.0000 | 0.1946 | 0.00 |
| 33 | STINGER | -39.59 | -8.05 | 0.00 | 0.000 | 17.074 | 137.26 | 0.0099 | -0.0004 | -0.1249 | 0.0000 | 0.1323 | 0.00 |
| | | | | | | | | | | | | | |
| 35 | SAGBEND | -45.32 | -9.84 | 0.00 | 0.000 | 17.261 | 143.25 | 0.0098 | -0.0005 | 0.0621 | 0.0000 | 0.0712 | 0.00 |
| 36 | SAGBEND | -51.05 | -11.62 | 0.00 | 0.000 | 16.808 | 149.25 | 0.0097 | -0.0005 | 0.0781 | 0.0000 | 0.0872 | 0.00 |
| 37 | SAGBEND | -56.80 | -13.29 | 0.00 | 0.000 | 15.847 | 155.25 | 0.0096 | -0.0006 | 0.0886 | 0.0000 | 0.0960 | 0.00 |
| 38 | SAGBEND | -62.59 | -14.86 | 0.00 | 0.000 | 14.473 | 161.25 | 0.0095 | -0.0007 | 0.1039 | 0.0000 | 0.1110 | 0.00 |
| 39 | SAGBEND | -68.42 | -16.26 | 0.00 | 0.000 | 12.898 | 167.25 | 0.0095 | -0.0007 | 0.1123 | 0.0000 | 0.1192 | 0.00 |
| 40 | SAGBEND | -74.29 | -17.50 | 0.00 | 0.000 | 11.131 | 173.25 | 0.0094 | -0.0008 | 0.1132 | 0.0000 | 0.1201 | 0.00 |
| 41 | SAGBEND | -80.19 | -18.55 | 0.00 | 0.000 | 9.369 | 179.25 | 0.0093 | -0.0008 | 0.1103 | 0.0000 | 0.1171 | 0.00 |
| 42 | SAGBEND | -86.12 | -19.42 | 0.00 | 0.000 | 7.554 | 185.25 | 0.0093 | -0.0008 | 0.1106 | 0.0000 | 0.1173 | 0.00 |
| 43 | SAGBEND | -92.08 | -20.10 | 0.00 | 0.000 | 5.722 | 191.25 | 0.0093 | -0.0009 | 0.1095 | 0.0000 | 0.1162 | 0.00 |
| 44 | SAGBEND | -98.06 | -20.61 | 0.00 | 0.000 | 4.033 | 197.25 | 0.0092 | -0.0009 | 0.0996 | 0.0000 | 0.1063 | 0.00 |
| 45 | SAGBEND | -104.04 | -20.95 | 0.00 | 0.000 | 2.626 | 203.25 | 0.0092 | -0.0009 | 0.0818 | 0.0000 | 0.0888 | 0.00 |
| 46 | SAGBEND | -110.04 | -21.17 | 0.00 | 0.000 | 1.575 | 209.25 | 0.0092 | -0.0009 | 0.0706 | 0.0000 | 0.0776 | 0.00 |
| 47 | SAGBEND | -116.03 | -21.30 | 0.00 | 0.000 | 0.836 | 215.25 | 0.0092 | -0.0009 | 0.0574 | 0.0000 | 0.0655 | 0.00 |
| | | | | | | | | | | | | | |
| 48 | SEABED | -122.03 | -21.36 | 0.00 | 0.000 | 0.308 | 221.25 | 0.0092 | -0.0009 | 0.0399 | 0.0000 | 0.0471 | 0.00 |
| 49 | SEABED | -128.03 | -21.38 | 0.00 | 0.000 | 0.028 | 227.25 | 0.0092 | -0.0009 | 0.0163 | 0.0000 | 0.0237 | 0.00 |
| 50 | SEABED | -134.03 | -21.37 | 0.00 | 0.000 | -0.036 | 233.25 | 0.0092 | -0.0009 | 0.0027 | 0.0000 | 0.0110 | 0.00 |
| 51 | SEABED | -140.03 | -21.37 | 0.00 | 0.000 | -0.023 | 239.25 | 0.0092 | -0.0009 | -0.0018 | 0.0000 | 0.0111 | 0.00 |
| 52 | SEABED | -146.03 | -21.37 | 0.00 | 0.000 | -0.008 | 245.25 | 0.0093 | -0.0009 | -0.0012 | 0.0000 | 0.0107 | 0.00 |
| 53 | SEABED | -152.03 | -21.37 | 0.00 | 0.000 | 0.000 | 251.25 | 0.0093 | -0.0009 | -0.0005 | 0.0000 | 0.0100 | 0.00 |
| 54 | SEABED | -158.03 | -21.37 | 0.00 | 0.000 | 0.001 | 257.25 | 0.0093 | -0.0009 | 0.0001 | 0.0000 | 0.0098 | 0.00 |
| 55 | SEABED | -164.03 | -21.37 | 0.00 | 0.000 | 0.001 | 263.25 | 0.0093 | -0.0009 | 0.0001 | 0.0000 | 0.0098 | 0.00 |
| 56 | SEABED | -170.03 | -21.37 | 0.00 | 0.000 | 0.000 | 269.25 | 0.0093 | -0.0009 | 0.0000 | 0.0000 | 0.0098 | 0.00 |
| 57 | SEABED | -176.03 | -21.37 | 0.00 | 0.000 | 0.000 | 275.25 | 0.0093 | -0.0009 | 0.0000 | 0.0000 | 0.0098 | 0.00 |
| 58 | SEABED | -182.03 | -21.37 | 0.00 | 0.000 | 0.000 | 281.25 | 0.0093 | -0.0009 | 0.0000 | 0.0000 | 0.0098 | 0.00 |
| 59 | SEABED | -188.03 | -21.37 | 0.00 | 0.000 | 0.000 | 287.25 | 0.0093 | -0.0009 | 0.0000 | 0.0000 | 0.0098 | 0.00 |

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 OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP        DATE - 3/25/2015   TIME - 12:18:21    PAGE   69
 PROJECT - Pipelay Analysis                                                        JOB NO. - Dynamic Analysis
 USER ID - Karun                                        LICENSED TO - OFFSHORE CONSTR. SPECIALISTS        CASE    5
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M A X I M U M   D Y N A M I C   P I P E   F O R C E S   A N D   S T R A I N S

NODE NO.	PIPE SECTION	X COORD (M)	Y COORD (M)	Z COORD (M)	HORIZ ANGLE (DEG)	VERT ANGLE (DEG)	PIPE LENGTH (M)	TENSILE STRAIN (PCT)	HOOP STRAIN (PCT)	BENDING STRAINS VERT (PCT)	HORIZ (PCT)	TOTAL STRAIN (PCT)	PERCNT ALLOW (PCT)
60	SEABED	-194.03	-21.37	0.00	0.000	0.000	293.25	0.0093	-0.0009	0.0000	0.0000	0.0098	0.00
61	SEABED	-200.03	-21.37	0.00	0.000	0.000	299.25	0.0093	-0.0009	0.0000	0.0000	0.0098	0.00
62	SEABED	-206.03	-21.37	0.00	0.000	0.000	305.25	0.0093	-0.0009	0.0000	0.0000	0.0098	0.00

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 OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP        DATE - 3/25/2015   TIME - 12:18:21    PAGE   70
 PROJECT - Pipelay Analysis                                                        JOB NO. - Dynamic Analysis
 USER ID - Karun                                        LICENSED TO - OFFSHORE CONSTR. SPECIALISTS        CASE    5
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M A X I M U M   D Y N A M I C   P I P E   F O R C E S   A N D   S T R A I N S

NODE NO.	PIPE SECTION	X COORD (M)	Y COORD (M)	Z COORD (M)	SUPPORT REACTION VERT (KN)	HORIZ (KN)	SUPT SEPARATIONS VERT (M)	HORIZ (M)	PIPE TENSION (KN)	BENDING MOMENTS VERT (KN-M)	HORIZ (KN-M)	TOTAL (KN-M)
1	LAYBARGE	96.27	6.92	0.00	12.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	LAYBARGE	84.24	6.65	0.00	20.95	0.00	0.00	0.00	-2.02	-19.73	0.00	19.73
5	LAYBARGE	73.41	6.38	0.00	43.95	0.00	0.00	0.00	-4.01	-91.54	0.00	91.54
7	TENSIONR	60.07	5.89	0.00	4.99	0.00	0.00	0.00	147.08	46.82	0.00	46.82
9	LAYBARGE	51.05	5.68	0.00	0.00	0.00	0.00	0.00	146.64	-40.02	0.00	40.02
10	LAYBARGE	46.41	5.55	0.00	63.47	0.00	0.00	0.00	145.92	-156.66	0.00	156.66
12	LAYBARGE	39.37	5.18	0.00	0.00	0.00	0.00	0.00	145.60	-4.89	0.00	4.89
13	TENSIONR	35.32	4.96	0.00	-10.60	0.00	0.00	0.00	278.92	38.38	0.00	38.38
15	LAYBARGE	26.07	4.47	0.00	0.00	0.00	0.00	0.00	278.85	-102.46	0.00	102.46
16	LAYBARGE	23.31	4.30	0.00	65.07	0.00	0.00	0.00	278.36	-191.24	0.00	191.24
18	LAYBARGE	8.86	2.76	0.00	76.48	0.00	0.00	0.00	276.41	-271.93	0.00	271.93
20	LAYBARGE	3.06	1.80	0.00	17.43	0.00	0.17	0.00	275.71	-147.48	0.00	147.48
24	STINGER	-7.59	-0.20	0.00	46.24	0.00	0.12	0.00	273.06	-157.41	0.00	157.41
26	STINGER	-16.54	-2.07	0.00	57.59	0.00	0.55	0.00	271.82	-264.34	0.00	264.34
29	STINGER	-26.14	-4.41	0.00	53.97	0.00	0.64	0.00	270.43	-249.26	0.00	249.26
31	STINGER	-36.58	-7.15	0.00	75.56	0.00	0.20	0.00	268.47	-302.65	0.00	302.65
33	STINGER	-39.59	-8.05	0.00	0.00	0.00	0.69	0.00	267.82	-201.91	0.00	201.91
35	SAGBEND	-45.32	-9.84	0.00	0.00	0.00	0.00	0.00	266.45	100.36	0.00	100.36
36	SAGBEND	-51.05	-11.62	0.00	0.00	0.00	0.00	0.00	265.01	126.27	0.00	126.27
37	SAGBEND	-56.80	-13.29	0.00	0.00	0.00	0.00	0.00	263.62	143.30	0.00	143.30
38	SAGBEND	-62.59	-14.86	0.00	0.00	0.00	0.00	0.00	262.31	168.00	0.00	168.00
39	SAGBEND	-68.42	-16.26	0.00	0.00	0.00	0.00	0.00	261.12	181.58	0.00	181.58
40	SAGBEND	-74.29	-17.50	0.00	0.00	0.00	0.00	0.00	260.06	182.99	0.00	182.99
41	SAGBEND	-80.19	-18.55	0.00	0.00	0.00	0.00	0.00	259.15	178.30	0.00	178.30
42	SAGBEND	-86.12	-19.42	0.00	0.00	0.00	0.00	0.00	258.41	178.73	0.00	178.73
43	SAGBEND	-92.08	-20.10	0.00	0.00	0.00	0.00	0.00	257.84	177.05	0.00	177.05
44	SAGBEND	-98.06	-20.61	0.00	0.00	0.00	0.00	0.00	257.45	160.95	0.00	160.95
45	SAGBEND	-104.04	-20.95	0.00	2.64	0.00	0.00	0.00	257.25	132.25	0.00	132.25
46	SAGBEND	-110.04	-21.17	0.00	10.22	0.00	0.00	0.00	257.23	114.07	0.00	114.07
47	SAGBEND	-116.03	-21.30	0.00	11.96	0.00	0.00	0.00	257.38	92.75	0.00	92.75
48	SEABED	-122.03	-21.36	0.00	10.55	0.00	0.00	0.00	257.67	64.50	0.00	64.50
49	SEABED	-128.03	-21.38	0.00	10.16	0.00	0.00	0.00	258.00	26.43	0.00	26.43
50	SEABED	-134.03	-21.37	0.00	9.45	0.00	0.00	0.00	258.29	4.35	0.00	4.35

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51   SEABED    -140.03   -21.37    0.00    8.14    0.00    0.00    0.00   258.56   -2.86    0.00    2.86
52   SEABED    -146.03   -21.37    0.00    7.24    0.00    0.00    0.00   258.83   -1.91    0.00    1.91
53   SEABED    -152.03   -21.37    0.00    6.99    0.00    0.00    0.00   259.09   -0.73    0.00    0.73
54   SEABED    -158.03   -21.37    0.00    6.99    0.00    0.00    0.00   259.34    0.12    0.00    0.12
55   SEABED    -164.03   -21.37    0.00    7.00    0.00    0.00    0.00   259.58    0.11    0.00    0.11
56   SEABED    -170.03   -21.37    0.00    6.99    0.00    0.00    0.00   259.81    0.06    0.00    0.06
57   SEABED    -176.03   -21.37    0.00    6.99    0.00    0.00    0.00   260.04    0.03    0.00    0.03
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 =================================================================================================================
   OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP          DATE - 3/25/2015    TIME - 12:18:21    PAGE    71
   PROJECT - Pipelay Analysis                                                     JOB NO. - Dynamic Analysis
   USER ID - Karun                                          LICENSED TO - OFFSHORE CONSTR. SPECIALISTS          CASE    5
 =================================================================================================================
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        M A X I M U M   D Y N A M I C   P I P E   F O R C E S   A N D   S T R A I N 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)	TOTAL (KN-M)
58	SEABED	-182.03	-21.37	0.00	6.99	0.00	0.00	0.00	260.26	-0.02	0.00	0.02
59	SEABED	-188.03	-21.37	0.00	6.99	0.00	0.00	0.00	260.47	-0.02	0.00	0.02
60	SEABED	-194.03	-21.37	0.00	6.99	0.00	0.00	0.00	260.67	-0.02	0.00	0.02
61	SEABED	-200.03	-21.37	0.00	6.99	0.00	0.00	0.00	260.87	-0.01	0.00	0.01
62	SEABED	-206.03	-21.37	0.00	0.00	0.00	0.00	0.00	261.06	0.00	0.00	0.00

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OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP          PAGE    72
Pipelay Analysis
JOB NO. - Dynamic Analysis       LICENSED TO - OFFSHORE CONSTR. SPECIALISTS
USER ID - Karun                  DATE - 3/25/2015   TIME - 12:18:21   CASE    6
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        S T A T I C   S O L U T I O N   S U M M A R Y

PIPE PROPERTIES (1)
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  PIPE SECTION LENGTH ..     0.00 M    ELASTIC MODULUS ......   207000. MPA
  OUTSIDE DIAMETER .....    27.310 CM  CROSS SECTIONAL AREA .   128.75 CM^2
  WALL THICKNESS .......     1.590 CM  MOMENT OF INERTIA ....   12671.5 CM^4
  WEIGHT/LENGTH IN AIR .   2205.00 N/M YIELD STRESS .........   450.00 MPA
  SUBMERGED WGHT/LENG ..   1164.00 N/M STRESS INTENS FACTOR .     1.000
  SPECIFIC GRAVITY .....     2.118     STEEL DENSITY ........   76982.0 N/M3
  WRAP COAT THICKNESS ..     0.280 CM  WRAP COAT DENSITY ....    9218.0 N/M3
  CONCRETE THICKNESS ...     4.000 CM  CONCRETE DENSITY .....   29846.0 N/M3
```

BARGE DATA
==========
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  TOTAL PIPE TENSION ...   250.00 KN   RADIUS OF CURVATURE ..     0.00 M
  NUMBER OF TENSIONERS .        2      BARGE TRIM ANGLE .....     0.500 DEG
  NO. OF PIPE SUPPORTS .        7      PIPE ANGLE AT STERN ..     9.594 DEG
  BARGE HEADING ........     0.000 DEG OFFSET FROM R.O.W. ...     0.00 M
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STINGER DATA
============
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  NO. OF PIPE SUPPORTS .        5      PIPE DEPTH AT STERN ..    -7.68 M
  NO. STINGER SECTIONS .        7      PIPE ANGLE AT STERN ..    17.345 DEG
  RADIUS OF CURVATURE ..   200.00 M    STINGER STERN DEPTH ..    -8.02 M
  STINGER LENGTH .......    39.00 M
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SAGBEND DATA
============
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  WATER DEPTH ..........    21.34 M    TENSION AT TOUCHDOWN .   209.80 KN
  TOUCHDOWN X-COORD. ...  -114.88 M    BOTTOM SLOPE ANGLE ...     0.000 DEG
  PROJECTED SPAN LENGTH    75.25 M     PIPE LENGTH GAIN .....     2.90 M
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============================== SOLUTION SUMMARY ==============================

NODE NO.	PIPE SECTION	X COORD (M)	Y COORD (M)	Z COORD (M)	SUPPORT REACT VERT (KN)	SUPPORT REACT HORIZ (KN)	TOTAL MOMENT (KN-M)	TOTAL STRAIN (PCT)	PCT ALL (%)
1	LAYBARGE	96.3	6.9	0.0	11.8	0.0	0.0	0.000	0.
3	LAYBARGE	84.3	6.6	0.0	20.0	0.0	17.7	0.011	0.
5	LAYBARGE	73.4	6.4	0.0	43.4	0.0	89.8	0.056	0.
7	TENSIONR	60.1	5.9	0.0	4.5	0.0	45.7	0.033	0.
9	LAYBARGE	51.1	5.7	0.0	0.0	0.0	38.9	0.029	0.
10	LAYBARGE	46.4	5.5	0.0	62.6	0.0	155.7	0.101	0.
12	LAYBARGE	39.4	5.2	0.0	0.0	0.0	1.6	0.006	0.
13	TENSIONR	35.4	5.0	0.0	-8.9	0.0	35.2	0.031	0.
15	LAYBARGE	26.1	4.5	0.0	0.0	0.0	93.4	0.067	0.
16	LAYBARGE	23.3	4.3	0.0	58.1	0.0	176.6	0.118	0.
18	LAYBARGE	8.9	2.7	0.0	60.1	0.0	193.4	0.129	0.
20	LAYBARGE	3.1	1.8	0.0	0.0	-0.1	50.5	0.040	0.

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OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP          PAGE    73
Pipelay Analysis
JOB NO. - Dynamic Analysis       LICENSED TO - OFFSHORE CONSTR. SPECIALISTS
USER ID - Karun                  DATE - 3/25/2015   TIME - 12:18:21   CASE    6
 =================================================================================================================
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        S T A T I C   S O L U T I O N   S U M M A R Y

24	STINGER	-7.5	0.0	0.0	0.0	0.3	18.1	0.020	0.
26	STINGER	-16.5	-1.7	0.0	42.7	0.6	168.5	0.113	0.
29	STINGER	-26.2	-3.9	0.0	14.0	0.7	114.7	0.080	0.
31	STINGER	-36.7	-6.8	0.0	37.7	-1.7	135.8	0.093	0.
33	STINGER	-39.6	-7.7	0.0	0.0	2.7	69.3	0.051	0.
42	SAGBEND	-86.1	-19.3	0.0	0.0	0.0	133.3	0.090	0.

47 SEABED -116.0 -21.4 0.0 3.5 0.5 58.9 0.044 0.

        M A X I M U M   D Y N A M I C   P I P E   F O R C E S   A N D   S T R A I N S

NODE NO.	PIPE SECTION	X COORD (M)	Y COORD (M)	Z COORD (M)	HORIZ ANGLE (DEG)	VERT ANGLE (DEG)	PIPE LENGTH (M)	TENSILE STRAIN (PCT)	HOOP STRAIN (PCT)	BENDING STRAINS VERT (PCT)	HORIZ (PCT)	TOTAL STRAIN (PCT)	PERCNT ALLOW (PCT)
1	LAYBARGE	96.25	6.93	0.00	0.003	1.678	0.00	0.0000	0.0000	0.0000	0.0000	0.0000	0.00
3	LAYBARGE	84.22	6.64	0.00	0.003	1.210	12.04	-0.0001	0.0000	-0.0122	-0.0002	0.0123	0.00
5	LAYBARGE	73.39	6.37	-0.01	0.003	1.973	22.87	-0.0002	0.0000	-0.0565	0.0002	0.0566	0.00
7	TENSIONR	60.04	5.89	0.00	0.003	1.661	36.22	0.0056	0.0000	0.0289	-0.0002	0.0340	0.00
9	LAYBARGE	51.03	5.68	0.00	0.003	1.310	45.24	0.0056	0.0000	-0.0246	0.0001	0.0296	0.00
10	LAYBARGE	46.38	5.55	0.00	0.003	2.244	49.89	0.0056	0.0000	-0.0970	-0.0003	0.1023	0.00
12	LAYBARGE	39.35	5.18	0.00	0.002	3.298	56.93	0.0056	0.0000	-0.0030	0.0000	0.0075	0.00
13	TENSIONR	35.30	4.95	0.00	0.002	3.136	60.99	0.0104	0.0000	0.0234	-0.0001	0.0336	0.00
15	LAYBARGE	26.04	4.48	0.00	0.002	3.354	70.26	0.0104	0.0000	-0.0626	-0.0001	0.0728	0.00
16	LAYBARGE	23.28	4.30	0.00	0.002	4.120	73.02	0.0104	0.0000	-0.1174	0.0003	0.1275	0.00
18	LAYBARGE	8.83	2.75	0.01	0.000	8.483	87.56	0.0103	0.0000	-0.1666	0.0004	0.1746	0.00
20	LAYBARGE	3.04	1.76	0.01	-0.001	10.257	93.44	0.0103	0.0000	-0.1077	-0.0002	0.1158	0.00
24	STINGER	-7.58	-0.35	0.01	0.000	11.463	104.23	0.0102	0.0000	-0.1344	0.0010	0.1442	0.00
26	STINGER	-16.51	-2.26	0.01	0.000	13.294	113.37	0.0101	-0.0001	-0.1396	0.0013	0.1493	0.00
29	STINGER	-26.07	-4.52	0.02	-0.001	14.080	123.32	0.0100	-0.0002	-0.1584	0.0016	0.1680	0.00
31	STINGER	-36.45	-7.35	0.02	-0.008	16.615	134.12	0.0098	-0.0004	-0.1785	-0.0024	0.1859	0.00
33	STINGER	-39.45	-8.25	0.02	0.012	17.256	137.25	0.0098	-0.0004	-0.1165	0.0242	0.1241	0.00
35	SAGBEND	-45.30	-10.02	0.01	0.113	17.307	143.25	0.0097	-0.0005	0.0575	0.0116	0.0667	0.00
36	SAGBEND	-51.03	-11.76	0.00	0.154	16.821	149.25	0.0096	-0.0005	0.0720	0.0069	0.0812	0.00
37	SAGBEND	-56.79	-13.38	-0.01	0.153	15.768	155.25	0.0095	-0.0006	0.0821	-0.0074	0.0895	0.00
38	SAGBEND	-62.58	-14.90	-0.02	0.131	14.407	161.25	0.0094	-0.0007	0.0935	-0.0078	0.1006	0.00
39	SAGBEND	-68.41	-16.32	-0.02	0.106	12.716	167.25	0.0093	-0.0007	0.1000	-0.0073	0.1068	0.00
40	SAGBEND	-74.29	-17.56	-0.03	0.019	10.997	173.25	0.0092	-0.0008	0.1085	-0.0073	0.1152	0.00
41	SAGBEND	-80.19	-18.57	-0.04	-0.023	9.229	179.25	0.0092	-0.0008	0.1116	-0.0066	0.1183	0.00
42	SAGBEND	-86.13	-19.41	-0.04	-0.036	7.457	185.25	0.0091	-0.0008	0.1082	-0.0060	0.1149	0.00
43	SAGBEND	-92.09	-20.07	-0.05	-0.049	5.665	191.25	0.0091	-0.0009	0.0992	-0.0059	0.1059	0.00
44	SAGBEND	-98.06	-20.57	-0.05	-0.074	3.950	197.25	0.0091	-0.0009	0.0911	-0.0049	0.0978	0.00
45	SAGBEND	-104.05	-20.91	-0.04	-0.081	2.622	203.25	0.0091	-0.0009	0.0794	-0.0071	0.0862	0.00
46	SAGBEND	-110.04	-21.13	-0.03	-0.100	1.653	209.25	0.0090	-0.0009	0.0683	0.0113	0.0754	0.00
47	SAGBEND	-116.04	-21.27	-0.03	-0.127	0.975	215.25	0.0091	-0.0009	0.0545	0.0113	0.0635	0.00
48	SEABED	-122.04	-21.34	-0.02	-0.104	0.458	221.25	0.0091	-0.0009	0.0430	0.0109	0.0523	0.00
49	SEABED	-128.04	-21.37	0.00	-0.082	0.104	227.25	0.0091	-0.0009	0.0229	0.0070	0.0331	0.00
50	SEABED	-134.04	-21.37	0.00	-0.022	-0.034	233.25	0.0091	-0.0009	0.0062	0.0044	0.0166	0.00
51	SEABED	-140.04	-21.37	0.00	0.003	-0.023	239.25	0.0091	-0.0009	-0.0016	0.0014	0.0109	0.00
52	SEABED	-146.04	-21.37	0.00	0.003	-0.013	245.25	0.0091	-0.0009	-0.0012	-0.0003	0.0103	0.00
53	SEABED	-152.04	-21.37	0.00	0.002	-0.003	251.25	0.0091	-0.0009	-0.0006	-0.0002	0.0098	0.00
54	SEABED	-158.04	-21.37	0.00	0.001	0.001	257.25	0.0091	-0.0009	-0.0002	-0.0001	0.0097	0.00
55	SEABED	-164.04	-21.37	0.00	0.000	0.001	263.25	0.0091	-0.0009	0.0001	0.0001	0.0097	0.00
56	SEABED	-170.04	-21.37	0.00	0.000	0.000	269.25	0.0091	-0.0009	0.0000	0.0001	0.0097	0.00
57	SEABED	-176.04	-21.37	0.00	0.000	0.000	275.25	0.0091	-0.0009	0.0000	0.0001	0.0097	0.00
58	SEABED	-182.04	-21.37	0.00	0.000	0.000	281.25	0.0092	-0.0009	0.0000	-0.0001	0.0097	0.00
59	SEABED	-188.04	-21.37	0.00	0.000	0.000	287.25	0.0092	-0.0009	0.0000	-0.0001	0.0097	0.00

        M A X I M U M   D Y N A M I C   P I P E   F O R C E S   A N D   S T R A I N S

NODE NO.	PIPE SECTION	X COORD (M)	Y COORD (M)	Z COORD (M)	HORIZ ANGLE (DEG)	VERT ANGLE (DEG)	PIPE LENGTH (M)	TENSILE STRAIN (PCT)	HOOP STRAIN (PCT)	BENDING STRAINS VERT (PCT)	HORIZ (PCT)	TOTAL STRAIN (PCT)	PERCNT ALLOW (PCT)
60	SEABED	-194.04	-21.37	0.00	0.000	0.000	293.25	0.0092	-0.0009	0.0000	-0.0002	0.0097	0.00
61	SEABED	-200.04	-21.37	0.00	0.000	0.000	299.25	0.0092	-0.0009	0.0000	-0.0002	0.0097	0.00
62	SEABED	-206.04	-21.37	0.00	0.000	0.000	305.25	0.0092	-0.0009	0.0000	0.0000	0.0097	0.00

        M A X I M U M   D Y N A M I C   P I P E   F O R C E S   A N D   S T R A I N S

NODE NO.	PIPE SECTION	X COORD (M)	Y COORD (M)	Z COORD (M)	SUPPORT REACTION VERT (KN)	HORIZ (KN)	SUPT SEPARATIONS VERT (M)	HORIZ (M)	PIPE TENSION (KN)	BENDING MOMENTS VERT (KN-M)	HORIZ (KN-M)	TOTAL (KN-M)
1	LAYBARGE	96.25	6.93	0.00	12.08	0.14	0.00	0.00	0.00	0.00	0.00	0.00
3	LAYBARGE	84.22	6.64	0.00	20.76	0.30	0.00	0.00	-2.64	-19.79	-0.34	19.79
5	LAYBARGE	73.39	6.37	-0.01	43.89	0.24	0.00	0.00	-5.18	-91.34	0.32	91.34
7	TENSIONR	60.04	5.89	0.00	4.93	-0.18	0.00	0.00	148.69	46.69	-0.29	46.69
9	LAYBARGE	51.03	5.68	0.00	0.00	0.00	0.00	0.00	148.56	-39.69	0.16	39.69
10	LAYBARGE	46.38	5.55	0.00	63.66	0.20	0.00	0.00	147.98	-156.76	-0.43	156.76
12	LAYBARGE	39.35	5.18	0.00	0.00	0.00	0.00	0.00	147.91	-4.79	0.06	4.79
13	TENSIONR	35.30	4.95	0.00	-10.22	-0.21	0.00	0.00	277.49	37.88	-0.19	37.88
15	LAYBARGE	26.04	4.48	0.00	0.00	0.00	0.00	0.00	277.23	-101.27	-0.22	101.27
16	LAYBARGE	23.28	4.30	0.00	64.82	-0.32	0.00	0.00	276.69	-189.79	0.52	189.79
18	LAYBARGE	8.83	2.75	0.01	75.73	0.36	0.00	0.00	274.42	-269.30	0.61	269.30

20	LAYBARGE	3.04	1.76	0.01	27.63	0.50	0.17	0.00	273.63	-174.18	-0.37	174.18
24	STINGER	-7.58	-0.35	0.01	58.26	1.91	0.11	0.00	270.92	-217.35	1.67	217.35
26	STINGER	-16.51	-2.26	0.01	56.62	2.64	0.63	0.00	269.11	-225.69	2.12	225.69
29	STINGER	-26.07	-4.52	0.02	55.66	2.58	0.71	0.00	267.39	-256.13	2.51	256.13
31	STINGER	-36.45	-7.35	0.02	73.46	-13.82	0.01	0.00	265.04	-288.59	-3.83	288.59
33	STINGER	-39.45	-8.25	0.02	-0.04	18.49	0.45	0.00	264.26	-188.36	39.08	188.68
35	SAGBEND	-45.30	-10.02	0.01	0.00	0.00	0.00	0.00	262.61	92.99	18.76	93.04
36	SAGBEND	-51.03	-11.76	0.00	0.00	0.00	0.00	0.00	260.97	116.45	11.22	116.46
37	SAGBEND	-56.79	-13.38	-0.01	0.00	0.00	0.00	0.00	259.47	132.79	-11.91	132.84
38	SAGBEND	-62.58	-14.90	-0.02	0.00	0.00	0.00	0.00	258.13	151.14	-12.64	151.44
39	SAGBEND	-68.41	-16.32	-0.02	0.00	0.00	0.00	0.00	256.95	161.66	-11.79	161.66
40	SAGBEND	-74.29	-17.56	-0.03	0.00	0.00	0.00	0.00	255.91	175.44	-11.76	175.44
41	SAGBEND	-80.19	-18.57	-0.04	0.00	0.00	0.00	0.00	255.01	180.47	-10.67	180.50
42	SAGBEND	-86.13	-19.41	-0.04	0.00	0.00	0.00	0.00	254.26	174.93	-9.67	174.98
43	SAGBEND	-92.09	-20.07	-0.05	0.00	0.00	0.00	0.00	253.68	160.44	-9.50	160.44
44	SAGBEND	-98.06	-20.57	-0.05	0.00	0.00	0.00	0.00	253.30	147.19	-7.85	147.21
45	SAGBEND	-104.05	-20.91	-0.04	3.27	-1.10	0.00	0.00	253.12	128.41	-11.47	128.42
46	SAGBEND	-110.04	-21.13	-0.03	10.55	3.10	0.00	0.00	253.15	110.46	18.26	110.46
47	SAGBEND	-116.04	-21.27	-0.03	10.73	3.62	0.00	0.00	253.36	88.04	18.30	88.09
48	SEABED	-122.04	-21.34	-0.02	10.57	3.43	0.00	0.00	253.69	69.58	17.69	69.85
49	SEABED	-128.04	-21.37	0.00	10.00	2.31	0.00	0.00	253.99	37.05	11.37	38.76
50	SEABED	-134.04	-21.37	0.00	9.31	-0.65	0.00	0.00	254.25	9.95	7.04	12.19
51	SEABED	-140.04	-21.37	0.00	8.47	-0.53	0.00	0.00	254.51	-2.65	2.24	2.65
52	SEABED	-146.04	-21.37	0.00	7.47	-0.42	0.00	0.00	254.76	-1.94	-0.56	1.96
53	SEABED	-152.04	-21.37	0.00	7.01	-0.23	0.00	0.00	255.01	-1.04	-0.34	1.06
54	SEABED	-158.04	-21.37	0.00	6.99	-0.14	0.00	0.00	255.24	-0.28	-0.20	0.29
55	SEABED	-164.04	-21.37	0.00	7.00	-0.14	0.00	0.00	255.47	0.08	0.22	0.22
56	SEABED	-170.04	-21.37	0.00	7.00	-0.15	0.00	0.00	255.69	0.06	0.20	0.20
57	SEABED	-176.04	-21.37	0.00	7.00	-0.15	0.00	0.00	255.91	0.04	0.20	0.20

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=============================================================================================
OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP          DATE - 3/25/2015   TIME - 12:18:21   PAGE   77
PROJECT - Pipelay Analysis                                            JOB NO. - Dynamic Analysis
USER ID - Karun                                    LICENSED TO - OFFSHORE CONSTR. SPECIALISTS        CASE    6
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M A X I M U M   D Y N A M I C   P I P E   F O R C E S   A N D   S T R A I N S

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NODE NO.	PIPE SECTION	X COORD (M)	Y COORD (M)	Z COORD (M)	SUPPORT REACTION VERT (KN)	HORIZ (KN)	SUPT SEPARATIONS VERT (M)	HORIZ (M)	PIPE TENSION (KN)	BENDING MOMENTS VERT (KN-M)	HORIZ (KN-M)	TOTAL (KN-M)
58	SEABED	-182.04	-21.37	0.00	6.99	0.14	0.00	0.00	256.11	-0.02	-0.20	0.20
59	SEABED	-188.04	-21.37	0.00	6.99	0.15	0.00	0.00	256.31	-0.02	-0.22	0.22
60	SEABED	-194.04	-21.37	0.00	6.99	0.14	0.00	0.00	256.51	0.01	-0.29	0.29
61	SEABED	-200.04	-21.37	0.00	7.00	0.09	0.00	0.00	256.69	-0.01	-0.33	0.33
62	SEABED	-206.04	-21.37	0.00	0.00	0.01	0.00	0.00	256.87	0.00	0.00	0.00

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OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP          PAGE  78
Pipelay Analysis
JOB NO. - Dynamic Analysis       LICENSED TO - OFFSHORE CONSTR. SPECIALISTS
USER ID - Karun                  DATE - 3/25/2015  TIME - 12:18:21  CASE   7
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S T A T I C   S O L U T I O N   S U M M A R Y

PIPE PROPERTIES (1)
=====================

PIPE SECTION LENGTH ..	0.00 M	ELASTIC MODULUS	207000. MPA
OUTSIDE DIAMETER	27.310 CM	CROSS SECTIONAL AREA .	128.75 CM^2
WALL THICKNESS	1.590 CM	MOMENT OF INERTIA	12671.5 CM^4
WEIGHT/LENGTH IN AIR .	2205.00 N/M	YIELD STRESS	450.00 MPA
SUBMERGED WGHT/LENG ..	1164.00 N/M	STRESS INTENS FACTOR .	1.000
SPECIFIC GRAVITY	2.118	STEEL DENSITY	76982.0 N/M3
WRAP COAT THICKNESS ..	0.280 CM	WRAP COAT DENSITY	9218.0 N/M3
CONCRETE THICKNESS ...	4.000 CM	CONCRETE DENSITY	29846.0 N/M3

BARGE DATA
==========

TOTAL PIPE TENSION ...	250.00 KN	RADIUS OF CURVATURE ..	0.00 M
NUMBER OF TENSIONERS .	2	BARGE TRIM ANGLE	0.500 DEG
NO. OF PIPE SUPPORTS .	7	PIPE ANGLE AT STERN ..	9.823 DEG
BARGE HEADING	0.000 DEG	OFFSET FROM R.O.W. ...	0.00 M

STINGER DATA
============

NO. OF PIPE SUPPORTS .	5	PIPE DEPTH AT STERN ..	-8.02 M
NO. STINGER SECTIONS .	7	PIPE ANGLE AT STERN ..	17.333 DEG
RADIUS OF CURVATURE ..	200.00 M	STINGER STERN DEPTH ..	-8.37 M
STINGER LENGTH	39.00 M		

SAGBEND DATA
============

WATER DEPTH	21.34 M	TENSION AT TOUCHDOWN .	209.81 KN
TOUCHDOWN X-COORD. ...	-113.79 M	BOTTOM SLOPE ANGLE ...	0.000 DEG
PROJECTED SPAN LENGTH	74.20 M	PIPE LENGTH GAIN	2.91 M

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========================= SOLUTION SUMMARY =========================
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NODE NO.	PIPE SECTION	X COORD (M)	Y COORD (M)	Z COORD (M)	SUPPORT REACT VERT (KN)	HORIZ (KN)	TOTAL MOMENT (KN-M)	TOTAL STRAIN (PCT)	PCT ALL (%)
1	LAYBARGE	96.3	6.9	0.0	11.8	0.0	0.0	0.000	0.
3	LAYBARGE	84.3	6.6	0.0	20.0	0.0	17.8	0.011	0.
5	LAYBARGE	73.4	6.4	0.0	43.4	0.0	89.8	0.056	0.
7	TENSIONR	60.1	5.9	0.0	4.5	0.0	45.6	0.033	0.

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    9  LAYBARGE    51.1    5.7    0.0    0.0    0.0    38.8   0.029   0.
   10  LAYBARGE    46.4    5.5    0.0   62.5    0.0   155.5   0.101   0.
   12  LAYBARGE    39.4    5.2    0.0    0.0    0.0     2.0   0.006   0.
   13  TENSIONR    35.4    5.0    0.0   -8.6    0.0    34.5   0.031   0.
   15  LAYBARGE    26.1    4.5    0.0    0.0    0.0    91.6   0.066   0.
   16  LAYBARGE    23.3    4.3    0.0   57.0    0.0   173.9   0.117   0.
   18  LAYBARGE     8.9    2.7    0.0   61.2    0.0   203.7   0.135   0.
   20  LAYBARGE     3.1    1.8    0.0    0.0   -0.1    63.1   0.048   0.
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OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP          PAGE  79
Pipelay Analysis
JOB NO. - Dynamic Analysis      LICENSED TO - OFFSHORE CONSTR. SPECIALISTS
USER ID - Karun                 DATE - 3/25/2015   TIME - 12:18:21   CASE    7
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         S T A T I C   S O L U T I O N   S U M M A R Y


   24  STINGER     -7.5   -0.1    0.0    7.3    0.7    43.4   0.036   0.
   26  STINGER    -16.5   -1.9    0.0   36.0    1.2   148.0   0.100   0.
   29  STINGER    -26.2   -4.2    0.0   13.9    1.2   102.2   0.072   0.
   31  STINGER    -36.6   -7.1    0.0   35.8   -3.2   121.9   0.084   0.
   33  STINGER    -39.6   -8.0    0.0    0.0    5.2    59.1   0.045   0.
   42  SAGBEND    -86.1  -19.5   -0.1    0.0    0.0   133.3   0.090   0.
   47  SEABED    -116.0  -21.4    0.0    4.9    0.9    51.2   0.040   0.
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 OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP        DATE - 3/25/2015   TIME - 12:18:21   PAGE   80
 PROJECT - Pipelay Analysis                                                          JOB NO. - Dynamic Analysis
 USER ID - Karun                                     LICENSED TO - OFFSHORE CONSTR. SPECIALISTS       CASE    7
=============================================================================
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        M A X I M U M   D Y N A M I C   P I P E   F O R C E S   A N D   S T R A I N S
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NODE NO.	PIPE SECTION	X COORD (M)	Y COORD (M)	Z COORD (M)	HORIZ ANGLE (DEG)	VERT ANGLE (DEG)	PIPE LENGTH (M)	TENSILE STRAIN (PCT)	HOOP STRAIN (PCT)	BENDING STRAINS VERT (PCT)	HORIZ (PCT)	TOTAL STRAIN (PCT)	PERCNT ALLOW (PCT)
1	LAYBARGE	96.30	6.95	0.00	0.001	1.645	0.00	0.0000	0.0000	0.0000	0.0000	0.0000	0.00
3	LAYBARGE	84.27	6.66	0.00	0.001	1.177	12.04	-0.0001	0.0000	-0.0118	-0.0004	0.0118	0.00
5	LAYBARGE	73.44	6.39	0.00	0.000	1.940	22.87	-0.0002	0.0000	-0.0563	-0.0008	0.0564	0.00
7	TENSIONR	60.09	5.89	0.00	0.000	1.628	36.22	0.0056	0.0000	-0.0293	-0.0006	0.0343	0.00
9	LAYBARGE	51.08	5.68	0.00	0.001	1.276	45.24	0.0055	0.0000	-0.0244	0.0003	0.0296	0.00
10	LAYBARGE	46.43	5.54	0.00	0.001	2.212	49.89	0.0055	0.0000	-0.0975	-0.0012	0.1030	0.00
12	LAYBARGE	39.40	5.18	0.00	0.001	3.265	56.93	0.0055	0.0000	-0.0027	0.0001	0.0075	0.00
13	TENSIONR	35.35	4.95	0.00	0.001	3.102	60.99	0.0103	0.0000	0.0226	-0.0004	0.0327	0.00
15	LAYBARGE	26.09	4.47	0.00	0.001	3.330	70.26	0.0103	0.0000	-0.0601	-0.0007	0.0702	0.00
16	LAYBARGE	23.33	4.29	0.00	0.001	4.099	73.02	0.0102	0.0000	-0.1141	-0.0015	0.1241	0.00
18	LAYBARGE	8.88	2.74	0.00	0.004	8.369	87.56	0.0101	0.0000	-0.1640	0.0017	0.1732	0.00
20	LAYBARGE	3.08	1.79	0.00	0.006	10.165	93.44	0.0101	0.0000	-0.0697	0.0006	0.0794	0.00
24	STINGER	-7.54	-0.20	0.00	0.021	11.437	104.23	0.0099	0.0000	-0.1104	0.0021	0.1202	0.00
26	STINGER	-16.47	-2.05	0.00	0.010	13.163	113.38	0.0098	-0.0001	-0.1353	0.0024	0.1450	0.00
29	STINGER	-26.11	-4.48	0.00	-0.005	14.720	123.33	0.0097	-0.0002	-0.1362	0.0024	0.1457	0.00
31	STINGER	-36.54	-7.43	0.00	-0.023	16.881	134.14	0.0095	-0.0003	-0.1413	-0.0028	0.1489	0.00
33	STINGER	-39.53	-8.35	0.00	0.024	17.184	137.27	0.0094	-0.0004	-0.0863	0.0197	0.0937	0.00
35	SAGBEND	-45.24	-10.14	-0.01	0.122	17.236	143.25	0.0093	-0.0005	0.0524	0.0094	0.0619	0.00
36	SAGBEND	-50.97	-11.88	-0.04	0.180	16.489	149.25	0.0092	-0.0005	0.0670	0.0048	0.0763	0.00
37	SAGBEND	-56.73	-13.50	-0.06	0.170	15.408	155.25	0.0091	-0.0006	0.0756	-0.0058	0.0847	0.00
38	SAGBEND	-62.54	-14.98	-0.08	0.120	14.057	161.25	0.0090	-0.0007	0.0840	-0.0075	0.0912	0.00
39	SAGBEND	-68.38	-16.35	-0.10	0.080	12.481	167.25	0.0089	-0.0007	0.0923	-0.0082	0.0994	0.00
40	SAGBEND	-74.26	-17.56	-0.11	0.052	10.758	173.25	0.0088	-0.0008	0.0959	-0.0085	0.1029	0.00
41	SAGBEND	-80.17	-18.62	-0.10	-0.019	9.071	179.25	0.0087	-0.0008	0.0982	-0.0079	0.1052	0.00
42	SAGBEND	-86.11	-19.51	-0.10	-0.091	7.453	185.25	0.0087	-0.0008	0.0981	-0.0068	0.1050	0.00
43	SAGBEND	-92.06	-20.21	-0.09	-0.154	5.831	191.25	0.0087	-0.0009	0.0938	-0.0058	0.1007	0.00
44	SAGBEND	-98.04	-20.72	-0.07	-0.177	4.114	197.25	0.0086	-0.0009	0.0870	-0.0043	0.0939	0.00
45	SAGBEND	-104.03	-21.06	-0.05	-0.191	2.555	203.25	0.0086	-0.0009	0.0755	0.0038	0.0825	0.00
46	SAGBEND	-110.03	-21.26	-0.04	-0.188	1.292	209.25	0.0086	-0.0009	0.0631	0.0083	0.0709	0.00
47	SEABED	-116.02	-21.35	-0.02	-0.159	0.473	215.25	0.0086	-0.0009	0.0447	0.0142	0.0532	0.00
48	SEABED	-122.02	-21.38	-0.01	-0.091	0.075	221.25	0.0086	-0.0009	0.0209	0.0129	0.0312	0.00
49	SEABED	-128.02	-21.38	0.00	-0.029	-0.045	227.25	0.0086	-0.0009	0.0048	0.0062	0.0155	0.00
50	SEABED	-134.02	-21.37	0.00	0.005	-0.035	233.25	0.0086	-0.0009	-0.0018	0.0016	0.0106	ALLOW
51	SEABED	-140.02	-21.37	0.00	0.005	-0.013	239.25	0.0086	-0.0009	-0.0013	-0.0003	0.0102	0.00
52	SEABED	-146.02	-21.37	0.00	0.003	-0.002	245.25	0.0086	-0.0009	-0.0006	-0.0003	0.0096	0.00
53	SEABED	-152.02	-21.37	0.00	0.001	0.001	251.25	0.0086	-0.0009	-0.0001	-0.0001	0.0091	0.00
54	SEABED	-158.02	-21.37	0.00	0.000	0.001	257.25	0.0086	-0.0009	0.0001	0.0001	0.0092	0.00
55	SEABED	-164.02	-21.37	0.00	0.000	0.000	263.25	0.0086	-0.0009	0.0000	0.0002	0.0092	0.00
56	SEABED	-170.02	-21.37	0.00	0.000	0.000	269.25	0.0086	-0.0009	0.0000	0.0001	0.0091	0.00
57	SEABED	-176.02	-21.37	0.00	0.000	0.000	275.25	0.0087	-0.0009	0.0000	-0.0001	0.0091	0.00
58	SEABED	-182.02	-21.37	0.00	0.000	0.000	281.25	0.0087	-0.0009	0.0000	-0.0001	0.0091	0.00
59	SEABED	-188.02	-21.37	0.00	0.000	0.000	287.25	0.0087	-0.0009	0.0000	-0.0002	0.0092	0.00

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 OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP        DATE - 3/25/2015   TIME - 12:18:21   PAGE   81
 PROJECT - Pipelay Analysis                                                          JOB NO. - Dynamic Analysis
 USER ID - Karun                                     LICENSED TO - OFFSHORE CONSTR. SPECIALISTS       CASE    7
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        M A X I M U M   D Y N A M I C   P I P E   F O R C E S   A N D   S T R A I N S
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NODE NO.	PIPE SECTION	X COORD (M)	Y COORD (M)	Z COORD (M)	HORIZ ANGLE (DEG)	VERT ANGLE (DEG)	PIPE LENGTH (M)	TENSILE STRAIN (PCT)	HOOP STRAIN (PCT)	BENDING STRAINS VERT (PCT)	HORIZ (PCT)	TOTAL STRAIN (PCT)	PERCNT ALLOW (PCT)
60	SEABED	-194.02	-21.37	0.00	0.000	0.000	293.25	0.0087	-0.0009	0.0000	0.0002	0.0092	0.00
61	SEABED	-200.02	-21.37	0.00	0.000	0.000	299.25	0.0087	-0.0009	0.0000	0.0003	0.0092	0.00
62	SEABED	-206.02	-21.37	0.00	0.000	0.000	305.25	0.0087	-0.0009	0.0000	0.0000	0.0091	0.00

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OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP          DATE - 3/25/2015   TIME - 12:18:21   PAGE   82
PROJECT - Pipelay Analysis                                                        JOB NO. - Dynamic Analysis
USER ID - Karun                                          LICENSED TO - OFFSHORE CONSTR. SPECIALISTS        CASE    7
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M A X I M U M   D Y N A M I C   P I P E   F O R C E S   A N D   S T R A I N 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	LAYBARGE	96.30	6.95	0.00	12.28	0.26	0.00	0.00	0.00	0.00	0.00	0.00
3	LAYBARGE	84.27	6.66	0.00	21.26	-0.65	0.00	0.00	-2.08	-19.10	-0.68	19.10
5	LAYBARGE	73.44	6.39	0.00	44.58	-0.76	0.00	0.00	-4.11	-90.99	-1.24	91.00
7	TENSIONR	60.09	5.89	0.00	5.77	-0.64	0.00	0.00	147.76	47.35	-0.96	47.35
9	LAYBARGE	51.08	5.68	0.00	0.00	0.00	0.00	0.00	147.48	-39.38	0.50	39.38
10	LAYBARGE	46.43	5.54	0.00	64.68	-1.00	0.00	0.00	146.85	-157.59	-1.99	157.60
12	LAYBARGE	39.40	5.18	0.00	0.00	0.00	0.00	0.00	146.66	-4.35	0.16	4.35
13	TENSIONR	35.35	4.95	0.00	-9.59	0.50	0.00	0.00	273.72	36.48	-0.59	36.48
15	LAYBARGE	26.09	4.47	0.00	0.00	0.00	0.00	0.00	272.91	-97.22	-1.10	97.23
16	LAYBARGE	23.33	4.29	0.00	62.90	-1.04	0.00	0.00	272.21	-184.41	-2.39	184.42
18	LAYBARGE	8.88	2.74	0.00	72.05	0.99	0.00	0.00	269.09	-265.05	2.72	265.05
20	LAYBARGE	3.08	1.79	0.00	0.00	0.49	0.14	0.00	267.98	-112.67	0.95	112.67
24	STINGER	-7.54	-0.20	0.00	51.33	2.22	0.06	0.00	263.87	-178.48	3.41	178.48
26	STINGER	-16.47	-2.05	0.00	49.13	3.37	0.31	0.00	261.76	-218.77	3.96	218.77
29	STINGER	-26.11	-4.48	0.00	50.98	2.70	0.33	0.00	259.29	-220.11	3.85	220.11
31	STINGER	-36.54	-7.43	0.00	61.18	-11.72	0.01	0.00	256.01	-228.46	-4.49	228.47
33	STINGER	-39.53	-8.35	0.00	0.11	15.47	0.43	0.00	255.23	-139.45	31.91	139.47
35	SAGBEND	-45.24	-10.14	-0.01	0.00	0.00	0.00	0.00	253.34	84.76	15.24	85.05
36	SAGBEND	-50.97	-11.88	-0.04	0.00	0.00	0.00	0.00	251.34	108.38	7.82	108.43
37	SAGBEND	-56.73	-13.50	-0.06	0.00	0.00	0.00	0.00	249.44	122.15	-9.37	122.29
38	SAGBEND	-62.54	-14.98	-0.08	0.00	0.00	0.00	0.00	247.69	135.84	-12.10	135.84
39	SAGBEND	-68.38	-16.35	-0.10	0.00	0.00	0.00	0.00	246.11	149.17	-13.31	149.19
40	SAGBEND	-74.26	-17.56	-0.11	0.00	0.00	0.00	0.00	244.75	154.97	-13.70	154.98
41	SAGBEND	-80.17	-18.62	-0.10	0.00	0.00	0.00	0.00	243.61	158.70	-12.81	158.79
42	SAGBEND	-86.11	-19.51	-0.10	0.00	0.00	0.00	0.00	242.70	158.61	-11.00	158.64
43	SAGBEND	-92.06	-20.21	-0.09	0.00	0.00	0.00	0.00	242.03	151.57	-9.37	151.60
44	SAGBEND	-98.04	-20.72	-0.07	0.00	0.00	0.00	0.00	241.57	140.67	-6.99	140.67
45	SAGBEND	-104.03	-21.06	-0.05	0.02	-0.23	0.00	0.00	241.32	122.12	6.06	122.22
46	SAGBEND	-110.03	-21.26	-0.04	4.38	1.76	0.00	0.00	241.28	102.09	13.46	102.18
47	SEABED	-116.02	-21.35	-0.02	10.32	3.64	0.00	0.00	241.40	72.26	22.97	73.32
48	SEABED	-122.02	-21.38	-0.01	10.33	3.48	0.00	0.00	241.59	33.84	20.83	36.71
49	SEABED	-128.02	-21.38	0.00	9.70	-1.01	0.00	0.00	241.73	7.81	10.01	11.64
50	SEABED	-134.02	-21.37	0.00	8.40	-0.99	0.00	0.00	241.86	-2.96	2.65	3.46
51	SEABED	-140.02	-21.37	0.00	7.40	-0.59	0.00	0.00	241.99	-2.15	-0.56	2.16
52	SEABED	-146.02	-21.37	0.00	7.00	-0.30	0.00	0.00	242.11	-0.96	-0.47	1.02
53	SEABED	-152.02	-21.37	0.00	6.97	0.22	0.00	0.00	242.23	-0.22	-0.21	0.26
54	SEABED	-158.02	-21.37	0.00	6.99	0.23	0.00	0.00	242.35	0.09	0.24	0.26
55	SEABED	-164.02	-21.37	0.00	7.00	0.23	0.00	0.00	242.46	0.06	0.25	0.25
56	SEABED	-170.02	-21.37	0.00	7.00	0.23	0.00	0.00	242.57	0.03	0.24	0.24
57	SEABED	-176.02	-21.37	0.00	7.00	0.23	0.00	0.00	242.68	0.01	-0.22	0.22

```
=====================================================================================================
OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP          DATE - 3/25/2015   TIME - 12:18:21   PAGE   83
PROJECT - Pipelay Analysis                                                        JOB NO. - Dynamic Analysis
USER ID - Karun                                          LICENSED TO - OFFSHORE CONSTR. SPECIALISTS        CASE    7
=====================================================================================================
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M A X I M U M   D Y N A M I C   P I P E   F O R C E S   A N D   S T R A I N 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)
58	SEABED	-182.02	-21.37	0.00	7.00	0.24	0.00	0.00	242.78	0.00	-0.23	0.23
59	SEABED	-188.02	-21.37	0.00	7.00	-0.24	0.00	0.00	242.88	0.00	-0.28	0.28
60	SEABED	-194.02	-21.37	0.00	7.00	-0.22	0.00	0.00	242.98	0.00	0.39	0.39
61	SEABED	-200.02	-21.37	0.00	7.00	-0.14	0.00	0.00	243.07	0.00	0.45	0.45
62	SEABED	-206.02	-21.37	0.00	7.00	-0.02	0.00	0.00	243.16	0.00	0.00	0.00

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=============================================================================
OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP          PAGE  84
Pipelay Analysis
JOB NO. - Dynamic Analysis      LICENSED TO - OFFSHORE CONSTR. SPECIALISTS
USER ID - Karun                 DATE - 3/25/2015   TIME - 12:18:21   CASE    8
=============================================================================
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S T A T I C   S O L U T I O N   S U M M A R Y

PIPE PROPERTIES (1)
====================

PIPE SECTION LENGTH ..	0.00 M	ELASTIC MODULUS	207000. MPA
OUTSIDE DIAMETER	27.310 CM	CROSS SECTIONAL AREA .	128.75 CM^2
WALL THICKNESS	1.590 CM	MOMENT OF INERTIA	12671.5 CM^4
WEIGHT/LENGTH IN AIR .	2205.00 N/M	YIELD STRESS	450.00 MPA
SUBMERGED WGHT/LENG ..	1164.00 N/M	STRESS INTENS FACTOR .	1.000
SPECIFIC GRAVITY	2.118	STEEL DENSITY	76982.0 N/M3
WRAP COAT THICKNESS ..	0.280 CM	WRAP COAT DENSITY	9218.0 N/M3
CONCRETE THICKNESS ...	4.000 CM	CONCRETE DENSITY	29846.0 N/M3

BARGE DATA
==========

TOTAL PIPE TENSION ...	250.00 KN	RADIUS OF CURVATURE ..	0.00 M
NUMBER OF TENSIONERS .	2	BARGE TRIM ANGLE	0.500 DEG

```
   NO. OF PIPE SUPPORTS .        7       PIPE ANGLE AT STERN ..    9.965 DEG
   BARGE HEADING ........    0.000 DEG   OFFSET FROM R.O.W. ...    0.00 M

STINGER DATA
============
   NO. OF PIPE SUPPORTS .        5       PIPE DEPTH AT STERN ..    -8.33 M
   NO. STINGER SECTIONS .        7       PIPE ANGLE AT STERN ..   17.336 DEG
   RADIUS OF CURVATURE ..   200.00 M     STINGER STERN DEPTH ..    -8.69 M
   STINGER LENGTH .......    39.00 M

SAGBEND DATA
============
   WATER DEPTH ..........    21.34 M     TENSION AT TOUCHDOWN .   209.82 KN
   TOUCHDOWN X-COORD. ...  -112.74 M     BOTTOM SLOPE ANGLE ...    0.000 DEG
   PROJECTED SPAN LENGTH    73.22 M      PIPE LENGTH GAIN .....    2.93 M

============================== SOLUTION SUMMARY ==============================
NODE  PIPE       X       Y       Z     SUPPORT REACT    TOTAL   TOTAL   PCT
NO.  SECTION   COORD   COORD   COORD    VERT   HORIZ   MOMENT  STRAIN   ALL
              (M  )   (M  )   (M  )    (KN )   (KN )   (KN-M)  (PCT )   (%)
=============================================================================
  1  LAYBARGE   96.3    6.9    0.0     11.8    0.0      0.0   0.000    0.
  3  LAYBARGE   84.3    6.6    0.0     20.0    0.0     17.8   0.011    0.
  5  LAYBARGE   73.4    6.4    0.0     43.4    0.0     89.8   0.056    0.
  7  TENSIONR   60.1    5.9    0.0      4.5    0.0     45.6   0.033    0.
  9  LAYBARGE   51.1    5.7    0.0      0.0    0.0     38.8   0.029    0.
 10  LAYBARGE   46.4    5.5    0.0     62.5    0.0    155.4   0.101    0.
 12  LAYBARGE   39.4    5.2    0.0      0.0    0.0      2.1   0.006    0.
 13  TENSIONR   35.4    5.0    0.0     -8.4    0.0     34.2   0.030    0.
 15  LAYBARGE   26.1    4.5    0.0      0.0    0.0     90.8   0.065    0.
 16  LAYBARGE   23.3    4.3    0.0     56.4    0.0    172.7   0.116    0.
 18  LAYBARGE    8.9    2.7    0.0     60.9    0.0    208.6   0.138    0.
 20  LAYBARGE    3.1    1.8    0.0      0.0    0.0     74.4   0.055    0.

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OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP         PAGE  85
Pipelay Analysis
JOB NO. - Dynamic Analysis      LICENSED TO - OFFSHORE CONSTR. SPECIALISTS
USER ID - Karun                 DATE - 3/25/2015  TIME - 12:18:21   CASE   8
=============================================================================

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


 24  STINGER    -7.5   -0.2    0.0     17.1    0.3     75.7   0.056    0.
 26  STINGER   -16.5   -2.1    0.0     26.9    0.6    122.1   0.084    0.
 29  STINGER   -26.1   -4.5    0.0     15.3    0.6     93.9   0.067    0.
 31  STINGER   -36.5   -7.4    0.0     33.5   -1.6    107.7   0.075    0.
 33  STINGER   -39.5   -8.3    0.0      0.0    2.6     47.7   0.038    0.
 41  SAGBEND   -80.1  -18.7    0.0      0.0    0.0    133.4   0.090    0.
 47  SEABED   -116.0  -21.4    0.0      6.3    0.5     43.6   0.035    0.

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  OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP        DATE - 3/25/2015   TIME - 12:18:21    PAGE   86
  PROJECT - Pipelay Analysis                                                              JOB NO. - Dynamic Analysis
  USER ID - Karun                                        LICENSED TO - OFFSHORE CONSTR. SPECIALISTS      CASE   8
 =============================================================================

      M A X I M U M   D Y N A M I C   P I P E   F O R C E S   A N D   S T R A I N S


=========================================================================================================================
NODE  PIPE        X       Y       Z     HORIZ    VERT     PIPE    TENSILE   HOOP   BENDING STRAINS     TOTAL   PERCNT
NO.  SECTION    COORD   COORD   COORD   ANGLE   ANGLE    LENGTH   STRAIN   STRAIN   VERT    HORIZ      STRAIN   ALLOW
               (M  )   (M  )   (M  )   (DEG )   (DEG )    (M  )   (PCT )   (PCT )  (PCT )  (PCT )      (PCT )   (PCT )
=========================================================================================================================
  1  LAYBARGE   96.29    6.93   0.00   -0.005   1.657     0.00   0.0000   0.0000   0.0000   0.0000    0.0000   0.00
  3  LAYBARGE   84.25    6.64   0.00   -0.005   1.189    12.04  -0.0001   0.0000  -0.0121   0.0002    0.0121   0.00
  5  LAYBARGE   73.43    6.37  -0.01   -0.005   1.952    22.87  -0.0002   0.0000  -0.0564   0.0002    0.0564   0.00
  7  TENSIONR   60.08    5.87   0.00   -0.005   1.640    36.22   0.0056   0.0000   0.0287  -0.0002    0.0340   0.00
  9  LAYBARGE   51.06    5.67   0.00   -0.005   1.288    45.24   0.0057   0.0000  -0.0244   0.0001    0.0297   0.00
 10  LAYBARGE   46.42    5.53   0.00   -0.004   2.226    49.89   0.0056   0.0000  -0.0968  -0.0002    0.1024   0.00
 12  LAYBARGE   39.39    5.17   0.00   -0.004   3.277    56.93   0.0056   0.0000  -0.0028   0.0000    0.0079   0.00
 13  TENSIONR   35.33    4.95   0.00   -0.004   3.104    60.99   0.0104   0.0000   0.0240   0.0001    0.0326   0.00
 15  LAYBARGE   26.08    4.47   0.00   -0.004   3.352    70.26   0.0104   0.0000  -0.0642   0.0002    0.0725   0.00
 16  LAYBARGE   23.32    4.29   0.01   -0.004   4.147    73.02   0.0104   0.0000  -0.1188   0.0004    0.1271   0.00
 18  LAYBARGE    8.86    2.75   0.00   -0.002   8.449    87.56   0.0103   0.0000  -0.1657  -0.0005    0.1757   0.00
 20  LAYBARGE    3.07    1.82   0.00   -0.002  10.263    93.44   0.0102   0.0000  -0.1476   0.0007    0.1556   0.00

 24  STINGER    -7.56   -0.31   0.01    0.000  11.873   104.24   0.0101   0.0000  -0.1344   0.0011    0.1440   0.00
 26  STINGER   -16.49   -2.42   0.01   -0.004  13.756   113.39   0.0100  -0.0001  -0.1628   0.0010    0.1725   0.00
 29  STINGER   -26.03   -4.88   0.01    0.000  15.144   123.34   0.0098  -0.0002  -0.1600   0.0015    0.1677   0.00
 31  STINGER   -36.41   -7.81   0.01   -0.001  17.169   134.14   0.0097  -0.0004  -0.1601  -0.0020    0.1676   0.00
 33  STINGER   -39.42   -8.74   0.01    0.003  17.612   137.27   0.0096  -0.0004  -0.0998   0.0195    0.1077   0.00

 35  SAGBEND   -45.18  -10.52   0.01    0.039  17.305   143.25   0.0095  -0.0005   0.0684   0.0092    0.0776   0.00
 36  SAGBEND   -50.91  -12.24   0.00    0.077  16.552   149.25   0.0094  -0.0006   0.0783  -0.0067    0.0874   0.00
 37  SAGBEND   -56.67  -13.84   0.00    0.139  15.350   155.25   0.0093  -0.0006   0.0870  -0.0084    0.0961   0.00
 38  SAGBEND   -62.48  -15.25   0.01    0.100  13.805   161.25   0.0092  -0.0007   0.0943  -0.0089    0.1018   0.00
 39  SAGBEND   -68.33  -16.53   0.01    0.035  12.056   167.25   0.0091  -0.0007   0.1043  -0.0091    0.1113   0.00
 40  SAGBEND   -74.22  -17.72   0.01   -0.035  10.279   173.25   0.0091  -0.0008   0.1074  -0.0086    0.1144   0.00
 41  SAGBEND   -80.14  -18.72   0.01   -0.028   8.612   179.25   0.0090  -0.0008   0.1051  -0.0078    0.1119   0.00
 42  SAGBEND   -86.08  -19.53   0.01    0.006   7.009   185.25   0.0090  -0.0008   0.1016  -0.0059    0.1084   0.00
 43  SAGBEND   -92.05  -20.17   0.01    0.024   5.311   191.25   0.0089  -0.0009   0.1007  -0.0047    0.1075   0.00
 44  SAGBEND   -98.03  -20.65   0.02    0.013   3.778   197.25   0.0089  -0.0009   0.0915  -0.0049    0.0983   0.00
 45  SAGBEND  -104.01  -20.97   0.02    0.007   2.473   203.25   0.0089  -0.0009   0.0783   0.0090    0.0851   0.00
 46  SAGBEND  -110.01  -21.18   0.01    0.047   1.493   209.25   0.0089  -0.0009   0.0622  -0.0135    0.0707   0.00
 47  SAGBEND  -116.01  -21.30   0.00    0.062   0.807   215.25   0.0089  -0.0009   0.0521  -0.0115    0.0610   0.00

 48  SEABED   -122.01  -21.36   0.00    0.022   0.311   221.25   0.0089  -0.0009   0.0379  -0.0101    0.0470   0.00
 49  SEABED   -128.01  -21.37   0.00   -0.009   0.036   227.25   0.0089  -0.0009   0.0163  -0.0067    0.0260   0.00
 50  SEABED   -134.01  -21.37   0.00   -0.007  -0.030   233.25   0.0089  -0.0009   0.0030   0.0025    0.0129   0.00
 51  SEABED   -140.01  -21.37   0.00   -0.003  -0.021   239.25   0.0090  -0.0009  -0.0014   0.0006    0.0105   0.00
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   52    SEABED     -146.01    -21.37     0.00    -0.001   -0.008    245.25   0.0090   -0.0009   -0.0011    0.0004    0.0101    0.00
   53    SEABED     -152.01    -21.37     0.00    -0.001   -0.001    251.25   0.0090   -0.0009   -0.0005    0.0003    0.0095    0.00
   54    SEABED     -158.01    -21.37     0.00     0.000    0.001    257.25   0.0090   -0.0009   -0.0001    0.0001    0.0095    0.00
   55    SEABED     -164.01    -21.37     0.00     0.000    0.001    263.25   0.0090   -0.0009    0.0000    0.0001    0.0095    0.00
   56    SEABED     -170.01    -21.37     0.00     0.000    0.000    269.25   0.0090   -0.0009    0.0000    0.0001    0.0095    0.00
   57    SEABED     -176.01    -21.37     0.00     0.000    0.000    275.25   0.0090   -0.0009    0.0000   -0.0001    0.0095    0.00
   58    SEABED     -182.01    -21.37     0.00     0.000    0.000    281.25   0.0090   -0.0009    0.0000   -0.0001    0.0095    0.00
   59    SEABED     -188.01    -21.37     0.00     0.000    0.000    287.25   0.0090   -0.0009    0.0000   -0.0001    0.0096    0.00
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===================================================================================================================================
  OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP            DATE -  3/25/2015    TIME - 12:18:21     PAGE   87
  PROJECT - Pipelay Analysis                                                       JOB NO. - Dynamic Analysis
  USER ID - Karun                                             LICENSED TO - OFFSHORE CONSTR. SPECIALISTS        CASE    8
===================================================================================================================================
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            M A X I M U M   D Y N A M I C   P I P E   F O R C E S   A N D   S T R A I N S


===================================================================================================================================
  NODE   PIPE         X         Y         Z      HORIZ    VERT     PIPE     TENSILE    HOOP    BENDING STRAINS    TOTAL    PERCNT
  NO.    SECTION    COORD     COORD     COORD    ANGLE    ANGLE   LENGTH    STRAIN    STRAIN    VERT     HORIZ    STRAIN    ALLOW
                     (M )      (M )      (M )    (DEG )   (DEG )    (M )     (PCT )    (PCT )   (PCT )   (PCT )   (PCT )    (PCT )
===================================================================================================================================
   60    SEABED     -194.01    -21.37     0.00     0.000    0.000    293.25   0.0090   -0.0009    0.0000   -0.0002    0.0096    0.00
   61    SEABED     -200.01    -21.37     0.00     0.000    0.000    299.25   0.0090   -0.0009    0.0000   -0.0002    0.0096    0.00
   62    SEABED     -206.01    -21.37     0.00     0.000    0.000    305.25   0.0090   -0.0009    0.0000    0.0000    0.0095    0.00
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===================================================================================================================================
  OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP            DATE -  3/25/2015    TIME - 12:18:21     PAGE   88
  PROJECT - Pipelay Analysis                                                       JOB NO. - Dynamic Analysis
  USER ID - Karun                                             LICENSED TO - OFFSHORE CONSTR. SPECIALISTS        CASE    8
===================================================================================================================================
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            M A X I M U M   D Y N A M I C   P I P E   F O R C E S   A N D   S T R A I N S


===================================================================================================================================
  NODE   PIPE         X         Y         Z     SUPPORT REACTION   SUPT SEPARATIONS   PIPE              BENDING MOMENTS
  NO.    SECTION    COORD     COORD     COORD     VERT    HORIZ      VERT    HORIZ    TENSION    VERT     HORIZ     TOTAL
                     (M )      (M )      (M )     (KN )    (KN )     (M )     (M )     (KN )    (KN-M)    (KN-M)    (KN-M)
===================================================================================================================================
    1    LAYBARGE     96.29      6.93     0.00    12.03     0.15     0.00     0.00      0.00      0.00      0.00      0.00
    3    LAYBARGE     84.25      6.64     0.00    20.77     0.34     0.00     0.00     -2.29    -19.51      0.38     19.51
    5    LAYBARGE     73.43      6.37    -0.01    43.94     0.26     0.00     0.00     -4.52    -91.16      0.31     91.16
    7    TENSIONR     60.08      5.87     0.00     5.06     0.19     0.00     0.00    150.13     46.47     -0.28     46.47
    9    LAYBARGE     51.06      5.67     0.00     0.00     0.00     0.00     0.00    150.43    -39.49      0.14     39.49
   10    LAYBARGE     46.42      5.53     0.00    63.63    -0.20     0.00     0.00    150.05   -156.56     -0.40    156.56
   12    LAYBARGE     39.39      5.17     0.00     0.00     0.00     0.00     0.00    150.22     -4.46     -0.03      4.46
   13    TENSIONR     35.33      4.95     0.00   -10.45     0.12     0.00     0.00    276.59     38.84      0.13     38.84
   15    LAYBARGE     26.08      4.47     0.00     0.00     0.00     0.00     0.00    276.18   -103.79      0.28    103.79
   16    LAYBARGE     23.32      4.29     0.01    64.46    -0.31     0.00     0.00    275.59   -192.10      0.62    192.10
   18    LAYBARGE      8.86      2.75     0.00    70.60    -0.32     0.00     0.00    273.03   -267.84     -0.79    267.84
   20    LAYBARGE      3.07      1.82     0.00    43.98    -0.41     0.19     0.00    272.12   -238.64      1.07    238.64

   24    STINGER      -7.56     -0.31     0.01    59.50     1.45     0.15     0.00    268.49   -217.21      1.81    217.21
   26    STINGER     -16.49     -2.42     0.01    67.31     2.40     0.55     0.00    266.53   -263.13      1.61    263.13
   29    STINGER     -26.03     -4.88     0.01    60.20     2.55     0.58     0.00    264.45   -258.64      2.39    258.65
   31    STINGER     -36.41     -7.81     0.01    70.78   -10.88     0.29     0.00    261.90   -258.87     -3.17    258.87
   33    STINGER     -39.42     -8.74     0.01    -0.03    15.47     0.82     0.00    260.99   -161.38     31.56    161.91

   35    SAGBEND     -45.18    -10.52     0.01     0.00     0.00     0.00     0.00    259.14    110.65     14.91    110.77
   36    SAGBEND     -50.91    -12.24     0.00     0.00     0.00     0.00     0.00    257.34    126.54    -10.80    126.68
   37    SAGBEND     -56.67    -13.84     0.00     0.00     0.00     0.00     0.00    255.69    140.66    -13.52    140.77
   38    SAGBEND     -62.48    -15.25     0.01     0.00     0.00     0.00     0.00    254.20    152.50    -14.39    152.61
   39    SAGBEND     -68.33    -16.53     0.01     0.00     0.00     0.00     0.00    252.88    168.68    -14.69    168.88
   40    SAGBEND     -74.22    -17.72     0.01     0.00     0.00     0.00     0.00    251.71    173.66    -13.85    173.90
   41    SAGBEND     -80.14    -18.72     0.01     0.00     0.00     0.00     0.00    250.72    169.83    -12.56    170.02
   42    SAGBEND     -86.08    -19.53     0.01     0.00     0.00     0.00     0.00    249.95    164.18     -9.50    164.28
   43    SAGBEND     -92.05    -20.17     0.01     0.00     0.00     0.00     0.00    249.42    162.73     -7.54    162.73
   44    SAGBEND     -98.03    -20.65     0.02     0.00     0.00     0.00     0.00    249.15    147.89     -7.85    147.91
   45    SAGBEND    -104.01    -20.97     0.02     2.34     1.43     0.00     0.00    249.14    126.53     14.48    126.54
   46    SAGBEND    -110.01    -21.18     0.01     9.87     3.71     0.00     0.00    249.32    100.51    -21.89    100.55
   47    SAGBEND    -116.01    -21.30     0.00    11.47     3.55     0.00     0.00    249.64     84.21    -18.57     84.21

   48    SEABED     -122.01    -21.36     0.00    10.73    -3.34     0.00     0.00    249.94     61.33    -16.39     61.50
   49    SEABED     -128.01    -21.37     0.00     9.67     1.82     0.00     0.00    250.19     26.39    -10.84     27.57
   50    SEABED     -134.01    -21.37     0.00     9.17     0.65     0.00     0.00    250.45      4.90      4.07      6.34
   51    SEABED     -140.01    -21.37     0.00     8.10     0.42     0.00     0.00    250.69     -2.30      0.93      2.30
   52    SEABED     -146.01    -21.37     0.00     7.26    -0.15     0.00     0.00    250.92     -1.76      0.59      1.77
   53    SEABED     -152.01    -21.37     0.00     6.98     0.14     0.00     0.00    251.15     -0.74      0.41      0.77
   54    SEABED     -158.01    -21.37     0.00     7.00    -0.15     0.00     0.00    251.37     -0.12      0.22      0.22
   55    SEABED     -164.01    -21.37     0.00     7.00    -0.14     0.00     0.00    251.59      0.07      0.21      0.21
   56    SEABED     -170.01    -21.37     0.00     7.00    -0.14     0.00     0.00    251.79      0.06      0.20      0.20
   57    SEABED     -176.01    -21.37     0.00     6.99    -0.14     0.00     0.00    251.99      0.03     -0.20      0.20
```

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===================================================================================================================================
  OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP            DATE -  3/25/2015    TIME - 12:18:21     PAGE   89
  PROJECT - Pipelay Analysis                                                       JOB NO. - Dynamic Analysis
  USER ID - Karun                                             LICENSED TO - OFFSHORE CONSTR. SPECIALISTS        CASE    8
===================================================================================================================================
```

```
            M A X I M U M   D Y N A M I C   P I P E   F O R C E S   A N D   S T R A I N S


===================================================================================================================================
  NODE   PIPE         X         Y         Z     SUPPORT REACTION   SUPT SEPARATIONS   PIPE              BENDING MOMENTS
  NO.    SECTION    COORD     COORD     COORD     VERT    HORIZ      VERT    HORIZ    TENSION    VERT     HORIZ     TOTAL
                     (M )      (M )      (M )     (KN )    (KN )     (M )     (M )     (KN )    (KN-M)    (KN-M)    (KN-M)
===================================================================================================================================
   58    SEABED     -182.01    -21.37     0.00     6.99    -0.14     0.00     0.00    252.19     -0.02     -0.21      0.21
   59    SEABED     -188.01    -21.37     0.00     6.99    -0.14     0.00     0.00    252.37     -0.02     -0.22      0.22
   60    SEABED     -194.01    -21.37     0.00     6.99    -0.13     0.00     0.00    252.55     -0.01     -0.29      0.29
   61    SEABED     -200.01    -21.37     0.00     6.99     0.09     0.00     0.00    252.73     -0.01     -0.33      0.33
   62    SEABED     -206.01    -21.37     0.00     0.00     0.01     0.00     0.00    252.90      0.00      0.00      0.00
```

```
   MMMMMM        MMMMMMMMMMM    MMMMMMMMMMM    MMMMMMMMM      MMMMMMMMM      MMMMMMMMM      MMMMMMMMMMM    MMMMMMMM
  MMMMMMMMMM     MMMMMMMMMMM    MMMMMMMMMMM    MMMMMMMMMM     MMMMMMMMMM     MMMMMMMMMM     MMMMMMMMMMM    MMMMMMMMMM
 MMM     MMM     MMM            MMM            MMM   MMMM     MMM   MMMM     MMM            M        MMM
 MMM     MMM     MMM            MMM            MMM     MMM    MMM     MMM    MMM                     MMM
 MMM     MMM     MMM            MMM            MMM     MMM    MMM     MMM    MMM                     MMM
 MMM     MMM     MMMMMMMMM      MMMMMMMMM      MMMMMMMMMMM    MMM            MMMMMMMMMM     MMMMMM
 MMM     MMM     MMMMMMMMM      MMMMMMMMM      MMMMMMMMM      MMM            MMMMMMMMMM     MMMMMM
 MMM     MMM     MMM            MMM            MMM            MMM            MMM                     MMM
 MMM     MMM     MMM            MMM            MMM            MMM            MMM                     MMM
  MMM   MMM      MMM            MMM            MMM            MMM            MMM            M        MMM
  MMMMMMMMMM     MMM            MMM            MMMMMMMMM      MMM            MMMMMMMMMMM    MMMMMMMMMM
   MMMMMM        MMM            MMM            MMMMMMMMM      MMM            MMMMMMMMMMM    MMMMMMMM
```

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==============================================================================
OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP          PAGE   3
Pipelay Analysis
JOB NO. - Dynamic Analysis     LICENSED TO - OFFSHORE CONSTR. SPECIALISTS
USER ID - Karun                DATE - 3/25/2015  TIME - 15:22:21   CASE   1
==============================================================================

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


TIME HISTORY PLOT TABLE ENTRIES
===============================
    PLOT TABLE INDEX ................        1
    PLOT NUMBER .....................        1
    NODE NUMBER OF PLOTTED PARAMETER ..     15
    PLOT PARAMETER CODE NUMBER ........      2
    AXIS LABEL FOR ORDINATE .......... "Y COORD. OF PIPE AT STERN SHOE "
    AXIS LABEL FOR ABSCISSA .......... "SOLUTION TIME                 "
    PLOT TITLE ....................... "TIME HISTORY OF VERT. BENDING STRESS - BARGE STERN    "

    TIME HISTORY PLOT START TIME ......      0.00 SECONDS
    TIME HISTORY PLOT END TIME ........      0.00 SECONDS
    MINIMUM RANGE OF PLOT PARAMETER ...    0.000
    MAXIMUM RANGE OF PLOT PARAMETER ...    0.000

TIME HISTORY PLOT TABLE ENTRIES
===============================
    PLOT TABLE INDEX ................        2
    PLOT NUMBER .....................        1
    NODE NUMBER OF PLOTTED PARAMETER ..     15
    PLOT PARAMETER CODE NUMBER ........     13
    AXIS LABEL FOR ORDINATE .......... "VERTICAL PIPE BENDING STRESS   "
    AXIS LABEL FOR ABSCISSA .......... "SOLUTION TIME                 "
    PLOT TITLE ....................... "TIME HISTORY OF VERT. BENDING STRESS - STERN SHOE     "

    TIME HISTORY PLOT START TIME ......      0.00 SECONDS
    TIME HISTORY PLOT END TIME ........      0.00 SECONDS
    MINIMUM RANGE OF PLOT PARAMETER ...    0.000
    MAXIMUM RANGE OF PLOT PARAMETER ...    0.000

TIME HISTORY PLOT TABLE ENTRIES
===============================
    PLOT TABLE INDEX ................        3
    PLOT NUMBER .....................        2
    NODE NUMBER OF PLOTTED PARAMETER ..     35
```

```
    PLOT PARAMETER CODE NUMBER ........        2
    AXIS LABEL FOR ORDINATE .......... "Y COORD. OF PIPE AT STINGER TIP "
    AXIS LABEL FOR ABSCISSA ........... "SOLUTION TIME                  "
    PLOT TITLE ....................... "TIME HISTORY OF VERT. BENDING STRESS - STINGER TIP     "

    TIME HISTORY PLOT START TIME ......       0.00 SECONDS
    TIME HISTORY PLOT END TIME ........       0.00 SECONDS
    MINIMUM RANGE OF PLOT PARAMETER ...    0.000
    MAXIMUM RANGE OF PLOT PARAMETER ...    0.000

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OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP         PAGE   4
Pipelay Analysis
JOB NO. - Dynamic Analysis       LICENSED TO - OFFSHORE CONSTR. SPECIALISTS
USER ID - Karun                  DATE - 3/25/2015   TIME - 15:22:21   CASE   1
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                 I N P U T   D A T A   E C H O


TIME HISTORY PLOT TABLE ENTRIES
===============================
    PLOT TABLE INDEX .................        4
    PLOT NUMBER .....................        2
    NODE NUMBER OF PLOTTED PARAMETER ..       35
    PLOT PARAMETER CODE NUMBER .......       13
    AXIS LABEL FOR ORDINATE .......... "VERTICAL PIPE BENDING STRESS    "
    AXIS LABEL FOR ABSCISSA ........... "SOLUTION TIME                  "
    PLOT TITLE ....................... "TIME HISTORY OF VERT. BENDING STRESS - STINGER TIP     "

    TIME HISTORY PLOT START TIME ......       0.00 SECONDS
    TIME HISTORY PLOT END TIME ........       0.00 SECONDS
    MINIMUM RANGE OF PLOT PARAMETER ...    0.000
    MAXIMUM RANGE OF PLOT PARAMETER ...    0.000

TIME HISTORY PLOT TABLE ENTRIES
===============================
    PLOT TABLE INDEX .................        5
    PLOT NUMBER .....................        3
    NODE NUMBER OF PLOTTED PARAMETER ..       35
    PLOT PARAMETER CODE NUMBER ........        3
    AXIS LABEL FOR ORDINATE .......... "Z COORD. OF PIPE AT STINGER TIP "
    AXIS LABEL FOR ABSCISSA ........... "SOLUTION TIME                  "
    PLOT TITLE ....................... "TIME HISTORY OF HORI. BENDING STRESS - STINGER TIP     "

    TIME HISTORY PLOT START TIME ......       0.00 SECONDS
    TIME HISTORY PLOT END TIME ........       0.00 SECONDS
    MINIMUM RANGE OF PLOT PARAMETER ...    0.000
    MAXIMUM RANGE OF PLOT PARAMETER ...    0.000

TIME HISTORY PLOT TABLE ENTRIES
===============================
    PLOT TABLE INDEX .................        6
    PLOT NUMBER .....................        3
    NODE NUMBER OF PLOTTED PARAMETER ..       35
    PLOT PARAMETER CODE NUMBER ........       16
    AXIS LABEL FOR ORDINATE .......... "HORIZONTAL PIPE BENDING STRESS  "
    AXIS LABEL FOR ABSCISSA ........... "SOLUTION TIME                  "
    PLOT TITLE ....................... "TIME HISTORY OF HORI. BENDING STRESS - STINGER TIP     "

    TIME HISTORY PLOT START TIME ......       0.00 SECONDS
    TIME HISTORY PLOT END TIME ........       0.00 SECONDS
    MINIMUM RANGE OF PLOT PARAMETER ...    0.000
    MAXIMUM RANGE OF PLOT PARAMETER ...    0.000


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OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP         PAGE   5
Pipelay Analysis
JOB NO. - Dynamic Analysis       LICENSED TO - OFFSHORE CONSTR. SPECIALISTS
USER ID - Karun                  DATE - 3/25/2015   TIME - 15:22:21   CASE   1
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PROFILE PLOT TABLE ENTRIES
==========================
    PLOT TABLE INDEX .................        7
    PLOT NUMBER .....................        5
    PLOT TYPE OPTION NUMBER ..........        1
    DYNAMIC PROFILE TIME POINT ........    0.000
    DYNAMIC PROFILE TIME INCREMENT ....    0.000
    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 ....................... "PIPE ELEVATION PROFILE AND DYNAMIC STRESS RANGE        "
    MINIMUM VERTICAL AXIS RANGE .......    0.000
    MAXIMUM VERTICAL AXIS RANGE .......    0.000
    MINIMUM HORIZONTAL AXIS RANGE .....    0.000
    MAXIMUM HORIZONTAL AXIS RANGE .....    0.000

PROFILE PLOT TABLE ENTRIES
==========================
    PLOT TABLE INDEX .................        8
    PLOT NUMBER .....................        5
    PLOT TYPE OPTION NUMBER ..........        3
    DYNAMIC PROFILE TIME POINT ........    0.000
    DYNAMIC PROFILE TIME INCREMENT ....    0.000
    ORDINATE PARAMETER CODE NUMBER ....       14
    AXIS LABEL FOR ORDINATE .......... "TOTAL DYNAMIC PIPE STRESS RANGE "
```

```
    ABSCISSA PARAMETER CODE NUMBER ....        1
    AXIS LABEL FOR ABSCISSA .......... "PIPE HORIZONTAL X COORDINATE     "

    PLOT TITLE ....................... "PIPE ELEVATION PROFILE AND DYNAMIC STRESS RANGE        "
    MINIMUM VERTICAL AXIS RANGE .......    0.000
    MAXIMUM VERTICAL AXIS RANGE .......    0.000
    MINIMUM HORIZONTAL AXIS RANGE .....    0.000
    MAXIMUM HORIZONTAL AXIS RANGE .....    0.000
```

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OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP         PAGE   6
Pipelay Analysis
JOB NO. - Dynamic Analysis      LICENSED TO - OFFSHORE CONSTR. SPECIALISTS
USER ID - Karun                 DATE -  3/25/2015   TIME - 15:22:21   CASE   1
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              I N P U T   D A T A   E C H O


    PROFILE PLOT TABLE ENTRIES
    ==========================
       PLOT TABLE INDEX ..................        9
       PLOT NUMBER ......................        5
       PLOT TYPE OPTION NUMBER ..........        4
       DYNAMIC PROFILE TIME POINT ........    0.000
       DYNAMIC PROFILE TIME INCREMENT ....    0.000
       ORDINATE PARAMETER CODE NUMBER ....       14
       AXIS LABEL FOR ORDINATE .......... "TOTAL DYNAMIC PIPE STRESS RANGE "
       ABSCISSA PARAMETER CODE NUMBER ....        1
       AXIS LABEL FOR ABSCISSA .......... "PIPE HORIZONTAL X COORDINATE     "

       PLOT TITLE ....................... "PIPE ELEVATION PROFILE AND DYNAMIC STRESS RANGE        "
       MINIMUM VERTICAL AXIS RANGE .......    0.000
       MAXIMUM VERTICAL AXIS RANGE .......    0.000
       MINIMUM HORIZONTAL AXIS RANGE .....    0.000
       MAXIMUM HORIZONTAL AXIS RANGE .....    0.000

    PRINTED OUTPUT SELECTED
    =======================
       STATIC PIPE FORCES AND STRESSES ...      NO
       STATIC SOLUTION SUMMARY ..........      YES
       DYNAMIC PIPE FORCES AND STRESSES ..      YES
       DYNAMIC RANGE OF PIPE DATA ........      NO
       DYNAMIC TRACKING OF PIPE DATA .....      NO
       OVERBEND PIPE SUPPORT GEOMETRY ....      NO
       STINGER BALLAST SCHEDULE DATA .....      NO
       SUPPORT REACTIONS IN BARGE COORDS .      NO

       INTERNAL FORCES IN PIPE & CABLE ...      NO
       INTERNAL FORCES IN STINGER  .......      NO
       PRINT PIPE STRAINS IN OUTPUT ......      NO
       DNV OS-F101 COMPLIANCE REPORT .....      YES
       API RP-1111 COMPLIANCE REPORT .....      NO
       PRINT DNV/API FACTORS & PARAMETERS       NO
       USE THICK WALL HOOP STRESS EQN. ...      NO
       USE DNV 1981 FOR TOTAL PIPE STRESS       NO

       ENABLE/DISABLE WARNING MESSAGES ...   ENABLE
       GENERATE SPREAD SHEET PLOT FILE ...      NO
       GENERATE ASCII PLOT DATA FILES ....      NO
```

```
================================================================================
OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP         PAGE   7
Pipelay Analysis
JOB NO. - Dynamic Analysis      LICENSED TO - OFFSHORE CONSTR. SPECIALISTS
USER ID - Karun                 DATE -  3/25/2015   TIME - 15:22:21   CASE   1
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```

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


    PIPE TENSION DATA
    =================
       STATIC PIPE TENSION ON LAY VESSEL .  250.000 K-NEWTON
       MINIMUM DYNAMIC PIPE TENSION ......  225.000 K-NEWTON
       MAXIMUM DYNAMIC PIPE TENSION ......  275.000 K-NEWTON
       STATIC HORIZONTAL BOTTOM TENSION ..    0.000 K-NEWTON
       NO. OF VALUES FOR TENSION PROFILE .        0
       VALUES ARE FOR PIPE SPAN ANALYSIS .       NO
       MAXIMUM PIPE PAYOUT SPEED .........    0.000 M/SEC
       MAXIMUM PIPE TAKEUP SPEED .........    0.000 M/SEC

    PIPE PROPERTIES
    ===============
       PIPE PROPERTY TABLE ROW ...........        1
       PIPE SECTION LENGTH ...............    0.000 METERS
       STEEL MODULUS OF ELASTICITY .......  207000. M-PASCAL
       STEEL CROSS SECTIONAL AREA ........  128.750 CM^2
       COATED PIPE AVG MOMENT OF INERTIA . 12671.51 CM^4
       WEIGHT PER-UNIT-LENGTH IN AIR .....  2205.00 N/M
       WEIGHT PER-UNIT-LENGTH SUBMERGED ..  1164.00 N/M
       MAXIMUM ALLOWABLE PIPE STRAIN ..... 0.000000 PERCENT

       STEEL OUTSIDE DIAMETER ............   27.3100 CM
       STEEL WALL THICKNESS ..............    1.5900 CM
       YIELD STRESS ......................   450.00 M-PASCAL
       STRESS/STRAIN INTENSE FACTOR ......    0.0000
       HYDRODYNAMIC OUTSIDE DIAMETER .....    0.000 CM
       DRAG COEFFICIENT ..................    0.0000
       HYDRODYNAMIC TOTAL AREA ...........    0.000 CM^2
       ADDED MASS COEFFICIENT ............    0.0000
       POISSON'S RATIO FOR STEEL PIPE ....    0.0000
```

```
     COEFFICIENT OF THERMAL EXPANSION ..0.00000000 1/DEG C

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OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP          PAGE   8
Pipelay Analysis
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   PIPE COATING PROPERTIES
   =======================
     PIPE PROPERTY TABLE INDEX .........        1
     CORROSION COATING THICKNESS .......    0.280 CM
     CORROSION COATING WEIGHT DENSITY ..   9218.0 N/M^3
     CORROSION COATING ELASTIC MODULUS .    0.000 M-PASCAL
     CONCRETE COATING THICKNESS ........    4.000 CM
     CONCRETE COATING WEIGHT DENSITY ...   29846. N/M^3
     CONCRETE COATING ELASTIC MODULUS ..    0.000 M-PASCAL
     DESIRED PIPE SPECIFIC GRAVITY .....    0.0000
     CONCRETE STIFFENING EFFECTIVENESS .    0.000
     NO NOT CALC. STRESS FOR BARE PIPE .       NO

     AVERAGE LENGTH OF PIPE JOINT ......   12.200 METERS
     EFFECTIVE FIELD JOINT LENGTH ......    0.700 METERS
     FIELD JOINT FILL WEIGHT DENSITY ...   2177.0 N/M^3
     FIELD JOINT FILL ELASTIC MODULUS...    0.000 M-PASCAL
     FIELD JOINT STIFFENING EFFECT. ....    0.000
     FIELD JOINT BENDING MODEL .........        0 IGNORE COATING STIFFNESS
     WEIGHT DENSITY OF STEEL ...........   76982. N/M^3
     WEIGHT DENSITY OF PIPE CONTENTS ...      0.0 N/M^3
     REF. ELEVATION FOR STATIC HEAD ....     0.00 METERS
     FREE FLOOD PIPE DURING PIPELAY ....       NO

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OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP          PAGE   9
Pipelay Analysis
JOB NO. - Dynamic Analysis      LICENSED TO - OFFSHORE CONSTR. SPECIALISTS
USER ID - Karun                 DATE - 3/25/2015  TIME - 15:22:21  CASE   1
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               I N P U T   D A T A   E C H O


   LAYBARGE DESCRIPTION
   ====================
     NUMBER OF PIPE NODES ..............       12
     BARGE GEOMETRY SPECIFIED BY .......        1 X-Y COORDINATES
     OVERBEND PIPE SUPPORT RADIUS ......    0.000 METERS
     ADJUST Y COORDINATES MANUALLY .....       NO
     TANGENT POINT X-COORDINATE ........    0.000 METERS
     TANGENT POINT Y-COORDINATE ........    0.000 METERS
     PIPE ANGLE RELATIVE TO DECK .......   0.0000 DEGREES
     HEIGHT OF DECK ABOVE WATER ........    4.087 METERS
     LAYBARGE FORWARD (X) OFFSET .......    0.000 METERS
     BARGE TRIM ANGLE .................   0.5000 DEGREES

     STERN SHOE X COORDINATE ..........     0.000 METERS
     STERN SHOE Y COORDINATE ..........     0.000 METERS
     ROTATION CENTER X COORDINATE ......   55.200 METERS
     ROTATION CENTER Y COORDINATE ......   -4.087 METERS
     ROTATION CENTER Z COORDINATE ......    0.000 METERS
     BARGE HEADING ....................    0.0000 DEGREES
     BARGE OFFSET FROM RIGHT-OF-WAY ....    0.000 METERS
     PIPE RAMP PIVOT X COORDINATE ......    0.000 METERS
     PIPE RAMP PIVOT Y COORDINATE ......    0.000 METERS
     PIPE RAMP PIVOT VERTICAL ANGLE ....    0.000 DEGREES
     PIPE RAMP PIVOT Z COORDINATE ......    0.000 METERS
     PIPE RAMP HEADING ON BARGE DECK ...    0.000 DEGREES

      NODE X    NODE Y         SUPPORT            DAVIT
      COORD     COORD           TYPE             SPACING
      (M  )     (M  )                             (M  )
     =======   =======   ====================    =======
      96.368     2.489     1  SIMPLE SUPPORT       0.000
      84.332     2.305     1  SIMPLE SUPPORT       0.000
      73.503     2.131     1  SIMPLE SUPPORT       0.000
      60.152     1.754     2  PIPE TENSIONER       0.000
      51.139     1.956   100  UNSUPPORTED NODE     0.000
      46.492     1.532     1  SIMPLE SUPPORT       0.000
      39.452     1.586   100  UNSUPPORTED NODE     0.000
      35.401     1.040     2  PIPE TENSIONER       0.000
      26.141     0.824   100  UNSUPPORTED NODE     0.000
      23.381     0.480    10  USER DEFINED SPT     0.000
       8.913    -0.940    10  USER DEFINED SPT     0.000
       3.123    -1.920    11  USER DEFINED SPT     0.000

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OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP          PAGE  10
Pipelay Analysis
JOB NO. - Dynamic Analysis      LICENSED TO - OFFSHORE CONSTR. SPECIALISTS
USER ID - Karun                 DATE - 3/25/2015  TIME - 15:22:21  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 ......       10
```

```
      SUPPORT ELEMENT TYPE .............           1 SIMPLE SUPPORT
      SUPPORT INITIAL STATE FLAG ........           0
      TENSIONER AXIAL STIFFNESS (F/L) ...   0.000E+00 KN/M
      VERTICAL STIFFNESS (F/L) ..........   0.000E+00 KN/M
      STATIC VERTICAL DEFLECTION ........      0.0000 CM
      LATERAL STIFFNESS (F/L) ...........   0.000E+00 KN/M

      BOTTOM ROLLER ANGLE TO HORIZONTAL .      30.000 DEGREES
      SIDE ROLLER ANGLE TO VERTICAL .....       0.000 DEGREES
      SIDE ROLLER OFFSET FROM C.L. ......       0.000 METERS
      BED ROLLER LENGTH .................       0.000 METERS
      HEIGHT OF TOP ROLLER ABOVE BED ....       0.000 METERS
      TENSIONER X-AXIS ROTATIONAL STIF. .       0.000 KN/DEG
      TENSIONER Y-AXIS ROTATIONAL STIF. .       0.000 KN/DEG
      TENSIONER Y-AXIS ROTATIONAL STIF. .       0.000 KN/DEG

  SUPPORT ELEMENT PROPERTIES
  ==========================
      SUPPORT PROPERTY TABLE INDEX ......          11
      SUPPORT ELEMENT TYPE .............           1 SIMPLE SUPPORT
      SUPPORT INITIAL STATE FLAG ........           0
      TENSIONER AXIAL STIFFNESS (F/L) ...   0.000E+00 KN/M
      VERTICAL STIFFNESS (F/L) ..........   0.000E+00 KN/M
      STATIC VERTICAL DEFLECTION ........      0.0000 CM
      LATERAL STIFFNESS (F/L) ...........   0.000E+00 KN/M

      BOTTOM ROLLER ANGLE TO HORIZONTAL .      30.000 DEGREES
      SIDE ROLLER ANGLE TO VERTICAL .....       0.000 DEGREES
      SIDE ROLLER OFFSET FROM C.L. ......       0.000 METERS
      BED ROLLER LENGTH .................       0.000 METERS
      HEIGHT OF TOP ROLLER ABOVE BED ....       0.000 METERS
      TENSIONER X-AXIS ROTATIONAL STIF. .       0.000 KN/DEG
      TENSIONER Y-AXIS ROTATIONAL STIF. .       0.000 KN/DEG
      TENSIONER Y-AXIS ROTATIONAL STIF. .       0.000 KN/DEG
```

```
================================================================================
OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP          PAGE  11
Pipelay Analysis
JOB NO. - Dynamic Analysis        LICENSED TO - OFFSHORE CONSTR. SPECIALISTS
USER ID - Karun                   DATE - 3/25/2015  TIME - 15:22:21  CASE   1
================================================================================
```

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


  SUPPORT ELEMENT PROPERTIES
  ==========================
      SUPPORT PROPERTY TABLE INDEX ......          21
      SUPPORT ELEMENT TYPE .............           1 SIMPLE SUPPORT
      SUPPORT INITIAL STATE FLAG ........           0
      TENSIONER AXIAL STIFFNESS (F/L) ...   0.000E+00 KN/M
      VERTICAL STIFFNESS (F/L) ..........   0.000E+00 KN/M
      STATIC VERTICAL DEFLECTION ........      0.0000 CM
      LATERAL STIFFNESS (F/L) ...........   0.000E+00 KN/M

      BOTTOM ROLLER ANGLE TO HORIZONTAL .      30.000 DEGREES
      SIDE ROLLER ANGLE TO VERTICAL .....       0.000 DEGREES
      SIDE ROLLER OFFSET FROM C.L. ......       0.000 METERS
      BED ROLLER LENGTH .................       0.000 METERS
      HEIGHT OF TOP ROLLER ABOVE BED ....       0.000 METERS
      TENSIONER X-AXIS ROTATIONAL STIF. .       0.000 KN/DEG
      TENSIONER Y-AXIS ROTATIONAL STIF. .       0.000 KN/DEG
      TENSIONER Y-AXIS ROTATIONAL STIF. .       0.000 KN/DEG

  SUPPORT ELEMENT PROPERTIES
  ==========================
      SUPPORT PROPERTY TABLE INDEX ......          22
      SUPPORT ELEMENT TYPE .............           1 SIMPLE SUPPORT
      SUPPORT INITIAL STATE FLAG ........           0
      TENSIONER AXIAL STIFFNESS (F/L) ...   0.000E+00 KN/M
      VERTICAL STIFFNESS (F/L) ..........   0.000E+00 KN/M
      STATIC VERTICAL DEFLECTION ........      0.0000 CM
      LATERAL STIFFNESS (F/L) ...........   0.000E+00 KN/M

      BOTTOM ROLLER ANGLE TO HORIZONTAL .      30.000 DEGREES
      SIDE ROLLER ANGLE TO VERTICAL .....       0.000 DEGREES
      SIDE ROLLER OFFSET FROM C.L. ......       0.000 METERS
      BED ROLLER LENGTH .................       0.000 METERS
      HEIGHT OF TOP ROLLER ABOVE BED ....       0.000 METERS
      TENSIONER X-AXIS ROTATIONAL STIF. .       0.000 KN/DEG
      TENSIONER Y-AXIS ROTATIONAL STIF. .       0.000 KN/DEG
      TENSIONER Y-AXIS ROTATIONAL STIF. .       0.000 KN/DEG
```

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================================================================================
OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP          PAGE  12
Pipelay Analysis
JOB NO. - Dynamic Analysis        LICENSED TO - OFFSHORE CONSTR. SPECIALISTS
USER ID - Karun                   DATE - 3/25/2015  TIME - 15:22:21  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 ......          23
      SUPPORT ELEMENT TYPE .............           1 SIMPLE SUPPORT
      SUPPORT INITIAL STATE FLAG ........           0
      TENSIONER AXIAL STIFFNESS (F/L) ...   0.000E+00 KN/M
      VERTICAL STIFFNESS (F/L) ..........   0.000E+00 KN/M
      STATIC VERTICAL DEFLECTION ........      0.0000 CM
      LATERAL STIFFNESS (F/L) ...........   0.000E+00 KN/M
```

```
      BOTTOM ROLLER ANGLE TO HORIZONTAL .     30.000 DEGREES
      SIDE ROLLER ANGLE TO VERTICAL .....      0.000 DEGREES
      SIDE OFFSET FROM C.L. ......             0.000 METERS
      BED ROLLER LENGTH .................      0.000 METERS
      HEIGHT OF TOP ROLLER ABOVE BED ....      0.000 METERS
      TENSIONER X-AXIS ROTATIONAL STIF. .      0.000 KN/DEG
      TENSIONER Y-AXIS ROTATIONAL STIF. .      0.000 KN/DEG
      TENSIONER Y-AXIS ROTATIONAL STIF. .      0.000 KN/DEG

  STINGER DESCRIPTION
  ===================
      NUMBER OF PIPE/STINGER NODES ......         7
      STINGER GEOMETRY SPECIFIED BY .....         1 X-Y COORD AND TANGENT PT
      STINGER TYPE ......................         6 ARTICULATED
      OVERBEND PIPE SUPPORT RADIUS ......    200.00 METERS
      HITCH X-COORDINATE ................     -1.855 METERS
      HITCH Y-COORDINATE ................     -3.712 METERS
      HITCH ANGULAR ORIENTATION .........      0.000 DEGREES

      X COORDINATE OF LOCAL ORIGIN ......     -1.855 METERS
      Y COORDINATE OF LOCAL ORIGIN ......     -3.712 METERS
      ROTATION ABOUT STINGER HITCH ......      0.000 DEGREES
      TANGENT POINT X-COORDINATE ........      3.123 METERS
      TANGENT POINT Y-COORDINATE ........     -1.850 METERS
      TANGENT POINT ANGLE ...............      0.000 DEGREES

      NODE X     NODE Y         SUPPORT              ELEMENT          ELEMENT
       COORD      COORD          TYPE                 TYPE            LENGTH
      (M   )     (M   )                                              (M   )
      ========   ========   ====================   ====================   =======
       -2.894      0.000    300  NO PIPE NODE        6  USER DEFINED      2.894
       -5.593      1.106     22  USER DEFINED       10  USER DEFINED      2.699
      -14.737      1.089     23  USER DEFINED       10  USER DEFINED      9.144
      -19.487      0.000    300  NO PIPE NODE        4  USER DEFINED      4.750
      -24.592      1.085     22  USER DEFINED       13  USER DEFINED      5.105
      -35.400      1.085     21  USER DEFINED       11  USER DEFINED     10.808
      -38.518      0.638      1  SIMPLE SUPPORT      4  USER DEFINED      3.118
```

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

```
  STINGER SECTION PROPERTIES
  ==========================
      STINGER PROPERTY TABLE INDEX ......         4
      STINGER ELEMENT TYPE ..............         1 FIXED END
      AXIAL STIFFNESS (EA) ..............  0.000E+00 K-NEWTON
      VERTICAL BENDING STIFFNESS (EI) ...  0.000E+00 KN-M^2
      VERTICAL HINGE STOP STIFFNESS .....  0.000E+00 N-M
      VERTICAL ANGLE OF FREE ROTATION ...      0.000 DEGREES
      VERTICAL PROJECTED AREA/LENGTH ....       4.30 METERS

      DISPLACED VOLUME PER-UNIT-LENGTH ..       3.600 M^2
      DRAG COEFFICIENT ..................      0.0000
      ADDED MASS COEFFICIENT ............      0.0000
      HORIZONTAL BENDING STIFFNESS ......  0.000E+00 KN-M^2
      HORIZONTAL HINGE STOP STIFFNESS ...  0.000E+00 N-M
      HORIZONTAL ANGLE OF ROTATION ......      0.0000 DEGREES
      HORIZONTAL PROJECTED AREA/LENGTH ..       4.300 METERS

  STINGER SECTION PROPERTIES
  ==========================
      STINGER PROPERTY TABLE INDEX ......         6
      STINGER ELEMENT TYPE ..............         2 HINGED END
      AXIAL STIFFNESS (EA) ..............  0.000E+00 K-NEWTON
      VERTICAL BENDING STIFFNESS (EI) ...  0.000E+00 KN-M^2
      VERTICAL HINGE STOP STIFFNESS .....  0.000E+00 N-M
      VERTICAL ANGLE OF FREE ROTATION ...     20.000 DEGREES
      VERTICAL PROJECTED AREA/LENGTH ....       4.30 METERS

      DISPLACED VOLUME PER-UNIT-LENGTH ..       3.600 M^2
      DRAG COEFFICIENT ..................      0.0000
      ADDED MASS COEFFICIENT ............      0.0000
      HORIZONTAL BENDING STIFFNESS ......  0.000E+00 KN-M^2
      HORIZONTAL HINGE STOP STIFFNESS ...  0.000E+00 N-M
      HORIZONTAL ANGLE OF ROTATION ......      0.0000 DEGREES
      HORIZONTAL PROJECTED AREA/LENGTH ..       4.300 METERS
```

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

```
  STINGER SECTION PROPERTIES
  ==========================
      STINGER PROPERTY TABLE INDEX ......        10
      STINGER ELEMENT TYPE ..............         1 FIXED END
      AXIAL STIFFNESS (EA) ..............  0.000E+00 K-NEWTON
      VERTICAL BENDING STIFFNESS (EI) ...  0.000E+00 KN-M^2
      VERTICAL HINGE STOP STIFFNESS .....  0.000E+00 N-M
```

```
    VERTICAL ANGLE OF FREE ROTATION ...      0.000 DEGREES
    VERTICAL PROJECTED AREA/LENGTH ....      4.30 METERS

    DISPLACED VOLUME PER-UNIT-LENGTH ..      3.600 M^2
    DRAG COEFFICIENT .................      0.0000
    ADDED MASS COEFFICIENT ............      0.0000
    HORIZONTAL BENDING STIFFNESS ......  0.000E+00 KN-M^2
    HORIZONTAL HINGE STOP STIFFNESS ...  0.000E+00 N-M
    HORIZONTAL ANGLE OF ROTATION ......      0.0000 DEGREES
    HORIZONTAL PROJECTED AREA/LENGTH ..      4.300 METERS

STINGER SECTION PROPERTIES
==========================
    STINGER PROPERTY TABLE INDEX ......         11
    STINGER ELEMENT TYPE ..............          1 FIXED END
    AXIAL STIFFNESS (EA) ..............  0.000E+00 K-NEWTON
    VERTICAL BENDING STIFFNESS (EI) ...  0.000E+00 KN-M^2
    VERTICAL HINGE STOP STIFFNESS .....  0.000E+00 N-M
    VERTICAL ANGLE OF FREE ROTATION ...      0.000 DEGREES
    VERTICAL PROJECTED AREA/LENGTH ....      5.40 METERS

    DISPLACED VOLUME PER-UNIT-LENGTH ..      5.400 M^2
    DRAG COEFFICIENT .................      0.0000
    ADDED MASS COEFFICIENT ............      0.0000
    HORIZONTAL BENDING STIFFNESS ......  0.000E+00 KN-M^2
    HORIZONTAL HINGE STOP STIFFNESS ...  0.000E+00 N-M
    HORIZONTAL ANGLE OF ROTATION ......      0.0000 DEGREES
    HORIZONTAL PROJECTED AREA/LENGTH ..      5.400 METERS


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STINGER SECTION PROPERTIES
==========================
    STINGER PROPERTY TABLE INDEX ......         13
    STINGER ELEMENT TYPE ..............          2 HINGED END
    AXIAL STIFFNESS (EA) ..............  0.000E+00 K-NEWTON
    VERTICAL BENDING STIFFNESS (EI) ...  0.000E+00 KN-M^2
    VERTICAL HINGE STOP STIFFNESS .....  0.000E+00 N-M
    VERTICAL ANGLE OF FREE ROTATION ...     11.000 DEGREES
    VERTICAL PROJECTED AREA/LENGTH ....      4.30 METERS

    DISPLACED VOLUME PER-UNIT-LENGTH ..      3.600 M^2
    DRAG COEFFICIENT .................      0.0000
    ADDED MASS COEFFICIENT ............      0.0000
    HORIZONTAL BENDING STIFFNESS ......  0.000E+00 KN-M^2
    HORIZONTAL HINGE STOP STIFFNESS ...  0.000E+00 N-M
    HORIZONTAL ANGLE OF ROTATION ......      0.0000 DEGREES
    HORIZONTAL PROJECTED AREA/LENGTH ..      4.300 METERS

STINGER SECTION WEIGHTS AND DISPLACEMENTS
=========================================
    SECTION      SECTION     DISPLACE
    NUMBER       WEIGHT       -MENT
                 (KN  )       (KN  )
    ======       ======      ======
       1         65.584       67.840
       2        142.262      130.680
       3        271.728      368.710
       4        170.075      189.690
       5        180.490      222.830
       6        428.110      807.400
       7        130.070      122.200

STINGER SECTION BALLAST SCHEDULE
================================
    SECTION      BALLAST
    NUMBER       CONTENTS
                 (KN  )
    =======      ========
       1          0.000
       2          0.000
       3        190.000
       4         10.000
       5          0.000
       6        250.000
       7         40.000


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OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP         PAGE  16
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SAGBEND GEOMETRY
================
    SAGBEND PIPE ELEMENT LENGTH .......      6.000 METERS
    WATER DEPTH ......................     21.34 METERS
    X-COORDINATE AT SPECIFIED DEPTH . .      0.00 METERS
    ESTIMATED SAGBEND X LENGTH ........      0.00 METERS
    ESTIMATED PIPE LENGTH ON SEABED ...      0.00 METERS
```

```
        X-COORD OF PIPE FREE END ON SEABED      0.00 METERS
        X-COORD POINT OF FIXITY ON SEABED .     0.00 METERS
        MAXIMUM SLOPE (ANGLE) OF SEABED ...     0.000 DEGREES
        DIRECTION OF MAXIMUM SLOPE ........     0.000 DEGREES

        PIPE/CABLE SPAN END CONDITION .....        0 PIPE/CABLE RESTING ON SEABED
        PIPE/CABLE SPAN LENGTH GIVEN BY ...        0 SPECIFIED PIPE/CABLE TENSION
        ESTIMATED SPAN DEPTH AT FREE END ..     0.00 METERS
        PIPE VERTICAL ANGLE AT FREE END ...     0.000 DEGREES
        BOTTOM HINGE OFFSET ...............     0.000 METERS
        BOTTOM HINGE MINIMUM ANGLE ........     0.000 DEGREES
        BOTTOM HINGE MAXIMUM ANGLE ........     0.000 DEGREES

    SOIL ELEMENT PROPERTIES
    =======================
        SOIL PROPERTY TABLE ROW INDEX .....        0
        SOIL ELEMENT TYPE (FUTURE USE) ....        0
        PIPE INDEX OR SEGMENT NUMBER ......        0
        LONGITUDINAL SOIL STIFFNESS .......     0.00 KN/M^2
        VERTICAL SOIL STIFFNESS ...........     0.00 KN/M^2
        LATERAL SOIL STIFFNESS ............     0.00 KN/M^2
        DEFLECTION UNDER REFERENCE LOAD ...   0.0000 CM

        LONGITUDINAL COEF. OF FRICTION ....    0.500
        LATERAL COEFFICIENT OF FRICTION ...    0.000
        NUMBER 0F INTEGRATION POINTS ......        0

    CURRENT VELOCITIES
    ==================
        WATER      CURRENT     DIRECTION
        DEPTH       SPEED      OF TRAVEL
        (M  )       (M/S )      (DEG )
        ======     =======     =========
        0.000       1.030       0.000
       10.000       0.540       0.000
       21.340       0.440       0.000

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OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP        PAGE  17
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    TIME INTEGRATION PARAMETERS
    ===========================
        TIME STEP LENGTH ..................   0.2000 SECONDS
        MAXIMUM TIME OF INTEGRATION .......  360.000 SECONDS
        SOLUTION SAMPLING TIME STEP........    0.400 SECONDS
        SOLUTION SAMPLING STARTS AT TIME ..   60.000 SECONDS
        DAMPING RATIO .....................   0.2000
        NUMBER OF VARIABLE TIME STEPS .....        0

    WAVE SPECTRUM EQUATION
    ======================
        SEA STATE ROW INDEX ...............        1
        WAVE SPECTRUM EQUATION TYPE .......        7 JONSWAP (CLASSIC)
        NUMBER OF WAVES IN SPECTRUM .......       30
        USE WAVE FREQUENCY OR PERIOD ...... FREQUENCY
        SEED FOR RANDOM WAVE PHASES .......        0
        MINIMUM FREQUENCY IN SPECTRUM .....   0.2094 RAD/SEC
        MAXIMUM FREQUENCY IN SPECTRUM .....   2.0944 RAD/SEC
        DIRECTION OF WAVE TRAVEL ..........   0.000 DEGREES
        1ST JONSWAP COEF. (ALPHA) ......... 0.0021000
        2ND JONSWAP COEF. (GAMMA) .........    1.000
        PEAK WAVE FREQUENCY ...............   0.8537 RAD/SEC

    BARGE MOTION RAO TABLE
    ======================
        SEA STATE NUMBER ..................        1
        USE PHASE LAG FOR RAOS ............        0
        VESSEL MOTIONS SIGN CONVENTION .... OFFPIPE
        USE WAVE FREQUENCY OR PERIOD ...... FREQUENCY
        RANDOM WAVE GENERATION SEED .......        0

        WAVE    /------ SURGE -----/  /------ SWAY ------/  /------ HEAVE -----/
     FREQUENCY  AMPLITUDE    PHASE   AMPLITUDE    PHASE    AMPLITUDE    PHASE
     (RAD/SEC)   (M/M )     (DEG)     (M/M )      (DEG)     (M/M )      (DEG)
     =========   =======    =======   =======    =======    =======    =======
       0.2513     1.9170     122.00    0.0010      54.00     1.0770      25.00
       0.3142     1.4330     132.00    0.0010      37.00     1.0490      38.00
       0.3307     1.3560     136.00    0.0010      29.00     1.0380      42.00
       0.3491     1.2830     141.00    0.0010      31.00     1.0220      47.00
       0.3696     1.2120     147.00    0.0010      34.00     1.0000      52.00
       0.3927     1.1380     154.00    0.0000       0.00     0.9710      59.00
       0.4189     1.0620     162.00    0.0000       0.00     0.9300      67.00
       0.4333     1.0180     167.00    0.0000       0.00     0.9030      71.00
       0.4488     0.9710     173.00    0.0000       0.00     0.8720      77.00
       0.4654     0.9200     179.00    0.0000       0.00     0.8360      83.00
       0.4833     0.8620    -174.00    0.0000       0.00     0.7930      89.00
       0.5027     0.7960    -166.00    0.0000       0.00     0.7420      97.00
       0.5236     0.7210    -158.00    0.0000       0.00     0.6840     106.00

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OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP        PAGE  18
Pipelay Analysis
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================================================================================
```

```
    0.5464   0.6330   -148.00   0.0000     0.00   0.6180    117.00
    0.5712   0.5330   -137.00   0.0000     0.00   0.5440    130.00
    0.5984   0.4200   -123.00   0.0000     0.00   0.4650    145.00
    0.6283   0.2960   -106.00   0.0000     0.00   0.3810    165.00
    0.6614   0.1710    -80.00   0.0000     0.00   0.3000   -168.00
    0.6981   0.0700    -22.00   0.0000     0.00   0.2330   -132.00
    0.7392   0.0890     84.00   0.0000     0.00   0.2000    -84.00
    0.7854   0.1490    137.00   0.0000     0.00   0.2030    -34.00
    0.8378   0.1740   -173.00   0.0000     0.00   0.2060     12.00
    0.8976   0.1590   -110.00   0.0000     0.00   0.1620     62.00
    0.9666   0.1310    -19.00   0.0000     0.00   0.0870    143.00
    1.0472   0.1240     97.00   0.0000     0.00   0.0590    -87.00
    1.1424   0.1190   -119.00   0.0000     0.00   0.0400     45.00
    1.2566   0.0900     64.00   0.0000     0.00   0.0320   -116.00
    1.3963   0.0630    -35.00   0.0000     0.00   0.0170    112.00
    1.5708   0.0520    -14.00   0.0000     0.00   0.0050     37.00
    2.0944   0.0100    -92.00   0.0000     0.00   0.0060     83.00
```

```
    WAVE     /------ ROLL ------/  /------ PITCH -----/  /------- YAW ------/
  FREQUENCY  AMPLITUDE   PHASE     AMPLITUDE   PHASE     AMPLITUDE   PHASE
  (RAD/SEC)  (DEG/M )    (DEG)     (DEG/M )    (DEG)     (DEG/M )    (DEG)
  =========  ========   =======    ========   =======    ========   =======
    0.2513   0.0010     -53.00     0.3790     -66.00     0.0070     157.00
    0.3142   0.0000       0.00     0.5960     -54.00     0.0030     149.00
    0.3307   0.0000       0.00     0.6580     -50.00     0.0030     150.00
    0.3491   0.0000       0.00     0.7290     -46.00     0.0020     153.00
    0.3696   0.0000       0.00     0.8120     -40.00     0.0020     157.00
    0.3927   0.0000       0.00     0.9060     -34.00     0.0020     162.00
    0.4189   0.0000       0.00     1.0170     -27.00     0.0010     170.00
    0.4333   0.0000       0.00     1.0760     -23.00     0.0010     174.00
    0.4488   0.0000       0.00     1.1390     -18.00     0.0010     178.00
    0.4654   0.0000       0.00     1.2040     -13.00     0.0010    -176.00
    0.4833   0.0000       0.00     1.2710      -8.00     0.0010    -170.00
    0.5027   0.0010     137.00     1.3340      -2.00     0.0010    -164.00
    0.5236   0.0010     131.00     1.3940       4.00     0.0010    -157.00
    0.5464   0.0010     103.00     1.4400      11.00     0.0010     149.00
    0.5712   0.0010      61.00     1.4680      20.00     0.0000       0.00
    0.5984   0.0010      47.00     1.4660      30.00     0.0000       0.00
    0.6283   0.0010      50.00     1.4140      41.00     0.0000       0.00
    0.6614   0.0000       0.00     1.3060      54.00     0.0000       0.00
    0.6981   0.0000       0.00     1.1290      71.00     0.0000       0.00
    0.7392   0.0000       0.00     0.8820      92.00     0.0000       0.00
    0.7854   0.0000       0.00     0.5830     123.00     0.0000       0.00
    0.8378   0.0000       0.00     0.3020     177.00     0.0000       0.00
    0.8976   0.0000       0.00     0.2510     -87.00     0.0000       0.00
    0.9666   0.0000       0.00     0.2530     -14.00     0.0000       0.00
    1.0472   0.0000       0.00     0.1410      74.00     0.0000       0.00
    1.1424   0.0000       0.00     0.0870    -112.00     0.0000       0.00
    1.2566   0.0000       0.00     0.0320      44.00     0.0000       0.00
```

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```
    1.3963   0.0000       0.00     0.0250      21.00     0.0000       0.00
    1.5708   0.0000       0.00     0.0330       8.00     0.0000       0.00
    2.0944   0.0000       0.00     0.0100      21.00     0.0000       0.00
```

STATIC SOLUTION CONVERGED IN (21) ITERATIONS

STATIC SOLUTION CONVERGED IN (10) ITERATIONS

===
OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP   PAGE 20
Pipelay Analysis
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CURRENT VELOCITIES
==================
```
    WATER     CURRENT    DIRECTION
    DEPTH      SPEED     OF TRAVEL
    (M  )     (M/S )      (DEG )
    ======    =======    =========
     0.000     1.030      45.000
    10.000     0.540      45.000
    21.340     0.440      45.000
```

TIME INTEGRATION PARAMETERS
===========================
```
    TIME STEP LENGTH ..................    0.2000 SECONDS
    MAXIMUM TIME OF INTEGRATION .......  360.000 SECONDS
    SOLUTION SAMPLING TIME STEP........    0.400 SECONDS
    SOLUTION SAMPLING STARTS AT TIME ..   60.000 SECONDS
    DAMPING RATIO .....................    0.2000
    NUMBER OF VARIABLE TIME STEPS .....        0
```

WAVE SPECTRUM EQUATION
======================
```
    SEA STATE ROW INDEX ...............        1
```

```
        WAVE SPECTRUM EQUATION TYPE .......        7 JONSWAP (CLASSIC)
        NUMBER OF WAVES IN SPECTRUM .......       30
        USE WAVE FREQUENCY OR PERIOD ...... FREQUENCY
        SEED FOR RANDOM WAVE PHASES .......        0
        MINIMUM FREQUENCY IN SPECTRUM .....    0.2094 RAD/SEC
        MAXIMUM FREQUENCY IN SPECTRUM .....    2.0944 RAD/SEC
        DIRECTION OF WAVE TRAVEL ..........   45.000 DEGREES
        1ST JONSWAP COEF. (ALPHA) ......... 0.0021000
        2ND JONSWAP COEF. (GAMMA) .........    1.000
        PEAK WAVE FREQUENCY ...............    0.8537 RAD/SEC
```

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================================================================================
OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP          PAGE  21
Pipelay Analysis
JOB NO. - Dynamic Analysis       LICENSED TO - OFFSHORE CONSTR. SPECIALISTS
USER ID - Karun                  DATE - 3/25/2015   TIME - 15:22:21   CASE   2
================================================================================
```

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


BARGE MOTION RAO TABLE
======================
        SEA STATE NUMBER ..................        1
        USE PHASE LAG FOR RAOS ............        0
        VESSEL MOTIONS SIGN CONVENTION .... OFFPIPE
        USE WAVE FREQUENCY OR PERIOD ...... FREQUENCY
        RANDOM WAVE GENERATION SEED .......        0

     WAVE     /------ SURGE -----/ /------ SWAY ------/ /------ HEAVE -----/
   FREQUENCY  AMPLITUDE    PHASE    AMPLITUDE    PHASE   AMPLITUDE    PHASE
   (RAD/SEC)  (M/M  )     (DEG)     (M/M  )     (DEG)    (M/M  )     (DEG)
   =========  =======    =======   =======    =======   =======    =======
     0.2513    1.3840     115.00    0.5050     -34.00    1.0870      17.00
     0.3142    1.0390     121.00    0.5970     -34.00    1.0780      27.00
     0.3307    0.9890     123.00    0.6000     -34.00    1.0730      29.00
     0.3491    0.9440     127.00    0.6000     -34.00    1.0660      33.00
     0.3696    0.9010     131.00    0.5910     -32.00    1.0560      36.00
     0.3927    0.8590     136.00    0.5760     -29.00    1.0420      41.00
     0.4189    0.8150     141.00    0.5540     -25.00    1.0220      47.00
     0.4333    0.7930     145.00    0.5410     -23.00    1.0090      50.00
     0.4488    0.7690     148.00    0.5250     -19.00    0.9940      53.00
     0.4654    0.7430     153.00    0.5070     -15.00    0.9750      57.00
     0.4833    0.7140     157.00    0.4890     -10.00    0.9540      62.00
     0.5027    0.6820     162.00    0.4730      -3.00    0.9280      67.00
     0.5236    0.6450     168.00    0.4750       3.00    0.8960      73.00
     0.5464    0.6040     175.00    0.4860       9.00    0.8540      79.00
     0.5712    0.5580    -176.00    0.4770      11.00    0.8160      88.00
     0.5984    0.5010    -168.00    0.4270      16.00    0.7770      97.00
     0.6283    0.4360    -157.00    0.3640      24.00    0.7270     108.00
     0.6614    0.3620    -144.00    0.3020      36.00    0.6660     119.00
     0.6981    0.2830    -128.00    0.2380      51.00    0.5890     133.00
     0.7392    0.2000    -107.00    0.1710      68.00    0.4900     148.00
     0.7854    0.1130     -80.00    0.1000      91.00    0.3590     166.00
     0.8378    0.0300      -8.00    0.0310     132.00    0.2100    -163.00
     0.8976    0.0750     115.00    0.0340     -65.00    0.1160    -100.00
     0.9666    0.1120     165.00    0.0690     -13.00    0.1140     -30.00
     1.0472    0.1080    -132.00    0.0720      39.00    0.0820      33.00
     1.1424    0.0850     -38.00    0.0410     110.00    0.0380     123.00
     1.2566    0.0500      96.00    0.0100     -39.00    0.0260     -82.00
     1.3963    0.0260     -72.00    0.0200     113.00    0.0080      90.00
     1.5708    0.0050    -150.00    0.0050      98.00    0.0010      55.00
     2.0944    0.0210      51.00    0.0020      46.00    0.0640      83.00
```

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================================================================================
OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP          PAGE  22
Pipelay Analysis
JOB NO. - Dynamic Analysis       LICENSED TO - OFFSHORE CONSTR. SPECIALISTS
USER ID - Karun                  DATE - 3/25/2015   TIME - 15:22:21   CASE   2
================================================================================
```

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


     WAVE     /------ ROLL ------/ /------ PITCH -----/ /------- YAW ------/
   FREQUENCY  AMPLITUDE    PHASE    AMPLITUDE    PHASE   AMPLITUDE    PHASE
   (RAD/SEC)  (DEG/M )    (DEG)     (DEG/M )    (DEG)    (DEG/M )    (DEG)
   =========  =======    =======   =======    =======   =======    =======
     0.2513    0.3290     -86.00    0.2710     -73.00    0.3030     -26.00
     0.3142    0.4910     -81.00    0.4300     -64.00    0.2430       0.00
     0.3307    0.5440     -78.00    0.4770     -62.00    0.2550       8.00
     0.3491    0.6050     -75.00    0.5320     -59.00    0.2770      16.00
     0.3696    0.6910     -72.00    0.5950     -55.00    0.3040      24.00
     0.3927    0.8090     -68.00    0.6700     -51.00    0.3370      31.00
     0.4189    0.9800     -64.00    0.7590     -46.00    0.3750      39.00
     0.4333    1.0920     -61.00    0.8090     -43.00    0.3980      43.00
     0.4488    1.2470     -59.00    0.8640     -40.00    0.4190      47.00
     0.4654    1.4560     -58.00    0.9220     -37.00    0.4410      52.00
     0.4833    1.7510     -59.00    0.9850     -33.00    0.4640      57.00
     0.5027    2.1650     -64.00    1.0490     -28.00    0.4870      63.00
     0.5236    2.6090     -78.00    1.1130     -24.00    0.5100      69.00
     0.5464    2.8450     -99.00    1.1840     -18.00    0.5360      77.00
     0.5712    2.5740    -126.00    1.2690     -12.00    0.5630      86.00
     0.5984    1.8260    -149.00    1.3510      -6.00    0.5870      94.00
     0.6283    1.1010    -158.00    1.4140       1.00    0.6010     105.00
     0.6614    0.6310    -159.00    1.4520       9.00    0.6050     117.00
     0.6981    0.3360    -158.00    1.4570      19.00    0.5970     131.00
     0.7392    0.1570    -168.00    1.4200      31.00    0.5720     148.00
     0.7854    0.0920     153.00    1.3180      44.00    0.5220     168.00
     0.8378    0.1000     133.00    1.0940      58.00    0.4400    -166.00
     0.8976    0.0870     145.00    0.6920      74.00    0.3150    -136.00
     0.9666    0.0490     178.00    0.2590     110.00    0.1590     -96.00
```

```
   1.0472    0.0080    -62.00    0.1010   -133.00    0.0200     23.00
   1.1424    0.0350     84.00    0.1160    -22.00    0.0990    179.00
   1.2566    0.0220    171.00    0.0240     76.00    0.0960    -95.00
   1.3963    0.0160     86.00    0.0130    -20.00    0.0080     43.00
   1.5708    0.0060    121.00    0.0040    -86.00    0.0270    -36.00
   2.0944    0.0580   -121.00    0.1670     74.00    0.0090     78.00

STATIC SOLUTION CONVERGED IN (     21 ) ITERATIONS

STATIC SOLUTION CONVERGED IN (     11 ) ITERATIONS
```

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================================================================================
OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP          PAGE  23
Pipelay Analysis
JOB NO. - Dynamic Analysis      LICENSED TO - OFFSHORE CONSTR. SPECIALISTS
USER ID - Karun                 DATE -  3/25/2015   TIME - 15:22:21   CASE   3
================================================================================
```

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


CURRENT VELOCITIES
==================
    WATER     CURRENT     DIRECTION
    DEPTH      SPEED      OF TRAVEL
    (M  )      (M/S )      (DEG )
    ======    =======    =========
    0.000      1.030       90.000
   10.000      0.540       90.000
   21.340      0.440       90.000

TIME INTEGRATION PARAMETERS
===========================
    TIME STEP LENGTH .................    0.2000 SECONDS
    MAXIMUM TIME OF INTEGRATION .......  360.000 SECONDS
    SOLUTION SAMPLING TIME STEP........    0.400 SECONDS
    SOLUTION SAMPLING STARTS AT TIME ..   60.000 SECONDS
    DAMPING RATIO ....................    0.2000
    NUMBER OF VARIABLE TIME STEPS .....        0

WAVE SPECTRUM EQUATION
======================
    SEA STATE ROW INDEX ..............        1
    WAVE SPECTRUM EQUATION TYPE .......        7 JONSWAP (CLASSIC)
    NUMBER OF WAVES IN SPECTRUM .......       30
    USE WAVE FREQUENCY OR PERIOD ...... FREQUENCY
    SEED FOR RANDOM WAVE PHASES .......        0
    MINIMUM FREQUENCY IN SPECTRUM .....   0.2094 RAD/SEC
    MAXIMUM FREQUENCY IN SPECTRUM .....   2.0944 RAD/SEC
    DIRECTION OF WAVE TRAVEL ..........   90.000 DEGREES
    1ST JONSWAP COEF. (ALPHA) ......... 0.0021000
    2ND JONSWAP COEF. (GAMMA) .........    1.000
    PEAK WAVE FREQUENCY ..............    0.8537 RAD/SEC
```

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================================================================================
OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP          PAGE  24
Pipelay Analysis
JOB NO. - Dynamic Analysis      LICENSED TO - OFFSHORE CONSTR. SPECIALISTS
USER ID - Karun                 DATE -  3/25/2015   TIME - 15:22:21   CASE   3
================================================================================
```

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


BARGE MOTION RAO TABLE
======================
    SEA STATE NUMBER .................        1
    USE PHASE LAG FOR RAOS ...........        0
    VESSEL MOTIONS SIGN CONVENTION .... OFFPIPE
    USE WAVE FREQUENCY OR PERIOD ...... FREQUENCY
    RANDOM WAVE GENERATION SEED .......        0

     WAVE    /------ SURGE -----/  /------ SWAY ------/  /------ HEAVE -----/
   FREQUENCY AMPLITUDE    PHASE    AMPLITUDE    PHASE    AMPLITUDE    PHASE
   (RAD/SEC)  (M/M )     (DEG)      (M/M )     (DEG)      (M/M )     (DEG)
   ========= =======    =======    =======    =======    =======    =======
     0.2513   0.0330     104.00     0.8160     -55.00     1.1000       0.00
     0.3142   0.0140     148.00     0.8750     -64.00     1.1070       0.00
     0.3307   0.0150     158.00     0.8790     -67.00     1.1090       0.00
     0.3491   0.0160     160.00     0.8790     -70.00     1.1110      -1.00
     0.3696   0.0170     162.00     0.8670     -72.00     1.1140      -1.00
     0.3927   0.0180     163.00     0.8500     -74.00     1.1160      -1.00
     0.4189   0.0190     163.00     0.8280     -75.00     1.1200      -2.00
     0.4333   0.0190     163.00     0.8140     -76.00     1.1220      -2.00
     0.4488   0.0190     163.00     0.8000     -76.00     1.1250      -2.00
     0.4654   0.0200     162.00     0.7840     -76.00     1.1280      -2.00
     0.4833   0.0200     164.00     0.7720     -75.00     1.1330      -3.00
     0.5027   0.0210     160.00     0.7720     -73.00     1.1360      -3.00
     0.5236   0.0210     154.00     0.7930     -72.00     1.1340      -4.00
     0.5464   0.0210     150.00     0.8260     -73.00     1.1280      -5.00
     0.5712   0.0210     144.00     0.8400     -76.00     1.1190      -6.00
     0.5984   0.0200     158.00     0.8210     -80.00     1.1500      -6.00
     0.6283   0.0230     165.00     0.7760     -82.00     1.1880      -7.00
     0.6614   0.0270     169.00     0.7260     -83.00     1.2330      -9.00
     0.6981   0.0330     166.00     0.6750     -82.00     1.2700     -13.00
     0.7392   0.0410     157.00     0.6220     -80.00     1.2840     -20.00
     0.7854   0.0490     143.00     0.5720     -78.00     1.2500     -29.00
     0.8378   0.0570     123.00     0.5170     -74.00     1.1160     -41.00
     0.8976   0.0570      96.00     0.4570     -70.00     0.8800     -53.00
     0.9666   0.0470      69.00     0.3950     -62.00     0.6020     -63.00
     1.0472   0.0330      50.00     0.3340     -52.00     0.3630     -66.00
     1.1424   0.0200      21.00     0.2770     -37.00     0.1860     -61.00
```

```
   1.2566    0.0090      13.00     0.2270     -17.00     0.0730      -50.00
   1.3963    0.0010     168.00     0.1770       9.00     0.0090      162.00
   1.5708    0.0110      78.00     0.1220      47.00     0.0330     -133.00
   2.0944    0.0110    -149.00     0.0470    -131.00     0.1930     -174.00
```

```
================================================================================
OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP          PAGE  25
Pipelay Analysis
JOB NO. - Dynamic Analysis        LICENSED TO - OFFSHORE CONSTR. SPECIALISTS
USER ID - Karun                   DATE - 3/25/2015  TIME - 15:22:21  CASE   3
================================================================================
```

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


       WAVE    /------ ROLL ------/  /------ PITCH -----/  /------- YAW ------/
    FREQUENCY  AMPLITUDE    PHASE    AMPLITUDE    PHASE    AMPLITUDE    PHASE
    (RAD/SEC)  (DEG/M )    (DEG)     (DEG/M )    (DEG)     (DEG/M )    (DEG)
    =========  ========   =======   ========   =======   ========   =======
      0.2513    0.4530    -102.00    0.0010     153.00    0.2430     -118.00
      0.3142    0.7000    -104.00    0.0020     160.00    0.1460     -142.00
      0.3307    0.7760    -105.00    0.0030     147.00    0.1250     -145.00
      0.3491    0.8670    -104.00    0.0040     140.00    0.1040     -146.00
      0.3696    1.0110    -105.00    0.0040     147.00    0.0920     -146.00
      0.3927    1.2130    -105.00    0.0050     153.00    0.0820     -145.00
      0.4189    1.5160    -106.00    0.0070     157.00    0.0740     -143.00
      0.4333    1.7320    -107.00    0.0080     158.00    0.0710     -142.00
      0.4488    2.0160    -109.00    0.0100     158.00    0.0680     -141.00
      0.4654    2.4010    -113.00    0.0120     157.00    0.0670     -140.00
      0.4833    2.9000    -121.00    0.0140     153.00    0.0680     -142.00
      0.5027    3.5130    -132.00    0.0180     147.00    0.0670     -144.00
      0.5236    4.0970    -149.00    0.0220     138.00    0.0620     -150.00
      0.5464    4.4130    -171.00    0.0260     129.00    0.0520     -157.00
      0.5712    4.1600     163.00    0.0290     122.00    0.0360     -160.00
      0.5984    3.5500     140.00    0.0370     131.00    0.0250     -159.00
      0.6283    2.7700     123.00    0.0530     130.00    0.0190     -146.00
      0.6614    2.0850     114.00    0.0770     124.00    0.0170     -133.00
      0.6981    1.5420     111.00    0.1080     111.00    0.0160     -126.00
      0.7392    1.1380     113.00    0.1480      92.00    0.0150     -123.00
      0.7854    0.8780     118.00    0.2000      68.00    0.0130     -120.00
      0.8378    0.6940     123.00    0.2480      37.00    0.0090     -121.00
      0.8976    0.5510     127.00    0.2490       3.00    0.0040     -139.00
      0.9666    0.4090     129.00    0.1850     -27.00    0.0030      133.00
      1.0472    0.2780     134.00    0.1180     -48.00    0.0080      109.00
      1.1424    0.1720     141.00    0.0590     -57.00    0.0110       97.00
      1.2566    0.0830     139.00    0.0240     -70.00    0.0150      102.00
      1.3963    0.0470      74.00    0.0020     149.00    0.0150       94.00
      1.5708    0.1310      60.00    0.0660      42.00    0.0070       84.00
      2.0944    0.1550      57.00    0.0720    -146.00    0.0010       10.00

STATIC SOLUTION CONVERGED IN (      21 ) ITERATIONS

STATIC SOLUTION CONVERGED IN (       7 ) ITERATIONS
```

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================================================================================
OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP          PAGE  26
Pipelay Analysis
JOB NO. - Dynamic Analysis        LICENSED TO - OFFSHORE CONSTR. SPECIALISTS
USER ID - Karun                   DATE - 3/25/2015  TIME - 15:22:21  CASE   4
================================================================================
```

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


CURRENT VELOCITIES
==================
     WATER      CURRENT     DIRECTION
     DEPTH       SPEED      OF TRAVEL
     (M  )       (M/S )       (DEG )
     ======     =======     =========
     0.000       1.030       135.000
    10.000       0.540       135.000
    21.340       0.440       135.000

TIME INTEGRATION PARAMETERS
===========================
    TIME STEP LENGTH .................    0.2000 SECONDS
    MAXIMUM TIME OF INTEGRATION .......  360.000 SECONDS
    SOLUTION SAMPLING TIME STEP........    0.400 SECONDS
    SOLUTION SAMPLING STARTS AT TIME ..   60.000 SECONDS
    DAMPING RATIO .....................    0.2000
    NUMBER OF VARIABLE TIME STEPS .....        0

WAVE SPECTRUM EQUATION
======================
    SEA STATE ROW INDEX ...............        1
    WAVE SPECTRUM EQUATION TYPE .......        7 JONSWAP (CLASSIC)
    NUMBER OF WAVES IN SPECTRUM .......       30
    USE WAVE FREQUENCY OR PERIOD ...... FREQUENCY
    SEED FOR RANDOM WAVE PHASES .......        0
    MINIMUM FREQUENCY IN SPECTRUM .....    0.2094 RAD/SEC
    MAXIMUM FREQUENCY IN SPECTRUM .....    2.0944 RAD/SEC
    DIRECTION OF WAVE TRAVEL ..........  135.000 DEGREES
    1ST JONSWAP COEF. (ALPHA) ......... 0.0021000
    2ND JONSWAP COEF. (GAMMA) .........    1.000
    PEAK WAVE FREQUENCY ...............    0.8537 RAD/SEC
```

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================================================================================
OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP          PAGE  27
Pipelay Analysis
JOB NO. - Dynamic Analysis        LICENSED TO - OFFSHORE CONSTR. SPECIALISTS
USER ID - Karun                   DATE - 3/25/2015  TIME - 15:22:21  CASE   4
================================================================================
```

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


 BARGE MOTION RAO TABLE
 ======================
     SEA STATE NUMBER ..................        1
     USE PHASE LAG FOR RAOS ............        0
     VESSEL MOTIONS SIGN CONVENTION .... OFFPIPE
     USE WAVE FREQUENCY OR PERIOD ...... FREQUENCY
     RANDOM WAVE GENERATION SEED .......        0

     WAVE     /------ SURGE -----/  /------ SWAY ------/  /------ HEAVE -----/
   FREQUENCY  AMPLITUDE   PHASE     AMPLITUDE   PHASE     AMPLITUDE   PHASE
   (RAD/SEC)   (M/M  )   (DEG)       (M/M  )    (DEG)      (M/M  )    (DEG)
   =========  =======   =======     =======   =======     =======   =======
     0.2513    1.3120   -101.00      0.4760    -69.00      1.0880    -18.00
     0.3142    1.0030   -116.00      0.6000    -93.00      1.0770    -28.00
     0.3307    0.9560   -119.00      0.5980    -99.00      1.0720    -31.00
     0.3491    0.9130   -123.00      0.5920   -104.00      1.0650    -35.00
     0.3696    0.8710   -128.00      0.5790   -111.00      1.0550    -40.00
     0.3927    0.8290   -133.00      0.5610   -118.00      1.0410    -45.00
     0.4189    0.7870   -139.00      0.5370   -125.00      1.0200    -51.00
     0.4333    0.7640   -143.00      0.5220   -129.00      1.0070    -55.00
     0.4488    0.7410   -147.00      0.5040   -134.00      0.9910    -59.00
     0.4654    0.7160   -151.00      0.4830   -138.00      0.9710    -63.00
     0.4833    0.6890   -156.00      0.4590   -143.00      0.9470    -69.00
     0.5027    0.6580   -162.00      0.4370   -146.00      0.9180    -74.00
     0.5236    0.6240   -169.00      0.4280   -149.00      0.8810    -81.00
     0.5464    0.5850   -176.00      0.4390   -155.00      0.8330    -89.00
     0.5712    0.5480    174.00      0.4390   -166.00      0.7820    -97.00
     0.5984    0.5070    164.00      0.4110    179.00      0.7270   -106.00
     0.6283    0.4520    152.00      0.3560    166.00      0.6530   -117.00
     0.6614    0.3910    138.00      0.2970    153.00      0.5640   -131.00
     0.6981    0.3230    121.00      0.2360    137.00      0.4540   -148.00
     0.7392    0.2540    100.00      0.1710    118.00      0.3150   -170.00
     0.7854    0.1890     71.00      0.1030     92.00      0.1450    159.00
     0.8378    0.1320     28.00      0.0420     42.00      0.0290    -42.00
     0.8976    0.0950    -32.00      0.0390    -78.00      0.1320    -92.00
     0.9666    0.0780   -100.00      0.0690   -134.00      0.1340   -128.00
     1.0472    0.0520   -172.00      0.0710    178.00      0.0920   -149.00
     1.1424    0.0060   -125.00      0.0390    122.00      0.0500   -169.00
     1.2566    0.0180   -111.00      0.0110    -80.00      0.0290   -157.00
     1.3963    0.0110   -139.00      0.0210    163.00      0.0150   -163.00
     1.5708    0.0030   -117.00      0.0090   -108.00      0.0040   -171.00
     2.0944    0.0160     71.00      0.0020   -157.00      0.0160    119.00


================================================================================
 OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP          PAGE  28
 Pipelay Analysis
 JOB NO. - Dynamic Analysis        LICENSED TO - OFFSHORE CONSTR. SPECIALISTS
 USER ID - Karun                   DATE - 3/25/2015   TIME - 15:22:21   CASE   4
================================================================================
                I N P U T   D A T A   E C H O


     WAVE     /------ ROLL ------/  /------ PITCH -----/  /------- YAW ------/
   FREQUENCY  AMPLITUDE   PHASE     AMPLITUDE   PHASE     AMPLITUDE   PHASE
   (RAD/SEC)   (DEG/M )   (DEG)      (DEG/M )   (DEG)      (DEG/M )   (DEG)
   =========  =======   =======     ========  =======     ========  =======
     0.2513    0.3360   -116.00      0.2760     74.00      0.3850    174.00
     0.3142    0.4690   -128.00      0.4360     65.00      0.3730    153.00
     0.3307    0.5200   -130.00      0.4830     62.00      0.3780    150.00
     0.3491    0.5860   -133.00      0.5390     59.00      0.3870    147.00
     0.3696    0.6720   -136.00      0.6040     55.00      0.4010    143.00
     0.3927    0.7920   -140.00      0.6820     50.00      0.4200    138.00
     0.4189    0.9670   -146.00      0.7750     45.00      0.4450    132.00
     0.4333    1.0890   -149.00      0.8280     42.00      0.4600    129.00
     0.4488    1.2500   -154.00      0.8870     38.00      0.4760    125.00
     0.4654    1.4690   -160.00      0.9520     34.00      0.4940    121.00
     0.4833    1.7830   -168.00      1.0230     29.00      0.5140    117.00
     0.5027    2.2160    175.00      1.0970     24.00      0.5410    111.00
     0.5236    2.6950    152.00      1.1760     18.00      0.5660    105.00
     0.5464    2.9100    119.00      1.2620     11.00      0.5870     98.00
     0.5712    2.6370     83.00      1.3660      3.00      0.6000     90.00
     0.5984    1.9710     48.00      1.4800     -5.00      0.6060     81.00
     0.6283    1.1660     24.00      1.5650    -17.00      0.6110     72.00
     0.6614    0.6780      9.00      1.6360    -30.00      0.6100     61.00
     0.6981    0.3560     -1.00      1.6650    -45.00      0.5960     48.00
     0.7392    0.1480     -3.00      1.6470    -64.00      0.5660     33.00
     0.7854    0.0610     53.00      1.5370    -86.00      0.5120     15.00
     0.8378    0.1010     83.00      1.2640   -114.00      0.4280     -6.00
     0.8976    0.1040     76.00      0.8130   -143.00      0.3050    -33.00
     0.9666    0.0800     75.00      0.3820   -159.00      0.1520    -69.00
     1.0472    0.0700     87.00      0.2160   -145.00      0.0190    169.00
     1.1424    0.0710     82.00      0.1850   -144.00      0.1040     40.00
     1.2566    0.0380     80.00      0.1140   -160.00      0.0960    -29.00
     1.3963    0.0490    105.00      0.0510   -153.00      0.0170    105.00
     1.5708    0.0310     86.00      0.0090   -167.00      0.0270    -62.00
     2.0944    0.0090     78.00      0.0430     71.00      0.0040    114.00


 STATIC SOLUTION CONVERGED IN (      21 ) ITERATIONS

 STATIC SOLUTION CONVERGED IN (      18 ) ITERATIONS


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 OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP          PAGE  29
 Pipelay Analysis
 JOB NO. - Dynamic Analysis        LICENSED TO - OFFSHORE CONSTR. SPECIALISTS
 USER ID - Karun                   DATE - 3/25/2015   TIME - 15:22:21   CASE   5
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        ================================================================================
                        I N P U T   D A T A   E C H O


        CURRENT VELOCITIES
        ==================
           WATER      CURRENT     DIRECTION
           DEPTH       SPEED      OF TRAVEL
           (M  )       (M/S )      (DEG )
           ======     =======     =========
           0.000       1.030       180.000
          10.000       0.540       180.000
          21.340       0.440       180.000

        TIME INTEGRATION PARAMETERS
        ===========================
           TIME STEP LENGTH ..................    0.2000 SECONDS
           MAXIMUM TIME OF INTEGRATION .......  360.000 SECONDS
           SOLUTION SAMPLING TIME STEP........    0.400 SECONDS
           SOLUTION SAMPLING STARTS AT TIME ..   60.000 SECONDS
           DAMPING RATIO .....................    0.2000
           NUMBER OF VARIABLE TIME STEPS .....        0

        WAVE SPECTRUM EQUATION
        ======================
           SEA STATE ROW INDEX ...............        1
           WAVE SPECTRUM EQUATION TYPE .......        7 JONSWAP (CLASSIC)
           NUMBER OF WAVES IN SPECTRUM .......       30
           USE WAVE FREQUENCY OR PERIOD ...... FREQUENCY
           SEED FOR RANDOM WAVE PHASES .......        0
           MINIMUM FREQUENCY IN SPECTRUM .....    0.2094 RAD/SEC
           MAXIMUM FREQUENCY IN SPECTRUM .....    2.0944 RAD/SEC
           DIRECTION OF WAVE TRAVEL ..........  180.000 DEGREES
           1ST JONSWAP COEF. (ALPHA) ......... 0.0021000
           2ND JONSWAP COEF. (GAMMA) .........    1.000
           PEAK WAVE FREQUENCY ...............    0.8537 RAD/SEC

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        OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP          PAGE  30
        Pipelay Analysis
        JOB NO. - Dynamic Analysis      LICENSED TO - OFFSHORE CONSTR. SPECIALISTS
        USER ID - Karun                 DATE -  3/25/2015  TIME - 15:22:21   CASE   5
        ================================================================================
                        I N P U T   D A T A   E C H O


        BARGE MOTION RAO TABLE
        ======================
           SEA STATE NUMBER ..................        1
           USE PHASE LAG FOR RAOS ............        0
           VESSEL MOTIONS SIGN CONVENTION .... OFFPIPE
           USE WAVE FREQUENCY OR PERIOD ...... FREQUENCY
           RANDOM WAVE GENERATION SEED .......        0

            WAVE     /------ SURGE -----/  /------ SWAY ------/  /------ HEAVE -----/
          FREQUENCY  AMPLITUDE   PHASE     AMPLITUDE   PHASE     AMPLITUDE   PHASE
          (RAD/SEC)   (M/M  )    (DEG)      (M/M  )    (DEG)      (M/M  )    (DEG)
          =========  =======    =======    =======    =======    =======    =======
            0.2513    1.8220    -108.00     0.0010     151.00     1.0760     -25.00
            0.3142    1.3750    -127.00     0.0000       0.00     1.0490     -40.00
            0.3307    1.3020    -132.00     0.0000       0.00     1.0370     -44.00
            0.3491    1.2310    -137.00     0.0000       0.00     1.0210     -49.00
            0.3696    1.1600    -143.00     0.0000       0.00     1.0000     -55.00
            0.3927    1.0860    -150.00     0.0000       0.00     0.9700     -63.00
            0.4189    1.0060    -159.00     0.0000       0.00     0.9280     -72.00
            0.4333    0.9630    -164.00     0.0000       0.00     0.9000     -77.00
            0.4488    0.9170    -170.00     0.0000       0.00     0.8680     -83.00
            0.4654    0.8670    -176.00     0.0000       0.00     0.8280     -89.00
            0.4833    0.8120     176.00     0.0000       0.00     0.7810     -97.00
            0.5027    0.7520     168.00     0.0000       0.00     0.7250    -105.00
            0.5236    0.6850     159.00     0.0000       0.00     0.6580    -114.00
            0.5464    0.6080     148.00     0.0000       0.00     0.5770    -125.00
            0.5712    0.5210     135.00     0.0000       0.00     0.4830    -137.00
            0.5984    0.4270     120.00     0.0000       0.00     0.3770    -151.00
            0.6283    0.3230     102.00     0.0000       0.00     0.2600    -167.00
            0.6614    0.2170      79.00     0.0000       0.00     0.1350     174.00
            0.6981    0.1170      48.00     0.0000       0.00     0.0100     175.00
            0.7392    0.0450     -17.00     0.0000       0.00     0.1040     -56.00
            0.7854    0.0530    -122.00     0.0000       0.00     0.1790     -85.00
            0.8378    0.0680    -175.00     0.0000       0.00     0.1880    -117.00
            0.8976    0.0440     135.00     0.0000       0.00     0.1330    -141.00
            0.9666    0.0110     -58.00     0.0000       0.00     0.0880    -144.00
            1.0472    0.0450    -147.00     0.0000       0.00     0.0740    -142.00
            1.1424    0.0270    -155.00     0.0000       0.00     0.0580    -164.00
            1.2566    0.0250    -166.00     0.0000       0.00     0.0440    -164.00
            1.3963    0.0280    -147.00     0.0000       0.00     0.0260     170.00
            1.5708    0.0070    -128.00     0.0000       0.00     0.0310     160.00
            2.0944    0.0080     162.00     0.0000       0.00     0.0100    -116.00

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        OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP          PAGE  31
        Pipelay Analysis
        JOB NO. - Dynamic Analysis      LICENSED TO - OFFSHORE CONSTR. SPECIALISTS
        USER ID - Karun                 DATE -  3/25/2015  TIME - 15:22:21   CASE   5
        ================================================================================
                        I N P U T   D A T A   E C H O


            WAVE     /------ ROLL ------/  /------ PITCH -----/  /------- YAW ------/
```

FREQUENCY (RAD/SEC)	AMPLITUDE (DEG/M)	PHASE (DEG)	AMPLITUDE (DEG/M)	PHASE (DEG)	AMPLITUDE (DEG/M)	PHASE (DEG)
0.2513	0.0000	0.00	0.3880	68.00	0.0050	-73.00
0.3142	0.0000	0.00	0.6090	55.00	0.0020	-111.00
0.3307	0.0000	0.00	0.6740	51.00	0.0020	-118.00
0.3491	0.0000	0.00	0.7480	46.00	0.0020	-125.00
0.3696	0.0000	0.00	0.8350	41.00	0.0010	-132.00
0.3927	0.0000	0.00	0.9350	35.00	0.0010	-141.00
0.4189	0.0000	0.00	1.0520	27.00	0.0010	-150.00
0.4333	0.0010	-124.00	1.1170	22.00	0.0010	-156.00
0.4488	0.0010	-134.00	1.1870	17.00	0.0010	-161.00
0.4654	0.0010	-146.00	1.2610	11.00	0.0010	-168.00
0.4833	0.0010	-159.00	1.3380	5.00	0.0000	0.00
0.5027	0.0010	-176.00	1.4170	-1.00	0.0000	0.00
0.5236	0.0020	158.00	1.4940	-10.00	0.0000	0.00
0.5464	0.0020	108.00	1.5540	-20.00	0.0000	0.00
0.5712	0.0020	41.00	1.5960	-32.00	0.0000	0.00
0.5984	0.0010	-1.00	1.6080	-45.00	0.0000	0.00
0.6283	0.0010	-30.00	1.5660	-60.00	0.0000	0.00
0.6614	0.0000	0.00	1.4470	-77.00	0.0000	0.00
0.6981	0.0000	0.00	1.2430	-95.00	0.0000	0.00
0.7392	0.0000	0.00	0.9510	-114.00	0.0000	0.00
0.7854	0.0000	0.00	0.6150	-126.00	0.0000	0.00
0.8378	0.0000	0.00	0.4150	-116.00	0.0000	0.00
0.8976	0.0000	0.00	0.4760	-115.00	0.0000	0.00
0.9666	0.0000	0.00	0.4370	-138.00	0.0000	0.00
1.0472	0.0000	0.00	0.2760	-158.00	0.0000	0.00
1.1424	0.0000	0.00	0.1900	-152.00	0.0000	0.00
1.2566	0.0000	0.00	0.1460	-170.00	0.0000	0.00
1.3963	0.0000	0.00	0.1090	-179.00	0.0000	0.00
1.5708	0.0000	0.00	0.0700	157.00	0.0000	0.00
2.0944	0.0000	0.00	0.0270	-127.00	0.0000	0.00

STATIC SOLUTION CONVERGED IN (21) ITERATIONS

STATIC SOLUTION CONVERGED IN (10) ITERATIONS

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OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP   PAGE 32
Pipelay Analysis
JOB NO. - Dynamic Analysis   LICENSED TO - OFFSHORE CONSTR. SPECIALISTS
USER ID - Karun   DATE - 3/25/2015 TIME - 15:22:21 CASE   6
==

                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)
0.000	1.030	225.000
10.000	0.540	225.000
21.340	0.440	225.000

TIME INTEGRATION PARAMETERS
===========================
    TIME STEP LENGTH ....   0.2000 SECONDS
    MAXIMUM TIME OF INTEGRATION .... 360.000 SECONDS
    SOLUTION SAMPLING TIME STEP........   0.400 SECONDS
    SOLUTION SAMPLING STARTS AT TIME ..   60.000 SECONDS
    DAMPING RATIO 0.2000
    NUMBER OF VARIABLE TIME STEPS   0

WAVE SPECTRUM EQUATION
======================
    SEA STATE ROW INDEX   1
    WAVE SPECTRUM EQUATION TYPE ....   7 JONSWAP (CLASSIC)
    NUMBER OF WAVES IN SPECTRUM   30
    USE WAVE FREQUENCY OR PERIOD ...... FREQUENCY
    SEED FOR RANDOM WAVE PHASES   0
    MINIMUM FREQUENCY IN SPECTRUM .....   0.2094 RAD/SEC
    MAXIMUM FREQUENCY IN SPECTRUM .....   2.0944 RAD/SEC
    DIRECTION OF WAVE TRAVEL .... 225.000 DEGREES
    1ST JONSWAP COEF. (ALPHA) 0.0021000
    2ND JONSWAP COEF. (GAMMA) 1.000
    PEAK WAVE FREQUENCY ....   0.8537 RAD/SEC

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OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP   PAGE 33
Pipelay Analysis
JOB NO. - Dynamic Analysis   LICENSED TO - OFFSHORE CONSTR. SPECIALISTS
USER ID - Karun   DATE - 3/25/2015 TIME - 15:22:21 CASE   6
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                I N P U T   D A T A   E C H O

BARGE MOTION RAO TABLE
======================
    SEA STATE NUMBER   1
    USE PHASE LAG FOR RAOS   0
    VESSEL MOTIONS SIGN CONVENTION .... OFFPIPE
    USE WAVE FREQUENCY OR PERIOD ...... FREQUENCY
    RANDOM WAVE GENERATION SEED   0

WAVE FREQUENCY (RAD/SEC)	/------ SURGE -----/ AMPLITUDE (M/M)	PHASE (DEG)	/------ SWAY ------/ AMPLITUDE (M/M)	PHASE (DEG)	/------ HEAVE -----/ AMPLITUDE (M/M)	PHASE (DEG)

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  =========   =======   =======   =======   =======   =======   =======
     0.2513    1.3160   -102.00    0.4790    110.00    1.0880    -18.00
     0.3142    1.0040   -116.00    0.6020     86.00    1.0770    -28.00
     0.3307    0.9580   -119.00    0.6000     81.00    1.0720    -31.00
     0.3491    0.9140   -123.00    0.5930     75.00    1.0650    -35.00
     0.3696    0.8720   -128.00    0.5800     68.00    1.0550    -39.00
     0.3921    0.8300   -133.00    0.5620     62.00    1.0410    -45.00
     0.4189    0.7870   -139.00    0.5380     54.00    1.0200    -51.00
     0.4333    0.7650   -143.00    0.5220     50.00    1.0070    -55.00
     0.4488    0.7420   -147.00    0.5050     45.00    0.9910    -59.00
     0.4654    0.7170   -151.00    0.4840     41.00    0.9710    -63.00
     0.4833    0.6900   -156.00    0.4600     36.00    0.9470    -68.00
     0.5027    0.6590   -162.00    0.4380     34.00    0.9180    -74.00
     0.5236    0.6240   -169.00    0.4290     30.00    0.8810    -81.00
     0.5464    0.5850   -176.00    0.4390     25.00    0.8320    -88.00
     0.5712    0.5480    174.00    0.4400     13.00    0.7820    -97.00
     0.5984    0.5080    164.00    0.4110      0.00    0.7270   -106.00
     0.6283    0.4520    152.00    0.3560    -13.00    0.6530   -117.00
     0.6614    0.3910    138.00    0.2980    -26.00    0.5640   -131.00
     0.6981    0.3230    121.00    0.2360    -41.00    0.4540   -148.00
     0.7392    0.2550    100.00    0.1710    -60.00    0.3150   -170.00
     0.7854    0.1890     71.00    0.1040    -87.00    0.1450    159.00
     0.8378    0.1330     29.00    0.0420   -137.00    0.0290    -41.00
     0.8976    0.0950    -31.00    0.0390    102.00    0.1320    -91.00
     0.9666    0.0780    -99.00    0.0690     46.00    0.1340   -127.00
     1.0472    0.0520   -171.00    0.0710      0.00    0.0920   -148.00
     1.1424    0.0060   -123.00    0.0390    -55.00    0.0500   -168.00
     1.2566    0.0180   -109.00    0.0110    101.00    0.0290   -155.00
     1.3963    0.0110   -137.00    0.0210    -13.00    0.0150   -160.00
     1.5708    0.0030   -114.00    0.0090     74.00    0.0040   -168.00
     2.0944    0.0160     76.00    0.0020     27.00    0.0160    124.00
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================================================================================
OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP          PAGE  34
Pipelay Analysis
JOB NO. - Dynamic Analysis        LICENSED TO - OFFSHORE CONSTR. SPECIALISTS
USER ID - Karun                   DATE -  3/25/2015   TIME - 15:22:21   CASE   6
================================================================================
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                  I N P U T   D A T A   E C H O


        WAVE    /------ ROLL ------/  /------ PITCH -----/  /------- YAW ------/
     FREQUENCY  AMPLITUDE    PHASE    AMPLITUDE    PHASE    AMPLITUDE    PHASE
     (RAD/SEC)  (DEG/M )    (DEG)     (DEG/M )    (DEG)     (DEG/M )    (DEG)
     =========  ========   =======   ========   =======   ========   =======
     0.2513     0.3350      63.00     0.2760      74.00     0.3640       1.00
     0.3142     0.4690      51.00     0.4360      65.00     0.3660     -22.00
     0.3307     0.5200      49.00     0.4830      62.00     0.3730     -26.00
     0.3491     0.5850      46.00     0.5390      59.00     0.3830     -30.00
     0.3696     0.6720      43.00     0.6040      55.00     0.3980     -34.00
     0.3921     0.7910      39.00     0.6820      50.00     0.4180     -39.00
     0.4189     0.9660      33.00     0.7750      45.00     0.4440     -45.00
     0.4333     1.0880      30.00     0.8280      42.00     0.4590     -49.00
     0.4488     1.2480      25.00     0.8870      38.00     0.4750     -53.00
     0.4654     1.4670      19.00     0.9520      34.00     0.4930     -57.00
     0.4833     1.7800      11.00     1.0230      30.00     0.5130     -61.00
     0.5027     2.2120      -4.00     1.0970      24.00     0.5400     -67.00
     0.5236     2.6920     -27.00     1.1760      18.00     0.5650     -73.00
     0.5464     2.9060     -60.00     1.2620      11.00     0.5860     -80.00
     0.5712     2.6330     -96.00     1.3660       3.00     0.5990     -88.00
     0.5984     1.9680    -131.00     1.4800      -5.00     0.6050     -97.00
     0.6283     1.1630    -155.00     1.5650     -16.00     0.6110    -106.00
     0.6614     0.6760    -170.00     1.6360     -29.00     0.6100    -117.00
     0.6981     0.3540     178.00     1.6650     -45.00     0.5960    -130.00
     0.7392     0.1470     177.00     1.6470     -63.00     0.5660    -145.00
     0.7854     0.0620    -125.00     1.5370     -86.00     0.5120    -163.00
     0.8378     0.1020     -95.00     1.2640    -113.00     0.4280     174.00
     0.8976     0.1040    -102.00     0.8130    -142.00     0.3050     147.00
     0.9666     0.0800    -103.00     0.3820    -158.00     0.1520     111.00
     1.0472     0.0700     -91.00     0.2160    -144.00     0.0190      -9.00
     1.1424     0.0710     -95.00     0.1850    -142.00     0.1040    -137.00
     1.2566     0.0380     -97.00     0.1140    -158.00     0.0960     152.00
     1.3963     0.0490     -72.00     0.0510    -151.00     0.0170     -72.00
     1.5708     0.0310     -90.00     0.0090    -164.00     0.0270     120.00
     2.0944     0.0090     -96.00     0.0430      76.00     0.0040     -60.00


STATIC SOLUTION CONVERGED IN (     21 ) ITERATIONS

STATIC SOLUTION CONVERGED IN (     18 ) ITERATIONS
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OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP          PAGE  35
Pipelay Analysis
JOB NO. - Dynamic Analysis        LICENSED TO - OFFSHORE CONSTR. SPECIALISTS
USER ID - Karun                   DATE -  3/25/2015   TIME - 15:22:21   CASE   7
================================================================================
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                  I N P U T   D A T A   E C H O


CURRENT VELOCITIES
==================
      WATER      CURRENT    DIRECTION
      DEPTH       SPEED     OF TRAVEL
      (M  )       (M/S )     (DEG )
     ======      =======    =========
      0.000       1.030      270.000
     10.000       0.540      270.000
     21.340       0.440      270.000


TIME INTEGRATION PARAMETERS
```

```
    ============================
      TIME STEP LENGTH ..................   0.2000 SECONDS
      MAXIMUM TIME OF INTEGRATION .......  360.000 SECONDS
      SOLUTION SAMPLING TIME STEP........    0.400 SECONDS
      SOLUTION SAMPLING STARTS AT TIME ..   60.000 SECONDS
      DAMPING RATIO .....................    0.2000
      NUMBER OF VARIABLE TIME STEPS .....        0


WAVE SPECTRUM EQUATION
=======================
      SEA STATE ROW INDEX ...............        1
      WAVE SPECTRUM EQUATION TYPE .......        7 JONSWAP (CLASSIC)
      NUMBER OF WAVES IN SPECTRUM .......       30
      USE WAVE FREQUENCY OR PERIOD ...... FREQUENCY
      SEED FOR RANDOM WAVE PHASES .......        0
      MINIMUM FREQUENCY IN SPECTRUM .....    0.2094 RAD/SEC
      MAXIMUM FREQUENCY IN SPECTRUM .....    2.0944 RAD/SEC
      DIRECTION OF WAVE TRAVEL ..........  270.000 DEGREES
      1ST JONSWAP COEF. (ALPHA) ......... 0.0021000
      2ND JONSWAP COEF. (GAMMA) .........    1.000
      PEAK WAVE FREQUENCY ...............    0.8537 RAD/SEC
```

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OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP          PAGE  36
Pipelay Analysis
JOB NO. - Dynamic Analysis         LICENSED TO - OFFSHORE CONSTR. SPECIALISTS
USER ID - Karun                    DATE - 3/25/2015   TIME - 15:22:21   CASE   7
================================================================================
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                  I N P U T   D A T A   E C H O


BARGE MOTION RAO TABLE
=======================
      SEA STATE NUMBER ..................        1
      USE PHASE LAG FOR RAOS ............        0
      VESSEL MOTIONS SIGN CONVENTION .... OFFPIPE
      USE WAVE FREQUENCY OR PERIOD ...... FREQUENCY
      RANDOM WAVE GENERATION SEED .......        0

      WAVE      /------ SURGE -----/  /------ SWAY ------/  /------ HEAVE -----/
   FREQUENCY   AMPLITUDE     PHASE    AMPLITUDE    PHASE    AMPLITUDE    PHASE
   (RAD/SEC)    (M/M  )      (DEG)     (M/M  )     (DEG)     (M/M  )     (DEG)
   =========   =======     =======    =======    =======    =======    =======
      0.2513    0.0310      101.00     0.8190     124.00     1.1000       0.00
      0.3142    0.0120      153.00     0.8760     115.00     1.1070       0.00
      0.3307    0.0130      164.00     0.8790     112.00     1.1090      -1.00
      0.3491    0.0150      166.00     0.8790     109.00     1.1110      -1.00
      0.3696    0.0160      167.00     0.8670     107.00     1.1130      -1.00
      0.3927    0.0170      167.00     0.8500     105.00     1.1160      -1.00
      0.4189    0.0180      166.00     0.8280     104.00     1.1200      -2.00
      0.4333    0.0190      166.00     0.8140     103.00     1.1220      -2.00
      0.4488    0.0190      165.00     0.7990     103.00     1.1250      -2.00
      0.4654    0.0190      165.00     0.7840     103.00     1.1280      -2.00
      0.4833    0.0190      166.00     0.7720     104.00     1.1330      -3.00
      0.5027    0.0200      162.00     0.7720     106.00     1.1360      -3.00
      0.5236    0.0210      156.00     0.7930     107.00     1.1340      -4.00
      0.5464    0.0200      151.00     0.8260     106.00     1.1280      -5.00
      0.5712    0.0200      146.00     0.8400     102.00     1.1190      -6.00
      0.5984    0.0200      159.00     0.8210      99.00     1.1500      -6.00
      0.6283    0.0230      166.00     0.7760      96.00     1.1880      -7.00
      0.6614    0.0270      170.00     0.7260      96.00     1.2330      -9.00
      0.6981    0.0330      167.00     0.6750      96.00     1.2700     -13.00
      0.7392    0.0410      157.00     0.6220      99.00     1.2830     -20.00
      0.7854    0.0490      143.00     0.5720     101.00     1.2500     -29.00
      0.8378    0.0560      122.00     0.5170     104.00     1.1150     -41.00
      0.8976    0.0570       96.00     0.4570     109.00     0.8800     -54.00
      0.9666    0.0470       69.00     0.3950     116.00     0.6020     -63.00
      1.0472    0.0330       49.00     0.3340     126.00     0.3630     -66.00
      1.1424    0.0200       20.00     0.2770     142.00     0.1860     -61.00
      1.2566    0.0090       12.00     0.2270     162.00     0.0730     -51.00
      1.3963    0.0010      167.00     0.1770    -171.00     0.0090     161.00
      1.5708    0.0110       77.00     0.1220    -133.00     0.0330    -134.00
      2.0944    0.0110     -151.00     0.0470      46.00     0.1930    -176.00
```

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OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP          PAGE  37
Pipelay Analysis
JOB NO. - Dynamic Analysis         LICENSED TO - OFFSHORE CONSTR. SPECIALISTS
USER ID - Karun                    DATE - 3/25/2015   TIME - 15:22:21   CASE   7
================================================================================
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```
                  I N P U T   D A T A   E C H O


      WAVE      /------ ROLL ------/  /------ PITCH -----/  /------- YAW ------/
   FREQUENCY   AMPLITUDE     PHASE    AMPLITUDE    PHASE    AMPLITUDE    PHASE
   (RAD/SEC)    (DEG/M )     (DEG)     (DEG/M )    (DEG)     (DEG/M )    (DEG)
   =========   =======     =======    =======    =======    =======    =======
      0.2513    0.4530       77.00     0.0010     143.00     0.2470      68.00
      0.3142    0.6990       74.00     0.0020     158.00     0.1480      44.00
      0.3307    0.7750       74.00     0.0030     145.00     0.1270      41.00
      0.3491    0.8670       75.00     0.0040     139.00     0.1060      40.00
      0.3696    1.0100       74.00     0.0040     147.00     0.0950      40.00
      0.3927    1.2120       74.00     0.0050     153.00     0.0850      40.00
      0.4189    1.5150       73.00     0.0070     157.00     0.0770      42.00
      0.4333    1.7310       71.00     0.0080     158.00     0.0740      42.00
      0.4488    2.0150       69.00     0.0090     158.00     0.0710      43.00
      0.4654    2.3990       66.00     0.0110     157.00     0.0690      43.00
      0.4833    2.8980       58.00     0.0140     153.00     0.0700      41.00
      0.5027    3.5110       47.00     0.0170     147.00     0.0680      39.00
      0.5236    4.0950       30.00     0.0210     138.00     0.0630      34.00
```

```
      0.5464    4.4100       8.00    0.0250    129.00    0.0520     27.00
      0.5712    4.1580     -16.00    0.0280    122.00    0.0360     25.00
      0.5984    3.5460     -39.00    0.0360    130.00    0.0250     28.00
      0.6283    2.7670     -56.00    0.0520    130.00    0.0200     41.00
      0.6614    2.0820     -65.00    0.0760    123.00    0.0180     53.00
      0.6981    1.5400     -68.00    0.1070    111.00    0.0170     58.00
      0.7392    1.1360     -66.00    0.1470     91.00    0.0170     61.00
      0.7854    0.8770     -62.00    0.2000     67.00    0.0140     64.00
      0.8378    0.6930     -56.00    0.2470     37.00    0.0090     65.00
      0.8976    0.5500     -52.00    0.2480      2.00    0.0040     54.00
      0.9666    0.4090     -50.00    0.1850    -28.00    0.0030    -46.00
      1.0472    0.2780     -45.00    0.1180    -48.00    0.0080    -72.00
      1.1424    0.1720     -38.00    0.0590    -57.00    0.0110    -84.00
      1.2566    0.0830     -40.00    0.0240    -71.00    0.0150    -79.00
      1.3963    0.0460    -106.00    0.0020    148.00    0.0150    -86.00
      1.5708    0.1310    -120.00    0.0660     41.00    0.0070    -97.00
      2.0944    0.1550    -124.00    0.0720   -148.00    0.0010   -172.00

STATIC SOLUTION CONVERGED IN (     21 ) ITERATIONS

STATIC SOLUTION CONVERGED IN (      7 ) ITERATIONS
```

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OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP          PAGE  38
Pipelay Analysis
JOB NO. - Dynamic Analysis        LICENSED TO - OFFSHORE CONSTR. SPECIALISTS
USER ID - Karun                   DATE -  3/25/2015   TIME - 15:22:21   CASE   8
================================================================================
```

                  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)
0.000	1.030	315.000
10.000	0.540	315.000
21.340	0.440	315.000

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

```
      TIME STEP LENGTH ..................    0.2000 SECONDS
      MAXIMUM TIME OF INTEGRATION .......  360.000 SECONDS
      SOLUTION SAMPLING TIME STEP........    0.400 SECONDS
      SOLUTION SAMPLING STARTS AT TIME ..   60.000 SECONDS
      DAMPING RATIO .....................    0.2000
      NUMBER OF VARIABLE TIME STEPS .....        0
```

WAVE SPECTRUM EQUATION
======================

```
      SEA STATE ROW INDEX ...............        1
      WAVE SPECTRUM EQUATION TYPE .......        7 JONSWAP (CLASSIC)
      NUMBER OF WAVES IN SPECTRUM .......       30
      USE WAVE FREQUENCY OR PERIOD ...... FREQUENCY
      SEED FOR RANDOM WAVE PHASES .......        0
      MINIMUM FREQUENCY IN SPECTRUM .....    0.2094 RAD/SEC
      MAXIMUM FREQUENCY IN SPECTRUM .....    2.0944 RAD/SEC
      DIRECTION OF WAVE TRAVEL ..........  315.000 DEGREES
      1ST JONSWAP COEF. (ALPHA) ......... 0.0021000
      2ND JONSWAP COEF. (GAMMA) .........    1.000
      PEAK WAVE FREQUENCY ...............    0.8537 RAD/SEC
```

```
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OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP          PAGE  39
Pipelay Analysis
JOB NO. - Dynamic Analysis        LICENSED TO - OFFSHORE CONSTR. SPECIALISTS
USER ID - Karun                   DATE -  3/25/2015   TIME - 15:22:21   CASE   8
================================================================================
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                  I N P U T   D A T A   E C H O

BARGE MOTION RAO TABLE
======================

```
      SEA STATE NUMBER ..................        1
      USE PHASE LAG FOR RAOS ............        0
      VESSEL MOTIONS SIGN CONVENTION .... OFFPIPE
      USE WAVE FREQUENCY OR PERIOD ...... FREQUENCY
      RANDOM WAVE GENERATION SEED .......        0
```

WAVE FREQUENCY (RAD/SEC)	SURGE AMPLITUDE (M/M)	SURGE PHASE (DEG)	SWAY AMPLITUDE (M/M)	SWAY PHASE (DEG)	HEAVE AMPLITUDE (M/M)	HEAVE PHASE (DEG)
0.2513	1.3890	115.00	0.5060	144.00	1.0870	17.00
0.3142	1.0390	121.00	0.5950	144.00	1.0780	26.00
0.3307	0.9890	123.00	0.5980	145.00	1.0730	29.00
0.3491	0.9430	127.00	0.5980	145.00	1.0660	32.00
0.3696	0.9000	131.00	0.5890	147.00	1.0560	36.00
0.3927	0.8580	135.00	0.5740	150.00	1.0420	41.00
0.4189	0.8150	141.00	0.5530	154.00	1.0220	46.00
0.4333	0.7920	145.00	0.5400	156.00	1.0090	49.00
0.4488	0.7680	148.00	0.5240	159.00	0.9940	53.00
0.4654	0.7420	152.00	0.5060	163.00	0.9750	57.00
0.4833	0.7140	157.00	0.4880	169.00	0.9540	62.00
0.5027	0.6820	162.00	0.4720	175.00	0.9280	67.00
0.5236	0.6450	168.00	0.4740	-176.00	0.8960	72.00
0.5464	0.6040	175.00	0.4850	-171.00	0.8540	79.00
0.5712	0.5570	-177.00	0.4760	-168.00	0.8160	87.00

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    0.5984    0.5010    -168.00    0.4260    -164.00    0.7760     96.00
    0.6283    0.4360    -157.00    0.3630    -155.00    0.7270    107.00
    0.6614    0.3620    -145.00    0.3010    -143.00    0.6650    119.00
    0.6981    0.2830    -128.00    0.2380    -129.00    0.5890    132.00
    0.7392    0.2000    -108.00    0.1710    -112.00    0.4890    147.00
    0.7854    0.1130     -81.00    0.1000     -89.00    0.3590    165.00
    0.8378    0.0310      -8.00    0.0310     -48.00    0.2100   -164.00
    0.8976    0.0760     114.00    0.0340     113.00    0.1160   -101.00
    0.9666    0.1120     163.00    0.0680     164.00    0.1140    -32.00
    1.0472    0.1080    -134.00    0.0720    -141.00    0.0820     32.00
    1.1424    0.0850     -40.00    0.0410     -71.00    0.0380    121.00
    1.2566    0.0500      93.00    0.0100     137.00    0.0260    -85.00
    1.3963    0.0260     -75.00    0.0200     -69.00    0.0080     87.00
    1.5708    0.0050    -154.00    0.0050     -85.00    0.0010     51.00
    2.0944    0.0210      44.00    0.0020    -140.00    0.0640     76.00
```

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OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP   PAGE 40
Pipelay Analysis
JOB NO. - Dynamic Analysis   LICENSED TO - OFFSHORE CONSTR. SPECIALISTS
USER ID - Karun   DATE - 3/25/2015   TIME - 15:22:21   CASE   8
==

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

      WAVE   /------ ROLL ------/ /------ PITCH -----/ /------- YAW ------/
   FREQUENCY AMPLITUDE   PHASE   AMPLITUDE   PHASE   AMPLITUDE   PHASE
   (RAD/SEC) (DEG/M)   (DEG)   (DEG/M)   (DEG)   (DEG/M)   (DEG)
   ========= ========   ======= ========   ======= ========   =======
    0.2513   0.3270   93.00   0.2710   -73.00   0.3770   153.00
    0.3142   0.4900   98.00   0.4300   -65.00   0.2700   174.00
    0.3307   0.5420   101.00   0.4770   -62.00   0.2760   -176.00
    0.3491   0.6040   104.00   0.5320   -59.00   0.2910   -167.00
    0.3696   0.6900   107.00   0.5950   -56.00   0.3140   -159.00
    0.3927   0.8080   111.00   0.6700   -51.00   0.3440   -151.00
    0.4189   0.9790   115.00   0.7590   -46.00   0.3800   -143.00
    0.4333   1.0910   118.00   0.8090   -43.00   0.4010   -138.00
    0.4488   1.2460   120.00   0.8640   -40.00   0.4220   -134.00
    0.4654   1.4560   121.00   0.9220   -37.00   0.4440   -129.00
    0.4833   1.7500   120.00   0.9850   -33.00   0.4660   -124.00
    0.5027   2.1650   115.00   1.0490   -29.00   0.4890   -118.00
    0.5236   2.6080   101.00   1.1120   -24.00   0.5110   -111.00
    0.5464   2.8450   79.00   1.1830   -19.00   0.5360   -103.00
    0.5712   2.5730   52.00   1.2690   -13.00   0.5640   -95.00
    0.5984   1.8250   30.00   1.3500   -6.00   0.5870   -86.00
    0.6283   1.1000   20.00   1.4140   0.00   0.6010   -75.00
    0.6614   0.6310   20.00   1.4510   9.00   0.6050   -63.00
    0.6981   0.3370   20.00   1.4560   19.00   0.5970   -49.00
    0.7392   0.1570   10.00   1.4190   30.00   0.5710   -32.00
    0.7854   0.0920   -27.00   1.3170   43.00   0.5220   -12.00
    0.8378   0.1000   -47.00   1.0930   57.00   0.4390   12.00
    0.8976   0.0870   -35.00   0.6910   73.00   0.3150   42.00
    0.9666   0.0490   -2.00   0.2590   108.00   0.1590   82.00
    1.0472   0.0080   116.00   0.1010   -134.00   0.0200   -157.00
    1.1424   0.0350   -97.00   0.1160   -25.00   0.0990   -2.00
    1.2566   0.0220   -10.00   0.0240   73.00   0.0960   82.00
    1.3963   0.0160   -96.00   0.0130   -23.00   0.0080   -139.00
    1.5708   0.0060   -62.00   0.0040   -90.00   0.0270   139.00
    2.0944   0.0580   51.00   0.1670   67.00   0.0090   -108.00

PIPE TENSION DATA
=================
    STATIC PIPE TENSION ON LAY VESSEL .   250.000 K-NEWTON
    MINIMUM DYNAMIC PIPE TENSION ......   225.000 K-NEWTON
    MAXIMUM DYNAMIC PIPE TENSION ......   275.000 K-NEWTON
    STATIC HORIZONTAL BOTTOM TENSION ..   0.000 K-NEWTON
    NO. OF VALUES FOR TENSION PROFILE .   0
    VALUES ARE FOR PIPE SPAN ANALYSIS .   NO
    MAXIMUM PIPE PAYOUT SPEED ....   0.000 M/SEC
    MAXIMUM PIPE TAKEUP SPEED ....   0.000 M/SEC

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OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP   PAGE 41
Pipelay Analysis
JOB NO. - Dynamic Analysis   LICENSED TO - OFFSHORE CONSTR. SPECIALISTS
USER ID - Karun   DATE - 3/25/2015   TIME - 15:22:21   CASE   8
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               I N P U T   D A T A   E C H O

SAGBEND GEOMETRY
================
    SAGBEND PIPE ELEMENT LENGTH ....   6.000 METERS
    WATER DEPTH ....   21.34 METERS
    X-COORDINATE AT SPECIFIED DEPTH . .   0.00 METERS
    ESTIMATED SAGBEND X LENGTH ....   0.00 METERS
    ESTIMATED PIPE LENGTH ON SEABED ...   0.00 METERS
    X-COORD OF PIPE FREE END ON SEABED   0.00 METERS
    X-COORD POINT OF FIXITY ON SEABED .   0.00 METERS
    MAXIMUM SLOPE (ANGLE) OF SEABED ...   0.000 DEGREES
    DIRECTION OF MAXIMUM SLOPE ....   0.000 DEGREES

    PIPE/CABLE SPAN END CONDITION .....   0 PIPE/CABLE RESTING ON SEABED
    PIPE/CABLE SPAN LENGTH GIVEN BY ...   0 SPECIFIED PIPE/CABLE TENSION
    ESTIMATED SPAN DEPTH AT FREE END ..   0.00 METERS
    PIPE VERTICAL ANGLE AT FREE END ...   0.000 DEGREES
    BOTTOM HINGE OFFSET ....   0.000 METERS
    BOTTOM HINGE MINIMUM ANGLE ....   0.000 DEGREES
    BOTTOM HINGE MAXIMUM ANGLE ....   0.000 DEGREES
```

```
SOIL ELEMENT PROPERTIES
=======================
   SOIL PROPERTY TABLE ROW INDEX .....        0
   SOIL ELEMENT TYPE (FUTURE USE) ....        0
   PIPE INDEX OR SEGMENT NUMBER ......        0
   LONGITUDINAL SOIL STIFFNESS .......     0.00 KN/M^2
   VERTICAL SOIL STIFFNESS ...........     0.00 KN/M^2
   LATERAL SOIL STIFFNESS ............     0.00 KN/M^2
   DEFLECTION UNDER REFERENCE LOAD ...  0.0000 CM

   LONGITUDINAL COEF. OF FRICTION ....    0.500
   LATERAL COEFFICIENT OF FRICTION ...    0.000
   NUMBER 0F INTEGRATION POINTS ......        0

STATIC SOLUTION CONVERGED IN (     21 ) ITERATIONS

STATIC SOLUTION CONVERGED IN (     11 ) ITERATIONS

END OF INPUT DATA

=================================================================================
OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP        PAGE  42
Pipelay Analysis
JOB NO. - Dynamic Analysis      LICENSED TO - OFFSHORE CONSTR. SPECIALISTS
USER ID - Karun                 DATE - 3/25/2015  TIME - 15:22:21  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 ( 1)
====================
   PIPE SECTION LENGTH ..     0.00 M    ELASTIC MODULUS ......  207000. MPA
   OUTSIDE DIAMETER .....    27.310 CM  CROSS SECTIONAL AREA .   128.75 CM^2
   WALL THICKNESS .......     1.590 CM  MOMENT OF INERTIA ....  12671.5 CM^4
   WEIGHT/LENGTH IN AIR .  2205.00 N/M  YIELD STRESS .........   450.00 MPA
   SUBMERGED WGHT/LENG ..  1164.00 N/M  STRESS INTENS FACTOR .    1.000
   SPECIFIC GRAVITY .....     2.118     STEEL DENSITY ........  76982.0 N/M3
   WRAP COAT THICKNESS ..     0.280 CM  WRAP COAT DENSITY ....   9218.0 N/M3
   CONCRETE THICKNESS ...     4.000 CM  CONCRETE DENSITY .....  29846.0 N/M3

BARGE DATA
==========
   TOTAL PIPE TENSION ...   250.00 KN   RADIUS OF CURVATURE ..     0.00 M
   NUMBER OF TENSIONERS .        2      BARGE TRIM ANGLE .....    0.500 DEG
   NO. OF PIPE SUPPORTS .        7      PIPE ANGLE AT STERN ..    9.904 DEG
   BARGE HEADING ........    0.000 DEG  OFFSET FROM R.O.W. ...     0.00 M

STINGER DATA
============
   NO. OF PIPE SUPPORTS .        5      PIPE DEPTH AT STERN ..    -8.20 M
   NO. STINGER SECTIONS .        7      PIPE ANGLE AT STERN ..   17.336 DEG
   RADIUS OF CURVATURE ..   200.00 M    STINGER STERN DEPTH ..    -8.55 M
   STINGER LENGTH .......    39.00 M

SAGBEND DATA
============
   WATER DEPTH ..........    21.34 M    TENSION AT TOUCHDOWN .   209.82 KN
   TOUCHDOWN X-COORD. ...  -113.20 M    BOTTOM SLOPE ANGLE ...    0.000 DEG
   PROJECTED SPAN LENGTH    73.65 M     PIPE LENGTH GAIN .....     2.92 M

============================== SOLUTION SUMMARY ==============================
NODE  PIPE      X       Y       Z     SUPPORT REACT    TOTAL   TOTAL   PCT
NO.   SECTION  COORD   COORD   COORD   VERT    HORIZ   MOMENT  STRESS  YLD
               (M  )   (M  )   (M  )   (KN )   (KN )   (KN-M)  (MPA )  (%)
=============================================================================
  1  LAYBARGE   96.3    6.9     0.0    11.8     0.0      0.0     0.0    0.
  3  LAYBARGE   84.3    6.6     0.0    20.0     0.0     17.8    22.8    5.
  5  LAYBARGE   73.4    6.4     0.0    43.4     0.0     89.8   115.1   26.
  7  TENSIONR   60.1    5.9     0.0     4.5     0.0     45.6    68.0   15.
  9  LAYBARGE   51.1    5.7     0.0     0.0     0.0     38.8    59.2   13.
 10  LAYBARGE   46.4    5.5     0.0    62.5     0.0    155.5   208.5   46.
 12  LAYBARGE   39.4    5.2     0.0     0.0     0.0      2.1    12.1    3.
 13  TENSIONR   35.4    5.0     0.0    -8.5     0.0     34.4    63.1   14.
 15  LAYBARGE   26.1    4.5     0.0     0.0     0.0     91.1   135.7   30.
 16  LAYBARGE   23.3    4.3     0.0    56.6     0.0    173.2   240.8   54.
 18  LAYBARGE    8.9    2.7     0.0    61.1     0.0    206.5   283.1   63.
 20  LAYBARGE    3.1    1.8     0.0     0.0     0.0     69.5   107.6   24.

=================================================================================
OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP        PAGE  43
Pipelay Analysis
JOB NO. - Dynamic Analysis      LICENSED TO - OFFSHORE CONSTR. SPECIALISTS
USER ID - Karun                 DATE - 3/25/2015  TIME - 15:22:21  CASE   1
=================================================================================

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


 24  STINGER    -7.5   -0.1     0.0    12.9     0.0     61.6    97.2   22.
 26  STINGER   -16.5   -2.0     0.0    30.8     0.0    133.3   188.8   42.
 29  STINGER   -26.2   -4.3     0.0    14.7     0.0     97.6   142.9   32.
 31  STINGER   -36.6   -7.3     0.0    34.5     0.0    113.7   163.1   36.
 33  STINGER   -39.6   -8.2     0.0     0.0     0.0     51.9    84.0   19.
 41  SAGBEND   -80.2  -18.7     0.0     0.0     0.0    133.2   187.0   42.
 47  SEABED   -116.0  -21.4     0.0     5.7     0.0     46.8    76.2   17.

  =============================================================================================================
  OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP       DATE - 3/25/2015   TIME - 15:22:21  PAGE   44
  PROJECT - Pipelay Analysis                                                    JOB NO. - Dynamic Analysis
  USER ID - Karun                                   LICENSED TO - OFFSHORE CONSTR. SPECIALISTS        CASE   1
  =============================================================================================================
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U N I T Y   R A T I O S   F O R   D N V   O S - F 1 0 1

==
NODE   PIPE   /-------------------- DNV LIMIT STATES --------------------/
NO.   SECTION   BURST   COLLAPSE   BUCKLE   LOCAL BUCKLING*
                 PRESSURE PRESSURE   PROPAGATE LOAD CNTL. DISP CNTL.
==
   1   LAYBARGE   0.000   0.000   0.000   0.000   0.000
   3   LAYBARGE   0.000   0.000   0.000   0.003   0.017
   5   LAYBARGE   0.000   0.000   0.000   0.075   0.063
   7   TENSIONR   0.000   0.000   0.000   0.020   0.032
   9   LAYBARGE   0.000   0.000   0.000   0.014   0.027
  10   LAYBARGE   0.000   0.000   0.000   0.226   0.095
  12   LAYBARGE   0.000   0.000   0.000   0.000   0.000
  13   TENSIONR   0.000   0.000   0.000   0.012   0.019
  15   LAYBARGE   0.000   0.000   0.000   0.080   0.056
  16   LAYBARGE   0.000   0.000   0.000   0.284   0.100
  18   LAYBARGE   0.000   0.000   0.000   0.397   0.116
  20   LAYBARGE   0.000   0.000   0.000   0.043   0.041

  24   STINGER   0.000   0.000   0.000   0.034   0.037
  26   STINGER   0.000   0.001   0.002   0.184   0.083
  29   STINGER   0.000   0.001   0.004   0.094   0.062
  31   STINGER   0.000   0.002   0.007   0.130   0.073
  33   STINGER   0.000   0.002   0.008   0.029   0.036

  35   SAGBEND   0.000   0.003   0.010   0.006   0.016
  36   SAGBEND   0.000   0.003   0.011   0.049   0.048
  37   SAGBEND   0.000   0.004   0.013   0.092   0.064
  38   SAGBEND   0.000   0.004   0.015   0.125   0.074
  39   SAGBEND   0.000   0.004   0.016   0.147   0.080
  40   SAGBEND   0.000   0.005   0.017   0.160   0.083
  41   SAGBEND   0.000   0.005   0.018   0.167   0.085
  42   SAGBEND   0.000   0.005   0.019   0.167   0.085
  43   SAGBEND   0.000   0.005   0.020   0.161   0.084
  44   SAGBEND   0.000   0.005   0.020   0.144   0.080
  45   SAGBEND   0.000   0.006   0.021   0.116   0.073
  46   SAGBEND   0.000   0.006   0.021   0.073   0.060

  47   SEABED   0.000   0.006   0.021   0.023   0.036
  48   SEABED   0.000   0.006   0.021   0.002   0.007
  49   SEABED   0.000   0.006   0.021   0.000   0.006
  50   SEABED   0.000   0.006   0.021   0.000   0.006
  51   SEABED   0.000   0.006   0.021   0.000   0.006
  52   SEABED   0.000   0.006   0.021   0.000   0.006
  53   SEABED   0.000   0.006   0.021   0.000   0.006
  54   SEABED   0.000   0.006   0.021   0.000   0.006
  55   SEABED   0.000   0.006   0.021   0.000   0.006
  56   SEABED   0.000   0.006   0.021   0.000   0.006
  57   SEABED   0.000   0.006   0.021   0.000   0.006
  58   SEABED   0.000   0.006   0.021   0.000   0.006
  59   SEABED   0.000   0.006   0.021   0.000   0.006

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 OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP   DATE - 3/25/2015   TIME - 15:22:21   PAGE   45
 PROJECT - Pipelay Analysis   JOB NO. - Dynamic Analysis
 USER ID - Karun   LICENSED TO - OFFSHORE CONSTR. SPECIALISTS   CASE   1
==

         U N I T Y   R A T I O S   F O R   D N V   O S - F 1 0 1

==
NODE   PIPE   /-------------------- DNV LIMIT STATES --------------------/
NO.   SECTION   BURST   COLLAPSE   BUCKLE   LOCAL BUCKLING*
                 PRESSURE PRESSURE   PROPAGATE LOAD CNTL. DISP CNTL.
==
  60   SEABED   0.000   0.006   0.021   0.000   0.006
  61   SEABED   0.000   0.006   0.021   0.000   0.006
  62   SEABED   0.000   0.006   0.021   0.000   0.006

 ._____.
 | |
 | *NOTE: THE DNV LIMIT STATE INEQUALITIES FOR LOCAL BUCKLING UNDER |
 | THE COMBINED EFFECTS OF BENDING AND INTERNAL OR EXTERNAL |
 | PRESSURE ARE HIGHLY NONLINEAR. THE MAGNITUDE OF THE UNITY |
 | RATIOS FOR THESE TWO LIMIT STATES MAY SIGNIFICANTLY UNDER |
 | ESTIMATE HOW CLOSE THE PIPE IS TO EXCEEDING THESE LIMIT |
 | STATES. FOR THIS REASON, DNV REFERS TO THESE VALUES AS |
 | "INTERACTION RATIOS" RATHER THAN "UNITY RATIOS". |
 |_____|

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 OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP   DATE - 3/25/2015   TIME - 15:22:21   PAGE   46
 PROJECT - Pipelay Analysis   JOB NO. - Dynamic Analysis
 USER ID - Karun   LICENSED TO - OFFSHORE CONSTR. SPECIALISTS   CASE   1
==

      M A X I M U M   D Y N A M I C   P I P E   F O R C E S   A N D   S T R E S S E S

==
NODE   PIPE   X   Y   Z   HORIZ   VERT   PIPE   TENSILE   HOOP   BENDING STRESSES   TOTAL   PERCNT
NO.   SECTION   COORD   COORD   COORD   ANGLE   ANGLE   LENGTH STRESS   STRESS   VERT   HORIZ   STRESS   YIELD
                 (M)   (M)   (M)   (DEG)   (DEG) (M)   (MPA)   (MPA)   (MPA)   (MPA)   (MPA)   (PCT)
==
   1   LAYBARGE   96.30   6.94   0.00   0.000   1.659   0.00   0.00   0.00   0.00   0.00   0.00   0.00
   3   LAYBARGE   84.27   6.64   0.00   0.000   1.188   12.04   -0.14   0.00   -24.40   0.00   24.45   5.43
   5   LAYBARGE   73.44   6.37   0.00   0.000   1.950   22.87   -0.27   0.00 -116.48   0.00   116.61   25.91
   7   TENSIONR   60.09   5.89   0.00   0.000   1.640   36.22   11.51   0.00   59.42   0.00   70.62   15.69
   9   LAYBARGE   51.08   5.68   0.00   0.000   1.286   45.24   11.50   0.00   -50.25   0.00   61.23   13.61
  10   LAYBARGE   46.44   5.55   0.00   0.000   2.221   49.89   11.46   0.00 -200.41   0.00   211.62   47.03
  12   LAYBARGE   39.40   5.18   0.00   0.000   3.274   56.93   11.47   0.00   -5.87   0.00   16.06   3.57

13	TENSIONR	35.35	4.95	0.00	0.000	3.112	60.99	21.66	0.00	47.20	0.00	68.14	15.14
15	LAYBARGE	26.10	4.46	0.00	0.000	3.338	70.26	21.65	0.00	-125.68	0.00	146.50	32.56
16	LAYBARGE	23.34	4.28	0.00	0.000	4.110	73.02	21.61	0.00	-236.88	0.00	257.64	57.25
18	LAYBARGE	8.88	2.74	0.00	0.000	8.500	87.56	21.44	0.00	-346.75	0.00	367.37	81.64
20	LAYBARGE	3.09	1.76	0.00	0.000	10.572	93.44	21.38	0.00	-347.42	0.00	364.79	81.06
24	STINGER	-7.57	-0.43	0.00	0.000	11.997	104.23	21.12	-0.08	-275.11	0.00	293.80	65.29
26	STINGER	-16.48	-2.47	0.00	0.000	13.784	113.38	20.92	-0.29	-349.47	0.00	369.37	82.08
29	STINGER	-25.98	-4.99	0.00	0.000	15.221	123.33	20.68	-0.51	-283.58	0.00	303.26	67.39
31	STINGER	-36.40	-7.99	0.00	0.000	16.791	134.14	20.36	-0.80	-325.84	0.00	341.34	75.85
33	STINGER	-39.40	-8.90	0.00	0.000	17.157	137.27	20.27	-0.88	-205.95	0.00	221.42	49.20
35	SAGBEND	-45.15	-10.65	0.00	0.000	17.262	143.25	20.08	-1.04	143.11	0.00	162.03	36.01
36	SAGBEND	-50.89	-12.32	0.00	0.000	16.436	149.25	19.88	-1.18	174.67	0.00	191.33	42.52
37	SAGBEND	-56.66	-13.92	0.00	0.000	15.125	155.25	19.70	-1.31	196.47	0.00	211.94	47.10
38	SAGBEND	-62.49	-15.40	0.00	0.000	13.613	161.25	19.53	-1.43	221.06	0.00	236.07	52.46
39	SAGBEND	-68.34	-16.73	0.00	0.000	11.865	167.25	19.37	-1.54	223.30	0.00	237.83	52.85
40	SAGBEND	-74.23	-17.92	0.00	0.000	10.166	173.25	19.23	-1.63	229.51	0.00	243.62	54.14
41	SAGBEND	-80.14	-18.93	0.00	0.000	8.640	179.25	19.10	-1.71	236.11	0.00	249.84	55.52
42	SAGBEND	-86.08	-19.73	0.00	0.000	6.962	185.25	19.00	-1.77	241.48	0.00	255.11	56.69
43	SAGBEND	-92.05	-20.34	0.00	0.000	5.219	191.25	18.92	-1.81	226.90	0.00	240.46	53.44
44	SAGBEND	-98.03	-20.78	0.00	0.000	3.495	197.25	18.86	-1.83	184.54	0.00	198.66	44.15
45	SAGBEND	-104.02	-21.07	0.00	0.000	2.094	203.25	18.83	-1.85	159.51	0.00	173.84	38.63
46	SAGBEND	-110.01	-21.23	0.00	0.000	1.177	209.25	18.82	-1.85	135.08	0.00	149.37	33.19
47	SAGBEND	-116.01	-21.33	0.00	0.000	0.585	215.25	18.82	-1.85	98.98	0.00	116.96	25.99
48	SEABED	-122.01	-21.37	0.00	0.000	0.178	221.25	18.85	-1.85	61.79	0.00	80.66	17.92
49	SEABED	-128.01	-21.37	0.00	0.000	-0.014	227.25	18.87	-1.85	20.87	0.00	39.76	8.84
50	SEABED	-134.01	-21.37	0.00	0.000	-0.027	233.25	18.89	-1.85	-3.79	0.00	22.86	5.08
51	SEABED	-140.01	-21.37	0.00	0.000	-0.016	239.25	18.91	-1.85	-2.85	0.00	22.51	5.00
52	SEABED	-146.01	-21.37	0.00	0.000	-0.004	245.25	18.93	-1.84	-1.78	0.00	21.16	4.70
53	SEABED	-152.01	-21.37	0.00	0.000	0.001	251.25	18.95	-1.84	-0.59	0.00	20.22	4.49
54	SEABED	-158.01	-21.37	0.00	0.000	0.001	257.25	18.97	-1.84	0.14	0.00	20.00	4.45
55	SEABED	-164.01	-21.37	0.00	0.000	0.000	263.25	18.99	-1.84	0.10	0.00	20.06	4.46
56	SEABED	-170.01	-21.37	0.00	0.000	0.000	269.25	19.00	-1.84	0.06	0.00	20.03	4.45
57	SEABED	-176.01	-21.37	0.00	0.000	0.000	275.25	19.02	-1.84	-0.03	0.00	20.01	4.45
58	SEABED	-182.01	-21.37	0.00	0.000	0.000	281.25	19.04	-1.84	-0.03	0.00	20.03	4.45
59	SEABED	-188.01	-21.37	0.00	0.000	0.000	287.25	19.05	-1.84	-0.03	0.00	20.05	4.46

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  OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP        DATE - 3/25/2015    TIME - 15:22:21    PAGE   47
  PROJECT - Pipelay Analysis                                                        JOB NO. - Dynamic Analysis
  USER ID - Karun                                    LICENSED TO - OFFSHORE CONSTR. SPECIALISTS        CASE    1
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M A X I M U M   D Y N A M I C   P I P E   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)	HORIZ (MPA)	TOTAL STRESS (MPA)	PERCNT YIELD (PCT)
60	SEABED	-194.01	-21.37	0.00	0.000	0.000	293.25	19.07	-1.84	-0.02	0.00	20.06	4.46
61	SEABED	-200.01	-21.37	0.00	0.000	0.000	299.25	19.08	-1.84	0.01	0.00	20.07	4.46
62	SEABED	-206.01	-21.37	0.00	0.000	0.000	305.25	19.09	-1.84	0.00	0.00	20.08	4.46

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========================================================================================================
  OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP        DATE - 3/25/2015    TIME - 15:22:21    PAGE   48
  PROJECT - Pipelay Analysis                                                        JOB NO. - Dynamic Analysis
  USER ID - Karun                                    LICENSED TO - OFFSHORE CONSTR. SPECIALISTS        CASE    1
========================================================================================================
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M A X I M U M   D Y N A M I C   P I P E   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)	HORIZ (KN)	SUPT SEPARATIONS VERT (M)	HORIZ (M)	PIPE TENSION (KN)	BENDING MOMENTS VERT (KN-M)	HORIZ (KN-M)	TOTAL (KN-M)
1	LAYBARGE	96.30	6.94	0.00	11.96	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	LAYBARGE	84.27	6.64	0.00	20.50	0.00	0.00	0.00	-1.76	-19.05	0.00	19.05
5	LAYBARGE	73.44	6.37	0.00	43.87	0.00	0.00	0.00	-3.51	-90.97	0.00	90.97
7	TENSIONR	60.09	5.89	0.00	4.83	0.00	0.00	0.00	147.83	46.40	0.00	46.40
9	LAYBARGE	51.08	5.68	0.00	0.00	0.00	0.00	0.00	147.70	-39.24	0.00	39.24
10	LAYBARGE	46.44	5.55	0.00	63.65	0.00	0.00	0.00	147.27	-156.51	0.00	156.51
12	LAYBARGE	39.40	5.18	0.00	0.00	0.00	0.00	0.00	147.38	-4.59	0.00	4.59
13	TENSIONR	35.35	4.95	0.00	-9.73	0.00	0.00	0.00	278.28	36.86	0.00	36.86
15	LAYBARGE	26.10	4.46	0.00	62.67	0.00	0.00	0.00	278.12	-98.15	0.00	98.15
16	LAYBARGE	23.34	4.28	0.00	62.67	0.00	0.00	0.00	277.60	-185.00	0.00	185.00
18	LAYBARGE	8.88	2.74	0.00	73.84	0.00	0.00	0.00	275.47	-270.80	0.00	270.80
20	LAYBARGE	3.09	1.76	0.00	57.82	0.00	0.15	0.00	274.72	-271.32	0.00	271.32
24	STINGER	-7.57	-0.43	0.00	57.79	0.00	0.12	0.00	271.43	-214.85	0.00	214.85
26	STINGER	-16.48	-2.47	0.00	67.14	0.00	0.97	0.00	269.96	-272.93	0.00	272.93
29	STINGER	-25.98	-4.99	0.00	66.21	0.00	0.99	0.00	268.23	-221.47	0.00	221.47
31	STINGER	-36.40	-7.99	0.00	71.20	0.00	0.31	0.00	265.92	-254.47	0.00	254.47
33	STINGER	-39.40	-8.90	0.00	0.00	0.00	0.86	0.00	265.22	-160.84	0.00	160.84
35	SAGBEND	-45.15	-10.65	0.00	0.00	0.00	0.00	0.00	263.71	111.76	0.00	111.76
36	SAGBEND	-50.89	-12.32	0.00	0.00	0.00	0.00	0.00	262.18	136.41	0.00	136.41
37	SAGBEND	-56.66	-13.92	0.00	0.00	0.00	0.00	0.00	260.75	153.43	0.00	153.43
38	SAGBEND	-62.49	-15.40	0.00	0.00	0.00	0.00	0.00	259.42	172.64	0.00	172.64
39	SAGBEND	-68.34	-16.73	0.00	0.00	0.00	0.00	0.00	258.19	174.39	0.00	174.39
40	SAGBEND	-74.23	-17.92	0.00	0.00	0.00	0.00	0.00	257.08	179.24	0.00	179.24
41	SAGBEND	-80.14	-18.93	0.00	0.00	0.00	0.00	0.00	256.11	184.40	0.00	184.40
42	SAGBEND	-86.08	-19.73	0.00	0.00	0.00	0.00	0.00	255.31	188.59	0.00	188.59
43	SAGBEND	-92.05	-20.34	0.00	0.00	0.00	0.00	0.00	254.72	177.20	0.00	177.20
44	SAGBEND	-98.03	-20.78	0.00	0.12	0.00	0.00	0.00	254.34	144.12	0.00	144.12
45	SAGBEND	-104.02	-21.07	0.00	7.07	0.00	0.00	0.00	254.17	124.57	0.00	124.57
46	SAGBEND	-110.01	-21.23	0.00	12.60	0.00	0.00	0.00	254.19	105.49	0.00	105.49
47	SAGBEND	-116.01	-21.33	0.00	11.90	0.00	0.00	0.00	254.38	77.30	0.00	77.30

48	SEABED	-122.01	-21.37	0.00	10.43	0.00	0.00	0.00	254.70	48.26	0.00	48.26
49	SEABED	-128.01	-21.37	0.00	9.82	0.00	0.00	0.00	255.00	16.30	0.00	16.30
50	SEABED	-134.01	-21.37	0.00	8.86	0.00	0.00	0.00	255.27	-2.96	0.00	2.96
51	SEABED	-140.01	-21.37	0.00	7.73	0.00	0.00	0.00	255.53	-2.23	0.00	2.23
52	SEABED	-146.01	-21.37	0.00	7.10	0.00	0.00	0.00	255.79	-1.39	0.00	1.39
53	SEABED	-152.01	-21.37	0.00	7.00	0.00	0.00	0.00	256.03	-0.46	0.00	0.46
54	SEABED	-158.01	-21.37	0.00	7.00	0.00	0.00	0.00	256.27	0.11	0.00	0.11
55	SEABED	-164.01	-21.37	0.00	7.00	0.00	0.00	0.00	256.50	0.08	0.00	0.08
56	SEABED	-170.01	-21.37	0.00	6.99	0.00	0.00	0.00	256.72	0.04	0.00	0.04
57	SEABED	-176.01	-21.37	0.00	6.99	0.00	0.00	0.00	256.93	-0.02	0.00	0.02

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 OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP          DATE - 3/25/2015   TIME - 15:22:21   PAGE   49
 PROJECT - Pipelay Analysis                                             JOB NO. - Dynamic Analysis
 USER ID - Karun                                         LICENSED TO - OFFSHORE CONSTR. SPECIALISTS       CASE    1
========================================================================================================
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M A X I M U M   D Y N A M I C   P I P E   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)	HORIZ (KN)	SUPT SEPARATIONS VERT (M)	HORIZ (M)	PIPE TENSION (KN)	BENDING MOMENTS VERT (KN-M)	HORIZ (KN-M)	TOTAL (KN-M)
58	SEABED	-182.01	-21.37	0.00	6.99	0.00	0.00	0.00	257.14	-0.02	0.00	0.02
59	SEABED	-188.01	-21.37	0.00	6.99	0.00	0.00	0.00	257.34	-0.02	0.00	0.02
60	SEABED	-194.01	-21.37	0.00	6.99	0.00	0.00	0.00	257.54	-0.02	0.00	0.02
61	SEABED	-200.01	-21.37	0.00	6.99	0.00	0.00	0.00	257.72	0.01	0.00	0.01
62	SEABED	-206.01	-21.37	0.00	0.00	0.00	0.00	0.00	257.91	0.00	0.00	0.00

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========================================================================================================
 OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP          DATE - 3/25/2015   TIME - 15:22:21   PAGE   50
 PROJECT - Pipelay Analysis                                             JOB NO. - Dynamic Analysis
 USER ID - Karun                                         LICENSED TO - OFFSHORE CONSTR. SPECIALISTS       CASE    1
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U N I T Y   R A T I O S   F O R   D N V   O S - F 1 0 1

NODE NO.	PIPE SECTION	BURST PRESSURE	COLLAPSE PRESSURE	BUCKLE PROPAGATE	LOCAL BUCKLING* LOAD CNTL.	DISP CNTL.
1	LAYBARGE	0.000	0.000	0.000	0.000	0.000
3	LAYBARGE	0.000	0.000	0.000	0.003	0.018
5	LAYBARGE	0.000	0.000	0.000	0.076	0.064
7	TENSIONR	0.000	0.000	0.000	0.020	0.033
9	LAYBARGE	0.000	0.000	0.000	0.014	0.028
10	LAYBARGE	0.000	0.000	0.000	0.228	0.095
12	LAYBARGE	0.000	0.000	0.000	0.000	0.000
13	TENSIONR	0.000	0.000	0.000	0.013	0.020
15	LAYBARGE	0.000	0.000	0.000	0.087	0.058
16	LAYBARGE	0.000	0.000	0.000	0.307	0.103
18	LAYBARGE	0.000	0.000	0.000	0.632	0.141
20	LAYBARGE	0.000	0.000	0.000	0.751	0.153
24	STINGER	0.000	0.000	0.001	0.477	0.126
26	STINGER	0.000	0.001	0.003	0.689	0.147
29	STINGER	0.000	0.002	0.006	0.467	0.125
31	STINGER	0.000	0.002	0.009	0.609	0.143
33	STINGER	0.000	0.003	0.010	0.254	0.099
35	SAGBEND	0.000	0.003	0.012	0.130	0.074
36	SAGBEND	0.000	0.004	0.013	0.174	0.086
37	SAGBEND	0.000	0.004	0.015	0.211	0.094
38	SAGBEND	0.000	0.004	0.016	0.264	0.103
39	SAGBEND	0.000	0.005	0.017	0.265	0.104
40	SAGBEND	0.000	0.005	0.018	0.278	0.107
41	SAGBEND	0.000	0.005	0.019	0.295	0.110
42	SAGBEND	0.000	0.005	0.020	0.310	0.112
43	SAGBEND	0.000	0.005	0.020	0.271	0.106
44	SAGBEND	0.000	0.006	0.021	0.174	0.088
45	SAGBEND	0.000	0.006	0.021	0.134	0.079
46	SAGBEND	0.000	0.006	0.021	0.093	0.069
47	SAGBEND	0.000	0.006	0.021	0.054	0.053
48	SEABED	0.000	0.006	0.021	0.024	0.036
49	SEABED	0.000	0.006	0.021	0.003	0.011
50	SEABED	0.000	0.006	0.021	0.000	0.006
51	SEABED	0.000	0.006	0.021	0.000	0.006
52	SEABED	0.000	0.006	0.021	0.000	0.006
53	SEABED	0.000	0.006	0.021	0.000	0.006
54	SEABED	0.000	0.006	0.021	0.000	0.006
55	SEABED	0.000	0.006	0.021	0.000	0.006
56	SEABED	0.000	0.006	0.021	0.000	0.006
57	SEABED	0.000	0.006	0.021	0.000	0.006
58	SEABED	0.000	0.006	0.021	0.000	0.006
59	SEABED	0.000	0.006	0.021	0.000	0.006

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 OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP          DATE - 3/25/2015   TIME - 15:22:21   PAGE   51
 PROJECT - Pipelay Analysis                                             JOB NO. - Dynamic Analysis
 USER ID - Karun                                         LICENSED TO - OFFSHORE CONSTR. SPECIALISTS       CASE    1
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U N I T Y   R A T I O S   F O R   D N V   O S - F 1 0 1

NODE NO.	PIPE SECTION	BURST PRESSURE	COLLAPSE PRESSURE	BUCKLE PROPAGATE	LOCAL BUCKLING* LOAD CNTL.	DISP CNTL.

```
  60   SEABED       0.000      0.006      0.021      0.000      0.006
  61   SEABED       0.000      0.006      0.021      0.000      0.006
  62   SEABED       0.000      0.006      0.021      0.000      0.006


  ._____.
  |                                                        |
  | *NOTE: THE DNV LIMIT STATE INEQUALITIES FOR LOCAL BUCKLING UNDER |
  |       THE COMBINED EFFECTS OF BENDING AND INTERNAL OR EXTERNAL  |
  |       PRESSURE ARE HIGHLY NONLINEAR. THE MAGNITUDE OF THE UNITY |
  |       RATIOS FOR THESE TWO LIMIT STATES MAY SIGNIFICANTLY UNDER |
  |       ESTIMATE HOW CLOSE THE PIPE IS TO EXCEEDING THESE LIMIT   |
  |       STATES.  FOR THIS REASON, DNV REFERS TO THESE VALUES AS   |
  |       "INTERACTION RATIOS" RATHER THAN "UNITY RATIOS".          |
  |_____|
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OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP          PAGE  52
Pipelay Analysis
JOB NO. - Dynamic Analysis       LICENSED TO - OFFSHORE CONSTR. SPECIALISTS
USER ID - Karun                  DATE -  3/25/2015  TIME - 15:22:21   CASE   2
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          S T A T I C   S O L U T I O N   S U M M A R Y


PIPE PROPERTIES ( 1)
====================
  PIPE SECTION LENGTH ..     0.00 M    ELASTIC MODULUS ......   207000. MPA
  OUTSIDE DIAMETER .....    27.310 CM  CROSS SECTIONAL AREA .   128.75 CM^2
  WALL THICKNESS .......     1.590 CM  MOMENT OF INERTIA ....  12671.5 CM^4
  WEIGHT/LENGTH IN AIR .   2205.00 N/M YIELD STRESS .........   450.00 MPA
  SUBMERGED WGHT/LENG ..   1164.00 N/M STRESS INTENS FACTOR .    1.000
  SPECIFIC GRAVITY .....     2.118     STEEL DENSITY ........  76982.0 N/M3
  WRAP COAT THICKNESS ..     0.280 CM  WRAP COAT DENSITY ....   9218.0 N/M3
  CONCRETE THICKNESS ...     4.000 CM  CONCRETE DENSITY .....  29846.0 N/M3

BARGE DATA
==========
  TOTAL PIPE TENSION ...   250.00 KN   RADIUS OF CURVATURE ..     0.00 M
  NUMBER OF TENSIONERS .       2        BARGE TRIM ANGLE .....    0.500 DEG
  NO. OF PIPE SUPPORTS .       7        PIPE ANGLE AT STERN ..    9.965 DEG
  BARGE HEADING ........    0.000 DEG   OFFSET FROM R.O.W. ...    0.00 M

STINGER DATA
============
  NO. OF PIPE SUPPORTS .       5        PIPE DEPTH AT STERN ..    -8.33 M
  NO. STINGER SECTIONS .       7        PIPE ANGLE AT STERN ..   17.337 DEG
  RADIUS OF CURVATURE ..   200.00 M     STINGER STERN DEPTH ..    -8.69 M
  STINGER LENGTH .......    39.00 M

SAGBEND DATA
============
  WATER DEPTH ..........    21.34 M     TENSION AT TOUCHDOWN .   209.82 KN
  TOUCHDOWN X-COORD. ...  -112.74 M     BOTTOM SLOPE ANGLE ...    0.000 DEG
  PROJECTED SPAN LENGTH    73.22 M      PIPE LENGTH GAIN .....    2.93 M

========================= SOLUTION SUMMARY ============================
NODE   PIPE       X       Y       Z    SUPPORT REACT    TOTAL   TOTAL   PCT
NO. SECTION     COORD   COORD   COORD   VERT   HORIZ   MOMENT  STRESS   YLD
                (M  )   (M  )   (M  )   (KN )  (KN )   (KN-M)  (MPA )   (%)
==============================================================================
  1  LAYBARGE    96.3    6.9     0.0    11.8    0.0      0.0     0.0    0.
  3  LAYBARGE    84.3    6.6     0.0    20.0    0.0     17.8    22.8    5.
  5  LAYBARGE    73.4    6.4     0.0    43.4    0.0     89.8   115.1   26.
  7  TENSIONR    60.1    5.9     0.0     4.5    0.0     45.6    68.0   15.
  9  LAYBARGE    51.1    5.7     0.0     0.0    0.0     38.8    59.1   13.
 10  LAYBARGE    46.4    5.5     0.0    62.5    0.0    155.4   208.5   46.
 12  LAYBARGE    39.4    5.2     0.0     0.0    0.0      2.1    12.2    3.
 13  TENSIONR    35.4    5.0     0.0    -8.4    0.0     34.2    62.9   14.
 15  LAYBARGE    26.1    4.5     0.0     0.0    0.0     90.8   135.3   30.
 16  LAYBARGE    23.3    4.3     0.0    56.4    0.0    172.7   240.1   53.
 18  LAYBARGE     8.9    2.7     0.0    60.9    0.0    208.7   285.9   64.
 20  LAYBARGE     3.1    1.8     0.0     0.0    0.0     74.4   113.9   25.
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OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP          PAGE  53
Pipelay Analysis
JOB NO. - Dynamic Analysis       LICENSED TO - OFFSHORE CONSTR. SPECIALISTS
USER ID - Karun                  DATE -  3/25/2015  TIME - 15:22:21   CASE   2
==============================================================================
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          S T A T I C   S O L U T I O N   S U M M A R Y


 24  STINGER     -7.5   -0.2     0.0    17.1   -0.3     75.7   115.1   26.
 26  STINGER    -16.5   -2.1     0.0    26.9   -0.6    122.1   174.4   39.
 29  STINGER    -26.1   -4.5     0.0    15.3   -0.6     94.0   138.2   31.
 31  STINGER    -36.5   -7.4     0.0    33.5    1.6    107.7   155.5   35.
 33  STINGER    -39.5   -8.3     0.0     0.0   -2.6     47.7    78.5   17.
 41  SAGBEND    -80.1  -18.7     0.0     0.0    0.0    133.4   187.3   42.
 47  SEABED    -116.0  -21.4     0.0     6.3   -0.5     43.6    72.1   16.
```

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  OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP         DATE -  3/25/2015   TIME - 15:22:21   PAGE   54
  PROJECT - Pipelay Analysis                                                     JOB NO. - Dynamic Analysis
  USER ID - Karun                                       LICENSED TO - OFFSHORE CONSTR. SPECIALISTS         CASE   2
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          U N I T Y   R A T I O S   F O R   D N V   O S - F 1 0 1


==============================================================================
NODE     PIPE    /-------------------- DNV LIMIT STATES --------------------/
```

NO.	SECTION	BURST PRESSURE	COLLAPSE PRESSURE	BUCKLE PROPAGATE	LOCAL BUCKLING* LOAD CNTL.	DISP CNTL.
1	LAYBARGE	0.000	0.000	0.000	0.000	0.000
3	LAYBARGE	0.000	0.000	0.000	0.003	0.017
5	LAYBARGE	0.000	0.000	0.000	0.075	0.063
7	TENSIONR	0.000	0.000	0.000	0.020	0.032
9	LAYBARGE	0.000	0.000	0.000	0.014	0.027
10	LAYBARGE	0.000	0.000	0.000	0.226	0.095
12	LAYBARGE	0.000	0.000	0.000	0.000	0.000
13	TENSIONR	0.000	0.000	0.000	0.012	0.019
15	LAYBARGE	0.000	0.000	0.000	0.079	0.056
16	LAYBARGE	0.000	0.000	0.000	0.283	0.100
18	LAYBARGE	0.000	0.000	0.000	0.401	0.116
20	LAYBARGE	0.000	0.000	0.000	0.047	0.044
24	STINGER	0.000	0.000	0.000	0.053	0.047
26	STINGER	0.000	0.001	0.002	0.167	0.080
29	STINGER	0.000	0.001	0.004	0.090	0.061
31	STINGER	0.000	0.002	0.007	0.122	0.071
33	STINGER	0.000	0.002	0.008	0.026	0.034
35	SAGBEND	0.000	0.003	0.010	0.008	0.018
36	SAGBEND	0.000	0.003	0.012	0.050	0.048
37	SAGBEND	0.000	0.004	0.013	0.094	0.065
38	SAGBEND	0.000	0.004	0.015	0.126	0.074
39	SAGBEND	0.000	0.004	0.016	0.148	0.080
40	SAGBEND	0.000	0.005	0.017	0.161	0.083
41	SAGBEND	0.000	0.005	0.018	0.167	0.085
42	SAGBEND	0.000	0.005	0.019	0.167	0.085
43	SAGBEND	0.000	0.005	0.020	0.160	0.084
44	SAGBEND	0.000	0.005	0.020	0.144	0.080
45	SAGBEND	0.000	0.006	0.021	0.114	0.073
46	SAGBEND	0.000	0.006	0.021	0.070	0.059
47	SEABED	0.000	0.006	0.021	0.021	0.035
48	SEABED	0.000	0.006	0.021	0.002	0.006
49	SEABED	0.000	0.006	0.021	0.000	0.006
50	SEABED	0.000	0.006	0.021	0.000	0.006
51	SEABED	0.000	0.006	0.021	0.000	0.006
52	SEABED	0.000	0.006	0.021	0.000	0.006
53	SEABED	0.000	0.006	0.021	0.000	0.006
54	SEABED	0.000	0.006	0.021	0.000	0.006
55	SEABED	0.000	0.006	0.021	0.000	0.006
56	SEABED	0.000	0.006	0.021	0.000	0.006
57	SEABED	0.000	0.006	0.021	0.000	0.006
58	SEABED	0.000	0.006	0.021	0.000	0.006
59	SEABED	0.000	0.006	0.021	0.000	0.006

OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP   DATE - 3/25/2015   TIME - 15:22:21   PAGE   55
PROJECT - Pipelay Analysis   JOB NO. - Dynamic Analysis
USER ID - Karun   LICENSED TO - OFFSHORE CONSTR. SPECIALISTS   CASE   2

U N I T Y   R A T I O S   F O R   D N V   O S - F 1 0 1

NODE NO.	PIPE SECTION	BURST PRESSURE	COLLAPSE PRESSURE	BUCKLE PROPAGATE	LOCAL BUCKLING* LOAD CNTL.	DISP CNTL.
			DNV LIMIT STATES			
60	SEABED	0.000	0.006	0.021	0.000	0.006
61	SEABED	0.000	0.006	0.021	0.000	0.006
62	SEABED	0.000	0.006	0.021	0.000	0.006

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|                                                         |
| *NOTE: THE DNV LIMIT STATE INEQUALITIES FOR LOCAL BUCKLING UNDER |
|      THE COMBINED EFFECTS OF BENDING AND INTERNAL OR EXTERNAL   |
|      PRESSURE ARE HIGHLY NONLINEAR. THE MAGNITUDE OF THE UNITY  |
|      RATIOS FOR THESE TWO LIMIT STATES MAY SIGNIFICANTLY UNDER  |
|      ESTIMATE HOW CLOSE THE PIPE IS TO EXCEEDING THESE LIMIT    |
|      STATES.  FOR THIS REASON, DNV REFERS TO THESE VALUES AS    |
|      "INTERACTION RATIOS" RATHER THAN "UNITY RATIOS".           |
|_____|
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OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP   DATE - 3/25/2015   TIME - 15:22:21   PAGE   56
PROJECT - Pipelay Analysis   JOB NO. - Dynamic Analysis
USER ID - Karun   LICENSED TO - OFFSHORE CONSTR. SPECIALISTS   CASE   2

M A X I M U M   D Y N A M I C   P I P E   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)	HORIZ (MPA)	TOTAL STRESS (MPA)	PERCNT YIELD (PCT)
1	LAYBARGE	96.30	6.93	-0.01	-0.002	1.670	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	LAYBARGE	84.27	6.64	-0.01	-0.003	1.207	12.04	-0.16	0.00	-24.48	0.44	24.52	5.45
5	LAYBARGE	73.44	6.39	0.00	-0.002	1.969	22.87	-0.32	0.00	-116.35	-0.38	116.49	25.89
7	TENSIONR	60.10	5.88	0.00	-0.002	1.657	36.22	11.75	0.00	59.56	-0.32	70.72	15.72
9	LAYBARGE	51.08	5.68	0.00	-0.002	1.305	45.24	11.79	0.00	-50.39	0.18	61.34	13.63
10	LAYBARGE	46.44	5.55	0.00	-0.002	2.239	49.89	11.77	0.00	-201.06	0.57	212.27	47.17
12	LAYBARGE	39.41	5.19	0.00	-0.001	3.294	56.93	11.80	0.00	-6.04	0.06	16.59	3.69
13	TENSIONR	35.36	4.97	0.00	-0.001	3.136	60.99	21.59	0.00	48.75	-0.24	69.39	15.42
15	LAYBARGE	26.11	4.48	0.01	-0.001	3.351	70.26	21.57	0.00	-130.08	-0.33	150.55	33.46
16	LAYBARGE	23.35	4.31	0.01	0.000	4.116	73.02	21.53	0.00	-243.20	-0.86	263.58	58.57
18	LAYBARGE	8.90	2.76	0.00	0.003	8.470	87.56	21.34	0.00	-342.40	1.04	362.63	80.58
20	LAYBARGE	3.11	1.77	0.00	0.005	10.310	93.44	21.28	0.00	-296.49	0.95	313.00	69.56

24	STINGER	-7.54	-0.40	0.00	0.003	11.879	104.23	20.98	-0.09	-275.62	-2.22	295.77	65.73
26	STINGER	-16.49	-2.46	-0.01	0.007	13.826	113.38	20.76	-0.27	-328.23	-2.19	347.97	77.33
29	STINGER	-26.04	-4.97	-0.01	0.006	14.935	123.33	20.47	-0.50	-310.35	-2.68	330.42	73.43
31	STINGER	-36.45	-7.91	-0.01	0.012	17.034	134.14	20.11	-0.77	-339.06	3.97	354.57	78.79
33	STINGER	-39.44	-8.83	-0.01	0.000	17.339	137.27	20.00	-0.85	-213.07	-36.78	229.79	51.06
35	SAGBEND	-45.17	-10.65	-0.01	-0.079	17.135	143.25	19.78	-1.01	135.79	-15.56	154.70	34.38
36	SAGBEND	-50.90	-12.38	0.00	-0.082	16.559	149.25	19.57	-1.17	160.70	-11.84	179.49	39.89
37	SAGBEND	-56.67	-13.99	0.00	-0.084	15.520	155.25	19.37	-1.31	176.02	21.32	194.32	43.18
38	SAGBEND	-62.48	-15.44	0.01	-0.063	13.977	161.25	19.18	-1.43	193.26	24.52	208.90	46.42
39	SAGBEND	-68.32	-16.75	0.01	-0.036	12.167	167.25	19.01	-1.54	211.14	23.07	226.12	50.25
40	SAGBEND	-74.21	-17.88	0.01	0.044	10.333	173.25	18.86	-1.64	223.05	20.83	237.47	52.77
41	SAGBEND	-80.13	-18.85	0.00	0.088	8.567	179.25	18.74	-1.71	227.96	17.36	242.08	53.79
42	SAGBEND	-86.08	-19.64	0.00	0.110	6.778	185.25	18.64	-1.77	220.74	13.17	234.62	52.14
43	SAGBEND	-92.04	-20.26	0.00	0.118	5.086	191.25	18.57	-1.81	203.36	10.72	217.33	48.30
44	SAGBEND	-98.02	-20.71	0.00	0.090	3.588	197.25	18.52	-1.83	185.41	-9.77	199.54	44.34
45	SAGBEND	-104.01	-21.02	0.00	0.051	2.312	203.25	18.51	-1.84	158.57	-21.78	173.79	38.62
46	SAGBEND	-110.01	-21.20	0.00	0.012	1.364	209.25	18.51	-1.85	127.31	-32.36	144.71	32.16
47	SAGBEND	-116.01	-21.31	0.00	-0.004	0.704	215.25	18.53	-1.85	105.49	-26.38	124.11	27.58
48	SEABED	-122.01	-21.36	0.00	-0.016	0.248	221.25	18.55	-1.85	70.51	21.31	89.12	19.81
49	SEABED	-128.01	-21.37	0.00	0.000	0.010	227.25	18.57	-1.85	27.25	9.53	45.79	10.18
50	SEABED	-134.01	-21.37	0.00	0.000	-0.029	233.25	18.59	-1.85	-4.06	-1.96	22.58	5.02
51	SEABED	-140.01	-21.37	0.00	0.001	-0.019	239.25	18.60	-1.85	-2.97	0.76	21.71	4.83
52	SEABED	-146.01	-21.37	0.00	0.001	-0.006	245.25	18.62	-1.85	-1.99	0.57	20.65	4.59
53	SEABED	-152.01	-21.37	0.00	0.000	0.000	251.25	18.64	-1.84	-0.73	0.28	19.73	4.39
54	SEABED	-158.01	-21.37	0.00	0.000	0.001	257.25	18.65	-1.84	0.16	-0.28	19.75	4.39
55	SEABED	-164.01	-21.37	0.00	0.000	0.000	263.25	18.67	-1.84	0.12	-0.28	19.73	4.39
56	SEABED	-170.01	-21.37	0.00	0.000	0.000	269.25	18.68	-1.84	0.06	-0.28	19.74	4.39
57	SEABED	-176.01	-21.37	0.00	0.000	0.000	275.25	18.70	-1.84	-0.03	-0.28	19.74	4.39
58	SEABED	-182.01	-21.37	0.00	0.000	0.000	281.25	18.71	-1.84	-0.03	-0.28	19.71	4.38
59	SEABED	-188.01	-21.37	0.00	0.000	0.000	287.25	18.72	-1.84	-0.02	-0.30	19.75	4.39

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 OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP        DATE - 3/25/2015    TIME - 15:22:21    PAGE   57
 PROJECT - Pipelay Analysis                                           JOB NO. - Dynamic Analysis
 USER ID - Karun                                LICENSED TO - OFFSHORE CONSTR. SPECIALISTS           CASE    2
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M A X I M U M   D Y N A M I C   P I P E   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)	HORIZ (MPA)	TOTAL STRESS (MPA)	PERCNT YIELD (PCT)
60	SEABED	-194.01	-21.37	0.00	0.000	0.000	293.25	18.74	-1.84	-0.02	-0.39	19.83	4.41
61	SEABED	-200.01	-21.37	0.00	0.000	0.000	299.25	18.75	-1.84	-0.01	-0.43	19.87	4.41
62	SEABED	-206.01	-21.37	0.00	0.000	0.000	305.25	18.76	-1.84	0.00	0.00	19.75	4.39

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 OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP        DATE - 3/25/2015    TIME - 15:22:21    PAGE   58
 PROJECT - Pipelay Analysis                                           JOB NO. - Dynamic Analysis
 USER ID - Karun                                LICENSED TO - OFFSHORE CONSTR. SPECIALISTS           CASE    2
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M A X I M U M   D Y N A M I C   P I P E   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)	HORIZ (KN)	SUPT SEPARATIONS VERT (M)	HORIZ (M)	PIPE TENSION (KN)	BENDING MOMENTS VERT (KN-M)	HORIZ (KN-M)	TOTAL (KN-M)
1	LAYBARGE	96.30	6.93	-0.01	12.03	0.14	0.00	0.00	0.00	0.00	0.00	0.00
3	LAYBARGE	84.27	6.64	-0.01	20.64	0.31	0.00	0.00	-2.09	-19.12	0.34	19.12
5	LAYBARGE	73.44	6.39	0.00	43.80	0.21	0.00	0.00	-4.13	-90.86	-0.30	90.86
7	TENSIONR	60.10	5.88	0.00	4.91	0.16	0.00	0.00	150.93	46.51	-0.25	46.51
9	LAYBARGE	51.08	5.68	0.00	0.00	0.00	0.00	0.00	151.44	-39.36	0.14	39.36
10	LAYBARGE	46.44	5.55	0.00	63.92	0.24	0.00	0.00	151.19	-157.03	0.45	157.03
12	LAYBARGE	39.41	5.19	0.00	0.00	0.00	0.00	0.00	151.55	-4.72	0.04	4.72
13	TENSIONR	35.36	4.97	0.00	-10.29	-0.19	0.00	0.00	277.39	38.07	-0.19	38.07
15	LAYBARGE	26.11	4.48	0.01	0.00	0.00	0.00	0.00	277.10	-101.58	-0.26	101.59
16	LAYBARGE	23.35	4.31	0.01	64.74	-0.38	0.00	0.00	276.56	-189.93	-0.67	189.93
18	LAYBARGE	8.90	2.76	0.00	71.63	-0.39	0.00	0.00	274.17	-267.41	0.81	267.41
20	LAYBARGE	3.11	1.77	0.00	43.42	-0.49	0.17	0.00	273.35	-231.55	0.74	231.55
24	STINGER	-7.54	-0.40	0.00	58.60	-1.39	0.12	0.00	269.80	-215.25	-1.73	215.25
26	STINGER	-16.49	-2.46	-0.01	66.79	-2.10	0.58	0.00	268.23	-256.34	-1.71	256.34
29	STINGER	-26.04	-4.97	-0.01	57.65	-2.53	0.63	0.00	265.92	-242.38	-2.10	242.39
31	STINGER	-36.45	-7.91	-0.01	71.30	9.13	0.23	0.00	263.05	-264.80	3.10	264.81
33	STINGER	-39.44	-8.83	-0.01	-0.03	-15.12	0.73	0.00	262.19	-166.40	-28.72	167.38
35	SAGBEND	-45.17	-10.65	-0.01	0.00	0.00	0.00	0.00	260.41	106.05	-12.15	106.07
36	SAGBEND	-50.90	-12.38	0.00	0.00	0.00	0.00	0.00	258.63	125.50	-9.24	125.55
37	SAGBEND	-56.67	-13.99	0.00	0.00	0.00	0.00	0.00	256.98	137.47	16.65	137.55
38	SAGBEND	-62.48	-15.44	0.01	0.00	0.00	0.00	0.00	255.46	150.93	19.15	151.53
39	SAGBEND	-68.32	-16.75	0.01	0.00	0.00	0.00	0.00	254.07	164.89	18.02	165.48
40	SAGBEND	-74.21	-17.88	0.01	0.00	0.00	0.00	0.00	252.86	174.20	16.27	174.53
41	SAGBEND	-80.13	-18.85	0.00	0.00	0.00	0.00	0.00	251.85	178.03	13.56	178.22
42	SAGBEND	-86.08	-19.64	0.00	0.00	0.00	0.00	0.00	251.07	172.39	10.28	172.46
43	SAGBEND	-92.04	-20.26	0.00	0.00	0.00	0.00	0.00	250.53	158.82	8.37	158.82
44	SAGBEND	-98.02	-20.71	0.00	0.00	0.00	0.00	0.00	250.24	144.80	-7.63	144.80
45	SAGBEND	-104.01	-21.02	0.00	3.53	-1.70	0.00	0.00	250.19	123.84	-17.01	123.84
46	SAGBEND	-110.01	-21.20	0.00	10.22	-4.37	0.00	0.00	250.34	99.43	-25.27	99.43
47	SAGBEND	-116.01	-21.31	0.00	11.18	3.98	0.00	0.00	250.62	82.39	-20.60	82.40
48	SEABED	-122.01	-21.36	0.00	10.75	2.57	0.00	0.00	250.90	55.07	16.64	55.08
49	SEABED	-128.01	-21.37	0.00	9.70	0.91	0.00	0.00	251.14	21.28	7.44	21.34
50	SEABED	-134.01	-21.37	0.00	9.03	-0.70	0.00	0.00	251.37	-3.17	-1.53	3.19
51	SEABED	-140.01	-21.37	0.00	7.92	-0.38	0.00	0.00	251.59	-2.32	0.59	2.32
52	SEABED	-146.01	-21.37	0.00	7.20	0.15	0.00	0.00	251.81	-1.55	0.44	1.55

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 53   SEABED    -152.01   -21.37     0.00     6.98   -0.15     0.00    0.00    252.02   -0.57    0.22    0.58
 54   SEABED    -158.01   -21.37     0.00     7.00   -0.15     0.00    0.00    252.22    0.13   -0.22    0.23
 55   SEABED    -164.01   -21.37     0.00     7.00    0.15     0.00    0.00    252.42    0.09   -0.22    0.22
 56   SEABED    -170.01   -21.37     0.00     7.00    0.15     0.00    0.00    252.61    0.05   -0.22    0.22
 57   SEABED    -176.01   -21.37     0.00     7.00   -0.15     0.00    0.00    252.80   -0.02   -0.22    0.22
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OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP          DATE - 3/25/2015   TIME - 15:22:21   PAGE   59
PROJECT - Pipelay Analysis                                             JOB NO. - Dynamic Analysis
USER ID - Karun                                       LICENSED TO - OFFSHORE CONSTR. SPECIALISTS      CASE    2
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MAXIMUM DYNAMIC PIPE FORCES AND STRESSES

NODE NO.	PIPE SECTION	X COORD (M)	Y COORD (M)	Z COORD (M)	SUPPORT REACTION VERT (KN)	HORIZ (KN)	SUPT SEPARATIONS VERT (M)	HORIZ (M)	PIPE TENSION (KN)	BENDING MOMENTS VERT (KN-M)	HORIZ (KN-M)	TOTAL (KN-M)
58	SEABED	-182.01	-21.37	0.00	6.99	-0.15	0.00	0.00	252.98	-0.02	-0.22	0.22
59	SEABED	-188.01	-21.37	0.00	6.99	-0.15	0.00	0.00	253.15	-0.02	-0.23	0.23
60	SEABED	-194.01	-21.37	0.00	6.99	-0.14	0.00	0.00	253.32	-0.02	-0.30	0.30
61	SEABED	-200.01	-21.37	0.00	7.00	-0.09	0.00	0.00	253.48	-0.01	-0.33	0.33
62	SEABED	-206.01	-21.37	0.00	0.00	-0.01	0.00	0.00	253.63	0.00	0.00	0.00

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OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP          DATE - 3/25/2015   TIME - 15:22:21   PAGE   60
PROJECT - Pipelay Analysis                                             JOB NO. - Dynamic Analysis
USER ID - Karun                                       LICENSED TO - OFFSHORE CONSTR. SPECIALISTS      CASE    2
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UNITY RATIOS FOR DNV OS-F101

NODE NO.	PIPE SECTION	DNV LIMIT STATES BURST PRESSURE	COLLAPSE PRESSURE	BUCKLE PROPAGATE	LOCAL BUCKLING* LOAD CNTL.	DISP CNTL.
1	LAYBARGE	0.000	0.000	0.000	0.000	0.000
3	LAYBARGE	0.000	0.000	0.000	0.003	0.018
5	LAYBARGE	0.000	0.000	0.000	0.076	0.064
7	TENSIONR	0.000	0.000	0.000	0.020	0.033
9	LAYBARGE	0.000	0.000	0.000	0.014	0.028
10	LAYBARGE	0.000	0.000	0.000	0.228	0.095
12	LAYBARGE	0.000	0.000	0.000	0.000	0.000
13	TENSIONR	0.000	0.000	0.000	0.013	0.020
15	LAYBARGE	0.000	0.000	0.000	0.091	0.059
16	LAYBARGE	0.000	0.000	0.000	0.317	0.104
18	LAYBARGE	0.000	0.000	0.000	0.612	0.141
20	LAYBARGE	0.000	0.000	0.000	0.540	0.134
24	STINGER	0.000	0.000	0.001	0.480	0.126
26	STINGER	0.000	0.001	0.003	0.601	0.139
29	STINGER	0.000	0.002	0.006	0.566	0.136
31	STINGER	0.000	0.002	0.009	0.664	0.148
33	STINGER	0.000	0.003	0.010	0.276	0.103
35	SAGBEND	0.000	0.003	0.011	0.117	0.071
36	SAGBEND	0.000	0.004	0.013	0.146	0.078
37	SAGBEND	0.000	0.004	0.015	0.166	0.084
38	SAGBEND	0.000	0.004	0.016	0.197	0.092
39	SAGBEND	0.000	0.005	0.017	0.235	0.099
40	SAGBEND	0.000	0.005	0.018	0.262	0.104
41	SAGBEND	0.000	0.005	0.019	0.273	0.106
42	SAGBEND	0.000	0.005	0.020	0.254	0.103
43	SAGBEND	0.000	0.005	0.020	0.211	0.096
44	SAGBEND	0.000	0.006	0.021	0.175	0.089
45	SAGBEND	0.000	0.006	0.021	0.133	0.078
46	SAGBEND	0.000	0.006	0.021	0.086	0.064
47	SAGBEND	0.000	0.006	0.021	0.062	0.056
48	SEABED	0.000	0.006	0.021	0.032	0.041
49	SEABED	0.000	0.006	0.021	0.005	0.016
50	SEABED	0.000	0.006	0.021	0.000	0.006
51	SEABED	0.000	0.006	0.021	0.000	0.006
52	SEABED	0.000	0.006	0.021	0.000	0.006
53	SEABED	0.000	0.006	0.021	0.000	0.006
54	SEABED	0.000	0.006	0.021	0.000	0.006
55	SEABED	0.000	0.006	0.021	0.000	0.006
56	SEABED	0.000	0.006	0.021	0.000	0.006
57	SEABED	0.000	0.006	0.021	0.000	0.006
58	SEABED	0.000	0.006	0.021	0.000	0.006
59	SEABED	0.000	0.006	0.021	0.000	0.006

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OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP          DATE - 3/25/2015   TIME - 15:22:21   PAGE   61
PROJECT - Pipelay Analysis                                             JOB NO. - Dynamic Analysis
USER ID - Karun                                       LICENSED TO - OFFSHORE CONSTR. SPECIALISTS      CASE    2
===========================================================================================================
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UNITY RATIOS FOR DNV OS-F101

NODE NO.	PIPE SECTION	DNV LIMIT STATES BURST PRESSURE	COLLAPSE PRESSURE	BUCKLE PROPAGATE	LOCAL BUCKLING* LOAD CNTL.	DISP CNTL.
60	SEABED	0.000	0.006	0.021	0.000	0.006
61	SEABED	0.000	0.006	0.021	0.000	0.006
62	SEABED	0.000	0.006	0.021	0.000	0.006

```
    |                                                         |
    | *NOTE: THE DNV LIMIT STATE INEQUALITIES FOR LOCAL BUCKLING UNDER |
    |        THE COMBINED EFFECTS OF BENDING AND INTERNAL OR EXTERNAL  |
    |        PRESSURE ARE HIGHLY NONLINEAR. THE MAGNITUDE OF THE UNITY |
    |        RATIOS FOR THESE TWO LIMIT STATES MAY SIGNIFICANTLY UNDER |
    |        ESTIMATE HOW CLOSE THE PIPE IS TO EXCEEDING THESE LIMIT   |
    |        STATES.  FOR THIS REASON, DNV REFERS TO THESE VALUES AS   |
    |        "INTERACTION RATIOS" RATHER THAN "UNITY RATIOS".          |
    |_____|
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OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP          PAGE  62
Pipelay Analysis
JOB NO. - Dynamic Analysis        LICENSED TO - OFFSHORE CONSTR. SPECIALISTS
USER ID - Karun                   DATE - 3/25/2015  TIME - 15:22:21   CASE   3
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          S T A T I C   S O L U T I O N   S U M M A R Y


PIPE PROPERTIES ( 1)
=====================
  PIPE SECTION LENGTH ..     0.00 M     ELASTIC MODULUS ......   207000. MPA
  OUTSIDE DIAMETER .....    27.310 CM   CROSS SECTIONAL AREA .   128.75 CM^2
  WALL THICKNESS .......     1.590 CM   MOMENT OF INERTIA ....  12671.5 CM^4
  WEIGHT/LENGTH IN AIR .   2205.00 N/M  YIELD STRESS .........   450.00 MPA
  SUBMERGED WGHT/LENG ..   1164.00 N/M  STRESS INTENS FACTOR .     1.000
  SPECIFIC GRAVITY .....      2.118     STEEL DENSITY ........  76982.0 N/M3
  WRAP COAT THICKNESS ..     0.280 CM   WRAP COAT DENSITY ....   9218.0 N/M3
  CONCRETE THICKNESS ...     4.000 CM   CONCRETE DENSITY .....  29846.0 N/M3

BARGE DATA
==========
  TOTAL PIPE TENSION ...   250.00 KN    RADIUS OF CURVATURE ..     0.00 M
  NUMBER OF TENSIONERS .        2       BARGE TRIM ANGLE .....     0.500 DEG
  NO. OF PIPE SUPPORTS .        7       PIPE ANGLE AT STERN ..     9.823 DEG
  BARGE HEADING ........    0.000 DEG   OFFSET FROM R.O.W. ...     0.00 M

STINGER DATA
============
  NO. OF PIPE SUPPORTS .        5       PIPE DEPTH AT STERN ..    -8.02 M
  NO. STINGER SECTIONS .        7       PIPE ANGLE AT STERN ..    17.333 DEG
  RADIUS OF CURVATURE ..   200.00 M     STINGER STERN DEPTH ..    -8.37 M
  STINGER LENGTH .......    39.00 M

SAGBEND DATA
============
  WATER DEPTH ..........    21.34 M     TENSION AT TOUCHDOWN .   209.81 KN
  TOUCHDOWN X-COORD. ...  -113.79 M     BOTTOM SLOPE ANGLE ...     0.000 DEG
  PROJECTED SPAN LENGTH    74.20 M      PIPE LENGTH GAIN .....     2.91 M

============================== SOLUTION SUMMARY ==============================
NODE  PIPE       X      Y      Z     SUPPORT REACT   TOTAL   TOTAL   PCT
NO.   SECTION  COORD  COORD  COORD   VERT   HORIZ   MOMENT  STRESS   YLD
               (M  )  (M  )  (M  )   (KN )   (KN )   (KN-M)  (MPA )   (%)
=============================================================================
  1  LAYBARGE   96.3    6.9    0.0   11.8    0.0     0.0     0.0     0.
  3  LAYBARGE   84.3    6.6    0.0   20.0    0.0    17.8    22.8     5.
  5  LAYBARGE   73.4    6.4    0.0   43.4    0.0    89.8   115.1    26.
  7  TENSIONR   60.1    5.9    0.0    4.5    0.0    45.6    68.0    15.
  9  LAYBARGE   51.1    5.7    0.0    0.0    0.0    38.8    59.2    13.
 10  LAYBARGE   46.4    5.5    0.0   62.5    0.0   155.5   208.6    46.
 12  LAYBARGE   39.4    5.2    0.0    0.0    0.0     2.0    11.9     3.
 13  TENSIONR   35.4    5.0    0.0   -8.6    0.0    34.5    63.3    14.
 15  LAYBARGE   26.1    4.5    0.0    0.0    0.0    91.6   136.3    30.
 16  LAYBARGE   23.3    4.3    0.0   57.0    0.0   173.9   241.7    54.
 18  LAYBARGE    8.9    2.7    0.0   61.2    0.0   203.7   279.5    62.
 20  LAYBARGE    3.1    1.8    0.0    0.0    0.1    63.1    99.4    22.
```

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================================================================================
OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP          PAGE  63
Pipelay Analysis
JOB NO. - Dynamic Analysis        LICENSED TO - OFFSHORE CONSTR. SPECIALISTS
USER ID - Karun                   DATE - 3/25/2015  TIME - 15:22:21   CASE   3
================================================================================
```

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


 24  STINGER    -7.5   -0.1    0.0    7.3   -0.7    43.4    73.8    16.
 26  STINGER   -16.5   -1.9    0.0   36.0   -1.2   148.0   207.5    46.
 29  STINGER   -26.2   -4.2    0.0   13.9   -1.2   102.2   148.7    33.
 31  STINGER   -36.6   -7.1    0.0   35.8    3.2   121.9   173.6    39.
 33  STINGER   -39.6   -8.0    0.0    0.0   -5.2    59.1    93.2    21.
 42  SAGBEND   -86.1  -19.5    0.1    0.0    0.0   133.3   187.1    42.
 47  SEABED   -116.0  -21.4    0.0    4.9   -0.9    51.2    81.8    18.
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  OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP    DATE - 3/25/2015   TIME - 15:22:21   PAGE   64
  PROJECT - Pipelay Analysis                                              JOB NO. - Dynamic Analysis
  USER ID - Karun                              LICENSED TO - OFFSHORE CONSTR. SPECIALISTS        CASE   3
================================================================================
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       U N I T Y   R A T I O S   F O R   D N V   O S - F 1 0 1


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NODE   PIPE     /--------------------- DNV LIMIT STATES ---------------------/
NO.    SECTION     BURST     COLLAPSE    BUCKLE      LOCAL BUCKLING*
                  PRESSURE   PRESSURE   PROPAGATE   LOAD CNTL.  DISP CNTL.
================================================================================
   1   LAYBARGE    0.000      0.000      0.000       0.000       0.000
   3   LAYBARGE    0.000      0.000      0.000       0.003       0.017
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    5   LAYBARGE     0.000       0.000       0.000       0.075       0.063
    7   TENSIONR     0.000       0.000       0.000       0.020       0.032
    9   LAYBARGE     0.000       0.000       0.000       0.014       0.027
   10   LAYBARGE     0.000       0.000       0.000       0.226       0.095
   12   LAYBARGE     0.000       0.000       0.000       0.000       0.000
   13   TENSIONR     0.000       0.000       0.000       0.012       0.019
   15   LAYBARGE     0.000       0.000       0.000       0.080       0.056
   16   LAYBARGE     0.000       0.000       0.000       0.285       0.100
   18   LAYBARGE     0.000       0.000       0.000       0.390       0.115
   20   LAYBARGE     0.000       0.000       0.000       0.038       0.039

   24   STINGER      0.000       0.000       0.000       0.018       0.026
   26   STINGER      0.000       0.000       0.002       0.207       0.088
   29   STINGER      0.000       0.001       0.004       0.099       0.064
   31   STINGER      0.000       0.002       0.007       0.141       0.075
   33   STINGER      0.000       0.002       0.007       0.008       0.033       0.039

   35   SAGBEND      0.000       0.003       0.010       0.005       0.013
   36   SAGBEND      0.000       0.003       0.011       0.047       0.047
   37   SAGBEND      0.000       0.003       0.013       0.091       0.064
   38   SAGBEND      0.000       0.004       0.014       0.124       0.074
   39   SAGBEND      0.000       0.004       0.016       0.146       0.079
   40   SAGBEND      0.000       0.005       0.017       0.160       0.083
   41   SAGBEND      0.000       0.005       0.018       0.167       0.085
   42   SAGBEND      0.000       0.005       0.019       0.168       0.085
   43   SAGBEND      0.000       0.005       0.020       0.161       0.084
   44   SAGBEND      0.000       0.005       0.020       0.146       0.081
   45   SAGBEND      0.000       0.005       0.020       0.118       0.074
   46   SAGBEND      0.000       0.006       0.021       0.076       0.061

   47   SEABED       0.000       0.006       0.021       0.025       0.038
   48   SEABED       0.000       0.006       0.021       0.002       0.009
   49   SEABED       0.000       0.006       0.021       0.000       0.006
   50   SEABED       0.000       0.006       0.021       0.000       0.006
   51   SEABED       0.000       0.006       0.021       0.000       0.006
   52   SEABED       0.000       0.006       0.021       0.000       0.006
   53   SEABED       0.000       0.006       0.021       0.000       0.006
   54   SEABED       0.000       0.006       0.021       0.000       0.006
   55   SEABED       0.000       0.006       0.021       0.000       0.006
   56   SEABED       0.000       0.006       0.021       0.000       0.006
   57   SEABED       0.000       0.006       0.021       0.000       0.006
   58   SEABED       0.000       0.006       0.021       0.000       0.006
   59   SEABED       0.000       0.006       0.021       0.000       0.006
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 OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP          DATE - 3/25/2015   TIME - 15:22:21   PAGE   65
 PROJECT - Pipelay Analysis                                                      JOB NO. - Dynamic Analysis
 USER ID - Karun                                         LICENSED TO - OFFSHORE CONSTR. SPECIALISTS      CASE   3
====================================================================================================
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U N I T Y   R A T I O S   F O R   D N V   O S - F 1 0 1

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===========================================================================
NODE    PIPE    /-------------------- DNV LIMIT STATES --------------------/
NO.    SECTION     BURST     COLLAPSE     BUCKLE      LOCAL BUCKLING*
                  PRESSURE   PRESSURE    PROPAGATE   LOAD CNTL.  DISP CNTL.
===========================================================================
   60   SEABED       0.000       0.006       0.021       0.000       0.006
   61   SEABED       0.000       0.006       0.021       0.000       0.006
   62   SEABED       0.000       0.006       0.021       0.000       0.006
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 ._____.
 |                                                       |
 | *NOTE: THE DNV LIMIT STATE INEQUALITIES FOR LOCAL BUCKLING UNDER |
 |        THE COMBINED EFFECTS OF BENDING AND INTERNAL OR EXTERNAL  |
 |        PRESSURE ARE HIGHLY NONLINEAR. THE MAGNITUDE OF THE UNITY |
 |        RATIOS FOR THESE TWO LIMIT STATES MAY SIGNIFICANTLY UNDER |
 |        ESTIMATE HOW CLOSE THE PIPE IS TO EXCEEDING THESE LIMIT   |
 |        STATES.  FOR THIS REASON, DNV REFERS TO THESE VALUES AS   |
 |        "INTERACTION RATIOS" RATHER THAN "UNITY RATIOS".          |
 |_____|
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 OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP          DATE - 3/25/2015   TIME - 15:22:21   PAGE   66
 PROJECT - Pipelay Analysis                                                      JOB NO. - Dynamic Analysis
 USER ID - Karun                                         LICENSED TO - OFFSHORE CONSTR. SPECIALISTS      CASE   3
====================================================================================================
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M A X I M U M   D Y N A M I C   P I P E   F O R C E S   A N D   S T R E S S E S

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============================================================================================================================
NODE  PIPE        X       Y       Z      HORIZ    VERT    PIPE    TENSILE   HOOP   BENDING STRESSES   TOTAL    PERCNT
NO.   SECTION   COORD   COORD   COORD    ANGLE   ANGLE   LENGTH   STRESS   STRESS    VERT    HORIZ    STRESS    YIELD
                (M  )   (M  )   (M  )    (DEG )  (DEG )   (M  )    (MPA )   (MPA )   (MPA )   (MPA )   (MPA )    (PCT )
============================================================================================================================
   1   LAYBARGE   96.32    6.93    0.02    0.001   1.648     0.00     0.00    0.00     0.00     0.00     0.00     0.00
   3   LAYBARGE   84.29    6.64    0.02   -0.001   1.183    12.04    -0.14    0.00   -24.60    -1.10    24.66     5.48
   5   LAYBARGE   73.46    6.37    0.02    0.001   1.946    22.87    -0.28    0.00  -116.78     1.50   116.87    25.97
   7   TENSIONR   60.11    5.88    0.02    0.001   1.632    36.22    11.60    0.00    60.16    -1.14    71.54    15.90
   9   LAYBARGE   51.10    5.67    0.01   -0.001   1.283    45.24    11.61    0.00   -50.41     0.65    61.57    13.68
  10   LAYBARGE   46.46    5.54    0.01    0.001   2.217    49.89    11.58    0.00  -201.17     2.38   212.76    47.28
  12   LAYBARGE   39.42    5.18    0.01    0.001   3.271    56.93    11.59    0.00    -5.77     0.24    16.10     3.58
  13   TENSIONR   35.37    4.95    0.01    0.001   3.105    60.99    21.53    0.00    46.88    -0.72    67.33    14.96
  15   LAYBARGE   26.11    4.46    0.01    0.002   3.333    70.26    21.49    0.00  -125.78     1.26   145.57    32.35
  16   LAYBARGE   23.35    4.29    0.01    0.002   4.093    73.02    21.45    0.00  -236.02     2.77   256.75    57.06
  18   LAYBARGE    8.90    2.74    0.01    0.002   8.359    87.56    21.26    0.00  -342.61     3.07   362.44    80.54
  20   LAYBARGE    3.10    1.80    0.01    0.002  10.170    93.44    21.19    0.00  -176.37     1.20   196.21    43.60

  24   STINGER    -7.53   -0.19    0.01   -0.010  11.444   104.23    20.94   -0.06  -235.60    -4.10   255.77    56.84
  26   STINGER   -16.48   -2.11    0.00   -0.006  13.161   113.38    20.70   -0.24  -270.99    -6.17   290.95    64.66
  29   STINGER   -26.10   -4.55    0.00   -0.001  14.527   123.33    20.45   -0.46  -267.29    -5.66   284.80    63.29
  31   STINGER   -36.55   -7.42    0.00    0.006  16.661   134.14    20.11   -0.72  -299.99     6.92   315.53    70.12
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| 33 | STINGER | -39.54 | -8.32 | 0.00 | -0.017 | 17.083 | 137.27 | 20.00 | -0.80 | -186.80 | -46.26 | 206.20 | 45.82 |

35	SAGBEND	-45.25	-10.10	0.00	-0.112	17.166	143.25	19.77	-0.95	102.06	-23.67	121.43	26.98
36	SAGBEND	-50.99	-11.86	0.01	-0.165	16.620	149.25	19.55	-1.10	130.87	-9.64	149.95	33.32
37	SAGBEND	-56.75	-13.54	0.02	-0.171	15.500	155.25	19.35	-1.23	151.26	11.30	170.11	37.80
38	SAGBEND	-62.55	-15.07	0.03	-0.126	14.116	161.25	19.16	-1.36	171.25	15.24	185.99	41.33
39	SAGBEND	-68.38	-16.41	0.04	-0.061	12.572	167.25	19.00	-1.47	192.25	17.67	206.89	45.98
40	SAGBEND	-74.26	-17.64	0.04	-0.038	10.902	173.25	18.86	-1.57	203.70	18.85	218.20	48.49
41	SAGBEND	-80.17	-18.70	0.04	-0.017	9.148	179.25	18.74	-1.66	207.96	17.57	222.46	49.44
42	SAGBEND	-86.10	-19.57	0.05	0.029	7.366	185.25	18.64	-1.73	206.46	16.75	220.86	49.08
43	SAGBEND	-92.06	-20.24	0.06	0.052	5.637	191.25	18.57	-1.78	196.92	15.01	211.08	46.91
44	SAGBEND	-98.04	-20.73	0.06	0.069	3.932	197.25	18.52	-1.82	179.69	11.88	193.33	42.96
45	SAGBEND	-104.03	-21.06	0.05	0.078	2.432	203.25	18.49	-1.84	156.13	-11.05	170.40	37.87
46	SAGBEND	-110.03	-21.25	0.04	0.126	1.275	209.25	18.49	-1.85	127.17	-23.89	143.54	31.90

47	SEABED	-116.02	-21.34	0.02	0.164	0.520	215.25	18.50	-1.85	95.02	-28.46	113.53	25.23
48	SEABED	-122.02	-21.37	0.01	0.116	0.112	221.25	18.52	-1.85	50.52	-26.76	70.88	15.75
49	SEABED	-128.02	-21.38	0.00	0.040	-0.038	227.25	18.55	-1.85	13.53	-15.46	34.52	7.67
50	SEABED	-134.02	-21.37	0.00	-0.003	-0.033	233.25	18.57	-1.85	-3.74	-4.40	23.13	5.14
51	SEABED	-140.02	-21.37	0.00	-0.005	-0.014	239.25	18.59	-1.85	-2.77	0.71	21.74	4.83
52	SEABED	-146.02	-21.37	0.00	-0.003	-0.003	245.25	18.61	-1.84	-1.43	0.72	20.36	4.53
53	SEABED	-152.02	-21.37	0.00	-0.001	0.001	251.25	18.62	-1.84	-0.37	0.35	19.70	4.38
54	SEABED	-158.02	-21.37	0.00	0.000	0.001	257.25	18.64	-1.84	0.12	0.26	19.72	4.38
55	SEABED	-164.02	-21.37	0.00	0.000	0.000	263.25	18.66	-1.84	0.08	0.27	19.72	4.38
56	SEABED	-170.02	-21.37	0.00	0.000	0.000	269.25	18.68	-1.84	0.04	0.26	19.71	4.38
57	SEABED	-176.02	-21.37	0.00	0.000	0.000	275.25	18.69	-1.84	0.01	0.25	19.72	4.38
58	SEABED	-182.02	-21.37	0.00	0.000	0.000	281.25	18.71	-1.84	0.00	0.26	19.74	4.39
59	SEABED	-188.02	-21.37	0.00	0.000	0.000	287.25	18.72	-1.84	0.00	0.32	19.76	4.39

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 OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP          DATE - 3/25/2015    TIME - 15:22:21    PAGE  67
 PROJECT - Pipelay Analysis                                             JOB NO. - Dynamic Analysis
 USER ID - Karun                              LICENSED TO - OFFSHORE CONSTR. SPECIALISTS             CASE    3
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M A X I M U M   D Y N A M I C   P I P E   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)	HORIZ (MPA)	TOTAL STRESS (MPA)	PERCNT YIELD (PCT)
60	SEABED	-194.02	-21.37	0.00	0.000	0.000	293.25	18.74	-1.84	0.00	0.44	19.79	4.40
61	SEABED	-200.02	-21.37	0.00	0.000	0.000	299.25	18.75	-1.84	0.00	0.51	19.82	4.40
62	SEABED	-206.02	-21.37	0.00	0.000	0.000	305.25	18.77	-1.84	0.00	0.00	19.75	4.39

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 OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP          DATE - 3/25/2015    TIME - 15:22:21    PAGE  68
 PROJECT - Pipelay Analysis                                             JOB NO. - Dynamic Analysis
 USER ID - Karun                              LICENSED TO - OFFSHORE CONSTR. SPECIALISTS             CASE    3
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M A X I M U M   D Y N A M I C   P I P E   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)	HORIZ (KN)	SUPT SEPARATIONS VERT (M)	HORIZ (M)	PIPE TENSION (KN)	BENDING MOMENTS VERT (KN-M)	HORIZ (KN-M)	TOTAL (KN-M)
1	LAYBARGE	96.32	6.93	0.02	12.27	-0.33	0.00	0.00	0.00	0.00	0.00	0.00
3	LAYBARGE	84.29	6.64	0.02	21.13	-0.82	0.00	0.00	-1.80	-19.21	-0.86	19.21
5	LAYBARGE	73.46	6.37	0.02	44.58	-0.89	0.00	0.00	-3.58	-91.20	1.17	91.21
7	TENSIONR	60.11	5.88	0.02	5.81	-0.78	0.00	0.00	149.05	46.98	-0.89	46.98
9	LAYBARGE	51.10	5.67	0.01	0.00	0.00	0.00	0.00	149.21	-39.37	0.51	39.37
10	LAYBARGE	46.46	5.54	0.01	64.43	-1.07	0.00	0.00	148.77	-157.11	1.86	157.12
12	LAYBARGE	39.42	5.18	0.01	0.00	0.00	0.00	0.00	148.85	-4.51	0.19	4.51
13	TENSIONR	35.37	4.95	0.01	-9.60	-0.59	0.00	0.00	276.56	36.61	-0.56	36.61
15	LAYBARGE	26.11	4.46	0.01	0.00	0.00	0.00	0.00	276.14	-98.23	0.98	98.23
16	LAYBARGE	23.35	4.29	0.01	62.67	-1.14	0.00	0.00	275.55	-184.32	2.16	184.32
18	LAYBARGE	8.90	2.74	0.01	72.93	-1.07	0.00	0.00	273.11	-267.57	2.40	267.57
20	LAYBARGE	3.10	1.80	0.01	9.43	0.37	0.15	0.00	272.23	-137.74	0.94	137.74

24	STINGER	-7.53	-0.19	0.01	53.15	-2.68	0.08	0.00	269.10	-184.00	-3.20	184.00
26	STINGER	-16.48	-2.11	0.00	46.88	-3.90	0.37	0.00	267.04	-211.64	-4.82	211.65
29	STINGER	-26.10	-4.55	0.00	42.10	-3.09	0.38	0.00	265.16	-208.75	-4.42	208.75
31	STINGER	-36.55	-7.42	0.00	62.94	13.59	0.00	0.00	262.59	-234.29	5.41	234.29
33	STINGER	-39.54	-8.32	0.00	0.14	-17.37	0.43	0.00	261.74	-145.89	-36.13	148.93

35	SAGBEND	-45.25	-10.10	0.00	0.00	0.00	0.00	0.00	259.93	79.70	-18.49	79.75
36	SAGBEND	-50.99	-11.86	0.01	0.00	0.00	0.00	0.00	258.12	102.20	-7.53	102.24
37	SAGBEND	-56.75	-13.54	0.02	0.00	0.00	0.00	0.00	256.46	118.13	8.83	118.15
38	SAGBEND	-62.55	-15.07	0.03	0.00	0.00	0.00	0.00	254.97	133.74	11.90	133.86
39	SAGBEND	-68.38	-16.41	0.04	0.00	0.00	0.00	0.00	253.68	150.14	13.80	150.30
40	SAGBEND	-74.26	-17.64	0.04	0.00	0.00	0.00	0.00	252.57	159.08	14.72	159.23
41	SAGBEND	-80.17	-18.70	0.04	0.00	0.00	0.00	0.00	251.65	162.41	13.73	162.83
42	SAGBEND	-86.10	-19.57	0.05	0.00	0.00	0.00	0.00	250.91	161.24	13.08	161.33
43	SAGBEND	-92.06	-20.24	0.06	0.00	0.00	0.00	0.00	250.37	153.79	11.72	153.92
44	SAGBEND	-98.04	-20.73	0.06	0.00	0.00	0.00	0.00	250.04	140.34	9.28	140.34
45	SAGBEND	-104.03	-21.06	0.05	0.22	-0.30	0.00	0.00	249.92	121.93	-8.63	121.96
46	SAGBEND	-110.03	-21.25	0.04	6.45	-2.41	0.00	0.00	250.01	99.31	-18.66	99.50

47	SEABED	-116.02	-21.34	0.02	10.53	-3.99	0.00	0.00	250.25	74.21	-22.23	74.39
48	SEABED	-122.02	-21.37	0.01	10.32	-3.97	0.00	0.00	250.58	39.46	-20.90	41.11
49	SEABED	-128.02	-21.38	0.00	9.64	1.00	0.00	0.00	250.86	10.57	-12.07	12.91
50	SEABED	-134.02	-21.37	0.00	8.58	0.93	0.00	0.00	251.12	-2.92	-3.44	4.00
51	SEABED	-140.02	-21.37	0.00	7.51	0.61	0.00	0.00	251.38	-2.17	0.55	2.17
52	SEABED	-146.02	-21.37	0.00	7.02	0.29	0.00	0.00	251.63	-1.11	0.56	1.14
53	SEABED	-152.02	-21.37	0.00	6.97	-0.20	0.00	0.00	251.86	-0.29	0.28	0.30
54	SEABED	-158.02	-21.37	0.00	6.99	-0.20	0.00	0.00	252.10	0.09	0.20	0.21
55	SEABED	-164.02	-21.37	0.00	7.00	-0.20	0.00	0.00	252.32	0.06	0.21	0.22
56	SEABED	-170.02	-21.37	0.00	7.00	-0.21	0.00	0.00	252.54	0.03	0.20	0.21
57	SEABED	-176.02	-21.37	0.00	7.00	-0.21	0.00	0.00	252.75	0.01	0.20	0.20

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 OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP          DATE - 3/25/2015   TIME - 15:22:21   PAGE   69
 PROJECT - Pipelay Analysis                                             JOB NO. - Dynamic Analysis
 USER ID - Karun                                        LICENSED TO - OFFSHORE CONSTR. SPECIALISTS         CASE    3
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M A X I M U M   D Y N A M I C   P I P E   F O R C E S   A N D   S T R E S S E S

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=========================================================================================================
NODE   PIPE        X        Y        Z     SUPPORT REACTION   SUPT SEPARATIONS    PIPE         BENDING MOMENTS
NO.    SECTION    COORD    COORD    COORD    VERT     HORIZ     VERT     HORIZ    TENSION    VERT     HORIZ    TOTAL
                  (M  )    (M  )    (M  )    (KN )    (KN )     (M  )    (M  )     (KN )    (KN-M)   (KN-M)   (KN-M)
=========================================================================================================
 58    SEABED    -182.02  -21.37    0.00     7.00    -0.21     0.00     0.00     252.95    0.00     0.21     0.21
 59    SEABED    -188.02  -21.37    0.00     7.00    -0.21     0.00     0.00     253.15    0.00     0.25     0.25
 60    SEABED    -194.02  -21.37    0.00     7.00    -0.19     0.00     0.00     253.34    0.00     0.35     0.35
 61    SEABED    -200.02  -21.37    0.00     7.00    -0.12     0.00     0.00     253.53    0.00     0.40     0.40
 62    SEABED    -206.02  -21.37    0.00     0.00    -0.02     0.00     0.00     253.70    0.00     0.00     0.00
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 OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP          DATE - 3/25/2015   TIME - 15:22:21   PAGE   70
 PROJECT - Pipelay Analysis                                             JOB NO. - Dynamic Analysis
 USER ID - Karun                                        LICENSED TO - OFFSHORE CONSTR. SPECIALISTS         CASE    3
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U N I T Y   R A T I O S   F O R   D N V   O S - F 1 0 1

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=================================================================
NODE   PIPE     /-------------------- DNV LIMIT STATES --------------------/
NO.    SECTION   BURST    COLLAPSE   BUCKLE      LOCAL BUCKLING*
                PRESSURE  PRESSURE  PROPAGATE  LOAD CNTL.  DISP CNTL.
=================================================================
  1    LAYBARGE   0.000    0.000     0.000      0.000       0.000
  3    LAYBARGE   0.000    0.000     0.000      0.003       0.018
  5    LAYBARGE   0.000    0.000     0.000      0.076       0.064
  7    TENSIONR   0.000    0.000     0.000      0.020       0.033
  9    LAYBARGE   0.000    0.000     0.000      0.014       0.028
 10    LAYBARGE   0.000    0.000     0.000      0.229       0.095
 12    LAYBARGE   0.000    0.000     0.000      0.000       0.000
 13    TENSIONR   0.000    0.000     0.000      0.013       0.020
 15    LAYBARGE   0.000    0.000     0.000      0.087       0.058
 16    LAYBARGE   0.000    0.000     0.000      0.306       0.103
 18    LAYBARGE   0.000    0.000     0.000      0.614       0.140
 20    LAYBARGE   0.000    0.000     0.000      0.182       0.082

 24    STINGER    0.000    0.000     0.001      0.347       0.109
 26    STINGER    0.000    0.001     0.003      0.394       0.116
 29    STINGER    0.000    0.001     0.005      0.410       0.120
 31    STINGER    0.000    0.002     0.008      0.510       0.133
 33    STINGER    0.000    0.002     0.009      0.216       0.093

 35    SAGBEND    0.000    0.003     0.011      0.065       0.054
 36    SAGBEND    0.000    0.003     0.012      0.093       0.064
 37    SAGBEND    0.000    0.004     0.014      0.118       0.072
 38    SAGBEND    0.000    0.004     0.015      0.149       0.082
 39    SAGBEND    0.000    0.004     0.017      0.189       0.091
 40    SAGBEND    0.000    0.005     0.018      0.213       0.096
 41    SAGBEND    0.000    0.005     0.019      0.223       0.098
 42    SAGBEND    0.000    0.005     0.020      0.218       0.097
 43    SAGBEND    0.000    0.005     0.020      0.197       0.093
 44    SAGBEND    0.000    0.005     0.020      0.168       0.086
 45    SAGBEND    0.000    0.006     0.021      0.130       0.078
 46    SAGBEND    0.000    0.006     0.021      0.086       0.065

 47    SEABED     0.000    0.006     0.021      0.050       0.051
 48    SEABED     0.000    0.006     0.021      0.017       0.031
 49    SEABED     0.000    0.006     0.021      0.002       0.008
 50    SEABED     0.000    0.006     0.021      0.000       0.006
 51    SEABED     0.000    0.006     0.021      0.000       0.006
 52    SEABED     0.000    0.006     0.021      0.000       0.006
 53    SEABED     0.000    0.006     0.021      0.000       0.006
 54    SEABED     0.000    0.006     0.021      0.000       0.006
 55    SEABED     0.000    0.006     0.021      0.000       0.006
 56    SEABED     0.000    0.006     0.021      0.000       0.006
 57    SEABED     0.000    0.006     0.021      0.000       0.006
 58    SEABED     0.000    0.006     0.021      0.000       0.006
 59    SEABED     0.000    0.006     0.021      0.000       0.006
```

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=========================================================================================================
 OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP          DATE - 3/25/2015   TIME - 15:22:21   PAGE   71
 PROJECT - Pipelay Analysis                                             JOB NO. - Dynamic Analysis
 USER ID - Karun                                        LICENSED TO - OFFSHORE CONSTR. SPECIALISTS         CASE    3
=========================================================================================================
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U N I T Y   R A T I O S   F O R   D N V   O S - F 1 0 1

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=================================================================
NODE   PIPE     /-------------------- DNV LIMIT STATES --------------------/
NO.    SECTION   BURST    COLLAPSE   BUCKLE      LOCAL BUCKLING*
                PRESSURE  PRESSURE  PROPAGATE  LOAD CNTL.  DISP CNTL.
=================================================================
 60    SEABED     0.000    0.006     0.021      0.000       0.006
 61    SEABED     0.000    0.006     0.021      0.000       0.006
 62    SEABED     0.000    0.006     0.021      0.000       0.006
```

```
 ._____.
 |                                                        |
 | *NOTE: THE DNV LIMIT STATE INEQUALITIES FOR LOCAL BUCKLING UNDER |
 |        THE COMBINED EFFECTS OF BENDING AND INTERNAL OR EXTERNAL  |
 |        PRESSURE ARE HIGHLY NONLINEAR. THE MAGNITUDE OF THE UNITY |
 |        RATIOS FOR THESE TWO LIMIT STATES MAY SIGNIFICANTLY UNDER |
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```
              |      ESTIMATE HOW CLOSE THE PIPE IS TO EXCEEDING THESE LIMIT     |
              |      STATES.  FOR THIS REASON, DNV REFERS TO THESE VALUES AS      |
              |      "INTERACTION RATIOS" RATHER THAN "UNITY RATIOS".             |
              |_____|
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================================================================================
OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP         PAGE  72
Pipelay Analysis
JOB NO. - Dynamic Analysis       LICENSED TO - OFFSHORE CONSTR. SPECIALISTS
USER ID - Karun                  DATE - 3/25/2015   TIME - 15:22:21   CASE   4
================================================================================
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             S T A T I C   S O L U T I O N   S U M M A R Y


PIPE PROPERTIES ( 1)
====================
   PIPE SECTION LENGTH ..     0.00 M     ELASTIC MODULUS ......   207000. MPA
   OUTSIDE DIAMETER .....    27.310 CM   CROSS SECTIONAL AREA .   128.75 CM^2
   WALL THICKNESS .......     1.590 CM   MOMENT OF INERTIA ....  12671.5 CM^4
   WEIGHT/LENGTH IN AIR .   2205.00 N/M  YIELD STRESS .........   450.00 MPA
   SUBMERGED WGHT/LENG ..   1164.00 N/M  STRESS INTENS FACTOR .   1.000
   SPECIFIC GRAVITY .....     2.118      STEEL DENSITY ........  76982.0 N/M3
   WRAP COAT THICKNESS ..     0.280 CM   WRAP COAT DENSITY ....   9218.0 N/M3
   CONCRETE THICKNESS ...     4.000 CM   CONCRETE DENSITY .....  29846.0 N/M3

BARGE DATA
==========
   TOTAL PIPE TENSION ...   250.00 KN    RADIUS OF CURVATURE ..     0.00 M
   NUMBER OF TENSIONERS .        2        BARGE TRIM ANGLE .....    0.500 DEG
   NO. OF PIPE SUPPORTS .        7        PIPE ANGLE AT STERN ..    9.594 DEG
   BARGE HEADING ........    0.000 DEG   OFFSET FROM R.O.W. ...     0.00 M

STINGER DATA
============
   NO. OF PIPE SUPPORTS .        5        PIPE DEPTH AT STERN ..    -7.68 M
   NO. STINGER SECTIONS .        7        PIPE ANGLE AT STERN ..   17.345 DEG
   RADIUS OF CURVATURE ..   200.00 M     STINGER STERN DEPTH ..    -8.02 M
   STINGER LENGTH .......    39.00 M

SAGBEND DATA
============
   WATER DEPTH ..........    21.34 M     TENSION AT TOUCHDOWN .   209.80 KN
   TOUCHDOWN X-COORD. ...  -114.89 M     BOTTOM SLOPE ANGLE ...    0.000 DEG
   PROJECTED SPAN LENGTH    75.23 M      PIPE LENGTH GAIN .....     2.90 M

============================= SOLUTION SUMMARY ============================
NODE  PIPE      X       Y       Z     SUPPORT REACT   TOTAL   TOTAL   PCT
NO.  SECTION  COORD   COORD   COORD    VERT   HORIZ   MOMENT  STRESS  YLD
              (M  )   (M  )   (M  )   (KN )   (KN )   (KN-M)  (MPA )  (%)
==========================================================================
   1  LAYBARGE   96.3    6.9    0.0    11.8    0.0     0.0     0.0    0.
   3  LAYBARGE   84.3    6.6    0.0    20.0    0.0    17.7    22.8    5.
   5  LAYBARGE   73.4    6.4    0.0    43.4    0.0    89.8   115.1   26.
   7  TENSIONR   60.1    5.9    0.0     4.5    0.0    45.7    68.0   15.
   9  LAYBARGE   51.1    5.7    0.0     0.0    0.0    38.9    59.3   13.
  10  LAYBARGE   46.4    5.5    0.0    62.6    0.0   155.7   208.8   46.
  12  LAYBARGE   39.4    5.2    0.0     0.0    0.0     1.6    11.5    3.
  13  TENSIONR   35.4    5.0    0.0    -8.9    0.0    35.2    64.2   14.
  15  LAYBARGE   26.1    4.5    0.0     0.0    0.0    93.4   138.6   31.
  16  LAYBARGE   23.3    4.3    0.0    58.1    0.0   176.6   245.1   54.
  18  LAYBARGE    8.9    2.7    0.0    60.1    0.0   193.4   266.3   59.
  20  LAYBARGE    3.1    1.8    0.0     0.0    0.1    50.5    83.3   19.
```

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================================================================================
OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP         PAGE  73
Pipelay Analysis
JOB NO. - Dynamic Analysis       LICENSED TO - OFFSHORE CONSTR. SPECIALISTS
USER ID - Karun                  DATE - 3/25/2015   TIME - 15:22:21   CASE   4
================================================================================
```

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


  24  STINGER    -7.6    0.0    0.0     0.0   -0.3    18.1    41.4    9.
  26  STINGER   -16.5   -1.7    0.0    42.7   -0.6   168.5   233.8   52.
  29  STINGER   -26.2   -3.9    0.0    14.0   -0.6   114.6   164.6   37.
  31  STINGER   -36.7   -6.8    0.0    37.7    1.7   135.8   191.5   43.
  33  STINGER   -39.7   -7.7    0.0     0.0   -2.7    69.1   106.0   24.
  42  SAGBEND   -86.1  -19.3    0.0     0.0    0.0   133.3   187.1   42.
  47  SEABED   -116.0  -21.4    0.0     3.5   -0.5    59.0    91.8   20.
```

```
  ===============================================================================================
  OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP        DATE - 3/25/2015   TIME - 15:22:21    PAGE   74
  PROJECT - Pipelay Analysis                                                       JOB NO. - Dynamic Analysis
  USER ID - Karun                                      LICENSED TO - OFFSHORE CONSTR. SPECIALISTS        CASE    4
  ===============================================================================================
```

```
      U N I T Y   R A T I O S   F O R   D N V   O S - F 1 0 1


================================================================================
NODE    PIPE    /--------------------- DNV LIMIT STATES ---------------------/
NO.   SECTION     BURST     COLLAPSE    BUCKLE       LOCAL BUCKLING*
                 PRESSURE   PRESSURE   PROPAGATE   LOAD CNTL.  DISP CNTL.
================================================================================
   1   LAYBARGE    0.000      0.000      0.000      0.000       0.000
   3   LAYBARGE    0.000      0.000      0.000      0.003       0.017
   5   LAYBARGE    0.000      0.000      0.000      0.075       0.063
   7   TENSIONR    0.000      0.000      0.000      0.020       0.032
   9   LAYBARGE    0.000      0.000      0.000      0.014       0.027
  10   LAYBARGE    0.000      0.000      0.000      0.226       0.095
  12   LAYBARGE    0.000      0.000      0.000      0.000       0.000
```

13	TENSIONR	0.000	0.000	0.000	0.012	0.019
15	LAYBARGE	0.000	0.000	0.000	0.082	0.056
16	LAYBARGE	0.000	0.000	0.000	0.290	0.101
18	LAYBARGE	0.000	0.000	0.000	0.368	0.112
20	LAYBARGE	0.000	0.000	0.000	0.030	0.034
24	STINGER	0.000	0.000	0.000	0.008	0.015
26	STINGER	0.000	0.000	0.002	0.241	0.094
29	STINGER	0.000	0.001	0.004	0.114	0.068
31	STINGER	0.000	0.002	0.007	0.160	0.080
33	STINGER	0.000	0.002	0.007	0.041	0.043
35	SAGBEND	0.000	0.002	0.009	0.004	0.009
36	SAGBEND	0.000	0.003	0.011	0.044	0.045
37	SAGBEND	0.000	0.003	0.013	0.088	0.063
38	SAGBEND	0.000	0.004	0.014	0.121	0.073
39	SAGBEND	0.000	0.004	0.016	0.144	0.079
40	SAGBEND	0.000	0.005	0.017	0.159	0.083
41	SAGBEND	0.000	0.005	0.018	0.166	0.085
42	SAGBEND	0.000	0.005	0.019	0.168	0.085
43	SAGBEND	0.000	0.005	0.020	0.162	0.084
44	SAGBEND	0.000	0.005	0.020	0.148	0.081
45	SAGBEND	0.000	0.005	0.020	0.121	0.075
46	SAGBEND	0.000	0.006	0.021	0.080	0.063
47	SEABED	0.000	0.006	0.021	0.030	0.041
48	SEABED	0.000	0.006	0.021	0.004	0.014
49	SEABED	0.000	0.006	0.021	0.000	0.006
50	SEABED	0.000	0.006	0.021	0.000	0.006
51	SEABED	0.000	0.006	0.021	0.000	0.006
52	SEABED	0.000	0.006	0.021	0.000	0.006
53	SEABED	0.000	0.006	0.021	0.000	0.006
54	SEABED	0.000	0.006	0.021	0.000	0.006
55	SEABED	0.000	0.006	0.021	0.000	0.006
56	SEABED	0.000	0.006	0.021	0.000	0.006
57	SEABED	0.000	0.006	0.021	0.000	0.006
58	SEABED	0.000	0.006	0.021	0.000	0.006
59	SEABED	0.000	0.006	0.021	0.000	0.006

UNITY RATIOS FOR DNV OS-F101

===
NODE	PIPE	/---------------------- DNV LIMIT STATES ----------------------/				
NO.	SECTION	BURST	COLLAPSE	BUCKLE	LOCAL BUCKLING*	
		PRESSURE	PRESSURE	PROPAGATE	LOAD CNTL.	DISP CNTL.
===
60	SEABED	0.000	0.006	0.021	0.000	0.006
61	SEABED	0.000	0.006	0.021	0.000	0.006
62	SEABED	0.000	0.006	0.021	0.000	0.006

```
._____.
|                                                      |
| *NOTE: THE DNV LIMIT STATE INEQUALITIES FOR LOCAL BUCKLING UNDER |
|       THE COMBINED EFFECTS OF BENDING AND INTERNAL OR EXTERNAL |
|       PRESSURE ARE HIGHLY NONLINEAR. THE MAGNITUDE OF THE UNITY |
|       RATIOS FOR THESE TWO LIMIT STATES MAY SIGNIFICANTLY UNDER |
|       ESTIMATE HOW CLOSE THE PIPE IS TO EXCEEDING THESE LIMIT |
|       STATES.  FOR THIS REASON, DNV REFERS TO THESE VALUES AS |
|       "INTERACTION RATIOS" RATHER THAN "UNITY RATIOS".        |
|_____|
```

MAXIMUM DYNAMIC PIPE FORCES AND STRESSES

===
NODE	PIPE	X	Y	Z	HORIZ	VERT	PIPE	TENSILE	HOOP	BENDING STRESSES		TOTAL	PERCNT
NO.	SECTION	COORD	COORD	COORD	ANGLE	ANGLE	LENGTH	STRESS	STRESS	VERT	HORIZ	STRESS	YIELD
		(M)	(M)	(M)	(DEG)	(DEG)	(M)	(MPA)	(MPA)	(MPA)	(MPA)	(MPA)	(PCT)
===
1	LAYBARGE	96.29	6.92	-0.01	-0.014	1.649	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	LAYBARGE	84.26	6.63	0.00	-0.015	1.184	12.04	-0.16	0.00	-25.65	0.66	25.70	5.71
5	LAYBARGE	73.43	6.37	0.00	-0.014	1.945	22.87	-0.32	0.00	-117.27	0.38	117.35	26.08
7	TENSIONR	60.09	5.89	0.01	-0.015	1.636	36.22	11.57	0.00	60.24	0.48	70.94	15.76
9	LAYBARGE	51.07	5.67	0.00	-0.015	1.282	45.24	11.57	0.00	-50.92	0.22	61.44	13.65
10	LAYBARGE	46.43	5.54	0.00	-0.015	2.216	49.89	11.54	0.00	-200.88	0.52	211.90	47.09
12	LAYBARGE	39.39	5.18	0.00	-0.014	3.272	56.93	11.54	0.00	-6.53	0.07	15.47	3.44
13	TENSIONR	35.34	4.95	0.00	-0.014	3.118	60.99	21.65	0.00	49.07	-0.24	69.89	15.53
15	LAYBARGE	26.09	4.46	0.00	-0.014	3.325	70.26	21.63	0.00	-130.84	0.37	151.53	33.67
16	LAYBARGE	23.33	4.29	0.01	-0.014	4.067	73.02	21.59	0.00	-244.64	-0.84	265.25	58.95
18	LAYBARGE	8.87	2.75	0.00	-0.013	8.498	87.56	21.44	0.00	-344.08	0.98	360.83	80.18
20	LAYBARGE	3.08	1.76	0.00	-0.012	10.261	93.44	21.37	0.00	-309.99	0.65	326.84	72.63
24	STINGER	-7.55	-0.35	0.00	-0.015	11.610	104.23	21.19	-0.10	-289.81	-2.51	309.76	68.84
26	STINGER	-16.45	-2.29	0.00	-0.017	13.441	113.38	20.99	-0.28	-280.22	-3.46	299.86	66.64
29	STINGER	-26.02	-4.51	0.01	-0.023	13.980	123.33	20.75	-0.48	-314.95	-4.78	334.38	74.31
31	STINGER	-36.45	-7.27	0.01	-0.009	16.254	134.14	20.46	-0.74	-376.79	5.28	392.07	87.13
33	STINGER	-39.45	-8.17	0.01	-0.034	17.005	137.27	20.36	-0.82	-249.72	-57.23	265.25	58.94
35	SAGBEND	-45.30	-9.99	0.02	-0.138	17.398	143.25	20.16	-0.98	126.06	-25.12	145.17	32.26
36	SAGBEND	-51.02	-11.73	0.03	-0.169	16.996	149.25	19.97	-1.13	157.55	-16.35	176.55	39.23
37	SAGBEND	-56.78	-13.40	0.04	-0.142	15.897	155.25	19.79	-1.27	178.84	16.71	195.12	43.36

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 38   SAGBEND      -62.58   -14.96   0.05  -0.134   14.350   161.25   19.64   -1.40    191.32    18.42   207.48   46.11
 39   SAGBEND      -68.42   -16.37   0.05  -0.099   12.683   167.25   19.50   -1.51    216.29    21.16   230.22   51.16
 40   SAGBEND      -74.29   -17.61   0.05  -0.049   10.924   173.25   19.37   -1.61    235.79    20.11   249.64   55.48
 41   SAGBEND      -80.19   -18.62   0.05   0.020    9.240   179.25   19.26   -1.69    241.76    19.94   255.34   56.74
 42   SAGBEND      -86.13   -19.46   0.05   0.070    7.465   185.25   19.16   -1.75    234.42    19.06   247.86   55.08
 43   SAGBEND      -92.08   -20.13   0.05   0.088    5.714   191.25   19.08   -1.80    215.85    14.14   229.49   51.00
 44   SAGBEND      -98.06   -20.62   0.05   0.123    3.973   197.25   19.02   -1.83    190.73    12.27   204.59   45.46
 45   SAGBEND     -104.05   -20.97   0.05   0.119    2.580   203.25   18.99   -1.84    165.96   -15.39   180.43   40.10
 46   SAGBEND     -110.04   -21.18   0.04   0.141    1.523   209.25   18.97   -1.85    143.33   -25.35   157.78   35.06
 47   SAGBEND     -116.04   -21.29   0.03   0.116    0.808   215.25   18.97   -1.85    109.40   -27.17   127.95   28.43

 48   SEABED      -122.04   -21.35   0.02   0.132    0.327   221.25   18.99   -1.85     78.85   -28.35    97.89   21.75
 49   SEABED      -128.04   -21.38   0.01   0.100    0.052   227.25   19.01   -1.85     34.85   -22.32    59.49   13.22
 50   SEABED      -134.04   -21.37   0.00   0.029   -0.034   233.25   19.03   -1.85      8.06   -12.08    33.49    7.44
 51   SEABED      -140.04   -21.37   0.00  -0.004   -0.021   239.25   19.06   -1.85     -3.30    -3.42    22.96    5.10
 52   SEABED      -146.04   -21.37   0.00  -0.003   -0.009   245.25   19.08   -1.85     -2.24     0.88    21.80    4.84
 53   SEABED      -152.04   -21.37   0.00  -0.003   -0.001   251.25   19.09   -1.84     -0.97     0.70    20.71    4.60
 54   SEABED      -158.04   -21.37   0.00   0.000    0.001   257.25   19.11   -1.84     -0.23     0.47    20.34    4.52
 55   SEABED      -164.04   -21.37   0.00   0.000    0.000   263.25   19.13   -1.84      0.12    -0.35    20.28    4.51
 56   SEABED      -170.04   -21.37   0.00   0.000    0.000   269.25   19.15   -1.84      0.06     0.34    20.22    4.49
 57   SEABED      -176.04   -21.37   0.00   0.000    0.000   275.25   19.16   -1.84     -0.03     0.34    20.18    4.48
 58   SEABED      -182.04   -21.37   0.00   0.000    0.000   281.25   19.18   -1.84     -0.02     0.34    20.20    4.49
 59   SEABED      -188.04   -21.37   0.00   0.000    0.000   287.25   19.20   -1.84     -0.02     0.38    20.30    4.51
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================================================================================================================
 OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP          DATE - 3/25/2015   TIME - 15:22:21   PAGE   77
 PROJECT - Pipelay Analysis                                                      JOB NO. - Dynamic Analysis
 USER ID - Karun                                               LICENSED TO - OFFSHORE CONSTR. SPECIALISTS       CASE    4
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          M A X I M U M   D Y N A M I C   P I P E   F O R C E S   A N D   S T R E S S E S
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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)	HORIZ (MPA)	TOTAL STRESS (MPA)	PERCNT YIELD (PCT)
60	SEABED	-194.04	-21.37	0.00	0.000	0.000	293.25	19.21	-1.84	-0.02	0.50	20.40	4.53
61	SEABED	-200.04	-21.37	0.00	0.000	0.000	299.25	19.23	-1.84	0.01	0.56	20.46	4.55
62	SEABED	-206.04	-21.37	0.00	0.000	0.000	305.25	19.24	-1.84	0.00	0.00	20.23	4.49

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 OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP          DATE - 3/25/2015   TIME - 15:22:21   PAGE   78
 PROJECT - Pipelay Analysis                                                      JOB NO. - Dynamic Analysis
 USER ID - Karun                                               LICENSED TO - OFFSHORE CONSTR. SPECIALISTS       CASE    4
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          M A X I M U M   D Y N A M I C   P I P E   F O R C E S   A N D   S T R E S S E S
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NODE NO.	PIPE SECTION	X COORD (M)	Y COORD (M)	Z COORD (M)	SUPPORT REACTION VERT (KN)	HORIZ (KN)	SUPT SEPARATIONS VERT (M)	HORIZ (M)	PIPE TENSION (KN)	BENDING MOMENTS VERT (KN-M)	HORIZ (KN-M)	TOTAL (KN-M)
1	LAYBARGE	96.29	6.92	-0.01	12.23	0.19	0.00	0.00	0.00	0.00	0.00	0.00
3	LAYBARGE	84.26	6.63	0.00	21.07	0.45	0.00	0.00	-2.09	-20.03	0.52	20.03
5	LAYBARGE	73.43	6.37	0.00	44.18	-0.29	0.00	0.00	-4.13	-91.59	0.30	91.59
7	TENSIONR	60.09	5.89	0.01	4.99	0.27	0.00	0.00	148.59	47.04	0.38	47.04
9	LAYBARGE	51.07	5.67	0.00	0.00	0.00	0.00	0.00	148.70	-39.77	0.17	39.77
10	LAYBARGE	46.43	5.54	0.00	63.67	0.21	0.00	0.00	148.23	-156.89	0.40	156.89
12	LAYBARGE	39.39	5.18	0.00	0.00	0.00	0.00	0.00	148.29	-5.10	0.06	5.10
13	TENSIONR	35.34	4.95	0.00	-10.43	-0.18	0.00	0.00	278.09	38.32	-0.19	38.32
15	LAYBARGE	26.09	4.46	0.00	0.00	0.00	0.00	0.00	277.89	-102.18	0.29	102.18
16	LAYBARGE	23.33	4.29	0.01	65.28	-0.36	0.00	0.00	277.33	-191.05	-0.65	191.05
18	LAYBARGE	8.87	2.75	0.00	75.33	-0.40	0.00	0.00	275.44	-268.72	0.77	268.72
20	LAYBARGE	3.08	1.76	0.00	45.06	-0.72	0.18	0.00	274.58	-242.09	0.51	242.09
24	STINGER	-7.55	-0.35	0.00	61.02	-1.71	0.12	0.00	272.42	-226.34	-1.96	226.34
26	STINGER	-16.45	-2.29	0.00	51.24	-3.06	0.70	0.00	270.81	-218.84	-2.70	218.84
29	STINGER	-26.02	-4.51	0.01	53.51	-3.33	0.79	0.00	269.10	-245.96	-3.73	245.97
31	STINGER	-36.45	-7.27	0.01	73.91	14.75	0.03	0.00	267.17	-294.26	4.12	294.27
33	STINGER	-39.45	-8.17	0.01	0.04	-22.02	0.47	0.00	266.37	-195.02	-44.69	195.23
35	SAGBEND	-45.30	-9.99	0.02	0.00	0.00	0.00	0.00	264.83	98.45	-19.62	98.45
36	SAGBEND	-51.02	-11.73	0.03	0.00	0.00	0.00	0.00	263.34	123.04	-12.77	123.09
37	SAGBEND	-56.78	-13.40	0.04	0.00	0.00	0.00	0.00	262.01	139.67	13.05	139.67
38	SAGBEND	-62.58	-14.96	0.05	0.00	0.00	0.00	0.00	260.83	149.41	14.39	149.42
39	SAGBEND	-68.42	-16.37	0.05	0.00	0.00	0.00	0.00	259.80	168.92	16.53	169.03
40	SAGBEND	-74.29	-17.61	0.05	0.00	0.00	0.00	0.00	258.88	184.15	15.70	184.23
41	SAGBEND	-80.19	-18.62	0.05	0.00	0.00	0.00	0.00	258.07	188.81	15.57	188.86
42	SAGBEND	-86.13	-19.46	0.05	0.00	0.00	0.00	0.00	257.37	183.07	14.88	183.09
43	SAGBEND	-92.08	-20.13	0.05	0.00	0.00	0.00	0.00	256.80	168.57	11.04	168.58
44	SAGBEND	-98.06	-20.62	0.05	0.00	0.00	0.00	0.00	256.38	148.96	9.58	148.97
45	SAGBEND	-104.05	-20.97	0.05	1.88	0.99	0.00	0.00	256.15	129.61	-12.02	129.61
46	SAGBEND	-110.04	-21.18	0.04	9.83	-3.32	0.00	0.00	256.11	111.94	-19.80	111.94
47	SAGBEND	-116.04	-21.29	0.03	10.89	-4.04	0.00	0.00	256.26	85.43	-21.22	85.50
48	SEABED	-122.04	-21.35	0.02	10.67	-3.31	0.00	0.00	256.56	61.58	-22.14	61.90
49	SEABED	-128.04	-21.38	0.01	10.08	-3.29	0.00	0.00	256.87	27.22	-17.43	31.66
50	SEABED	-134.04	-21.37	0.00	9.19	1.04	0.00	0.00	257.14	6.29	-9.44	11.34
51	SEABED	-140.04	-21.37	0.00	8.11	0.64	0.00	0.00	257.40	-2.57	-2.67	2.81
52	SEABED	-146.04	-21.37	0.00	7.32	0.34	0.00	0.00	257.65	-1.75	0.69	1.75
53	SEABED	-152.04	-21.37	0.00	6.99	0.18	0.00	0.00	257.90	-0.76	0.54	0.93
54	SEABED	-158.04	-21.37	0.00	6.99	0.18	0.00	0.00	258.14	-0.18	0.37	0.41
55	SEABED	-164.04	-21.37	0.00	7.00	0.18	0.00	0.00	258.37	0.09	-0.27	0.27
56	SEABED	-170.04	-21.37	0.00	7.00	-0.18	0.00	0.00	258.59	0.05	0.27	0.27
57	SEABED	-176.04	-21.37	0.00	6.99	-0.18	0.00	0.00	258.80	-0.02	0.27	0.27

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 OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP          DATE - 3/25/2015   TIME - 15:22:21   PAGE   79
 PROJECT - Pipelay Analysis                                                      JOB NO. - Dynamic Analysis
 USER ID - Karun                                               LICENSED TO - OFFSHORE CONSTR. SPECIALISTS       CASE    4
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            M A X I M U M   D Y N A M I C   P I P E   F O R C E S   A N D   S T R E S S E S
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| NODE | PIPE | X | Y | Z | SUPPORT REACTION | | SUPT SEPARATIONS | | PIPE | BENDING MOMENTS | | |
| NO. | SECTION | COORD | COORD | COORD | VERT | HORIZ | VERT | HORIZ | TENSION | VERT | HORIZ | TOTAL |
		(M)	(M)	(M)	(KN)	(KN)	(M)	(M)	(KN)	(KN-M)	(KN-M)	(KN-M)
58	SEABED	-182.04	-21.37	0.00	6.99	-0.19	0.00	0.00	259.01	-0.02	0.27	0.27
59	SEABED	-188.04	-21.37	0.00	6.99	-0.19	0.00	0.00	259.21	-0.02	0.30	0.30
60	SEABED	-194.04	-21.37	0.00	6.99	-0.18	0.00	0.00	259.41	-0.02	0.39	0.39
61	SEABED	-200.04	-21.37	0.00	6.99	-0.12	0.00	0.00	259.59	0.01	0.44	0.44
62	SEABED	-206.04	-21.37	0.00	0.00	-0.02	0.00	0.00	259.77	0.00	0.00	0.00

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  OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP   DATE - 3/25/2015   TIME - 15:22:21   PAGE   80
  PROJECT - Pipelay Analysis   JOB NO. - Dynamic Analysis
  USER ID - Karun   LICENSED TO - OFFSHORE CONSTR. SPECIALISTS   CASE   4
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       U N I T Y   R A T I O S   F O R   D N V   O S - F 1 0 1

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| NODE | PIPE | /-------------------- DNV LIMIT STATES --------------------/ | | | | |
| NO. | SECTION | BURST | COLLAPSE | BUCKLE | LOCAL BUCKLING* | |
		PRESSURE	PRESSURE	PROPAGATE	LOAD CNTL.	DISP CNTL.
1	LAYBARGE	0.000	0.000	0.000	0.000	0.000
3	LAYBARGE	0.000	0.000	0.000	0.003	0.018
5	LAYBARGE	0.000	0.000	0.000	0.077	0.064
7	TENSIONR	0.000	0.000	0.000	0.020	0.033
9	LAYBARGE	0.000	0.000	0.000	0.015	0.028
10	LAYBARGE	0.000	0.000	0.000	0.228	0.095
12	LAYBARGE	0.000	0.000	0.000	0.000	0.000
13	TENSIONR	0.000	0.000	0.000	0.014	0.021
15	LAYBARGE	0.000	0.000	0.000	0.091	0.059
16	LAYBARGE	0.000	0.000	0.000	0.319	0.105
18	LAYBARGE	0.000	0.000	0.000	0.619	0.142
20	LAYBARGE	0.000	0.000	0.000	0.593	0.139
24	STINGER	0.000	0.000	0.001	0.532	0.131
26	STINGER	0.000	0.001	0.003	0.424	0.120
29	STINGER	0.000	0.001	0.005	0.584	0.138
31	STINGER	0.000	0.002	0.008	0.832	0.163
33	STINGER	0.000	0.002	0.009	0.381	0.118
35	SAGBEND	0.000	0.003	0.011	0.101	0.066
36	SAGBEND	0.000	0.003	0.013	0.140	0.077
37	SAGBEND	0.000	0.004	0.014	0.171	0.086
38	SAGBEND	0.000	0.004	0.016	0.192	0.090
39	SAGBEND	0.000	0.005	0.017	0.247	0.101
40	SAGBEND	0.000	0.005	0.018	0.296	0.110
41	SAGBEND	0.000	0.005	0.019	0.311	0.112
42	SAGBEND	0.000	0.005	0.020	0.290	0.109
43	SAGBEND	0.000	0.005	0.020	0.242	0.102
44	SAGBEND	0.000	0.006	0.021	0.185	0.091
45	SAGBEND	0.000	0.006	0.021	0.141	0.081
46	SAGBEND	0.000	0.006	0.021	0.106	0.073
47	SAGBEND	0.000	0.006	0.021	0.067	0.058
48	SEABED	0.000	0.006	0.021	0.040	0.046
49	SEABED	0.000	0.006	0.021	0.012	0.025
50	SEABED	0.000	0.006	0.021	0.002	0.006
51	SEABED	0.000	0.006	0.021	0.000	0.006
52	SEABED	0.000	0.006	0.021	0.000	0.006
53	SEABED	0.000	0.006	0.021	0.000	0.006
54	SEABED	0.000	0.006	0.021	0.000	0.006
55	SEABED	0.000	0.006	0.021	0.000	0.006
56	SEABED	0.000	0.006	0.021	0.000	0.006
57	SEABED	0.000	0.006	0.021	0.000	0.006
58	SEABED	0.000	0.006	0.021	0.000	0.006
59	SEABED	0.000	0.006	0.021	0.000	0.006

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  OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP   DATE - 3/25/2015   TIME - 15:22:21   PAGE   81
  PROJECT - Pipelay Analysis   JOB NO. - Dynamic Analysis
  USER ID - Karun   LICENSED TO - OFFSHORE CONSTR. SPECIALISTS   CASE   4
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       U N I T Y   R A T I O S   F O R   D N V   O S - F 1 0 1

===
| NODE | PIPE | /-------------------- DNV LIMIT STATES -------------------/ | | | | |
| NO. | SECTION | BURST | COLLAPSE | BUCKLE | LOCAL BUCKLING* | |
		PRESSURE	PRESSURE	PROPAGATE	LOAD CNTL.	DISP CNTL.
60	SEABED	0.000	0.006	0.021	0.000	0.006
61	SEABED	0.000	0.006	0.021	0.000	0.006
62	SEABED	0.000	0.006	0.021	0.000	0.006

._____.
| |
| *NOTE: THE DNV LIMIT STATE INEQUALITIES FOR LOCAL BUCKLING UNDER |
| THE COMBINED EFFECTS OF BENDING AND INTERNAL OR EXTERNAL |
| PRESSURE ARE HIGHLY NONLINEAR. THE MAGNITUDE OF THE UNITY |
| RATIOS FOR THESE TWO LIMIT STATES MAY SIGNIFICANTLY UNDER |
| ESTIMATE HOW CLOSE THE PIPE IS TO EXCEEDING THESE LIMIT |
| STATES. FOR THIS REASON, DNV REFERS TO THESE VALUES AS |
| "INTERACTION RATIOS" RATHER THAN "UNITY RATIOS". |
|_____|

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OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP   PAGE 82
Pipelay Analysis
JOB NO. - Dynamic Analysis   LICENSED TO - OFFSHORE CONSTR. SPECIALISTS
USER ID - Karun   DATE - 3/25/2015 TIME - 15:22:21   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 (1)
  ====================
    PIPE SECTION LENGTH ..   0.00 M   ELASTIC MODULUS ......   207000. MPA
    OUTSIDE DIAMETER .....   27.310 CM   CROSS SECTIONAL AREA .   128.75 CM^2
    WALL THICKNESS ....   1.590 CM   MOMENT OF INERTIA ....   12671.5 CM^4
    WEIGHT/LENGTH IN AIR . 2205.00 N/M   YIELD STRESS ....   450.00 MPA
    SUBMERGED WGHT/LENG .. 1164.00 N/M   STRESS INTENS FACTOR .   1.000
    SPECIFIC GRAVITY .....   2.118   STEEL DENSITY 76982.0 N/M3
    WRAP COAT THICKNESS ..   0.280 CM   WRAP COAT DENSITY 9218.0 N/M3
    CONCRETE THICKNESS ...   4.000 CM   CONCRETE DENSITY 29846.0 N/M3

  BARGE DATA
  ==========
    TOTAL PIPE TENSION ...   250.00 KN   RADIUS OF CURVATURE ..   0.00 M
    NUMBER OF TENSIONERS .   2   BARGE TRIM ANGLE .....   0.500 DEG
    NO. OF PIPE SUPPORTS .   7   PIPE ANGLE AT STERN ..   9.744 DEG
    BARGE HEADING ....   0.000 DEG OFFSET FROM R.O.W. ...   0.00 M

  STINGER DATA
  ============
    NO. OF PIPE SUPPORTS .   5   PIPE DEPTH AT STERN ..   -7.84 M
    NO. STINGER SECTIONS .   7   PIPE ANGLE AT STERN ..   17.326 DEG
    RADIUS OF CURVATURE ..   200.00 M   STINGER STERN DEPTH ..   -8.19 M
    STINGER LENGTH ....   39.00 M

  SAGBEND DATA
  ============
    WATER DEPTH ....   21.34 M   TENSION AT TOUCHDOWN .   209.80 KN
    TOUCHDOWN X-COORD. ... -114.37 M   BOTTOM SLOPE ANGLE ...   0.000 DEG
    PROJECTED SPAN LENGTH   74.74 M   PIPE LENGTH GAIN .....   2.90 M

============================== SOLUTION SUMMARY ===============================
NODE PIPE   X   Y   Z   SUPPORT REACT   TOTAL   TOTAL   PCT
NO.   SECTION COORD   COORD   COORD   VERT   HORIZ   MOMENT   STRESS   YLD
               (M)   (M)   (M)   (KN)   (KN)   (KN-M)   (MPA)   (%)
==
   1 LAYBARGE   96.3   6.9   0.0   11.8   0.0   0.0   0.0   0.
   3 LAYBARGE   84.3   6.6   0.0   20.0   0.0   17.7   22.8   5.
   5 LAYBARGE   73.4   6.4   0.0   43.4   0.0   89.8   115.1   26.
   7 TENSIONR   60.1   5.9   0.0   4.5   0.0   45.7   68.0   15.
   9 LAYBARGE   51.1   5.7   0.0   0.0   0.0   38.8   59.2   13.
  10 LAYBARGE   46.4   5.5   0.0   62.6   0.0   155.5   208.6   46.
  12 LAYBARGE   39.4   5.2   0.0   0.0   0.0   1.9   11.8   3.
  13 TENSIONR   35.4   5.0   0.0   -8.6   0.0   34.7   63.6   14.
  15 LAYBARGE   26.1   4.5   0.0   0.0   0.0   92.1   136.9   30.
  16 LAYBARGE   23.3   4.3   0.0   57.3   0.0   174.7   242.6   54.
  18 LAYBARGE   8.9   2.7   0.0   61.4   0.0   201.0   276.0   61.
  20 LAYBARGE   3.1   1.8   0.0   0.0   0.0   56.8   91.4   20.

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OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP   PAGE 83
Pipelay Analysis
JOB NO. - Dynamic Analysis   LICENSED TO - OFFSHORE CONSTR. SPECIALISTS
USER ID - Karun   DATE - 3/25/2015 TIME - 15:22:21   CASE   5
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              S T A T I C   S O L U T I O N   S U M M A R Y

  24 STINGER   -7.5   -0.1   0.0   1.9   0.0   25.5   51.0   11.
  26 STINGER -16.5   -1.8   0.0   41.1   0.0   162.1   225.6   50.
  29 STINGER -26.2   -4.0   0.0   13.0   0.0   106.4   154.1   34.
  31 STINGER -36.6   -6.9   0.0   37.2   0.0   130.1   184.2   41.
  33 STINGER -39.6   -7.8   0.0   0.0   0.0   64.5   100.1   22.
  42 SAGBEND -86.1 -19.4   0.0   0.0   0.0   133.3   187.2   42.
  47 SEABED -116.0 -21.4   0.0   4.1   0.0   55.1   86.9   19.

          U N I T Y   R A T I O S   F O R   D N V   O S - F 1 0 1

==
NODE   PIPE   /-------------------- DNV LIMIT STATES --------------------/
NO.   SECTION   BURST   COLLAPSE   BUCKLE   LOCAL BUCKLING*
                 PRESSURE PRESSURE   PROPAGATE LOAD CNTL. DISP CNTL.
==
    1   LAYBARGE   0.000   0.000   0.000   0.000   0.000
    3   LAYBARGE   0.000   0.000   0.000   0.003   0.017
    5   LAYBARGE   0.000   0.000   0.000   0.075   0.063
    7   TENSIONR   0.000   0.000   0.000   0.020   0.032
    9   LAYBARGE   0.000   0.000   0.000   0.014   0.027
   10   LAYBARGE   0.000   0.000   0.000   0.226   0.095
   12   LAYBARGE   0.000   0.000   0.000   0.000   0.000
   13   TENSIONR   0.000   0.000   0.000   0.012   0.019
   15   LAYBARGE   0.000   0.000   0.000   0.081   0.056
   16   LAYBARGE   0.000   0.000   0.000   0.287   0.100
   18   LAYBARGE   0.000   0.000   0.000   0.384   0.114
   20   LAYBARGE   0.000   0.000   0.000   0.034   0.036

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   24   STINGER      0.000      0.000      0.000      0.011      0.018
   26   STINGER      0.000      0.000      0.002      0.230      0.092
   29   STINGER      0.000      0.001      0.004      0.104      0.065
   31   STINGER      0.000      0.002      0.007      0.152      0.078
   33   STINGER      0.000      0.002      0.008      0.037      0.041

   35   SAGBEND      0.000      0.003      0.009      0.004      0.011
   36   SAGBEND      0.000      0.003      0.011      0.045      0.046
   37   SAGBEND      0.000      0.003      0.013      0.089      0.063
   38   SAGBEND      0.000      0.004      0.014      0.122      0.073
   39   SAGBEND      0.000      0.004      0.016      0.145      0.079
   40   SAGBEND      0.000      0.005      0.017      0.159      0.083
   41   SAGBEND      0.000      0.005      0.018      0.167      0.085
   42   SAGBEND      0.000      0.005      0.019      0.168      0.085
   43   SAGBEND      0.000      0.005      0.020      0.162      0.084
   44   SAGBEND      0.000      0.005      0.020      0.147      0.081
   45   SAGBEND      0.000      0.005      0.020      0.120      0.074
   46   SAGBEND      0.000      0.006      0.021      0.078      0.062

   47   SEABED       0.000      0.006      0.021      0.027      0.039
   48   SEABED       0.000      0.006      0.021      0.003      0.012
   49   SEABED       0.000      0.006      0.021      0.000      0.006
   50   SEABED       0.000      0.006      0.021      0.000      0.006
   51   SEABED       0.000      0.006      0.021      0.000      0.006
   52   SEABED       0.000      0.006      0.021      0.000      0.006
   53   SEABED       0.000      0.006      0.021      0.000      0.006
   54   SEABED       0.000      0.006      0.021      0.000      0.006
   55   SEABED       0.000      0.006      0.021      0.000      0.006
   56   SEABED       0.000      0.006      0.021      0.000      0.006
   57   SEABED       0.000      0.006      0.021      0.000      0.006
   58   SEABED       0.000      0.006      0.021      0.000      0.006
   59   SEABED       0.000      0.006      0.021      0.000      0.006
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   OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP          DATE - 3/25/2015   TIME - 15:22:21   PAGE   85
   PROJECT - Pipelay Analysis                                                          JOB NO. - Dynamic Analysis
   USER ID - Karun                                          LICENSED TO - OFFSHORE CONSTR. SPECIALISTS        CASE    5
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         U N I T Y   R A T I O S   F O R   D N V   O S - F 1 0 1

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NODE     PIPE     /-------------------- DNV LIMIT STATES --------------------/
NO.      SECTION    BURST     COLLAPSE    BUCKLE      LOCAL BUCKLING*
                   PRESSURE   PRESSURE   PROPAGATE   LOAD CNTL.  DISP CNTL.
================================================================================================
   60   SEABED       0.000      0.006      0.021      0.000      0.006
   61   SEABED       0.000      0.006      0.021      0.000      0.006
   62   SEABED       0.000      0.006      0.021      0.000      0.006

   ._____.
   |                                                        |
   | *NOTE: THE DNV LIMIT STATE INEQUALITIES FOR LOCAL BUCKLING UNDER |
   |    THE COMBINED EFFECTS OF BENDING AND INTERNAL OR EXTERNAL |
   |    PRESSURE ARE HIGHLY NONLINEAR. THE MAGNITUDE OF THE UNITY |
   |    RATIOS FOR THESE TWO LIMIT STATES MAY SIGNIFICANTLY UNDER |
   |    ESTIMATE HOW CLOSE THE PIPE IS TO EXCEEDING THESE LIMIT |
   |    STATES.  FOR THIS REASON, DNV REFERS TO THESE VALUES AS |
   |    "INTERACTION RATIOS" RATHER THAN "UNITY RATIOS".     |
   |_____|
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   OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP          DATE - 3/25/2015   TIME - 15:22:21   PAGE   86
   PROJECT - Pipelay Analysis                                                          JOB NO. - Dynamic Analysis
   USER ID - Karun                                          LICENSED TO - OFFSHORE CONSTR. SPECIALISTS        CASE    5
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      M A X I M U M   D Y N A M I C   P I P E   F O R C E S   A N D   S T R E S S E S

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NODE   PIPE       X        Y        Z      HORIZ    VERT     PIPE    TENSILE   HOOP    BENDING STRESSES  TOTAL   PERCNT
NO.    SECTION   COORD    COORD    COORD   ANGLE    ANGLE    LENGTH  STRESS   STRESS    VERT     HORIZ   STRESS   YIELD
                 (M  )    (M  )    (M  )   (DEG )   (DEG )   (M  )   (MPA )   (MPA )   (MPA )   (MPA )   (MPA )   (PCT )
================================================================================================
   1   LAYBARGE   96.30    6.94    0.00    0.000    1.646     0.00    0.00     0.00     0.00     0.00     0.00     0.00
   3   LAYBARGE   84.26    6.65    0.00    0.000    1.178    12.04   -0.16     0.00   -25.31     0.00    25.36     5.64
   5   LAYBARGE   73.44    6.38    0.00    0.000    1.940    22.87   -0.32     0.00  -116.98     0.00   117.07    26.01
   7   TENSIONR   60.09    5.89    0.00    0.000    1.629    36.22   11.47     0.00    59.88     0.00    70.50    15.67
   9   LAYBARGE   51.07    5.68    0.00    0.000    1.277    45.24   11.44     0.00   -51.24     0.00    61.85    13.74
  10   LAYBARGE   46.43    5.55    0.00    0.000    2.214    49.89   11.38     0.00  -200.83     0.00   212.08    47.13
  12   LAYBARGE   39.40    5.19    0.00    0.000    3.265    56.93   11.36     0.00    -5.90     0.00    15.05     3.34
  13   TENSIONR   35.35    4.96    0.00    0.000    3.094    60.99   21.72     0.00    49.52     0.00    70.42    15.65
  15   LAYBARGE   26.09    4.48    0.00    0.000    3.337    70.26   21.72     0.00  -132.33     0.00   153.03    34.01
  16   LAYBARGE   23.33    4.30    0.00    0.000    4.126    73.02   21.68     0.00  -246.14     0.00   266.76    59.28
  18   LAYBARGE    8.88    2.75    0.00    0.000    8.358    87.56   21.53     0.00  -346.24     0.00   363.02    80.67
  20   LAYBARGE    3.08    1.82    0.00    0.000    9.981    93.44   21.48     0.00  -137.41     0.00   157.96    35.10

  24   STINGER    -7.57   -0.19    0.00    0.000   10.980   104.23   21.26    -0.05  -197.87     0.00   218.09    48.47
  26   STINGER   -16.53   -2.03    0.00    0.000   12.629   113.38   21.08    -0.24  -350.04     0.00   369.71    82.16
  29   STINGER   -26.15   -4.39    0.00    0.000   14.488   123.33   20.86    -0.45  -328.55     0.00   348.30    77.40
  31   STINGER   -36.59   -7.22    0.00    0.000   16.575   134.14   20.57    -0.73  -389.34     0.00   404.35    89.86
  33   STINGER   -39.61   -8.13    0.00    0.000   17.122   137.27   20.49    -0.82  -257.31     0.00   272.30    60.51

  35   SAGBEND   -45.29   -9.91    0.00    0.000   17.461   143.25   20.31    -0.98   136.87     0.00   156.06    34.68
  36   SAGBEND   -51.03  -11.65    0.00    0.000   16.924   149.25   20.12    -1.13   165.60     0.00   184.60    41.02
  37   SAGBEND   -56.79  -13.31    0.00    0.000   15.699   155.25   19.93    -1.27   203.73     0.00   218.75    48.61
  38   SAGBEND   -62.58  -14.84    0.00    0.000   14.217   161.25   19.76    -1.40   225.43     0.00   240.31    53.40
  39   SAGBEND   -68.42  -16.24    0.00    0.000   12.738   167.25   19.60    -1.51   230.40     0.00   244.63    54.36
  40   SAGBEND   -74.29  -17.48    0.00    0.000   11.079   173.25   19.46    -1.61   231.62     0.00   246.34    54.74
  41   SAGBEND   -80.20  -18.54    0.00    0.000    9.308   179.25   19.34    -1.69   232.01     0.00   246.42    54.76
  42   SAGBEND   -86.13  -19.41    0.00    0.000    7.587   185.25   19.24    -1.76   232.87     0.00   246.58    54.80
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43	SAGBEND	-92.08	-20.10	0.00	0.000	5.836	191.25	19.15	-1.80	225.73	0.00	239.36	53.19
44	SAGBEND	-98.06	-20.60	0.00	0.000	4.089	197.25	19.09	-1.83	200.94	0.00	214.79	47.73
45	SAGBEND	-104.04	-20.94	0.00	0.000	2.652	203.25	19.04	-1.84	170.16	0.00	184.50	41.00
46	SAGBEND	-110.04	-21.16	0.00	0.000	1.584	209.25	19.02	-1.85	149.41	0.00	164.18	36.49
47	SAGBEND	-116.03	-21.29	0.00	0.000	0.883	215.25	19.02	-1.85	120.69	0.00	135.67	30.15
48	SEABED	-122.03	-21.35	0.00	0.000	0.365	221.25	19.03	-1.85	84.42	0.00	101.00	22.45
49	SEABED	-128.03	-21.38	0.00	0.000	0.057	227.25	19.06	-1.85	39.28	0.00	56.31	12.51
50	SEABED	-134.03	-21.37	0.00	0.000	-0.036	233.25	19.08	-1.85	8.44	0.00	27.00	6.00
51	SEABED	-140.03	-21.37	0.00	0.000	-0.023	239.25	19.11	-1.85	-3.60	0.00	22.99	5.11
52	SEABED	-146.03	-21.37	0.00	0.000	-0.010	245.25	19.13	-1.85	-2.48	0.00	22.16	4.92
53	SEABED	-152.03	-21.37	0.00	0.000	-0.001	251.25	19.15	-1.84	-1.12	0.00	20.86	4.64
54	SEABED	-158.03	-21.37	0.00	0.000	0.001	257.25	19.17	-1.84	-0.24	0.00	20.24	4.50
55	SEABED	-164.03	-21.37	0.00	0.000	0.001	263.25	19.19	-1.84	0.14	0.00	20.24	4.50
56	SEABED	-170.03	-21.37	0.00	0.000	0.000	269.25	19.21	-1.84	0.09	0.00	20.24	4.50
57	SEABED	-176.03	-21.37	0.00	0.000	0.000	275.25	19.22	-1.84	0.05	0.00	20.24	4.50
58	SEABED	-182.03	-21.37	0.00	0.000	0.000	281.25	19.24	-1.84	0.03	0.00	20.25	4.50
59	SEABED	-188.03	-21.37	0.00	0.000	0.000	287.25	19.26	-1.84	-0.03	0.00	20.25	4.50

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  OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP        DATE - 3/25/2015   TIME - 15:22:21    PAGE   87
  PROJECT - Pipelay Analysis                                                          JOB NO. - Dynamic Analysis
  USER ID - Karun                                           LICENSED TO - OFFSHORE CONSTR. SPECIALISTS      CASE    5
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M A X I M U M   D Y N A M I C   P I P E   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)	HORIZ (MPA)	TOTAL STRESS (MPA)	PERCNT YIELD (PCT)
60	SEABED	-194.03	-21.37	0.00	0.000	0.000	293.25	19.28	-1.84	-0.02	0.00	20.27	4.50
61	SEABED	-200.03	-21.37	0.00	0.000	0.000	299.25	19.29	-1.84	0.01	0.00	20.28	4.51
62	SEABED	-206.03	-21.37	0.00	0.000	0.000	305.25	19.31	-1.84	0.00	0.00	20.29	4.51

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  OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP        DATE - 3/25/2015   TIME - 15:22:21    PAGE   88
  PROJECT - Pipelay Analysis                                                          JOB NO. - Dynamic Analysis
  USER ID - Karun                                           LICENSED TO - OFFSHORE CONSTR. SPECIALISTS      CASE    5
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M A X I M U M   D Y N A M I C   P I P E   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)	HORIZ (KN)	SUPT SEPARATIONS VERT (M)	HORIZ (M)	PIPE TENSION (KN)	BENDING MOMENTS VERT (KN-M)	HORIZ (KN-M)	TOTAL (KN-M)
1	LAYBARGE	96.30	6.94	0.00	12.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	LAYBARGE	84.26	6.65	0.00	20.84	0.00	0.00	0.00	-2.07	-19.76	0.00	19.76
5	LAYBARGE	73.44	6.38	0.00	44.03	0.00	0.00	0.00	-4.09	-91.36	0.00	91.36
7	TENSIONR	60.09	5.89	0.00	4.96	0.00	0.00	0.00	147.31	46.77	0.00	46.77
9	LAYBARGE	51.07	5.68	0.00	0.00	0.00	0.00	0.00	146.94	-40.02	0.00	40.02
10	LAYBARGE	46.43	5.55	0.00	63.71	0.00	0.00	0.00	146.25	-156.84	0.00	156.84
12	LAYBARGE	39.40	5.19	0.00	0.00	0.00	0.00	0.00	145.98	-4.60	0.00	4.60
13	TENSIONR	35.35	4.96	0.00	-10.80	0.00	0.00	0.00	279.08	38.67	0.00	38.67
15	LAYBARGE	26.09	4.48	0.00	0.00	0.00	0.00	0.00	279.04	-103.35	0.00	103.35
16	LAYBARGE	23.33	4.30	0.00	65.32	0.00	0.00	0.00	278.56	-192.23	0.00	192.23
18	LAYBARGE	8.88	2.75	0.00	75.61	0.00	0.00	0.00	276.65	-270.40	0.00	270.40
20	LAYBARGE	3.08	1.82	0.00	2.42	0.00	0.18	0.00	275.99	-107.31	0.00	107.31
24	STINGER	-7.57	-0.19	0.00	45.99	0.00	0.12	0.00	273.21	-154.53	0.00	154.53
26	STINGER	-16.53	-2.03	0.00	66.30	0.00	0.47	0.00	271.90	-273.37	0.00	273.37
29	STINGER	-26.15	-4.39	0.00	56.39	0.00	0.56	0.00	270.45	-256.59	0.00	256.59
31	STINGER	-36.59	-7.22	0.00	76.46	0.00	0.26	0.00	268.35	-304.07	0.00	304.07
33	STINGER	-39.61	-8.13	0.00	0.00	0.00	0.78	0.00	267.75	-200.95	0.00	200.95
35	SAGBEND	-45.29	-9.91	0.00	0.00	0.00	0.00	0.00	266.38	106.89	0.00	106.89
36	SAGBEND	-51.03	-11.65	0.00	0.00	0.00	0.00	0.00	264.89	129.33	0.00	129.33
37	SAGBEND	-56.79	-13.31	0.00	0.00	0.00	0.00	0.00	263.46	159.11	0.00	159.11
38	SAGBEND	-62.58	-14.84	0.00	0.00	0.00	0.00	0.00	262.11	176.05	0.00	176.05
39	SAGBEND	-68.42	-16.24	0.00	0.00	0.00	0.00	0.00	260.89	179.93	0.00	179.93
40	SAGBEND	-74.29	-17.48	0.00	0.00	0.00	0.00	0.00	259.82	180.89	0.00	180.89
41	SAGBEND	-80.20	-18.54	0.00	0.00	0.00	0.00	0.00	258.89	181.19	0.00	181.19
42	SAGBEND	-86.13	-19.41	0.00	0.00	0.00	0.00	0.00	258.12	181.87	0.00	181.87
43	SAGBEND	-92.08	-20.10	0.00	0.00	0.00	0.00	0.00	257.52	176.29	0.00	176.29
44	SAGBEND	-98.06	-20.60	0.00	0.00	0.00	0.00	0.00	257.08	156.92	0.00	156.92
45	SAGBEND	-104.04	-20.94	0.00	2.44	0.00	0.00	0.00	256.82	132.89	0.00	132.89
46	SAGBEND	-110.04	-21.16	0.00	9.73	0.00	0.00	0.00	256.74	116.68	0.00	116.68
47	SAGBEND	-116.03	-21.29	0.00	11.67	0.00	0.00	0.00	256.85	94.25	0.00	94.25
48	SEABED	-122.03	-21.35	0.00	10.56	0.00	0.00	0.00	257.12	65.93	0.00	65.93
49	SEABED	-128.03	-21.38	0.00	10.21	0.00	0.00	0.00	257.47	30.68	0.00	30.68
50	SEABED	-134.03	-21.37	0.00	9.51	0.00	0.00	0.00	257.77	6.59	0.00	6.59
51	SEABED	-140.03	-21.37	0.00	8.30	0.00	0.00	0.00	258.05	-2.81	0.00	2.81
52	SEABED	-146.03	-21.37	0.00	7.35	0.00	0.00	0.00	258.32	-1.93	0.00	1.93
53	SEABED	-152.03	-21.37	0.00	6.98	0.00	0.00	0.00	258.59	-0.88	0.00	0.88
54	SEABED	-158.03	-21.37	0.00	6.99	0.00	0.00	0.00	258.84	-0.19	0.00	0.19
55	SEABED	-164.03	-21.37	0.00	7.00	0.00	0.00	0.00	259.09	0.11	0.00	0.11
56	SEABED	-170.03	-21.37	0.00	6.99	0.00	0.00	0.00	259.34	0.07	0.00	0.07
57	SEABED	-176.03	-21.37	0.00	6.99	0.00	0.00	0.00	259.57	0.04	0.00	0.04

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  OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP        DATE - 3/25/2015   TIME - 15:22:21    PAGE   89
  PROJECT - Pipelay Analysis                                                          JOB NO. - Dynamic Analysis
  USER ID - Karun                                           LICENSED TO - OFFSHORE CONSTR. SPECIALISTS      CASE    5
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M A X I M U M   D Y N A M I C   P I P E   F O R C E S   A N D   S T R E S S E S

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NODE NO.	PIPE SECTION	X COORD (M)	Y COORD (M)	Z COORD (M)	SUPPORT REACTION VERT (KN)	HORIZ (KN)	SUPT SEPARATIONS VERT (M)	HORIZ (M)	PIPE TENSION (KN)	BENDING MOMENTS VERT (KN-M)	HORIZ (KN-M)	TOTAL (KN-M)
58	SEABED	-182.03	-21.37	0.00	6.99	0.00	0.00	0.00	259.79	0.02	0.00	0.02
59	SEABED	-188.03	-21.37	0.00	6.99	0.00	0.00	0.00	260.01	-0.02	0.00	0.02
60	SEABED	-194.03	-21.37	0.00	6.99	0.00	0.00	0.00	260.22	-0.02	0.00	0.02
61	SEABED	-200.03	-21.37	0.00	6.99	0.00	0.00	0.00	260.43	0.01	0.00	0.01
62	SEABED	-206.03	-21.37	0.00	0.00	0.00	0.00	0.00	260.63	0.00	0.00	0.00

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 OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP          DATE - 3/25/2015    TIME - 15:22:21    PAGE   90
 PROJECT - Pipelay Analysis                                                               JOB NO. - Dynamic Analysis
 USER ID - Karun                                              LICENSED TO - OFFSHORE CONSTR. SPECIALISTS       CASE    5
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U N I T Y   R A T I O S   F O R   D N V   O S - F 1 0 1

NODE NO.	PIPE SECTION	/-------------------- DNV LIMIT STATES --------------------/ BURST PRESSURE	COLLAPSE PRESSURE	BUCKLE PROPAGATE	LOCAL BUCKLING* LOAD CNTL.	DISP CNTL.
1	LAYBARGE	0.000	0.000	0.000	0.000	0.000
3	LAYBARGE	0.000	0.000	0.000	0.003	0.018
5	LAYBARGE	0.000	0.000	0.000	0.076	0.064
7	TENSIONR	0.000	0.000	0.000	0.020	0.033
9	LAYBARGE	0.000	0.000	0.000	0.015	0.028
10	LAYBARGE	0.000	0.000	0.000	0.228	0.095
12	LAYBARGE	0.000	0.000	0.000	0.000	0.000
13	TENSIONR	0.000	0.000	0.000	0.014	0.021
15	LAYBARGE	0.000	0.000	0.000	0.093	0.059
16	LAYBARGE	0.000	0.000	0.000	0.322	0.105
18	LAYBARGE	0.000	0.000	0.000	0.627	0.142
20	LAYBARGE	0.000	0.000	0.000	0.106	0.065
24	STINGER	0.000	0.000	0.001	0.242	0.093
26	STINGER	0.000	0.001	0.003	0.691	0.148
29	STINGER	0.000	0.001	0.005	0.639	0.143
31	STINGER	0.000	0.002	0.008	0.892	0.167
33	STINGER	0.000	0.002	0.009	0.405	0.121
35	SAGBEND	0.000	0.003	0.011	0.119	0.071
36	SAGBEND	0.000	0.003	0.013	0.156	0.080
37	SAGBEND	0.000	0.004	0.014	0.228	0.097
38	SAGBEND	0.000	0.004	0.016	0.276	0.105
39	SAGBEND	0.000	0.005	0.017	0.284	0.107
40	SAGBEND	0.000	0.005	0.018	0.284	0.107
41	SAGBEND	0.000	0.005	0.019	0.284	0.108
42	SAGBEND	0.000	0.005	0.020	0.286	0.108
43	SAGBEND	0.000	0.005	0.020	0.268	0.106
44	SAGBEND	0.000	0.006	0.021	0.209	0.096
45	SAGBEND	0.000	0.006	0.021	0.147	0.083
46	SAGBEND	0.000	0.006	0.021	0.117	0.075
47	SAGBEND	0.000	0.006	0.021	0.083	0.065
48	SEABED	0.000	0.006	0.021	0.045	0.050
49	SEABED	0.000	0.006	0.021	0.011	0.026
50	SEABED	0.000	0.006	0.021	0.001	0.006
51	SEABED	0.000	0.006	0.021	0.000	0.006
52	SEABED	0.000	0.006	0.021	0.000	0.006
53	SEABED	0.000	0.006	0.021	0.000	0.006
54	SEABED	0.000	0.006	0.021	0.000	0.006
55	SEABED	0.000	0.006	0.021	0.000	0.006
56	SEABED	0.000	0.006	0.021	0.000	0.006
57	SEABED	0.000	0.006	0.021	0.000	0.006
58	SEABED	0.000	0.006	0.021	0.000	0.006
59	SEABED	0.000	0.006	0.021	0.000	0.006

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 OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP          DATE - 3/25/2015    TIME - 15:22:21    PAGE   91
 PROJECT - Pipelay Analysis                                                               JOB NO. - Dynamic Analysis
 USER ID - Karun                                              LICENSED TO - OFFSHORE CONSTR. SPECIALISTS       CASE    5
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U N I T Y   R A T I O S   F O R   D N V   O S - F 1 0 1

NODE NO.	PIPE SECTION	/-------------------- DNV LIMIT STATES --------------------/ BURST PRESSURE	COLLAPSE PRESSURE	BUCKLE PROPAGATE	LOCAL BUCKLING* LOAD CNTL.	DISP CNTL.
60	SEABED	0.000	0.006	0.021	0.000	0.006
61	SEABED	0.000	0.006	0.021	0.000	0.006
62	SEABED	0.000	0.006	0.021	0.000	0.006

```
 ._____.
 |                                                        |
 | *NOTE: THE DNV LIMIT STATE INEQUALITIES FOR LOCAL BUCKLING UNDER |
 |        THE COMBINED EFFECTS OF BENDING AND INTERNAL OR EXTERNAL  |
 |        PRESSURE ARE HIGHLY NONLINEAR. THE MAGNITUDE OF THE UNITY |
 |        RATIOS FOR THESE TWO LIMIT STATES MAY SIGNIFICANTLY UNDER |
 |        ESTIMATE HOW CLOSE THE PIPE IS TO EXCEEDING THESE LIMIT   |
 |        STATES.  FOR THIS REASON, DNV REFERS TO THESE VALUES AS   |
 |        "INTERACTION RATIOS" RATHER THAN "UNITY RATIOS".          |
 |_____|
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=================================================================================================================
 OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP          PAGE   92
 Pipelay Analysis
 JOB NO. - Dynamic Analysis       LICENSED TO - OFFSHORE CONSTR. SPECIALISTS
 USER ID - Karun                  DATE - 3/25/2015   TIME - 15:22:21   CASE    6
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================================================================================
        S T A T I C   S O L U T I O N   S U M M A R Y

PIPE PROPERTIES ( 1)
====================
  PIPE SECTION LENGTH ..    0.00 M     ELASTIC MODULUS ......   207000. MPA
  OUTSIDE DIAMETER .....   27.310 CM   CROSS SECTIONAL AREA .   128.75 CM^2
  WALL THICKNESS .......    1.590 CM   MOMENT OF INERTIA ....  12671.5 CM^4
  WEIGHT/LENGTH IN AIR .  2205.00 N/M  YIELD STRESS ........    450.00 MPA
  SUBMERGED WGHT/LENG ..  1164.00 N/M  STRESS INTENS FACTOR .    1.000
  SPECIFIC GRAVITY .....    2.118      STEEL DENSITY ........  76982.0 N/M3
  WRAP COAT THICKNESS ..    0.280 CM   WRAP COAT DENSITY ....   9218.0 N/M3
  CONCRETE THICKNESS ...    4.000 CM   CONCRETE DENSITY .....  29846.0 N/M3

BARGE DATA
==========
  TOTAL PIPE TENSION ...   250.00 KN   RADIUS OF CURVATURE ..     0.00 M
  NUMBER OF TENSIONERS .       2       BARGE TRIM ANGLE .....    0.500 DEG
  NO. OF PIPE SUPPORTS .       7       PIPE ANGLE AT STERN ..    9.594 DEG
  BARGE HEADING ........    0.000 DEG  OFFSET FROM R.O.W. ...     0.00 M

STINGER DATA
============
  NO. OF PIPE SUPPORTS .       5       PIPE DEPTH AT STERN ..    -7.68 M
  NO. STINGER SECTIONS .       7       PIPE ANGLE AT STERN ..   17.345 DEG
  RADIUS OF CURVATURE ..   200.00 M    STINGER STERN DEPTH ..    -8.02 M
  STINGER LENGTH .......    39.00 M

SAGBEND DATA
============
  WATER DEPTH ..........    21.34 M    TENSION AT TOUCHDOWN .   209.80 KN
  TOUCHDOWN X-COORD. ...  -114.89 M    BOTTOM SLOPE ANGLE ...    0.000 DEG
  PROJECTED SPAN LENGTH    75.23 M     PIPE LENGTH GAIN .....     2.90 M

============================== SOLUTION SUMMARY ==============================
NODE   PIPE      X      Y      Z    SUPPORT REACT   TOTAL   TOTAL   PCT
NO. SECTION    COORD  COORD  COORD   VERT   HORIZ  MOMENT  STRESS   YLD
            (M  )  (M  )  (M  )  (KN  )  (KN  )  (KN-M)  (MPA )   (%)
=============================================================================
  1  LAYBARGE   96.3    6.9    0.0   11.8    0.0     0.0     0.0    0.
  3  LAYBARGE   84.3    6.6    0.0   20.0    0.0    17.7    22.8    5.
  5  LAYBARGE   73.4    6.4    0.0   43.4    0.0    89.8   115.1   26.
  7  TENSIONR   60.1    5.9    0.0    4.5    0.0    45.7    68.0   15.
  9  LAYBARGE   51.1    5.7    0.0    0.0    0.0    38.9    59.3   13.
 10  LAYBARGE   46.4    5.5    0.0   62.6    0.0   155.7   208.8   46.
 12  LAYBARGE   39.4    5.2    0.0    0.0    0.0     1.6    11.5    3.
 13  TENSIONR   35.4    5.0    0.0   -8.9    0.0    35.2    64.2   14.
 15  LAYBARGE   26.1    4.5    0.0    0.0    0.0    93.4   138.6   31.
 16  LAYBARGE   23.3    4.3    0.0   58.1    0.0   176.6   245.1   54.
 18  LAYBARGE    8.9    2.7    0.0   60.1    0.0   193.4   266.3   59.
 20  LAYBARGE    3.1    1.8    0.0    0.0   -0.1    50.5    83.3   19.

=============================================================================
OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP        PAGE  93
Pipelay Analysis
JOB NO. - Dynamic Analysis     LICENSED TO - OFFSHORE CONSTR. SPECIALISTS
USER ID - Karun                DATE - 3/25/2015  TIME - 15:22:21  CASE   6
=============================================================================

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


 24  STINGER    -7.6    0.0    0.0    0.0    0.3    18.1    41.4    9.
 26  STINGER   -16.5   -1.7    0.0   42.7    0.6   168.5   233.8   52.
 29  STINGER   -26.2   -3.9    0.0   14.0    0.6   114.6   164.6   37.
 31  STINGER   -36.7   -6.8    0.0   37.7   -1.7   135.8   191.5   43.
 33  STINGER   -39.7   -7.7    0.0    0.0    2.7    69.1   106.0   24.
 42  SAGBEND   -86.1  -19.3    0.0    0.0    0.0   133.3   187.1   42.
 47  SEABED   -116.0  -21.4    0.0    3.5    0.5    59.0    91.8   20.
```

```
 ===========================================================================================================================
   OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP          DATE - 3/25/2015   TIME - 15:22:21    PAGE   94
   PROJECT - Pipelay Analysis                                                                JOB NO. - Dynamic Analysis
   USER ID - Karun                                       LICENSED TO - OFFSHORE CONSTR. SPECIALISTS         CASE    6
 ===========================================================================================================================
```

```
        U N I T Y   R A T I O S   F O R   D N V   O S - F 1 0 1

=============================================================================
NODE    PIPE   /-------------------- DNV LIMIT STATES --------------------/
NO.   SECTION      BURST    COLLAPSE    BUCKLE     LOCAL BUCKLING*
                  PRESSURE  PRESSURE   PROPAGATE  LOAD CNTL.  DISP CNTL.
=============================================================================
  1   LAYBARGE    0.000     0.000      0.000      0.000      0.000
  3   LAYBARGE    0.000     0.000      0.000      0.003      0.017
  5   LAYBARGE    0.000     0.000      0.000      0.075      0.063
  7   TENSIONR    0.000     0.000      0.000      0.020      0.032
  9   LAYBARGE    0.000     0.000      0.000      0.014      0.027
 10   LAYBARGE    0.000     0.000      0.000      0.226      0.095
 12   LAYBARGE    0.000     0.000      0.000      0.000      0.000
 13   TENSIONR    0.000     0.000      0.000      0.012      0.019
 15   LAYBARGE    0.000     0.000      0.000      0.082      0.056
 16   LAYBARGE    0.000     0.000      0.000      0.290      0.101
 18   LAYBARGE    0.000     0.000      0.000      0.368      0.112
 20   LAYBARGE    0.000     0.000      0.000      0.030      0.034

 24   STINGER     0.000     0.000      0.000      0.008      0.015
 26   STINGER     0.000     0.000      0.002      0.241      0.094
 29   STINGER     0.000     0.001      0.004      0.114      0.068
 31   STINGER     0.000     0.002      0.007      0.160      0.080
```

```
  33    STINGER     0.000      0.002      0.007      0.041      0.043

  35    SAGBEND     0.000      0.002      0.009      0.004      0.009
  36    SAGBEND     0.000      0.003      0.011      0.044      0.045
  37    SAGBEND     0.000      0.003      0.013      0.088      0.063
  38    SAGBEND     0.000      0.004      0.014      0.121      0.073
  39    SAGBEND     0.000      0.004      0.016      0.144      0.079
  40    SAGBEND     0.000      0.005      0.017      0.159      0.083
  41    SAGBEND     0.000      0.005      0.018      0.166      0.085
  42    SAGBEND     0.000      0.005      0.019      0.168      0.085
  43    SAGBEND     0.000      0.005      0.020      0.162      0.084
  44    SAGBEND     0.000      0.005      0.020      0.148      0.081
  45    SAGBEND     0.000      0.005      0.020      0.121      0.075
  46    SAGBEND     0.000      0.006      0.021      0.080      0.063

  47    SEABED      0.000      0.006      0.021      0.030      0.041
  48    SEABED      0.000      0.006      0.021      0.004      0.014
  49    SEABED      0.000      0.006      0.021      0.000      0.006
  50    SEABED      0.000      0.006      0.021      0.000      0.006
  51    SEABED      0.000      0.006      0.021      0.000      0.006
  52    SEABED      0.000      0.006      0.021      0.000      0.006
  53    SEABED      0.000      0.006      0.021      0.000      0.006
  54    SEABED      0.000      0.006      0.021      0.000      0.006
  55    SEABED      0.000      0.006      0.021      0.000      0.006
  56    SEABED      0.000      0.006      0.021      0.000      0.006
  57    SEABED      0.000      0.006      0.021      0.000      0.006
  58    SEABED      0.000      0.006      0.021      0.000      0.006
  59    SEABED      0.000      0.006      0.021      0.000      0.006
```

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================================================================================================
 OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP        DATE - 3/25/2015   TIME - 15:22:21   PAGE   95
 PROJECT - Pipelay Analysis                                           JOB NO. - Dynamic Analysis
 USER ID - Karun                                 LICENSED TO - OFFSHORE CONSTR. SPECIALISTS          CASE    6
================================================================================================
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UNITY RATIOS FOR DNV OS-F101

```
================================================================================
NODE    PIPE    /--------------------- DNV LIMIT STATES ---------------------/
NO.     SECTION   BURST    COLLAPSE    BUCKLE      LOCAL BUCKLING*
                  PRESSURE  PRESSURE   PROPAGATE  LOAD CNTL.  DISP CNTL.
================================================================================
  60    SEABED    0.000     0.006      0.021      0.000      0.006
  61    SEABED    0.000     0.006      0.021      0.000      0.006
  62    SEABED    0.000     0.006      0.021      0.000      0.006


    ._____.
    |                                                        |
    | *NOTE: THE DNV LIMIT STATE INEQUALITIES FOR LOCAL BUCKLING UNDER |
    |      THE COMBINED EFFECTS OF BENDING AND INTERNAL OR EXTERNAL  |
    |      PRESSURE ARE HIGHLY NONLINEAR. THE MAGNITUDE OF THE UNITY |
    |      RATIOS FOR THESE TWO LIMIT STATES MAY SIGNIFICANTLY UNDER |
    |      ESTIMATE HOW CLOSE THE PIPE IS TO EXCEEDING THESE LIMIT   |
    |      STATES.  FOR THIS REASON, DNV REFERS TO THESE VALUES AS   |
    |      "INTERACTION RATIOS" RATHER THAN "UNITY RATIOS".          |
    |_____|
```

```
================================================================================================
 OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP        DATE - 3/25/2015   TIME - 15:22:21   PAGE   96
 PROJECT - Pipelay Analysis                                           JOB NO. - Dynamic Analysis
 USER ID - Karun                                 LICENSED TO - OFFSHORE CONSTR. SPECIALISTS          CASE    6
================================================================================================
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MAXIMUM DYNAMIC PIPE FORCES AND STRESSES

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================================================================================================================
NODE   PIPE        X       Y       Z     HORIZ    VERT    PIPE    TENSILE   HOOP   BENDING STRESSES   TOTAL   PERCNT
NO.    SECTION   COORD   COORD   COORD   ANGLE    ANGLE   LENGTH  STRESS   STRESS    VERT    HORIZ    STRESS  YIELD
                 (M )    (M )    (M )    (DEG )   (DEG )  (M )    (MPA )   (MPA )   (MPA )  (MPA )   (MPA )  (PCT )
================================================================================================================
   1   LAYBARGE   96.28    6.95    0.01   0.001    1.628   0.00    0.00     0.00     0.00     0.00     0.00    0.00
   3   LAYBARGE   84.24    6.66    0.01   0.000    1.168  12.04   -0.15     0.00   -25.23    -0.44    25.25    5.61
   5   LAYBARGE   73.42    6.39    0.00   0.001    1.931  22.87   -0.30     0.00  -117.27     0.35   117.37   26.08
   7   TENSIONR   60.07    5.87    0.00   0.000    1.616  36.22   11.54     0.00    59.74     0.42    70.41   15.65
   9   LAYBARGE   51.05    5.67    0.00   0.000    1.269  45.24   11.52     0.00   -51.10    -0.21    61.68   13.71
  10   LAYBARGE   46.41    5.55    0.00   0.001    2.208  49.89   11.47     0.00  -201.00     0.51   212.25   47.17
  12   LAYBARGE   39.38    5.19    0.01   0.001    3.255  56.93   11.46     0.00    -6.35     0.07    15.99    3.55
  13   TENSIONR   35.33    4.95    0.01   0.001    3.085  60.99   21.59     0.00    48.92     0.23    69.71   15.49
  15   LAYBARGE   26.07    4.45    0.00   0.001    3.329  70.26   21.57     0.00  -130.31     0.32   151.03   33.56
  16   LAYBARGE   23.31    4.27    0.00   0.001    4.114  73.02   21.53     0.00  -243.76     0.74   264.41   58.76
  18   LAYBARGE    8.86    2.73    0.00   0.003    8.483  87.56   21.35     0.00  -343.65     0.87   360.42   80.09
  20   LAYBARGE    3.07    1.76    0.00   0.003   10.285  93.44   21.29     0.00  -222.51    -0.48   239.23   53.16

  24   STINGER    -7.57   -0.40   -0.01   0.005   11.472 104.23   21.09    -0.10  -262.58     2.80   282.53   62.78
  26   STINGER   -16.52   -2.26   -0.01   0.005   13.051 113.38   20.88    -0.28  -325.64     3.48   345.29   76.73
  29   STINGER   -26.10   -4.55   -0.01   0.007   13.971 123.33   20.61    -0.48  -329.08     3.67   348.72   77.49
  31   STINGER   -36.52   -7.34   -0.02  -0.001   16.733 134.14   20.26    -0.74  -383.30    -5.88   398.66   88.59
  33   STINGER   -39.52   -8.24   -0.02   0.019   17.358 137.27   20.15    -0.83  -254.71    53.35   271.47   60.33

  35   SAGBEND   -45.30  -10.01   -0.02   0.104   17.563 143.25   19.95    -0.98   125.71    24.07   145.08   32.24
  36   SAGBEND   -51.04  -11.75   -0.03   0.168   16.819 149.25   19.75    -1.13   159.35    12.23   178.34   39.63
  37   SAGBEND   -56.79  -13.40   -0.03   0.172   15.837 155.25   19.57    -1.27   174.79   -13.03   191.61   42.58
  38   SAGBEND   -62.58  -14.92   -0.03   0.136   14.455 161.25   19.41    -1.39   199.78   -16.25   214.29   47.62
  39   SAGBEND   -68.42  -16.36   -0.04   0.056   12.794 167.25   19.26    -1.51   211.80   -17.00   226.17   50.26
  40   SAGBEND   -74.29  -17.62   -0.04   0.027   11.062 173.25   19.13    -1.61   217.81   -15.60   231.98   51.55
  41   SAGBEND   -80.19  -18.68   -0.05   0.027    9.256 179.25   19.02    -1.69   223.82   -15.93   237.71   52.82
  42   SAGBEND   -86.12  -19.55   -0.05  -0.003    7.478 185.25   18.92    -1.76   223.32   -14.88   237.23   52.72
  43   SAGBEND   -92.08  -20.21   -0.05  -0.042    5.607 191.25   18.85    -1.80   214.60   -11.61   228.44   50.76
  44   SAGBEND   -98.06  -20.69   -0.06  -0.079    3.879 197.25   18.80    -1.83   201.03    -6.98   215.04   47.79
  45   SAGBEND  -104.05  -21.01   -0.05  -0.092    2.432 203.25   18.78    -1.84   172.92   -13.62   186.92   41.54
  46   SAGBEND  -110.04  -21.20   -0.04  -0.122    1.388 209.25   18.77    -1.85   139.91   -21.45   154.85   34.41
  47   SAGBEND  -116.04  -21.31   -0.02  -0.144    0.705 215.25   18.78    -1.85   108.07    25.84   125.46   27.88
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    48   SEABED      -122.04     -21.37      -0.01   -0.089    0.241    221.25    18.80    -1.85     70.36     24.23     89.65    19.92
    49   SEABED      -128.04     -21.37       0.00   -0.026    0.004    227.25    18.82    -1.85     26.56     13.41     46.83    10.41
    50   SEABED      -134.04     -21.37       0.00    0.000   -0.033    233.25    18.84    -1.85     -4.13      3.93     23.92     5.32
    51   SEABED      -140.04     -21.37       0.00    0.004   -0.019    239.25    18.86    -1.85     -3.15     -0.81     22.49     5.00
    52   SEABED      -146.04     -21.37       0.00    0.003   -0.006    245.25    18.88    -1.85     -1.98     -0.80     21.00     4.67
    53   SEABED      -152.04     -21.37       0.00    0.001    0.001    251.25    18.90    -1.84     -0.74     -0.46     20.10     4.47
    54   SEABED      -158.04     -21.37       0.00    0.000    0.001    257.25    18.91    -1.84      0.14     -0.25     20.10     4.47
    55   SEABED      -164.04     -21.37       0.00    0.000    0.001    263.25    18.93    -1.84      0.11      0.27     20.08     4.46
    56   SEABED      -170.04     -21.37       0.00    0.000    0.000    269.25    18.95    -1.84      0.06      0.28     20.04     4.45
    57   SEABED      -176.04     -21.37       0.00    0.000    0.000    275.25    18.96    -1.84      0.04      0.27     19.99     4.44
    58   SEABED      -182.04     -21.37       0.00    0.000    0.000    281.25    18.98    -1.84     -0.02      0.26     19.97     4.44
    59   SEABED      -188.04     -21.37       0.00    0.000    0.000    287.25    18.99    -1.84     -0.02      0.29     20.05     4.46
```

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   OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP          DATE - 3/25/2015    TIME - 15:22:21     PAGE    97
   PROJECT - Pipelay Analysis                                             JOB NO. - Dynamic Analysis
   USER ID - Karun                                     LICENSED TO - OFFSHORE CONSTR. SPECIALISTS          CASE    6
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             M A X I M U M   D Y N A M I C   P I P E   F O R C E S   A N D   S T R E S S E S

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================================================================================================
 NODE    PIPE        X          Y          Z      HORIZ     VERT      PIPE     TENSILE   HOOP    BENDING STRESSES   TOTAL    PERCNT
 NO.     SECTION    COORD      COORD      COORD    ANGLE     ANGLE    LENGTH   STRESS   STRESS    VERT     HORIZ    STRESS    YIELD
                    (M  )      (M  )      (M  )    (DEG )    (DEG )    (M  )    (MPA )   (MPA )   (MPA )   (MPA )    (MPA )    (PCT )
================================================================================================
    60   SEABED      -194.04     -21.37       0.00    0.000    0.000    293.25    19.00    -1.84     -0.02      0.36     20.14     4.48
    61   SEABED      -200.04     -21.37       0.00    0.000    0.000    299.25    19.02    -1.84     -0.01      0.40     20.19     4.49
    62   SEABED      -206.04     -21.37       0.00    0.000    0.000    305.25    19.03    -1.84      0.00      0.00     20.02     4.45
```

```
================================================================================================
   OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP          DATE - 3/25/2015    TIME - 15:22:21     PAGE    98
   PROJECT - Pipelay Analysis                                             JOB NO. - Dynamic Analysis
   USER ID - Karun                                     LICENSED TO - OFFSHORE CONSTR. SPECIALISTS          CASE    6
================================================================================================
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             M A X I M U M   D Y N A M I C   P I P E   F O R C E S   A N D   S T R E S S E S

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================================================================================================
 NODE    PIPE        X          Y          Z      SUPPORT REACTION   SUPT SEPARATIONS    PIPE             BENDING MOMENTS
 NO.     SECTION    COORD      COORD      COORD    VERT     HORIZ     VERT      HORIZ    TENSION    VERT     HORIZ     TOTAL
                    (M  )      (M  )      (M  )    (KN  )   (KN  )    (M  )     (M  )    (KN  )    (KN-M)    (KN-M)    (KN-M)
================================================================================================
     1   LAYBARGE      96.28       6.95       0.01    12.13    -0.14     0.00      0.00      0.00      0.00      0.00      0.00
     3   LAYBARGE      84.24       6.66       0.01    21.04    -0.31     0.00      0.00     -1.93    -19.70     -0.34     19.70
     5   LAYBARGE      73.42       6.39       0.00    44.02    -0.21     0.00      0.00     -3.84    -91.58      0.27     91.58
     7   TENSIONR      60.07       5.87       0.00     4.93     0.20     0.00      0.00    148.29     46.66      0.33     46.66
     9   LAYBARGE      51.05       5.67       0.00     0.00     0.00     0.00      0.00    148.03    -39.91     -0.16     39.91
    10   LAYBARGE      46.41       5.55       0.00    63.88    -0.19     0.00      0.00    147.39   -156.98      0.40    156.98
    12   LAYBARGE      39.38       5.19       0.01     0.00     0.00     0.00      0.00    147.20     -4.96      0.05      4.96
    13   TENSIONR      35.33       4.95       0.01   -10.41    -0.19     0.00      0.00    277.41     38.21      0.18     38.21
    15   LAYBARGE      26.07       4.45       0.00     0.00     0.00     0.00      0.00    277.13   -101.77      0.25    101.77
    16   LAYBARGE      23.31       4.27       0.00    64.94    -0.36     0.00      0.00    276.57   -190.37      0.58    190.37
    18   LAYBARGE       8.86       2.73       0.00    75.61     0.36     0.00      0.00    274.32   -268.38      0.68    268.38
    20   LAYBARGE       3.07       1.76       0.00    27.49     0.83     0.18      0.00    273.47   -173.78     -0.38    173.78

    24   STINGER       -7.57      -0.40      -0.01    56.94     2.26     0.13      0.00    271.36   -205.07      2.19    205.07
    26   STINGER      -16.52      -2.26      -0.01    59.61     3.22     0.62      0.00    269.74   -254.32      2.72    254.32
    29   STINGER      -26.10      -4.55      -0.01    61.02     2.90     0.72      0.00    267.68   -257.00      2.87    257.00
    31   STINGER      -36.52      -7.34      -0.02    76.92   -14.86     0.15      0.00    265.00   -299.35     -4.59    299.36
    33   STINGER      -39.52      -8.24      -0.02    -0.02    20.15     0.61      0.00    264.18   -198.92     41.66    200.03

    35   SAGBEND      -45.30     -10.01      -0.02     0.00     0.00     0.00      0.00    262.57     98.18     18.79     98.38
    36   SAGBEND      -51.04     -11.75      -0.03     0.00     0.00     0.00      0.00    260.97    124.45      9.55    124.49
    37   SAGBEND      -56.79     -13.40      -0.03     0.00     0.00     0.00      0.00    259.55    136.51    -10.18    136.53
    38   SAGBEND      -62.58     -14.92      -0.03     0.00     0.00     0.00      0.00    258.27    156.02    -12.69    156.03
    39   SAGBEND      -68.42     -16.36      -0.04     0.00     0.00     0.00      0.00    257.12    165.41    -13.28    165.42
    40   SAGBEND      -74.29     -17.62      -0.04     0.00     0.00     0.00      0.00    256.10    170.10    -12.18    170.11
    41   SAGBEND      -80.19     -18.68      -0.05     0.00     0.00     0.00      0.00    255.23    174.80    -12.44    174.80
    42   SAGBEND      -86.12     -19.55      -0.05     0.00     0.00     0.00      0.00    254.54    174.40    -11.62    174.42
    43   SAGBEND      -92.08     -20.21      -0.05     0.00     0.00     0.00      0.00    254.03    167.60     -9.07    167.61
    44   SAGBEND      -98.06     -20.69      -0.06     0.00     0.00     0.00      0.00    253.71    157.00     -5.45    157.00
    45   SAGBEND     -104.05     -21.01      -0.05     2.16     0.55     0.00      0.00    253.59    135.05    -10.64    135.06
    46   SAGBEND     -110.04     -21.20      -0.04     9.77    -2.91     0.00      0.00    253.64    109.26    -16.76    109.29
    47   SAGBEND     -116.04     -21.31      -0.02    10.94     3.95     0.00      0.00    253.86     84.40     20.18     84.43

    48   SEABED      -122.04     -21.37      -0.01    10.85     3.88     0.00      0.00    254.16     54.95     18.92     55.47
    49   SEABED      -128.04     -21.37       0.00     9.96     1.01     0.00      0.00    254.42     20.74     10.47     22.01
    50   SEABED      -134.04     -21.37       0.00     9.01    -0.66     0.00      0.00    254.67     -3.22      3.07      4.10
    51   SEABED      -140.04     -21.37       0.00     7.89    -0.42     0.00      0.00    254.91     -2.46     -0.63      2.46
    52   SEABED      -146.04     -21.37       0.00     7.16    -0.20     0.00      0.00    255.14     -1.55     -0.62      1.55
    53   SEABED      -152.04     -21.37       0.00     6.98    -0.15     0.00      0.00    255.36     -0.58     -0.36      0.59
    54   SEABED      -158.04     -21.37       0.00     6.99    -0.14     0.00      0.00    255.58      0.11     -0.19      0.21
    55   SEABED      -164.04     -21.37       0.00     7.00    -0.14     0.00      0.00    255.79      0.09      0.21      0.22
    56   SEABED      -170.04     -21.37       0.00     7.00    -0.14     0.00      0.00    255.99      0.05      0.22      0.22
    57   SEABED      -176.04     -21.37       0.00     7.00    -0.15     0.00      0.00    256.19      0.03      0.21      0.21
```

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   OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP          DATE - 3/25/2015    TIME - 15:22:21     PAGE    99
   PROJECT - Pipelay Analysis                                             JOB NO. - Dynamic Analysis
   USER ID - Karun                                     LICENSED TO - OFFSHORE CONSTR. SPECIALISTS          CASE    6
================================================================================================
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             M A X I M U M   D Y N A M I C   P I P E   F O R C E S   A N D   S T R E S S E S

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================================================================================================
 NODE    PIPE        X          Y          Z      SUPPORT REACTION   SUPT SEPARATIONS    PIPE             BENDING MOMENTS
 NO.     SECTION    COORD      COORD      COORD    VERT     HORIZ     VERT      HORIZ    TENSION    VERT     HORIZ     TOTAL
                    (M  )      (M  )      (M  )    (KN  )   (KN  )    (M  )     (M  )    (KN  )    (KN-M)    (KN-M)    (KN-M)
================================================================================================
    58   SEABED      -182.04     -21.37       0.00     6.99    -0.14     0.00      0.00    256.38     -0.02      0.20      0.20
```

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  59  SEABED    -188.04   -21.37    0.00    6.99   -0.14    0.00    0.00  256.56   -0.02    0.22    0.22
  60  SEABED    -194.04   -21.37    0.00    6.99   -0.13    0.00    0.00  256.74   -0.01    0.28    0.28
  61  SEABED    -200.04   -21.37    0.00    7.00   -0.09    0.00    0.00  256.91   -0.01    0.31    0.31
  62  SEABED    -206.04   -21.37    0.00    0.00   -0.01    0.00    0.00  257.08    0.00    0.00    0.00
```

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========================================================================================================
  OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP         DATE - 3/25/2015   TIME - 15:22:21   PAGE 100
  PROJECT - Pipelay Analysis                                            JOB NO. - Dynamic Analysis
  USER ID - Karun                                     LICENSED TO - OFFSHORE CONSTR. SPECIALISTS      CASE   6
========================================================================================================
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U N I T Y   R A T I O S   F O R   D N V   O S - F 1 0 1

NODE NO.	PIPE SECTION	BURST PRESSURE	COLLAPSE PRESSURE	BUCKLE PROPAGATE	LOCAL BUCKLING* LOAD CNTL.	DISP CNTL.
1	LAYBARGE	0.000	0.000	0.000	0.000	0.000
3	LAYBARGE	0.000	0.000	0.000	0.003	0.018
5	LAYBARGE	0.000	0.000	0.000	0.077	0.064
7	TENSIONR	0.000	0.000	0.000	0.020	0.033
9	LAYBARGE	0.000	0.000	0.000	0.015	0.028
10	LAYBARGE	0.000	0.000	0.000	0.228	0.095
12	LAYBARGE	0.000	0.000	0.000	0.000	0.000
13	TENSIONR	0.000	0.000	0.000	0.013	0.021
15	LAYBARGE	0.000	0.000	0.000	0.091	0.059
16	LAYBARGE	0.000	0.000	0.000	0.318	0.105
18	LAYBARGE	0.000	0.000	0.000	0.617	0.141
20	LAYBARGE	0.000	0.000	0.000	0.296	0.104
24	STINGER	0.000	0.000	0.001	0.434	0.120
26	STINGER	0.000	0.001	0.003	0.590	0.138
29	STINGER	0.000	0.001	0.005	0.641	0.144
31	STINGER	0.000	0.002	0.008	0.863	0.165
33	STINGER	0.000	0.002	0.009	0.401	0.120
35	SAGBEND	0.000	0.003	0.011	0.100	0.066
36	SAGBEND	0.000	0.003	0.013	0.144	0.078
37	SAGBEND	0.000	0.004	0.014	0.163	0.084
38	SAGBEND	0.000	0.004	0.016	0.211	0.095
39	SAGBEND	0.000	0.005	0.017	0.235	0.099
40	SAGBEND	0.000	0.005	0.018	0.247	0.102
41	SAGBEND	0.000	0.005	0.019	0.262	0.104
42	SAGBEND	0.000	0.005	0.020	0.260	0.104
43	SAGBEND	0.000	0.005	0.020	0.239	0.101
44	SAGBEND	0.000	0.006	0.021	0.209	0.096
45	SAGBEND	0.000	0.006	0.021	0.153	0.084
46	SAGBEND	0.000	0.006	0.021	0.101	0.071
47	SAGBEND	0.000	0.006	0.021	0.065	0.058
48	SEABED	0.000	0.006	0.021	0.032	0.041
49	SEABED	0.000	0.006	0.021	0.006	0.017
50	SEABED	0.000	0.006	0.021	0.000	0.006
51	SEABED	0.000	0.006	0.021	0.000	0.006
52	SEABED	0.000	0.006	0.021	0.000	0.006
53	SEABED	0.000	0.006	0.021	0.000	0.006
54	SEABED	0.000	0.006	0.021	0.000	0.006
55	SEABED	0.000	0.006	0.021	0.000	0.006
56	SEABED	0.000	0.006	0.021	0.000	0.006
57	SEABED	0.000	0.006	0.021	0.000	0.006
58	SEABED	0.000	0.006	0.021	0.000	0.006
59	SEABED	0.000	0.006	0.021	0.000	0.006

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========================================================================================================
  OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP         DATE - 3/25/2015   TIME - 15:22:21   PAGE 101
  PROJECT - Pipelay Analysis                                            JOB NO. - Dynamic Analysis
  USER ID - Karun                                     LICENSED TO - OFFSHORE CONSTR. SPECIALISTS      CASE   6
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U N I T Y   R A T I O S   F O R   D N V   O S - F 1 0 1

NODE NO.	PIPE SECTION	BURST PRESSURE	COLLAPSE PRESSURE	BUCKLE PROPAGATE	LOCAL BUCKLING* LOAD CNTL.	DISP CNTL.
60	SEABED	0.000	0.006	0.021	0.000	0.006
61	SEABED	0.000	0.006	0.021	0.000	0.006
62	SEABED	0.000	0.006	0.021	0.000	0.006

```
._____.
|                                                        |
| *NOTE: THE DNV LIMIT STATE INEQUALITIES FOR LOCAL BUCKLING UNDER |
|        THE COMBINED EFFECTS OF BENDING AND INTERNAL OR EXTERNAL  |
|        PRESSURE ARE HIGHLY NONLINEAR. THE MAGNITUDE OF THE UNITY |
|        RATIOS FOR THESE TWO LIMIT STATES MAY SIGNIFICANTLY UNDER |
|        ESTIMATE HOW CLOSE THE PIPE IS TO EXCEEDING THESE LIMIT   |
|        STATES.  FOR THIS REASON, DNV REFERS TO THESE VALUES AS   |
|        "INTERACTION RATIOS" RATHER THAN "UNITY RATIOS".          |
|_____|
```

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========================================================================================================
OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP         PAGE 102
Pipelay Analysis
JOB NO. - Dynamic Analysis        LICENSED TO - OFFSHORE CONSTR. SPECIALISTS
USER ID - Karun                   DATE - 3/25/2015  TIME - 15:22:21  CASE   7
========================================================================================================
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S T A T I C   S O L U T I O N   S U M M A R Y

```
PIPE PROPERTIES ( 1)
=====================
  PIPE SECTION LENGTH ..     0.00 M     ELASTIC MODULUS ......  207000. MPA
  OUTSIDE DIAMETER .....    27.310 CM   CROSS SECTIONAL AREA .   128.75 CM^2
  WALL THICKNESS .......     1.590 CM   MOMENT OF INERTIA ....  12671.5 CM^4
  WEIGHT/LENGTH IN AIR .   2205.00 N/M  YIELD STRESS .........   450.00 MPA
  SUBMERGED WGHT/LENG ..   1164.00 N/M  STRESS INTENS FACTOR .    1.000
  SPECIFIC GRAVITY .....     2.118      STEEL DENSITY ........  76982.0 N/M3
  WRAP COAT THICKNESS ..     0.280 CM   WRAP COAT DENSITY ....   9218.0 N/M3
  CONCRETE THICKNESS ...     4.000 CM   CONCRETE DENSITY .....  29846.0 N/M3

BARGE DATA
==========
  TOTAL PIPE TENSION ...    250.00 KN   RADIUS OF CURVATURE ..     0.00 M
  NUMBER OF TENSIONERS .         2      BARGE TRIM ANGLE .....     0.500 DEG
  NO. OF PIPE SUPPORTS .         7      PIPE ANGLE AT STERN ..     9.823 DEG
  BARGE HEADING ........     0.000 DEG  OFFSET FROM R.O.W. ...     0.00 M

STINGER DATA
============
  NO. OF PIPE SUPPORTS .         5      PIPE DEPTH AT STERN ..    -8.02 M
  NO. STINGER SECTIONS .         7      PIPE ANGLE AT STERN ..    17.333 DEG
  RADIUS OF CURVATURE ..    200.00 M    STINGER STERN DEPTH ..    -8.37 M
  STINGER LENGTH .......     39.00 M

SAGBEND DATA
============
  WATER DEPTH ..........     21.34 M    TENSION AT TOUCHDOWN .   209.81 KN
  TOUCHDOWN X-COORD. ...   -113.79 M    BOTTOM SLOPE ANGLE ...     0.000 DEG
  PROJECTED SPAN LENGTH     74.20 M     PIPE LENGTH GAIN .....     2.91 M

============================== SOLUTION SUMMARY ==============================
NODE  PIPE       X      Y      Z    SUPPORT REACT   TOTAL   TOTAL   PCT
NO. SECTION    COORD  COORD  COORD   VERT   HORIZ  MOMENT  STRESS   YLD
                (M  )  (M  )  (M  )  (KN )   (KN )  (KN-M)  (MPA )   (%)
=============================================================================
  1  LAYBARGE   96.3    6.9    0.0   11.8    0.0     0.0     0.0    0.
  3  LAYBARGE   84.3    6.6    0.0   20.0    0.0    17.8    22.8    5.
  5  LAYBARGE   73.4    6.4    0.0   43.4    0.0    89.8   115.1   26.
  7  TENSIONR   60.1    5.9    0.0    4.5    0.0    45.6    68.0   15.
  9  LAYBARGE   51.1    5.7    0.0    0.0    0.0    38.8    59.2   13.
 10  LAYBARGE   46.4    5.5    0.0   62.5    0.0   155.5   208.6   46.
 12  LAYBARGE   39.4    5.2    0.0    0.0    0.0     2.0    11.9    3.
 13  TENSIONR   35.4    5.0    0.0   -8.6    0.0    34.5    63.3   14.
 15  LAYBARGE   26.1    4.5    0.0    0.0    0.0    91.6   136.3   30.
 16  LAYBARGE   23.3    4.3    0.0   57.0    0.0   173.9   241.7   54.
 18  LAYBARGE    8.9    2.7    0.0   61.2    0.0   203.7   279.5   62.
 20  LAYBARGE    3.1    1.8    0.0    0.0   -0.1    63.1    99.4   22.

=============================================================================
OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP        PAGE 103
Pipelay Analysis
JOB NO. - Dynamic Analysis    LICENSED TO - OFFSHORE CONSTR. SPECIALISTS
USER ID - Karun               DATE - 3/25/2015  TIME - 15:22:21  CASE   7
=============================================================================

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


 24  STINGER    -7.5   -0.1    0.0    7.3    0.7    43.4    73.8   16.
 26  STINGER   -16.5   -1.9    0.0   36.0    1.2   148.0   207.5   46.
 29  STINGER   -26.2   -4.2    0.0   13.9    1.2   102.2   148.7   33.
 31  STINGER   -36.6   -7.1    0.0   35.8   -3.2   121.9   173.6   39.
 33  STINGER   -39.6   -8.0    0.0    0.0    5.2    59.1    93.2   21.
 42  SAGBEND   -86.1  -19.5   -0.1    0.0    0.0   133.3   187.1   42.
 47  SEABED   -116.0  -21.4    0.0    4.9    0.9    51.2    81.8   18.

=================================================================================================================
 OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP        DATE - 3/25/2015   TIME - 15:22:21   PAGE 104
 PROJECT - Pipelay Analysis                                                         JOB NO. - Dynamic Analysis
 USER ID - Karun                                       LICENSED TO - OFFSHORE CONSTR. SPECIALISTS        CASE   7
=================================================================================================================

      U N I T Y   R A T I O S   F O R   D N V   O S - F 1 0 1


=============================================================================
NODE    PIPE    /--------------------- DNV LIMIT STATES ---------------------/
NO.  SECTION     BURST    COLLAPSE    BUCKLE      LOCAL BUCKLING*
                PRESSURE  PRESSURE  PROPAGATE  LOAD CNTL.  DISP CNTL.
=============================================================================
   1  LAYBARGE    0.000    0.000     0.000      0.000      0.000
   3  LAYBARGE    0.000    0.000     0.000      0.003      0.017
   5  LAYBARGE    0.000    0.000     0.000      0.075      0.063
   7  TENSIONR    0.000    0.000     0.000      0.020      0.032
   9  LAYBARGE    0.000    0.000     0.000      0.014      0.027
  10  LAYBARGE    0.000    0.000     0.000      0.226      0.095
  12  LAYBARGE    0.000    0.000     0.000      0.000      0.000
  13  TENSIONR    0.000    0.000     0.000      0.012      0.019
  15  LAYBARGE    0.000    0.000     0.000      0.080      0.056
  16  LAYBARGE    0.000    0.000     0.000      0.285      0.100
  18  LAYBARGE    0.000    0.000     0.000      0.390      0.115
  20  LAYBARGE    0.000    0.000     0.000      0.038      0.039

  24  STINGER     0.000    0.000     0.000      0.018      0.026
  26  STINGER     0.000    0.000     0.002      0.207      0.088
  29  STINGER     0.000    0.001     0.004      0.099      0.064
  31  STINGER     0.000    0.002     0.007      0.141      0.075
  33  STINGER     0.000    0.002     0.008      0.033      0.039

  35  SAGBEND     0.000    0.003     0.010      0.005      0.013
  36  SAGBEND     0.000    0.003     0.011      0.047      0.047
  37  SAGBEND     0.000    0.003     0.013      0.091      0.064
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    38   SAGBEND       0.000        0.004        0.014        0.124        0.074
    39   SAGBEND       0.000        0.004        0.016        0.146        0.079
    40   SAGBEND       0.000        0.005        0.017        0.160        0.083
    41   SAGBEND       0.000        0.005        0.018        0.167        0.085
    42   SAGBEND       0.000        0.005        0.019        0.168        0.085
    43   SAGBEND       0.000        0.005        0.020        0.161        0.084
    44   SAGBEND       0.000        0.005        0.020        0.146        0.081
    45   SAGBEND       0.000        0.005        0.020        0.118        0.074
    46   SAGBEND       0.000        0.006        0.021        0.076        0.061

    47   SEABED        0.000        0.006        0.021        0.025        0.038
    48   SEABED        0.000        0.006        0.021        0.002        0.009
    49   SEABED        0.000        0.006        0.021        0.000        0.006
    50   SEABED        0.000        0.006        0.021        0.000        0.006
    51   SEABED        0.000        0.006        0.021        0.000        0.006
    52   SEABED        0.000        0.006        0.021        0.000        0.006
    53   SEABED        0.000        0.006        0.021        0.000        0.006
    54   SEABED        0.000        0.006        0.021        0.000        0.006
    55   SEABED        0.000        0.006        0.021        0.000        0.006
    56   SEABED        0.000        0.006        0.021        0.000        0.006
    57   SEABED        0.000        0.006        0.021        0.000        0.006
    58   SEABED        0.000        0.006        0.021        0.000        0.006
    59   SEABED        0.000        0.006        0.021        0.000        0.006
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    =================================================================================================================
    OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP          DATE - 3/25/2015    TIME - 15:22:21    PAGE  105
    PROJECT - Pipelay Analysis                                                                 JOB NO. - Dynamic Analysis
    USER ID - Karun                                              LICENSED TO - OFFSHORE CONSTR. SPECIALISTS         CASE   7
    =================================================================================================================
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           U N I T Y   R A T I O S   F O R   D N V   O S - F 1 0 1

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    ==========================================================================
    NODE    PIPE    /-------------------- DNV LIMIT STATES --------------------/
    NO.   SECTION     BURST      COLLAPSE      BUCKLE       LOCAL BUCKLING*
                    PRESSURE     PRESSURE     PROPAGATE    LOAD CNTL.  DISP CNTL.
    ==========================================================================
     60   SEABED       0.000        0.006        0.021        0.000        0.006
     61   SEABED       0.000        0.006        0.021        0.000        0.006
     62   SEABED       0.000        0.006        0.021        0.000        0.006
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    ._____.
    |                                                   |
    | *NOTE: THE DNV LIMIT STATE INEQUALITIES FOR LOCAL BUCKLING UNDER |
    |       THE COMBINED EFFECTS OF BENDING AND INTERNAL OR EXTERNAL   |
    |       PRESSURE ARE HIGHLY NONLINEAR. THE MAGNITUDE OF THE UNITY  |
    |       RATIOS FOR THESE TWO LIMIT STATES MAY SIGNIFICANTLY UNDER  |
    |       ESTIMATE HOW CLOSE THE PIPE IS TO EXCEEDING THESE LIMIT    |
    |       STATES.  FOR THIS REASON, DNV REFERS TO THESE VALUES AS    |
    |       "INTERACTION RATIOS" RATHER THAN "UNITY RATIOS".           |
    |_____|
```

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    =================================================================================================================
    OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP          DATE - 3/25/2015    TIME - 15:22:21    PAGE  106
    PROJECT - Pipelay Analysis                                                                 JOB NO. - Dynamic Analysis
    USER ID - Karun                                              LICENSED TO - OFFSHORE CONSTR. SPECIALISTS         CASE   7
    =================================================================================================================
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        M A X I M U M   D Y N A M I C   P I P E   F O R C E S   A N D   S T R E S S E S

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    ==================================================================================================================================
    NODE    PIPE      X        Y        Z      HORIZ    VERT     PIPE    TENSILE   HOOP    BENDING STRESSES   TOTAL    PERCNT
    NO.   SECTION   COORD    COORD    COORD    ANGLE    ANGLE    LENGTH  STRESS   STRESS    VERT    HORIZ     STRESS   YIELD
                    (M  )    (M  )    (M  )    (DEG )   (DEG )   (M  )   (MPA )   (MPA )   (MPA )   (MPA )    (MPA )   (PCT )
    ==================================================================================================================================
     1   LAYBARGE   96.29     6.94    -0.01   -0.001    1.642     0.00     0.00     0.00     0.00     0.00      0.00     0.00
     3   LAYBARGE   84.26     6.64    -0.01    0.000    1.174    12.04    -0.10     0.00   -24.65    -0.95     24.71     5.49
     5   LAYBARGE   73.43     6.37    -0.01   -0.001    1.938    22.87    -0.21     0.00  -116.40    -1.56    116.51    25.89
     7   TENSIONR   60.08     5.88    -0.01   -0.001    1.625    36.22    11.50     0.00    60.17    -1.06     71.24    15.83
     9   LAYBARGE   51.07     5.67    -0.01    0.000    1.274    45.24    11.47     0.00   -50.31    -0.60     61.36    13.64
    10   LAYBARGE   46.42     5.53    -0.01   -0.001    2.211    49.89    11.41     0.00  -201.12    -2.41    212.07    47.13
    12   LAYBARGE   39.39     5.17    -0.01   -0.002    3.263    56.93    11.39     0.00    -5.84     0.22     15.39     3.42
    13   TENSIONR   35.34     4.94    -0.01   -0.002    3.096    60.99    21.28     0.00    47.20     0.64     67.10    14.91
    15   LAYBARGE   26.08     4.45    -0.01   -0.002    3.324    70.26    21.21     0.00  -125.70     1.21    145.50    32.33
    16   LAYBARGE   23.32     4.27    -0.01   -0.002    4.092    73.02    21.15     0.00  -236.09    -2.88    255.82    56.85
    18   LAYBARGE    8.87     2.73    -0.01    0.001    8.382    87.56    20.91     0.00  -342.59     3.21    360.45    80.10
    20   LAYBARGE    3.07     1.76    -0.01    0.003   10.177    93.44    20.82     0.00  -163.22    -1.04    182.03    40.45

    24   STINGER    -7.57    -0.21    -0.01    0.009   11.534   104.23    20.51    -0.06  -236.30     3.84    255.78    56.84
    26   STINGER   -16.50    -2.06    -0.01    0.007   13.378   113.38    20.26    -0.23  -284.39     5.77    304.36    67.64
    29   STINGER   -26.10    -4.48    -0.01    0.011   14.742   123.33    19.97    -0.44  -277.71     5.19    297.44    66.10
    31   STINGER   -36.54    -7.38    -0.01    0.004   16.810   134.14    19.60    -0.70  -282.90    -6.07    298.46    66.33
    33   STINGER   -39.55    -8.30    -0.01    0.006   17.184   137.27    19.49    -0.78  -173.12    45.17    189.06    42.01

    35   SAGBEND   -45.25   -10.09    -0.01    0.123   17.201   143.25    19.27    -0.94   108.80    21.61    128.11    28.47
    36   SAGBEND   -50.98   -11.85    -0.02    0.159   16.674   149.25    19.04    -1.09   139.88     9.30    158.92    35.32
    37   SAGBEND   -56.74   -13.51    -0.02    0.169   15.600   155.25    18.82    -1.22   156.43    10.52    175.32    38.96
    38   SAGBEND   -62.54   -15.02    -0.02    0.149   14.164   161.25    18.61    -1.35   171.15   -14.94    186.17    41.37
    39   SAGBEND   -68.38   -16.42    -0.03    0.095   12.542   167.25    18.43    -1.47   190.81   -18.02    205.75    45.72
    40   SAGBEND   -74.26   -17.66    -0.04    0.047   10.830   173.25    18.26    -1.57   201.00   -18.44    215.63    47.92
    41   SAGBEND   -80.17   -18.71    -0.05    0.053    9.113   179.25    18.13    -1.66   204.93   -16.37    219.21    48.71
    42   SAGBEND   -86.10   -19.55    -0.05    0.032    7.464   185.25    18.01    -1.73   202.34   -14.79    216.63    48.14
    43   SAGBEND   -92.06   -20.22    -0.06   -0.015    5.658   191.25    17.92    -1.78   193.23   -13.44    207.33    46.07
    44   SAGBEND   -98.04   -20.71    -0.06   -0.058    3.925   197.25    17.86    -1.82   178.68   -10.33    192.67    42.82
    45   SAGBEND  -104.03   -21.05    -0.06   -0.098    2.487   203.25    17.82    -1.84   156.01   -11.77    170.44    37.88
    46   SAGBEND  -110.03   -21.24    -0.05   -0.127    1.324   209.25    17.80    -1.84   129.49    20.29    144.18    32.04
    47   SAGBEND  -116.02   -21.34    -0.03   -0.175    0.552   215.25    17.80    -1.85    96.13    27.23    114.70    25.49

    48   SEABED   -122.02   -21.37    -0.01   -0.141    0.130   221.25    17.82    -1.85    53.33    26.37     72.75    16.17
    49   SEABED   -128.02   -21.38     0.00   -0.053   -0.032   227.25    17.83    -1.85    15.17    16.99     37.49     8.33
    50   SEABED   -134.02   -21.37     0.00    0.003   -0.033   233.25    17.84    -1.85    -3.73     5.48     24.08     5.35
    51   SEABED   -140.02   -21.37     0.00    0.005   -0.015   239.25    17.85    -1.85    -2.71    -0.70     21.30     4.73
```

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  52   SEABED    -146.02   -21.37    0.00    0.004   -0.003    245.25    17.86    -1.84    -1.51    -0.64    19.97    4.44
  53   SEABED    -152.02   -21.37    0.00    0.001    0.001    251.25    17.87    -1.84    -0.42    -0.32    18.98    4.22
  54   SEABED    -158.02   -21.37    0.00    0.000    0.001    257.25    17.88    -1.84     0.12    -0.29    18.98    4.22
  55   SEABED    -164.02   -21.37    0.00    0.000    0.000    263.25    17.89    -1.84     0.08    -0.29    18.98    4.22
  56   SEABED    -170.02   -21.37    0.00    0.000    0.000    269.25    17.90    -1.84     0.04    -0.28    18.97    4.21
  57   SEABED    -176.02   -21.37    0.00    0.000    0.000    275.25    17.91    -1.84     0.01    -0.27    18.97    4.22
  58   SEABED    -182.02   -21.37    0.00    0.000    0.000    281.25    17.92    -1.84     0.00    -0.28    18.98    4.22
  59   SEABED    -188.02   -21.37    0.00    0.000    0.000    287.25    17.92    -1.84     0.00    -0.34    19.00    4.22
```

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   ===============================================================================================================
    OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP           DATE - 3/25/2015    TIME - 15:22:21     PAGE  107
    PROJECT - Pipelay Analysis                                              JOB NO. - Dynamic Analysis
    USER ID - Karun                                        LICENSED TO - OFFSHORE CONSTR. SPECIALISTS        CASE    7
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         M A X I M U M   D Y N A M I C   P I P E   F O R C E S   A N D   S T R E S S E S


   ===============================================================================================================
   NODE    PIPE         X          Y          Z       HORIZ    VERT      PIPE     TENSILE   HOOP    BENDING STRESSES   TOTAL    PERCNT
   NO.    SECTION     COORD      COORD      COORD     ANGLE    ANGLE    LENGTH    STRESS   STRESS    VERT    HORIZ     STRESS    YIELD
                       (M )       (M )       (M )     (DEG )   (DEG )    (M )     (MPA )   (MPA )   (MPA )   (MPA )    (MPA )    (PCT )
   ===============================================================================================================
   60   SEABED    -194.02   -21.37    0.00    0.000    0.000    293.25    17.93    -1.84     0.00    -0.47    19.05    4.23
   61   SEABED    -200.02   -21.37    0.00    0.000    0.000    299.25    17.94    -1.84     0.00    -0.54    19.07    4.24
   62   SEABED    -206.02   -21.37    0.00    0.000    0.000    305.25    17.95    -1.84     0.00     0.00    18.94    4.21
```

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   ===============================================================================================================
    OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP           DATE - 3/25/2015    TIME - 15:22:21     PAGE  108
    PROJECT - Pipelay Analysis                                              JOB NO. - Dynamic Analysis
    USER ID - Karun                                        LICENSED TO - OFFSHORE CONSTR. SPECIALISTS        CASE    7
```

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         M A X I M U M   D Y N A M I C   P I P E   F O R C E S   A N D   S T R E S S E S


   ===============================================================================================================
   NODE    PIPE         X          Y          Z      SUPPORT REACTION   SUPT SEPARATIONS   PIPE              BENDING MOMENTS
   NO.    SECTION     COORD      COORD      COORD     VERT    HORIZ      VERT    HORIZ    TENSION     VERT    HORIZ     TOTAL
                       (M )       (M )       (M )     (KN )   (KN )      (M )    (M )      (KN )     (KN-M)   (KN-M)    (KN-M)
   ===============================================================================================================
    1   LAYBARGE    96.29     6.94    -0.01    12.31    -0.29     0.00    0.00      0.00      0.00     0.00      0.00
    3   LAYBARGE    84.26     6.64    -0.01    21.40    -0.70     0.00    0.00     -1.34   -19.25    -0.74     19.26
    5   LAYBARGE    73.43     6.37    -0.01    44.61    -0.82     0.00    0.00     -2.71   -90.90    -1.22     90.91
    7   TENSIONR    60.08     5.88    -0.01     6.00    -0.69     0.00    0.00    147.71    46.99    -0.83     46.99
    9   LAYBARGE    51.07     5.67    -0.01     0.00     0.00     0.00    0.00    147.30   -39.29    -0.47     39.29
   10   LAYBARGE    46.42     5.53    -0.01    64.06    -1.04     0.00    0.00    146.61  -157.07    -1.88    157.08
   12   LAYBARGE    39.39     5.17    -0.01     0.00     0.00     0.00    0.00    146.39    -4.56     0.17      4.56
   13   TENSIONR    35.34     4.94    -0.01    -9.70    -0.50     0.00    0.00    273.36    36.86     0.50     36.86
   15   LAYBARGE    26.08     4.45    -0.01     0.00     0.00     0.00    0.00    272.48   -98.17     0.95     98.17
   16   LAYBARGE    23.32     4.27    -0.01    62.01    -1.10     0.00    0.00    271.77  -184.38    -2.25    184.38
   18   LAYBARGE     8.87     2.73    -0.01    71.11     1.06     0.00    0.00    268.60  -267.55     2.51    267.56
   20   LAYBARGE     3.07     1.76    -0.01     6.22    -0.50     0.15    0.00    267.47  -127.47    -0.81    127.47

   24   STINGER     -7.57    -0.21    -0.01    52.48     2.74     0.07    0.00    263.47  -184.55     3.00    184.55
   26   STINGER    -16.50    -2.06    -0.01    50.34     3.93     0.38    0.00    261.36  -222.10     4.51    222.10
   29   STINGER    -26.10    -4.48    -0.01    50.35     3.23     0.41    0.00    259.05  -216.88     4.05    216.89
   31   STINGER    -36.54    -7.38    -0.01    60.26   -12.65     0.00    0.00    255.90  -220.93    -4.74    220.93
   33   STINGER    -39.55    -8.30    -0.01     0.11    16.81     0.43    0.00    255.13  -135.20    35.28    135.52

   35   SAGBEND    -45.25   -10.09    -0.01     0.00     0.00     0.00    0.00    253.27    84.97    16.88     85.04
   36   SAGBEND    -50.98   -11.85    -0.02     0.00     0.00     0.00    0.00    251.31   109.24     7.26    109.24
   37   SAGBEND    -56.74   -13.51    -0.02     0.00     0.00     0.00    0.00    249.44   122.17     8.21    122.17
   38   SAGBEND    -62.54   -15.02    -0.02     0.00     0.00     0.00    0.00    247.73   133.66   -11.66    133.74
   39   SAGBEND    -68.38   -16.42    -0.03     0.00     0.00     0.00    0.00    246.19   149.01   -14.07    149.14
   40   SAGBEND    -74.26   -17.66    -0.04     0.00     0.00     0.00    0.00    244.83   156.98   -14.40    157.10
   41   SAGBEND    -80.17   -18.71    -0.05     0.00     0.00     0.00    0.00    243.68   160.04   -12.79    160.05
   42   SAGBEND    -86.10   -19.55    -0.05     0.00     0.00     0.00    0.00    242.73   158.02   -11.55    158.13
   43   SAGBEND    -92.06   -20.22    -0.06     0.00     0.00     0.00    0.00    242.01   150.90   -10.50    150.95
   44   SAGBEND    -98.04   -20.71    -0.06     0.00     0.00     0.00    0.00    241.51   139.55    -8.07    139.55
   45   SAGBEND   -104.03   -21.05    -0.06     0.15     0.25     0.00    0.00    241.24   121.84    -9.19    121.84
   46   SAGBEND   -110.03   -21.24    -0.05     6.07     2.06     0.00    0.00    241.18   101.13    15.84    101.35
   47   SAGBEND   -116.02   -21.34    -0.03    10.53     3.59     0.00    0.00    241.29    75.07    21.27     75.22

   48   SEABED    -122.02   -21.37    -0.01    10.46     3.98     0.00    0.00    241.49    41.65    20.59     42.45
   49   SEABED    -128.02   -21.38     0.00     9.57    -1.00     0.00    0.00    241.64    11.85    13.27     15.00
   50   SEABED    -134.02   -21.37     0.00     8.64    -0.87     0.00    0.00    241.78    -2.91     4.28      4.51
   51   SEABED    -140.02   -21.37     0.00     7.55    -0.64     0.00    0.00    241.92    -2.11    -0.55      2.12
   52   SEABED    -146.02   -21.37     0.00     7.03    -0.33     0.00    0.00    242.05    -1.18    -0.50      1.19
   53   SEABED    -152.02   -21.37     0.00     6.97     0.20     0.00    0.00    242.17    -0.32    -0.25      0.33
   54   SEABED    -158.02   -21.37     0.00     6.99     0.21     0.00    0.00    242.30     0.10    -0.22      0.23
   55   SEABED    -164.02   -21.37     0.00     6.99     0.21     0.00    0.00    242.42     0.06    -0.23      0.23
   56   SEABED    -170.02   -21.37     0.00     7.00     0.22     0.00    0.00    242.53     0.03    -0.22      0.22
   57   SEABED    -176.02   -21.37     0.00     7.00     0.22     0.00    0.00    242.64     0.01    -0.21      0.21
```

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   ===============================================================================================================
    OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP           DATE - 3/25/2015    TIME - 15:22:21     PAGE  109
    PROJECT - Pipelay Analysis                                              JOB NO. - Dynamic Analysis
    USER ID - Karun                                        LICENSED TO - OFFSHORE CONSTR. SPECIALISTS        CASE    7
   ===============================================================================================================
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         M A X I M U M   D Y N A M I C   P I P E   F O R C E S   A N D   S T R E S S E S


   ===============================================================================================================
   NODE    PIPE         X          Y          Z      SUPPORT REACTION   SUPT SEPARATIONS   PIPE              BENDING MOMENTS
   NO.    SECTION     COORD      COORD      COORD     VERT    HORIZ      VERT    HORIZ    TENSION     VERT    HORIZ     TOTAL
                       (M )       (M )       (M )     (KN )   (KN )      (M )    (M )      (KN )     (KN-M)   (KN-M)    (KN-M)
   ===============================================================================================================
   58   SEABED    -182.02   -21.37     0.00     7.00     0.22     0.00    0.00    242.75     0.00    -0.22      0.22
   59   SEABED    -188.02   -21.37     0.00     7.00     0.22     0.00    0.00    242.86     0.00    -0.27      0.27
   60   SEABED    -194.02   -21.37     0.00     7.00     0.20     0.00    0.00    242.96     0.00    -0.37      0.37
   61   SEABED    -200.02   -21.37     0.00     7.00     0.13     0.00    0.00    243.06     0.00    -0.42      0.42
   62   SEABED    -206.02   -21.37     0.00     0.00     0.02     0.00    0.00    243.15     0.00     0.00      0.00
```

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OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP          DATE - 3/25/2015   TIME - 15:22:21    PAGE  110
PROJECT - Pipelay Analysis                                            JOB NO. - Dynamic Analysis
USER ID - Karun                                     LICENSED TO - OFFSHORE CONSTR. SPECIALISTS        CASE   7
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U N I T Y   R A T I O S   F O R   D N V   O S - F 1 0 1

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===============================================================================
NODE    PIPE    /-------------------- DNV LIMIT STATES --------------------/
NO.    SECTION    BURST     COLLAPSE    BUCKLE        LOCAL BUCKLING*
                  PRESSURE  PRESSURE   PROPAGATE   LOAD CNTL.  DISP CNTL.
===============================================================================
   1   LAYBARGE    0.000     0.000      0.000        0.000       0.000
   3   LAYBARGE    0.000     0.000      0.000        0.003       0.018
   5   LAYBARGE    0.000     0.000      0.000        0.076       0.064
   7   TENSIONR    0.000     0.000      0.000        0.020       0.033
   9   LAYBARGE    0.000     0.000      0.000        0.014       0.028
  10   LAYBARGE    0.000     0.000      0.000        0.229       0.095
  12   LAYBARGE    0.000     0.000      0.000        0.000       0.000
  13   TENSIONR    0.000     0.000      0.000        0.013       0.020
  15   LAYBARGE    0.000     0.000      0.000        0.087       0.058
  16   LAYBARGE    0.000     0.000      0.000        0.306       0.103
  18   LAYBARGE    0.000     0.000      0.000        0.613       0.141
  20   LAYBARGE    0.000     0.000      0.000        0.154       0.077

  24   STINGER     0.000     0.000      0.001        0.349       0.110
  26   STINGER     0.000     0.001      0.003        0.438       0.121
  29   STINGER     0.000     0.001      0.005        0.446       0.123
  31   STINGER     0.000     0.002      0.008        0.449       0.126
  33   STINGER     0.000     0.002      0.009        0.176       0.085

  35   SAGBEND     0.000     0.003      0.011        0.074       0.057
  36   SAGBEND     0.000     0.003      0.012        0.108       0.068
  37   SAGBEND     0.000     0.004      0.014        0.128       0.074
  38   SAGBEND     0.000     0.004      0.015        0.149       0.081
  39   SAGBEND     0.000     0.004      0.017        0.186       0.090
  40   SAGBEND     0.000     0.005      0.018        0.207       0.094
  41   SAGBEND     0.000     0.005      0.019        0.214       0.096
  42   SAGBEND     0.000     0.005      0.019        0.208       0.095
  43   SAGBEND     0.000     0.005      0.020        0.191       0.092
  44   SAGBEND     0.000     0.005      0.020        0.167       0.086
  45   SAGBEND     0.000     0.006      0.021        0.130       0.078
  46   SAGBEND     0.000     0.006      0.021        0.088       0.066
  47   SAGBEND     0.000     0.006      0.021        0.051       0.051

  48   SEABED      0.000     0.006      0.021        0.018       0.032
  49   SEABED      0.000     0.006      0.021        0.003       0.010
  50   SEABED      0.000     0.006      0.021        0.000       0.006
  51   SEABED      0.000     0.006      0.021        0.000       0.006
  52   SEABED      0.000     0.006      0.021        0.000       0.006
  53   SEABED      0.000     0.006      0.021        0.000       0.006
  54   SEABED      0.000     0.006      0.021        0.000       0.006
  55   SEABED      0.000     0.006      0.021        0.000       0.006
  56   SEABED      0.000     0.006      0.021        0.000       0.006
  57   SEABED      0.000     0.006      0.021        0.000       0.006
  58   SEABED      0.000     0.006      0.021        0.000       0.006
  59   SEABED      0.000     0.006      0.021        0.000       0.006
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OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP          DATE - 3/25/2015   TIME - 15:22:21    PAGE  111
PROJECT - Pipelay Analysis                                            JOB NO. - Dynamic Analysis
USER ID - Karun                                     LICENSED TO - OFFSHORE CONSTR. SPECIALISTS        CASE   7
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U N I T Y   R A T I O S   F O R   D N V   O S - F 1 0 1

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===============================================================================
NODE    PIPE    /--------------------- DNV LIMIT STATES ---------------------/
NO.    SECTION    BURST     COLLAPSE    BUCKLE        LOCAL BUCKLING*
                  PRESSURE  PRESSURE   PROPAGATE   LOAD CNTL.  DISP CNTL.
===============================================================================
  60   SEABED      0.000     0.006      0.021        0.000       0.006
  61   SEABED      0.000     0.006      0.021        0.000       0.006
  62   SEABED      0.000     0.006      0.021        0.000       0.006
```

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._____.
|                                                          |
| *NOTE: THE DNV LIMIT STATE INEQUALITIES FOR LOCAL BUCKLING UNDER |
|       THE COMBINED EFFECTS OF BENDING AND INTERNAL OR EXTERNAL   |
|       PRESSURE ARE HIGHLY NONLINEAR. THE MAGNITUDE OF THE UNITY  |
|       RATIOS FOR THESE TWO LIMIT STATES MAY SIGNIFICANTLY UNDER  |
|       ESTIMATE HOW CLOSE THE PIPE IS TO EXCEEDING THESE LIMIT    |
|       STATES.  FOR THIS REASON, DNV REFERS TO THESE VALUES AS    |
|       "INTERACTION RATIOS" RATHER THAN "UNITY RATIOS".           |
|_____|
```

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OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP          PAGE  112
Pipelay Analysis
JOB NO. - Dynamic Analysis        LICENSED TO - OFFSHORE CONSTR. SPECIALISTS
USER ID - Karun                   DATE - 3/25/2015   TIME - 15:22:21   CASE   8
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S T A T I C   S O L U T I O N   S U M M A R Y

PIPE PROPERTIES (1)
====================
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 PIPE SECTION LENGTH ..     0.00 M     ELASTIC MODULUS ......   207000. MPA
 OUTSIDE DIAMETER .....    27.310 CM    CROSS SECTIONAL AREA .   128.75 CM^2
 WALL THICKNESS .......     1.590 CM    MOMENT OF INERTIA ....  12671.5 CM^4
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        WEIGHT/LENGTH IN AIR .    2205.00 N/M    YIELD STRESS .........    450.00 MPA
        SUBMERGED WGHT/LENG ..    1164.00 N/M    STRESS INTENS FACTOR .    1.000
        SPECIFIC GRAVITY .....       2.118       STEEL DENSITY ........   76982.0 N/M3
        WRAP COAT THICKNESS ..       0.280 CM    WRAP COAT DENSITY ....    9218.0 N/M3
        CONCRETE THICKNESS ...       4.000 CM    CONCRETE DENSITY .....   29846.0 N/M3

     BARGE DATA
     ==========
        TOTAL PIPE TENSION ...     250.00 KN    RADIUS OF CURVATURE ..       0.00 M
        NUMBER OF TENSIONERS .          2       BARGE TRIM ANGLE .....       0.500 DEG
        NO. OF PIPE SUPPORTS .          7       PIPE ANGLE AT STERN ..       9.965 DEG
        BARGE HEADING ........      0.000 DEG   OFFSET FROM R.O.W. ...       0.00 M

     STINGER DATA
     ============
        NO. OF PIPE SUPPORTS .          5       PIPE DEPTH AT STERN ..      -8.33 M
        NO. STINGER SECTIONS .          7       PIPE ANGLE AT STERN ..      17.337 DEG
        RADIUS OF CURVATURE ..     200.00 M     STINGER STERN DEPTH ..      -8.69 M
        STINGER LENGTH .......      39.00 M

     SAGBEND DATA
     ============
        WATER DEPTH ..........      21.34 M     TENSION AT TOUCHDOWN .     209.82 KN
        TOUCHDOWN X-COORD. ...    -112.74 M     BOTTOM SLOPE ANGLE ...       0.000 DEG
        PROJECTED SPAN LENGTH      73.22 M      PIPE LENGTH GAIN .....       2.93 M

     ============================= SOLUTION SUMMARY =============================
     NODE   PIPE      X       Y       Z     SUPPORT REACT    TOTAL   TOTAL   PCT
     NO.  SECTION   COORD   COORD   COORD    VERT   HORIZ   MOMENT  STRESS   YLD
                     (M  )   (M  )   (M  )   (KN )   (KN )   (KN-M)  (MPA )   (%)
     ============================================================================
      1  LAYBARGE   96.3    6.9     0.0     11.8     0.0     0.0     0.0     0.
      3  LAYBARGE   84.3    6.6     0.0     20.0     0.0    17.8    22.8     5.
      5  LAYBARGE   73.4    6.4     0.0     43.4     0.0    89.8   115.1    26.
      7  TENSIONR   60.1    5.9     0.0      4.5     0.0    45.6    68.0    15.
      9  LAYBARGE   51.1    5.7     0.0      0.0     0.0    38.8    59.1    13.
     10  LAYBARGE   46.4    5.5     0.0     62.5     0.0   155.4   208.5    46.
     12  LAYBARGE   39.4    5.2     0.0      0.0     0.0     2.1    12.2     3.
     13  TENSIONR   35.4    5.0     0.0     -8.4     0.0    34.2    62.9    14.
     15  LAYBARGE   26.1    4.5     0.0      0.0     0.0    90.8   135.3    30.
     16  LAYBARGE   23.3    4.3     0.0     56.4     0.0   172.7   240.1    53.
     18  LAYBARGE    8.9    2.7     0.0     60.9     0.0   208.7   285.9    64.
     20  LAYBARGE    3.1    1.8     0.0      0.0     0.0    74.4   113.9    25.

     ============================================================================
     OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP        PAGE 113
     Pipelay Analysis
     JOB NO. - Dynamic Analysis      LICENSED TO - OFFSHORE CONSTR. SPECIALISTS
     USER ID - Karun                 DATE - 3/25/2015  TIME - 15:22:21  CASE   8
     ============================================================================

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


     24  STINGER   -7.5   -0.2     0.0     17.1     0.3    75.7   115.1    26.
     26  STINGER  -16.5   -2.1     0.0     26.9     0.6   122.1   174.4    39.
     29  STINGER  -26.1   -4.5     0.0     15.3     0.6    94.0   138.2    31.
     31  STINGER  -36.5   -7.4     0.0     33.5    -1.6   107.7   155.5    35.
     33  STINGER  -39.5   -8.3     0.0      0.0     2.6    47.7    78.5    17.
     41  SAGBEND  -80.1  -18.7     0.0      0.0     0.0   133.4   187.3    42.
     47  SEABED  -116.0  -21.4     0.0      6.3     0.5    43.6    72.1    16.

    ==================================================================================================
     OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP       DATE - 3/25/2015   TIME - 15:22:21   PAGE 114
     PROJECT - Pipelay Analysis                                          JOB NO. - Dynamic Analysis
     USER ID - Karun                                  LICENSED TO - OFFSHORE CONSTR. SPECIALISTS       CASE   8
    ==================================================================================================

         U N I T Y   R A T I O S   F O R   D N V   O S - F 1 0 1

     ============================================================================
     NODE   PIPE    /--------------------- DNV LIMIT STATES ---------------------/
     NO.  SECTION    BURST     COLLAPSE    BUCKLE      LOCAL BUCKLING*
                    PRESSURE   PRESSURE   PROPAGATE   LOAD CNTL.  DISP CNTL.
     ============================================================================
       1  LAYBARGE   0.000      0.000      0.000       0.000      0.000
       3  LAYBARGE   0.000      0.000      0.000       0.003      0.017
       5  LAYBARGE   0.000      0.000      0.000       0.075      0.063
       7  TENSIONR   0.000      0.000      0.000       0.020      0.032
       9  LAYBARGE   0.000      0.000      0.000       0.014      0.027
      10  LAYBARGE   0.000      0.000      0.000       0.226      0.095
      12  LAYBARGE   0.000      0.000      0.000       0.000      0.000
      13  TENSIONR   0.000      0.000      0.000       0.012      0.019
      15  LAYBARGE   0.000      0.000      0.000       0.079      0.056
      16  LAYBARGE   0.000      0.000      0.000       0.283      0.100
      18  LAYBARGE   0.000      0.000      0.000       0.401      0.116
      20  LAYBARGE   0.000      0.000      0.000       0.047      0.044

      24  STINGER    0.000      0.000      0.000       0.053      0.047
      26  STINGER    0.000      0.001      0.002       0.167      0.080
      29  STINGER    0.000      0.001      0.004       0.090      0.061
      31  STINGER    0.000      0.002      0.007       0.122      0.071
      33  STINGER    0.000      0.002      0.008       0.026      0.034

      35  SAGBEND    0.000      0.003      0.010       0.008      0.018
      36  SAGBEND    0.000      0.003      0.012       0.050      0.048
      37  SAGBEND    0.000      0.004      0.013       0.094      0.065
      38  SAGBEND    0.000      0.004      0.015       0.126      0.074
      39  SAGBEND    0.000      0.004      0.016       0.148      0.080
      40  SAGBEND    0.000      0.005      0.017       0.161      0.083
      41  SAGBEND    0.000      0.005      0.018       0.167      0.085
      42  SAGBEND    0.000      0.005      0.019       0.167      0.085
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43    SAGBEND      0.000       0.005       0.020       0.160       0.084
44    SAGBEND      0.000       0.005       0.020       0.144       0.080
45    SAGBEND      0.000       0.006       0.021       0.114       0.073
46    SAGBEND      0.000       0.006       0.021       0.070       0.059

47    SEABED       0.000       0.006       0.021       0.021       0.035
48    SEABED       0.000       0.006       0.021       0.002       0.006
49    SEABED       0.000       0.006       0.021       0.000       0.006
50    SEABED       0.000       0.006       0.021       0.000       0.006
51    SEABED       0.000       0.006       0.021       0.000       0.006
52    SEABED       0.000       0.006       0.021       0.000       0.006
53    SEABED       0.000       0.006       0.021       0.000       0.006
54    SEABED       0.000       0.006       0.021       0.000       0.006
55    SEABED       0.000       0.006       0.021       0.000       0.006
56    SEABED       0.000       0.006       0.021       0.000       0.006
57    SEABED       0.000       0.006       0.021       0.000       0.006
58    SEABED       0.000       0.006       0.021       0.000       0.006
59    SEABED       0.000       0.006       0.021       0.000       0.006
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  OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP        DATE - 3/25/2015   TIME - 15:22:21    PAGE  115
  PROJECT - Pipelay Analysis                                                    JOB NO. - Dynamic Analysis
  USER ID - Karun                                          LICENSED TO - OFFSHORE CONSTR. SPECIALISTS       CASE    8
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U N I T Y   R A T I O S   F O R   D N V   O S - F 1 0 1

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===============================================================================
NODE    PIPE     /-------------------- DNV LIMIT STATES --------------------/
NO.     SECTION    BURST      COLLAPSE     BUCKLE        LOCAL BUCKLING*
                  PRESSURE    PRESSURE    PROPAGATE   LOAD CNTL.  DISP CNTL.
===============================================================================

60    SEABED       0.000       0.006       0.021       0.000       0.006
61    SEABED       0.000       0.006       0.021       0.000       0.006
62    SEABED       0.000       0.006       0.021       0.000       0.006
```

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._____.
|                                                          |
| *NOTE: THE DNV LIMIT STATE INEQUALITIES FOR LOCAL BUCKLING UNDER |
|        THE COMBINED EFFECTS OF BENDING AND INTERNAL OR EXTERNAL  |
|        PRESSURE ARE HIGHLY NONLINEAR. THE MAGNITUDE OF THE UNITY |
|        RATIOS FOR THESE TWO LIMIT STATES MAY SIGNIFICANTLY UNDER |
|        ESTIMATE HOW CLOSE THE PIPE IS TO EXCEEDING THESE LIMIT   |
|        STATES.  FOR THIS REASON, DNV REFERS TO THESE VALUES AS   |
|        "INTERACTION RATIOS" RATHER THAN "UNITY RATIOS".          |
|_____|
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  OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP        DATE - 3/25/2015   TIME - 15:22:21    PAGE  116
  PROJECT - Pipelay Analysis                                                    JOB NO. - Dynamic Analysis
  USER ID - Karun                                          LICENSED TO - OFFSHORE CONSTR. SPECIALISTS       CASE    8
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M A X I M U M   D Y N A M I C   P I P E   F O R C E S   A N D   S T R E S S E S

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=========================================================================================================================
NODE    PIPE        X        Y        Z      HORIZ    VERT     PIPE    TENSILE   HOOP    BENDING STRESSES  TOTAL   PERCNT
NO.     SECTION   COORD    COORD    COORD    ANGLE    ANGLE   LENGTH   STRESS   STRESS    VERT     HORIZ   STRESS  YIELD
                  (M  )    (M  )    (M  )    (DEG )   (DEG )   (M  )    (MPA )   (MPA )   (MPA )   (MPA )   (MPA )  (PCT )
=========================================================================================================================
   1    LAYBARGE   96.32     6.94     0.00   -0.009    1.649     0.00     0.00     0.00     0.00     0.00     0.00    0.00
   3    LAYBARGE   84.28     6.65     0.00   -0.009    1.182    12.04    -0.16     0.00   -24.81     0.57    24.86    5.52
   5    LAYBARGE   73.46     6.38     0.00   -0.009    1.946    22.87    -0.31     0.00  -116.61    -0.38   116.75   25.95
   7    TENSIONR   60.11     5.89     0.00   -0.009    1.631    36.22    11.52     0.00    59.51     0.31    70.47   15.66
   9    LAYBARGE   51.10     5.68     0.00   -0.009    1.283    45.24    11.51     0.00   -50.33    -0.14    61.45   13.65
  10    LAYBARGE   46.45     5.54     0.00   -0.009    2.220    49.89    11.46     0.00  -200.78     0.47   211.71   47.05
  12    LAYBARGE   39.42     5.18     0.00   -0.010    3.270    56.93    11.45     0.00    -5.88    -0.05    15.91    3.54
  13    TENSIONR   35.37     4.95    -0.01   -0.010    3.107    60.99    21.62     0.00    47.90     0.16    69.23   15.39
  15    LAYBARGE   26.12     4.47     0.00   -0.010    3.335    70.26    21.60     0.00  -128.10     0.34   149.31   33.18
  16    LAYBARGE   23.36     4.29     0.00   -0.010    4.099    73.02    21.56     0.00  -240.33     0.91   261.55   58.12
  18    LAYBARGE    8.90     2.76     0.00   -0.012    8.470    87.56    21.38     0.00  -342.96    -0.93   359.67   79.93
  20    LAYBARGE    3.11     1.78     0.00   -0.014   10.333    93.44    21.32     0.00  -263.13     1.27   279.76   62.17

  24    STINGER    -7.56    -0.34     0.00   -0.013   11.699   104.23    21.04    -0.08  -267.72     1.99   287.77   63.95
  26    STINGER   -16.48    -2.45     0.01   -0.018   13.712   113.38    20.83    -0.27  -351.90     2.26   371.84   82.63
  29    STINGER   -26.05    -4.89     0.01   -0.011   15.119   123.33    20.57    -0.48  -321.80     3.64   342.00   76.00
  31    STINGER   -36.47    -7.81     0.01   -0.014   17.058   134.14    20.23    -0.75  -320.15    -3.54   335.58   74.57
  33    STINGER   -39.46    -8.73     0.01   -0.003   17.461   137.27    20.14    -0.83  -195.43    39.50   211.14   46.92

  35    SAGBEND   -45.17   -10.51     0.01    0.051   17.494   143.25    19.94    -0.99   132.18    20.45   151.39   33.64
  36    SAGBEND   -50.90   -12.23     0.00    0.059   16.595   149.25    19.73    -1.14   162.90    15.33   181.94   40.43
  37    SAGBEND   -56.67   -13.83     0.00    0.099   15.353   155.25    19.54    -1.27   178.54   -17.63   197.35   43.86
  38    SAGBEND   -62.48   -15.29    -0.01    0.106   13.774   161.25    19.36    -1.39   197.62   -21.65   212.12   47.14
  39    SAGBEND   -68.33   -16.66    -0.03    0.062   12.061   167.25    19.20    -1.51   215.52   -22.30   231.02   51.34
  40    SAGBEND   -74.22   -17.86    -0.03    0.057   10.351   173.25    19.06    -1.61   223.13   -20.24   238.36   52.97
  41    SAGBEND   -80.13   -18.87    -0.04    0.013    8.713   179.25    18.93    -1.70   222.65   -17.37   236.65   52.59
  42    SAGBEND   -86.08   -19.68    -0.04   -0.022    7.053   185.25    18.83    -1.76   214.70   -13.63   228.58   50.79
  43    SAGBEND   -92.04   -20.32    -0.05   -0.039    5.197   191.25    18.76    -1.80   209.28   -10.41   223.26   49.61
  44    SAGBEND   -98.02   -20.77    -0.05   -0.050    3.582   197.25    18.70    -1.83   198.27     8.39   212.20   47.15
  45    SAGBEND  -104.01   -21.07    -0.04   -0.055    2.192   203.25    18.67    -1.84   165.91    18.53   180.04   40.01
  46    SAGBEND  -110.01   -21.24    -0.03   -0.107    1.198   209.25    18.66    -1.85   128.54   -30.58   143.32   31.85
  47    SAGBEND  -116.01   -21.34    -0.01   -0.124    0.542   215.25    18.67    -1.85    98.74    32.48   117.06   26.01

  48    SEABED   -122.01   -21.34    -0.01   -0.051    0.141   221.25    18.69    -1.85    56.33    26.75    75.74   16.83
  49    SEABED   -128.01   -21.37     0.00   -0.026   -0.022   227.25    18.71    -1.85    17.75    11.17    39.14    8.70
  50    SEABED   -134.01   -21.37     0.00    0.002   -0.029   233.25    18.73    -1.85    -3.77     4.04    22.55    5.01
  51    SEABED   -140.01   -21.37     0.00    0.003   -0.014   239.25    18.75    -1.85    -2.82    -1.10    22.25    4.95
  52    SEABED   -146.01   -21.37     0.00    0.002   -0.003   245.25    18.77    -1.84    -1.62    -0.91    20.94    4.65
  53    SEABED   -152.01   -21.37     0.00    0.000    0.001   251.25    18.79    -1.84    -0.48    -0.47    20.09    4.46
  54    SEABED   -158.01   -21.37     0.00    0.000    0.001   257.25    18.81    -1.84     0.14    -0.25    19.95    4.43
  55    SEABED   -164.01   -21.37     0.00    0.000    0.000   263.25    18.82    -1.84     0.09     0.24    19.97    4.44
  56    SEABED   -170.01   -21.37     0.00    0.000    0.000   269.25    18.84    -1.84     0.06    -0.25    19.97    4.44
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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)
57	SEABED	-176.01	-21.37	0.00	0.000	0.000	275.25	18.85	-1.84	-0.02	-0.25	19.95	4.43
58	SEABED	-182.01	-21.37	0.00	0.000	0.000	281.25	18.87	-1.84	-0.02	-0.25	19.92	4.43
59	SEABED	-188.01	-21.37	0.00	0.000	0.000	287.25	18.88	-1.84	-0.02	-0.27	19.90	4.42

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  OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP          DATE - 3/25/2015    TIME - 15:22:21    PAGE  117
  PROJECT - Pipelay Analysis                                                        JOB NO. - Dynamic Analysis
  USER ID - Karun                                          LICENSED TO - OFFSHORE CONSTR. SPECIALISTS          CASE    8
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MAXIMUM   DYNAMIC   PIPE   FORCES   AND   STRESSES

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)
60	SEABED	-194.01	-21.37	0.00	0.000	0.000	293.25	18.90	-1.84	-0.02	-0.35	19.89	4.42
61	SEABED	-200.01	-21.37	0.00	0.000	0.000	299.25	18.91	-1.84	-0.01	-0.39	19.92	4.43
62	SEABED	-206.01	-21.37	0.00	0.000	0.000	305.25	18.92	-1.84	0.00	0.00	19.91	4.42

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  OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP          DATE - 3/25/2015    TIME - 15:22:21    PAGE  118
  PROJECT - Pipelay Analysis                                                        JOB NO. - Dynamic Analysis
  USER ID - Karun                                          LICENSED TO - OFFSHORE CONSTR. SPECIALISTS          CASE    8
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MAXIMUM   DYNAMIC   PIPE   FORCES   AND   STRESSES

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)	TOTAL (KN-M)
1	LAYBARGE	96.32	6.94	0.00	12.11	0.17	0.00	0.00	0.00	0.00	0.00	0.00
3	LAYBARGE	84.28	6.65	0.00	20.83	0.39	0.00	0.00	-2.02	-19.38	0.44	19.38
5	LAYBARGE	73.46	6.38	0.00	43.94	-0.26	0.00	0.00	-4.00	-91.07	-0.29	91.07
7	TENSIONR	60.11	5.89	0.00	5.00	-0.19	0.00	0.00	148.03	46.47	0.25	46.47
9	LAYBARGE	51.10	5.68	0.00	0.00	0.00	0.00	0.00	147.84	-39.30	-0.11	39.30
10	LAYBARGE	46.45	5.54	0.00	63.62	0.19	0.00	0.00	147.24	-156.80	0.37	156.80
12	LAYBARGE	39.42	5.18	0.00	0.00	0.00	0.00	0.00	147.10	-4.59	-0.04	4.59
13	TENSIONR	35.37	4.95	-0.01	-10.00	0.16	0.00	0.00	277.77	37.40	0.12	37.40
15	LAYBARGE	26.12	4.47	0.00	0.00	0.00	0.00	0.00	277.54	-100.04	0.27	100.04
16	LAYBARGE	23.36	4.29	0.00	64.04	0.42	0.00	0.00	277.01	-187.69	0.71	187.70
18	LAYBARGE	8.90	2.76	0.00	72.62	0.43	0.00	0.00	274.73	-267.84	-0.73	267.84
20	LAYBARGE	3.11	1.78	0.00	37.21	-0.46	0.16	0.00	273.94	-205.49	0.99	205.50
24	STINGER	-7.56	-0.34	0.00	57.36	1.45	0.11	0.00	270.37	-209.08	1.56	209.08
26	STINGER	-16.48	-2.45	0.01	67.44	2.59	0.62	0.00	268.79	-274.82	1.76	274.82
29	STINGER	-26.05	-4.89	0.01	57.24	3.07	0.70	0.00	266.83	-251.31	2.84	251.32
31	STINGER	-36.47	-7.81	0.01	66.07	-10.28	0.34	0.00	264.21	-250.03	-2.77	250.03
33	STINGER	-39.46	-8.73	0.01	-0.02	14.79	0.89	0.00	263.54	-152.63	30.85	152.87
35	SAGBEND	-45.17	-10.51	0.01	0.00	0.00	0.00	0.00	261.97	103.23	15.97	103.34
36	SAGBEND	-50.90	-12.23	0.00	0.00	0.00	0.00	0.00	260.33	127.22	11.98	127.34
37	SAGBEND	-56.67	-13.83	0.00	0.00	0.00	0.00	0.00	258.79	139.43	-13.77	139.44
38	SAGBEND	-62.48	-15.29	-0.01	0.00	0.00	0.00	0.00	257.37	154.33	-16.91	154.48
39	SAGBEND	-68.33	-16.66	-0.03	0.00	0.00	0.00	0.00	256.09	168.31	-17.42	168.60
40	SAGBEND	-74.22	-17.86	-0.03	0.00	0.00	0.00	0.00	254.96	174.26	-15.81	174.44
41	SAGBEND	-80.13	-18.87	-0.04	0.00	0.00	0.00	0.00	254.02	173.89	-13.56	173.94
42	SAGBEND	-86.08	-19.68	-0.04	0.00	0.00	0.00	0.00	253.27	167.67	-10.65	167.70
43	SAGBEND	-92.04	-20.32	-0.05	0.00	0.00	0.00	0.00	252.72	163.44	-8.13	163.44
44	SAGBEND	-98.02	-20.77	-0.05	0.00	0.06	0.00	0.00	252.37	154.84	6.55	154.84
45	SAGBEND	-104.01	-21.07	-0.04	2.91	1.40	0.00	0.00	252.21	129.57	14.47	129.62
46	SAGBEND	-110.01	-21.24	-0.03	10.23	-4.00	0.00	0.00	252.24	100.39	-23.88	100.51
47	SAGBEND	-116.01	-21.34	-0.01	12.12	4.81	0.00	0.00	252.42	77.11	25.37	77.21
48	SEABED	-122.01	-21.37	-0.01	10.66	2.92	0.00	0.00	252.72	43.99	20.89	44.98
49	SEABED	-128.01	-21.37	0.00	9.73	1.08	0.00	0.00	253.00	13.87	8.72	16.38
50	SEABED	-134.01	-21.37	0.00	8.74	-0.74	0.00	0.00	253.26	-2.95	3.15	3.22
51	SEABED	-140.01	-21.37	0.00	7.63	-0.33	0.00	0.00	253.50	-2.20	-0.86	2.22
52	SEABED	-146.01	-21.37	0.00	7.08	0.15	0.00	0.00	253.73	-1.26	-0.71	1.29
53	SEABED	-152.01	-21.37	0.00	6.98	0.15	0.00	0.00	253.96	-0.38	-0.37	0.44
54	SEABED	-158.01	-21.37	0.00	7.00	0.15	0.00	0.00	254.18	0.11	-0.20	0.20
55	SEABED	-164.01	-21.37	0.00	7.00	0.14	0.00	0.00	254.40	0.07	0.19	0.19
56	SEABED	-170.01	-21.37	0.00	7.00	0.14	0.00	0.00	254.61	0.05	-0.19	0.19
57	SEABED	-176.01	-21.37	0.00	6.99	0.14	0.00	0.00	254.81	-0.02	-0.19	0.19

```
=================================================================================================================
  OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP          DATE - 3/25/2015    TIME - 15:22:21    PAGE  119
  PROJECT - Pipelay Analysis                                                        JOB NO. - Dynamic Analysis
  USER ID - Karun                                          LICENSED TO - OFFSHORE CONSTR. SPECIALISTS          CASE    8
=================================================================================================================
```

MAXIMUM   DYNAMIC   PIPE   FORCES   AND   STRESSES

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)	TOTAL (KN-M)
58	SEABED	-182.01	-21.37	0.00	6.99	0.14	0.00	0.00	255.00	-0.02	-0.19	0.19
59	SEABED	-188.01	-21.37	0.00	6.99	0.14	0.00	0.00	255.19	-0.02	-0.21	0.21
60	SEABED	-194.01	-21.37	0.00	6.99	0.13	0.00	0.00	255.37	-0.01	-0.27	0.27
61	SEABED	-200.01	-21.37	0.00	6.99	0.09	0.00	0.00	255.54	-0.01	-0.31	0.31
62	SEABED	-206.01	-21.37	0.00	0.00	0.01	0.00	0.00	255.71	0.00	0.00	0.00

```
=================================================================================================================
  OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP          DATE - 3/25/2015    TIME - 15:22:21    PAGE  120
  PROJECT - Pipelay Analysis                                                        JOB NO. - Dynamic Analysis
  USER ID - Karun                                          LICENSED TO - OFFSHORE CONSTR. SPECIALISTS          CASE    8
=================================================================================================================
```

```
       U N I T Y   R A T I O S   F O R   D N V   O S - F 1 0 1

======================================================================
NODE    PIPE    /-------------------- DNV LIMIT STATES --------------------/
NO.    SECTION    BURST    COLLAPSE    BUCKLE      LOCAL BUCKLING*
                 PRESSURE  PRESSURE   PROPAGATE   LOAD CNTL.  DISP CNTL.
----------------------------------------------------------------------
======================================================================
   1   LAYBARGE    0.000     0.000      0.000       0.000       0.000
   3   LAYBARGE    0.000     0.000      0.000       0.003       0.018
   5   LAYBARGE    0.000     0.000      0.000       0.076       0.064
   7   TENSIONR    0.000     0.000      0.000       0.020       0.033
   9   LAYBARGE    0.000     0.000      0.000       0.014       0.028
  10   LAYBARGE    0.000     0.000      0.000       0.228       0.095
  12   LAYBARGE    0.000     0.000      0.000       0.000       0.000
  13   TENSIONR    0.000     0.000      0.000       0.013       0.020
  15   LAYBARGE    0.000     0.000      0.000       0.089       0.059
  16   LAYBARGE    0.000     0.000      0.000       0.313       0.104
  18   LAYBARGE    0.000     0.000      0.000       0.614       0.141
  20   LAYBARGE    0.000     0.000      0.000       0.421       0.120

  24   STINGER     0.000     0.000      0.001       0.452       0.123
  26   STINGER     0.000     0.001      0.003       0.699       0.148
  29   STINGER     0.000     0.001      0.005       0.611       0.140
  31   STINGER     0.000     0.002      0.008       0.587       0.141
  33   STINGER     0.000     0.003      0.009       0.228       0.095

  35   SAGBEND     0.000     0.003      0.011       0.111       0.069
  36   SAGBEND     0.000     0.003      0.013       0.151       0.079
  37   SAGBEND     0.000     0.004      0.014       0.172       0.084
  38   SAGBEND     0.000     0.004      0.016       0.206       0.094
  39   SAGBEND     0.000     0.005      0.017       0.246       0.101
  40   SAGBEND     0.000     0.005      0.018       0.262       0.104
  41   SAGBEND     0.000     0.005      0.019       0.259       0.104
  42   SAGBEND     0.000     0.005      0.020       0.238       0.101
  43   SAGBEND     0.000     0.005      0.020       0.226       0.099
  44   SAGBEND     0.000     0.006      0.021       0.202       0.095
  45   SAGBEND     0.000     0.006      0.021       0.140       0.081
  46   SAGBEND     0.000     0.006      0.021       0.087       0.065
  47   SAGBEND     0.000     0.006      0.021       0.054       0.053

  48   SEABED      0.000     0.006      0.021       0.021       0.034
  49   SEABED      0.000     0.006      0.021       0.003       0.011
  50   SEABED      0.000     0.006      0.021       0.000       0.006
  51   SEABED      0.000     0.006      0.021       0.000       0.006
  52   SEABED      0.000     0.006      0.021       0.000       0.006
  53   SEABED      0.000     0.006      0.021       0.000       0.006
  54   SEABED      0.000     0.006      0.021       0.000       0.006
  55   SEABED      0.000     0.006      0.021       0.000       0.006
  56   SEABED      0.000     0.006      0.021       0.000       0.006
  57   SEABED      0.000     0.006      0.021       0.000       0.006
  58   SEABED      0.000     0.006      0.021       0.000       0.006
  59   SEABED      0.000     0.006      0.021       0.000       0.006
```

```
=================================================================================================================
 OFFPIPE-3 OFFSHORE PIPELAY ANALYSIS SYSTEM - VERSION - 3.01BP          DATE - 3/25/2015   TIME - 15:22:21   PAGE 121
 PROJECT - Pipelay Analysis                                             JOB NO. - Dynamic Analysis
 USER ID - Karun                                LICENSED TO - OFFSHORE CONSTR. SPECIALISTS          CASE    8
=================================================================================================================
```

```
       U N I T Y   R A T I O S   F O R   D N V   O S - F 1 0 1

======================================================================
NODE    PIPE    /-------------------- DNV LIMIT STATES --------------------/
NO.    SECTION    BURST    COLLAPSE    BUCKLE      LOCAL BUCKLING*
                 PRESSURE  PRESSURE   PROPAGATE   LOAD CNTL.  DISP CNTL.
----------------------------------------------------------------------
======================================================================
  60   SEABED      0.000     0.006      0.021       0.000       0.006
  61   SEABED      0.000     0.006      0.021       0.000       0.006
  62   SEABED      0.000     0.006      0.021       0.000       0.006
```

```
 ._____.
 |                                                    |
 | *NOTE: THE DNV LIMIT STATE INEQUALITIES FOR LOCAL BUCKLING UNDER |
 |        THE COMBINED EFFECTS OF BENDING AND INTERNAL OR EXTERNAL  |
 |        PRESSURE ARE HIGHLY NONLINEAR. THE MAGNITUDE OF THE UNITY |
 |        RATIOS FOR THESE TWO LIMIT STATES MAY SIGNIFICANTLY UNDER |
 |        ESTIMATE HOW CLOSE THE PIPE IS TO EXCEEDING THESE LIMIT   |
 |        STATES.  FOR THIS REASON, DNV REFERS TO THESE VALUES AS   |
 |        "INTERACTION RATIOS" RATHER THAN "UNITY RATIOS".          |
 |_____|
```

APPENDIX-5

Local Buckling Check

INTERACTION RATIOS FOR INSTALLATION CONDITION ON BARGE

10" Gas Pipeline (WATER DEPTH 21.34 METER)

1.0 SCOPE

This calculation worksheet computes interaction ratio as per DNV-OS-F101 rules for submarine pipeline system for the given load effect and pipelines data.

Unit Conversions

$$kip := 10^3 lb \qquad kipf := 10^3 lbf \qquad ksi := \frac{kipf}{in^2} \qquad KN := 10^3 N \qquad Mpa := 10^6 Pa$$

2.0 INPUT PARTICULAR

2.1 Pipeline Data

$D := 273.1\,mm$	outside diameter	
$t := 15.9\,mm$	pipe thickness	
$t_2 := t$	characteristic wall thickness	
$f_0 := 1.5\%$	ovality	
$\alpha_{fab} := 0.85$	max. fabrication factor (1.0 for seamless, 0.93 for UO&TRB, 0.85 for UOE)	
$smys := 448\,Mpa$	specified minimum yield strength	
$smts := 530\,Mpa$	specified minimum tensile strength	
$T_o := 7$	installation temperature degree centigrade (C)	
$\alpha_U := 0.96$	material strength factor (0.96 Normal NDT and 1.0 for NDT level 1)	
$\alpha_A := 0.95$	anisotropic factor (0.95 for relaxed testing requirements, 1.0 other case)	
$E := 207000\,Mpa$	young's modulus	
$\upsilon := 0.3$	poisson ratio	
$\rho := 1025\,\dfrac{kg}{m^3}$	water density	

$$f_{ytemp} := \left[linterp\left[\begin{pmatrix} 0 \\ 50 \\ 100 \\ 200 \end{pmatrix}, \begin{pmatrix} 0MPa \\ 0MPa \\ 30MPa \\ 70MPa \end{pmatrix}, T_o \right] \right]$$

$$f_{ytemp} := 0Mpa$$

$$f_y := (smys - f_{ytemp})\alpha_U \qquad f_y = 430.08 \cdot Mpa \qquad \text{characteristic yield strength}$$

$$f_u := (smts - f_{ytemp})\alpha_U \alpha_A \qquad f_u = 483.36 \cdot Mpa \qquad \text{characteristic tensile strength, assumed similar temperature derating for smys and smts}$$

2.2 Load Effects (at node of max. stresss)

$wd := 0m$		water depth
$M_F := 203.68 KN\,m$		function moment (as per OFFPIPE)
$M_t := 272.23 KN\,m$		Total Moment (as per OFFPIPE)
$M_E := M_t - M_F$	$M_E = 68.55\,m \cdot KN$	environmental moment

$S_F := 240.05 KN$ function effective axial force
important Notes: Tensile is positive
in the as-laid condition, this is equall to the effective (residual) Tension
for intermediate depth during laying, this should be calculated
  based on OFFPIPE tensile stress result print outs (+ve is
  tensile, -ve is compressive, i.e. stress steel area)
during the operational case and hydrotest case calculated based on
  internal pressure, temp, poisson effect, boundary condition, etc.

$S_E := 269.09 KN$		environmental effective axial force important Notes : refer abovelocal
$P_{ld} := 0 Mpa$		design pressure (this is the internal pressure considering the static head of the content/test medium. Refer code also)
$P_e := \rho \cdot wd \cdot g$	$P_e = 0 \cdot Mpa$	external pressure

2.3 Safety Class: Low (being installation phase)

Resistance Factors: Stress

$\gamma_{SC} := 1.04$ safety class resistance factors (Ref: DNV-OS-F101, Table 5.5)
1.046 safety class low-pressure containment
1.138 safety class normal-pressure containment
1.308 safety class high-pressure containment
1.040 safety class low-other load effects
1.140 safety class normal-other load effects
1.260 safety class high-other load effects

$\gamma_m := 1.15$ material resistance factor (Ref: DNV-OS-F101, table 5.4)
1.15 for SLS/ULS/ALS
1.00 for FLS

2.4 Limit State: Serviceabilty Limit State

Load Factor (Ref: DNV-OS-F101, Table 5.6)

$\gamma_{Fa} := 1.2$	functional load factor for load comb id. a
$\gamma_{Fb} := 1.1$	functional load factor for load comb id. b
$\gamma_{Ea} := 0.7$	environmental load factor for load comb id. a
$\gamma_{Eb} := 1.3$	environmental load factor for load comb id. b
$\gamma_p := 1.05$	pressure load for load comb a and b
$\gamma_C := 1.0$	condition load effect factor (Ref: DNV-OS-F101, Table 5.7)

1.07 for p/l resting on uneven seabed or snaked condition
0.82 for p/l on continuously stiff supported
0.93 for system pressure test
1.00 otherwise

_____ END OF INPUT _____

3.0 CALCULATIONS

3.1 Characteristic Capacities

$$P_{el} := \frac{2 \cdot E \left(\dfrac{t_2}{D}\right)^3}{1 - v^2} \qquad P_{el} = 89.781 \cdot Mpa \qquad \text{elastic collapse capacity}$$

$$P_p := 2 \cdot f_y \cdot \left(\frac{t_2}{D}\right) \cdot \alpha_{fab} \qquad P_p = 42.567 \cdot Mpa \qquad \text{plastic collapse capacity}$$

The characteristic capacity for external pressure (collapse) is given as a third order polynomial, which is calculated below :

$$b := -P_{el}$$

$$c := -\left[P_p^2 + P_p \cdot P_{el} \cdot f_0 \left(\frac{D}{t_2}\right)\right]$$

$$d := P_{el} \cdot P_p^2$$

$$u := \frac{1}{3} \cdot \left(\frac{-1}{3} \cdot b^2 + c\right)$$

$$v := \frac{1}{2} \cdot \left(\frac{2}{27} \cdot b^3 - \frac{1}{3} \cdot b \cdot c + d\right)$$

$$\phi := acos\left(\frac{-v}{\sqrt{-u^3}}\right) \qquad \phi = 1.734$$

$$y := -2 \cdot \sqrt{-u} \cdot cos\left(\frac{\phi}{3} + \frac{60 \cdot \pi}{180}\right)$$

$$P_c := y - \frac{1}{3} \cdot b \qquad P_c = 34.574 \cdot Mpa \qquad \text{the external pressure capacity}$$

(I) Combine Loading Criteria - Load Controlled Condition

3.2 Load Capacities

$$M_p := f_y \cdot (D - t_2)^2 \cdot t_2 \qquad M_p = 452.364 \, m \cdot KN \qquad \text{plastic moment capacity}$$

$$S_p := f_y \cdot \left[(D - t_2) \cdot t_2 \cdot \pi\right] \qquad S_p = 5.525 \times 10^3 \cdot KN \qquad \text{plastic axial capacity}$$

3.3 Load Capacities

Load Combination 'a' and 'b' (SLS and ULS)

$M_{da} := M_F \cdot \gamma_{Fa} \cdot \gamma_C + M_E \cdot \gamma_{Ea} = 292.401 \ m \cdot kN$ design bending moment for load combination 'a'

$M_{db} := M_F \cdot \gamma_{Fb} \cdot \gamma_C + M_E \cdot \gamma_{Eb} = 313.163 \ m \cdot kN$ design bending moment for load combination 'b'

$S_{da} := S_F \cdot \gamma_{Fa} \cdot \gamma_C + S_E \cdot \gamma_{Ea} = 476.423 \cdot kN$ design effective axial force for load combination 'a'

$S_{db} := S_F \cdot \gamma_{Fb} \cdot \gamma_C + S_E \cdot \gamma_{Eb} = 613.872 \cdot kN$ design differential over pressure

$\Delta_{pd} := \gamma_p \cdot \left(P_{ld} - P_e \right) = 0 \cdot Mpa$ design differential over pressure (-ve indicates external over pressure and +ve indicates internal over pressure)

Interaction Equation for External Over Pressure

$$q_h := \begin{vmatrix} \dfrac{\left(P_{ld} - P_e \right)}{P_b(t_2) \cdot \dfrac{2}{\sqrt{3}}} & \text{if } P_{ld} < P_e \\ 0 & \text{otherwise} \end{vmatrix}$$

$$P_b(t_2) := \min\left[\frac{(2 \cdot t_2)}{(D - t_2)} \cdot \frac{f_u}{1.15} \cdot \frac{2}{\sqrt{3}} , \frac{(2 \cdot t_2)}{(D - t_2)} \cdot f_y \cdot \frac{2}{\sqrt{3}} \right]$$

$$P_b(t_2) = 60.007 \cdot Mpa$$

$$\beta := \begin{vmatrix} (0.4 + q_h) & \text{if } \dfrac{D}{t_2} < 15 \\[4mm] \left[(0.4 + q_h) \cdot \left(\dfrac{60 - \dfrac{D}{t_2}}{45} \right) \right] & \text{if } 15 \le \dfrac{D}{t_2} \le 60 \\[4mm] 0 & \text{otherwise} \end{vmatrix}$$

$$\beta = 0.381$$

$$\alpha_c := \begin{vmatrix} (1 - \beta) + \beta \cdot \dfrac{f_u}{f_y} & \text{if } (1 - \beta) + \beta \cdot \dfrac{f_u}{f_y} < 1.2 \\ 1.2 & \text{otherwise} \end{vmatrix}$$

$\alpha_c = 1.047$ **flow stress parameter**

Load Condition 'a'

$$\left[\left[\left[\gamma_{SC} \cdot \gamma_m \cdot \left(\frac{M_{db}}{\alpha_c \cdot M_p} \right) + \gamma_{SC} \cdot \gamma_m \cdot \left(\frac{S_{da}}{\alpha_c \cdot S_p} \right)^2 \right]^2 + \left[\gamma_{SC} \cdot \gamma_m \cdot \left(\frac{P_e}{P_c} \right) \right]^2 \right] \right] = 0.638 \quad \textbf{this value should be less than 1.0}$$

Load Condition 'b'

$$\left[\left[\left[\gamma_{SC} \cdot \gamma_m \cdot \left(\frac{M_{da}}{\alpha_c \cdot M_p} \right) + \gamma_{SC} \cdot \gamma_m \cdot \left(\frac{S_{db}}{\alpha_c \cdot S_p} \right)^2 \right]^2 + \left[\gamma_{SC} \cdot \gamma_m \cdot \left(\frac{P_e}{P_c} \right) \right]^2 \right] \right] = 0.565 \quad \textbf{this value should be less than 1.0}$$

INTERACTION RATIOS FOR INSTALLATION CONDITION ON STINGER

10" Gas Pipeline (WATER DEPTH 21.34 METER)

1.0 SCOPE

This calculation worksheet computes interaction ratio as per DNV-OS-F101 rules for submarine pipeline system for the given load effect and pipelines data.

Unit Conversions

$$kip := 10^3 lb \qquad kipf := 10^3 lbf \qquad ksi := \frac{kipf}{in^2} \qquad KN := 10^3 N \qquad Mpa := 10^6 Pa$$

2.0 INPUT PARTICULAR

2.1 Pipeline Data

$D := 273.1\,mm$	outside diameter
$t := 15.9\,mm$	pipe thickness
$t_2 := t$	characteristic wall thickness
$f_0 := 1.5\%$	ovality
$\alpha_{fab} := 0.85$	max. fabrication factor (1.0 for seamless, 0.93 for UO&TRB, 0.85 for UOE)
$smys := 448\,Mpa$	specified minimum yield strength
$smts := 530\,Mpa$	specified minimum tensile strength
$T_o := 7$	installation temperature degree centigrade (C)
$\alpha_U := 0.96$	material strength factor (0.96 Normal NDT and 1.0 for NDT level 1)
$\alpha_A := 0.95$	anisotropic factor (0.95 for relaxed testing requirements, 1.0 other case)
$E := 207000\,Mpa$	young's modulus
$\upsilon := 0.3$	poisson ratio
$\rho := 1025\,\dfrac{kg}{m^3}$	water density

$$f_{ytemp} := \left[linterp\left[\begin{pmatrix} 0 \\ 50 \\ 100 \\ 200 \end{pmatrix}, \begin{pmatrix} 0MPa \\ 0MPa \\ 30MPa \\ 70MPa \end{pmatrix}, T_o \right] \right] \qquad f_{ytemp} := 0Mpa$$

$f_y := (smys - f_{ytemp})\alpha_U$	$f_y = 430.08 \cdot Mpa$	characteristic yield strength
$f_u := (smts - f_{ytemp})\alpha_U \alpha_A$	$f_u = 483.36 \cdot Mpa$	characteristic tensile strength, assumed similar temperature derating for smys and smts

2.2 Load Effects (at node of max. stresss)

$wd := 7.90\,m$		water depth
$M_F := 150.769\,KN\,m$		function moment (as per OFFPIPE)
$M_t := 300.55\,KN\,m$		Total Moment (as per OFFPIPE)
$M_E := M_t - M_F$	$M_E = 149.781\,m\cdot KN$	environmental moment

$S_F := 232.26\,KN$

function effective axial force
important Notes: Tensile is positive
in the as-laid condition, this is equall to the effective (residual) Tension
for intermediate depth during laying, this should be calculated based on OFFPIPE tensile stress result print outs (+ve is tensile, -ve is compressive, i.e. stress steel area)
during the operational case and hydrotest case calculated based on internal pressure, temp, poisson effect, boundary condition, etc.

$S_E := 256.34\,KN$		environmental effective axial force important Notes : refer above
$P_{ld} := 0\,Mpa$		local design pressure (this is the internal pressure considering the static head of the content/test medium. Refer code also)
$P_e := \rho\cdot wd\cdot g$	$P_e = 0.079\cdot Mpa$	external pressure

2.3 Safety Class: Low (being installation phase)

Resistance Factors: Stress

$\gamma_{SC} := 1.04$

safety class resistance factors (Ref: DNV-OS-F101, Table 5.5)
1.046 safety class low-pressure containment
1.138 safety class normal-pressure containment
1.308 safety class high-pressure containment
1.040 safety class low-other load effects
1.140 safety class normal-other load effects
1.260 safety class high-other load effects

$\gamma_m := 1.15$

material resistance factor (Ref: DNV-OS-F101, table 5.4)
1.15 for SLS/ULS/ALS
1.00 for FLS

2.4 Limit State: Serviceabilty Limit State

Load Factor (Ref: DNV-OS-F101, Table 5.6)

$\gamma_{Fa} := 1.2$	functional load factor for load comb id. a
$\gamma_{Fb} := 1.1$	functional load factor for load comb id. b
$\gamma_{Ea} := 0.7$	environmental load factor for load comb id. a
$\gamma_{Eb} := 1.3$	environmental load factor for load comb id. b
$\gamma_p := 1.05$	pressure load for load comb a and b
$\gamma_C := 1.0$	condition load effect factor (Ref: DNV-OS-F101, Table 5.7)

1.07 for p/l resting on uneven seabed or snaked condition

0.82 for p/l on continuously stiff supported
0.93 for system pressure test
1.00 otherwise

_____ END OF INPUT _____

3.0 CALCULATIONS

3.1 Characteristic Capacities

$$P_{el} := \frac{2 \cdot E \left(\frac{t_2}{D} \right)^3}{1 - v^2} \qquad P_{el} = 89.781 \cdot Mpa \qquad \text{elastic collapse capacity}$$

$$P_p := 2 \cdot f_y \cdot \left(\frac{t_2}{D} \right) \cdot \alpha_{fab} \qquad P_p = 42.567 \cdot Mpa \qquad \text{plastic collapse capacity}$$

The characteristic capacity for external pressure (collapse) is given as a third order polynomial, which is calculated below :

$$b := -P_{el}$$

$$c := -\left[P_p^2 + P_p \cdot P_{el} \cdot f_0 \left(\frac{D}{t_2} \right) \right]$$

$$d := P_{el} \cdot P_p^2$$

$$u := \frac{1}{3} \cdot \left(\frac{-1}{3} \cdot b^2 + c \right)$$

$$v := \frac{1}{2} \cdot \left(\frac{2}{27} \cdot b^3 - \frac{1}{3} \cdot b \cdot c + d \right)$$

$$\phi := acos \left(\frac{-v}{\sqrt{-u^3}} \right) \qquad \phi = 1.734$$

$$y := -2 \cdot \sqrt{-u} \cdot cos \left(\frac{\phi}{3} + \frac{60 \cdot \pi}{180} \right)$$

$$P_c := y - \frac{1}{3} \cdot b \qquad P_c = 34.574 \cdot Mpa \qquad \text{the external pressure capacity}$$

(I) Combine Loading Criteria - Load Controlled Condition

3.2 Load Capacities

$$M_p := f_y \cdot (D - t_2)^2 \cdot t_2 \qquad M_p = 452.364 \ m \cdot KN \qquad \text{plastic moment capacity}$$

$$S_p := f_y \cdot \left[(D - t_2) \cdot t_2 \cdot \pi \right] \qquad S_p = 5.525 \times 10^3 \cdot KN \qquad \text{plastic axial capacity}$$

3.3 Load Capacities

Load Combination 'a' and 'b' (SLS and ULS)

$M_{da} := M_F \cdot \gamma_{Fa} \cdot \gamma_C + M_E \cdot \gamma_{Ea} = 285.769 \; m \cdot kN$ design bending moment for load combination 'a'

$M_{db} := M_F \cdot \gamma_{Fb} \cdot \gamma_C + M_E \cdot \gamma_{Eb} = 360.561 \; m \cdot kN$ design bending moment for load combination 'b'

$S_{da} := S_F \cdot \gamma_{Fa} \cdot \gamma_C + S_E \cdot \gamma_{Ea} = 458.15 \cdot kN$ design effective axial force for load combination 'a'

$S_{db} := S_F \cdot \gamma_{Fb} \cdot \gamma_C + S_E \cdot \gamma_{Eb} = 588.728 \cdot kN$ design differential over pressure

$\Delta_{pd} := \gamma_p \cdot \left(P_{ld} - P_e \right) = -0.083 \cdot Mpa$ design differential over pressure (-ve indicates external over pressure and +ve indicates internal over pressure)

Interaction Equation for External Over Pressure

$$q_h := \begin{vmatrix} \dfrac{\left(P_{ld} - P_e \right)}{P_b(t_2) \cdot \dfrac{2}{\sqrt{3}}} & \text{if } P_{ld} < P_e \\ 0 & \text{otherwise} \end{vmatrix}$$

$$P_b(t_2) := \min\left[\frac{(2 \cdot t_2)}{(D - t_2)} \cdot \frac{f_u}{1.15} \cdot \frac{2}{\sqrt{3}}, \; \frac{(2 \cdot t_2)}{(D - t_2)} \cdot f_y \cdot \frac{2}{\sqrt{3}} \right]$$

$$P_b(t_2) = 60.007 \cdot Mpa$$

$$\beta := \begin{vmatrix} \left(0.4 + q_h \right) & \text{if } \dfrac{D}{t_2} < 15 \\[2em] \left[\left(0.4 + q_h \right) \cdot \left(\dfrac{60 - \dfrac{D}{t_2}}{45} \right) \right] & \text{if } 15 \le \dfrac{D}{t_2} \le 60 \\[1em] 0 & \text{otherwise} \end{vmatrix}$$
    $\beta = 0.38$

$$\alpha_c := \begin{vmatrix} (1 - \beta) + \beta \cdot \dfrac{f_u}{f_y} & \text{if } (1 - \beta) + \beta \cdot \dfrac{f_u}{f_y} < 1.2 \\ 1.2 & \text{otherwise} \end{vmatrix}$$
    $\alpha_c = 1.047$ **flow stress parameter**

Load Condition 'a'

$$\left[\left[\left[\gamma_{SC} \cdot \gamma_m \cdot \left(\frac{M_{db}}{\alpha_c \cdot M_p} \right) + \gamma_{SC} \cdot \gamma_m \cdot \left(\frac{S_{da}}{\alpha_c \cdot S_p} \right)^2 \right]^2 + \left[\gamma_{SC} \cdot \gamma_m \cdot \left(\frac{P_e}{P_c} \right) \right]^2 \right] \right] = 0.843$$ **this value should be less than 1.0**

Load Condition 'b'

$$\left[\left[\left[\gamma_{SC} \cdot \gamma_m \cdot \left(\frac{M_{da}}{\alpha_c \cdot M_p} \right) + \gamma_{SC} \cdot \gamma_m \cdot \left(\frac{S_{db}}{\alpha_c \cdot S_p} \right)^2 \right]^2 + \left[\gamma_{SC} \cdot \gamma_m \cdot \left(\frac{P_e}{P_c} \right) \right]^2 \right] \right] = 0.539$$ **this value should be less than 1.0**

INTERACTION RATIOS FOR INSTALLATION CONDITION ON SAGBEND

10" Gas Pipeline (WATER DEPTH 21.34 METER)

1.0 SCOPE

This calculation worksheet computes interaction ratio as per DNV-OS-F101 rules for submarine pipeline system for the given load effect and pipelines data.

Unit Conversions

$$kip := 10^3 lb \qquad kipf := 10^3 lbf \qquad ksi := \frac{kipf}{in^2} \qquad KN := 10^3 N \qquad Mpa := 10^6 Pa$$

2.0 INPUT PARTICULAR

2.1 Pipeline Data

$D := 273.1\,mm$	outside diameter
$t := 15.9\,mm$	pipe thickness
$t_2 := t$	characteristic wall thickness
$f_0 := 1.5\%$	ovality
$\alpha_{fab} := 0.85$	max. fabrication factor (1.0 for seamless, 0.93 for UO&TRB, 0.85 for UOE)
$smys := 448\,Mpa$	specified minimum yield strength
$smts := 530\,Mpa$	specified minimum tensile strength
$T_o := 7$	installation temperature degree centigrade (C)
$\alpha_U := 0.96$	material strength factor (0.96 Normal NDT and 1.0 for NDT level 1)
$\alpha_A := 0.95$	anisotropic factor (0.95 for relaxed testing requirements, 1.0 other case)
$E := 207000\,Mpa$	young's modulus
$\upsilon := 0.3$	poisson ratio
$\rho := 1025\,\dfrac{kg}{m^3}$	water density

$$f_{ytemp} := \left[linterp \left[\begin{pmatrix} 0 \\ 50 \\ 100 \\ 200 \end{pmatrix}, \begin{pmatrix} 0MPa \\ 0MPa \\ 30MPa \\ 70MPa \end{pmatrix}, T_o \right] \right] \qquad f_{ytemp} := 0Mpa$$

$f_y := (smys - f_{ytemp})\alpha_U$	$f_y = 430.08 \cdot Mpa$	characteristic yield strength
$f_u := (smts - f_{ytemp})\alpha_U \alpha_A$	$f_u = 483.36 \cdot Mpa$	characteristic tensile strength, assumed similar temperature derating for smys and smts

2.2 Load Effects (at node of max. stresss)

$wd := 18.43\,m$ water depth

$M_F := 132.686\,KN\,m$ function moment (as per OFFPIPE)

$M_t := 172.77\,KN\,m$ Total Moment (as per OFFPIPE)

$M_E := M_t - M_F$ $M_E = 40.084\,m \cdot KN$ environmental moment

$S_F := 213.13\,KN$ function effective axial force
important Notes: Tensile is positive
in the as-laid condition, this is equall to the effective (residual) Tension
for intermediate depth during laying, this should be calculated based on OFFPIPE tensile stress result print outs (+ve is tensile, -ve is compressive, i.e. stress steel area)
during the operational case and hydrotest case calculated based on internal pressure, temp, poisson effect, boundary condition, etc.

$S_E := 243.40\,KN$ environmental effective axial force important Notes : refer above

$P_{ld} := 0\,Mpa$ local design pressure (this is the internal pressure considering the static head of the content/test medium. Refer code also)

$P_e := \rho \cdot wd \cdot g$ $P_e = 0.185 \cdot Mpa$ external pressure

2.3 Safety Class: Low (being installation phase)

Resistance Factors: Stress

$\gamma_{SC} := 1.04$ safety class resistance factors (Ref: DNV-OS-F101, Table 5.5)
1.046 safety class low-pressure containment
1.138 safety class normal-pressure containment
1.308 safety class high-pressure containment
1.040 safety class low-other load effects
1.140 safety class normal-other load effects
1.260 safety class high-other load effects

$\gamma_m := 1.15$ material resistance factor (Ref: DNV-OS-F101, table 5.4)
1.15 for SLS/ULS/ALS
1.00 for FLS

2.4 Limit State: Serviceabilty Limit State

Load Factor (Ref: DNV-OS-F101, Table 5.6)

$\gamma_{Fa} := 1.2$ functional load factor for load comb id. a

$\gamma_{Fb} := 1.1$ functional load factor for load comb id. b

$\gamma_{Ea} := 0.7$ environmental load factor for load comb id. a

$\gamma_{Eb} := 1.3$ environmental load factor for load comb id. b

$\gamma_p := 1.05$ pressure load for load comb a and b

$\gamma_C := 1.0$ condition load effect factor (Ref: DNV-OS-F101, Table 5.7)
1.07 for p/l resting on uneven seabed or snaked condition
0.82 for p/l on continuously stiff supported
0.93 for system pressure test
1.00 otherwise

_____ END OF INPUT _____

3.0 CALCULATIONS

3.1 Characteristic Capacities

$$P_{el} := \frac{2 \cdot E \left(\frac{t_2}{D}\right)^3}{1 - \upsilon^2} \qquad P_{el} = 89.781 \cdot Mpa \qquad \text{elastic collapse capacity}$$

$$P_p := 2 \cdot f_y \cdot \left(\frac{t_2}{D}\right) \cdot \alpha_{fab} \qquad P_p = 42.567 \cdot Mpa \qquad \text{plastic collapse capacity}$$

The characteristic capacity for external pressure (collapse) is given as a third order polynomial, which is calculated below :

$$b := -P_{el}$$

$$c := -\left[P_p^2 + P_p \cdot P_{el} \cdot f_0 \left(\frac{D}{t_2}\right)\right]$$

$$d := P_{el} \cdot P_p^2$$

$$u := \frac{1}{3} \cdot \left(\frac{-1}{3} \cdot b^2 + c\right)$$

$$v := \frac{1}{2} \cdot \left(\frac{2}{27} \cdot b^3 - \frac{1}{3} \cdot b \cdot c + d\right)$$

$$\phi := a\cos\left(\frac{-v}{\sqrt{-u^3}}\right) \qquad \phi = 1.734$$

$$y := -2 \cdot \sqrt{-u} \cdot \cos\left(\frac{\phi}{3} + \frac{60 \cdot \pi}{180}\right)$$

$$P_c := y - \frac{1}{3} \cdot b \qquad P_c = 34.574 \cdot Mpa \qquad \text{the external pressure capacity}$$

(I) Combine Loading Criteria - Load Controlled Condition

3.2 Load Capacities

$$M_p := f_y \cdot (D - t_2)^2 \cdot t_2 \qquad M_p = 452.364 \, m \cdot KN \qquad \text{plastic moment capacity}$$

$$S_p := f_y \cdot \left[(D - t_2) \cdot t_2 \cdot \pi\right] \qquad S_p = 5.525 \times 10^3 \cdot KN \qquad \text{plastic axial capacity}$$

3.3 Load Capacities

Load Combination 'a' and 'b' (SLS and ULS)

$M_{da} := M_F \cdot \gamma_{Fa} \cdot \gamma_C + M_E \cdot \gamma_{Ea} = 187.282 \ m \cdot kN$ design bending moment for load combination 'a'

$M_{db} := M_F \cdot \gamma_{Fb} \cdot \gamma_C + M_E \cdot \gamma_{Eb} = 198.064 \ m \cdot kN$ design bending moment for load combination 'b'

$S_{da} := S_F \cdot \gamma_{Fa} \cdot \gamma_C + S_E \cdot \gamma_{Ea} = 426.136 \cdot kN$ design effective axial force for load combination 'a'

$S_{db} := S_F \cdot \gamma_{Fb} \cdot \gamma_C + S_E \cdot \gamma_{Eb} = 550.863 \cdot kN$ design differential over pressure

$\Delta_{pd} := \gamma_p \cdot (P_{ld} - P_e) = -0.195 \cdot Mpa$ design differential over pressure (-ve indicates external over pressure and +ve indicates internal over pressure)

Interaction Equation for External Over Pressure

$$q_h := \begin{vmatrix} \dfrac{(P_{ld} - P_e)}{P_b(t_2) \cdot \dfrac{2}{\sqrt{3}}} & \text{if } P_{ld} < P_e \\ \\ 0 & \text{otherwise} \end{vmatrix}$$

$$P_b(t_2) := \min\left[\frac{(2 \cdot t_2)}{(D - t_2)} \cdot \frac{f_u}{1.15} \cdot \frac{2}{\sqrt{3}}, \ \frac{(2 \cdot t_2)}{(D - t_2)} \cdot f_y \cdot \frac{2}{\sqrt{3}} \right]$$

$$P_b(t_2) = 60.007 \cdot Mpa$$

$$\beta := \begin{vmatrix} (0.4 + q_h) & \text{if } \dfrac{D}{t_2} < 15 \\ \\ \left[(0.4 + q_h) \cdot \left(\dfrac{60 - \dfrac{D}{t_2}}{45} \right) \right] & \text{if } 15 \le \dfrac{D}{t_2} \le 60 \\ \\ 0 & \text{otherwise} \end{vmatrix}$$
     $\beta = 0.378$

$$\alpha_c := \begin{vmatrix} (1 - \beta) + \beta \cdot \dfrac{f_u}{f_y} & \text{if } (1 - \beta) + \beta \cdot \dfrac{f_u}{f_y} < 1.2 \\ \\ 1.2 & \text{otherwise} \end{vmatrix}$$
     $\alpha_c = 1.047$ **flow stress parameter**

Load Condition 'a'

$$\left[\left[\left[\gamma_{SC} \cdot \gamma_m \cdot \left(\frac{M_{db}}{\alpha_c \cdot M_p} \right) + \gamma_{SC} \cdot \gamma_m \cdot \left(\frac{S_{da}}{\alpha_c \cdot S_p} \right)^2 \right]^2 + \left[\gamma_{SC} \cdot \gamma_m \cdot \left(\frac{P_e}{P_c} \right) \right]^2 \right] \right] = 0.257$$ **this value should be less than 1.0**

Load Condition 'b'

$$\left[\left[\left[\gamma_{SC} \cdot \gamma_m \cdot \left(\frac{M_{da}}{\alpha_c \cdot M_p} \right) + \gamma_{SC} \cdot \gamma_m \cdot \left(\frac{S_{db}}{\alpha_c \cdot S_p} \right)^2 \right]^2 + \left[\gamma_{SC} \cdot \gamma_m \cdot \left(\frac{P_e}{P_c} \right) \right]^2 \right] \right] = 0.234$$ **this value should be less than 1.0**

APPENDIX-6

Concrete Crushing Check

CONCRETE COATING CRUSHING CHECK

10" Gas Pipeline (WATER DEPTH 21.34 METER)

1.0 SCOPE

This worksheet checks pipeline overbend radius for concrete crushing in accordance with DNV OS-F101 Submarine Pipeline System.

2.0 INPUT PARTICULAR

$D := 273.1 \, mm$ Nominal Outside Diameter

$\varepsilon_{bending} := 0.1949\%$ Maximum Bending Strain at Overbend Area (from OFFPIPE output)

$\varepsilon_{axial} := 0.0099\%$ Axial Strain at Overbend Area (from OFFPIPE output)

$\varepsilon_{cc} := -0.2\%$ Limit mean strain giving crushing of concrete:

- 0.2 % if no other information available
- 0.22% for 42" dia Pipe and concrete cooating thickness greather than 40mm
- 0.24% for 16" dia pipe and concrete coating thickness greather than 40mm with linear interpolation in between (Negative value denotes compressive strain)

$\gamma_{cc} := 1.05$ Safety Factor

_____ END OF INPUT _____

3.0 CALCULATIONS

$$R := \frac{\left(\dfrac{D}{2}\right)}{\varepsilon_{bending}}$$ $R = 70.062 \, m$ Minimum radius of overbend curvature

$$\varepsilon_{mean} := -\left(\frac{D}{2R}\right) + \varepsilon_{axial}$$ $\varepsilon_{mean} = -0.185 \, \%$ Mean overbend strain

$\gamma_{cc} \cdot \varepsilon_{mean} = -0.194 \, \%$

$Result := if\left(\gamma_{cc} \cdot \varepsilon_{mean} \geq \varepsilon_{cc}, "OK", "FAILED"\right)$ $Result = "OK"$

Conclusion

The Stresses, strain and percentage yielding of the pipe in STINGER, SAGBEND as well as SEA BED region were found to be within the limits. Thus it was concluded that it is safe to carry on Subsea pipeline installation operation with the configuration as mentioned and concrete burst check and local buckling check is calculated and it was within the limit.

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