Structural Integrity Re-Use Assessment for Fixed Structures

By

Kyaw Thiha Hla Myint

17824

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Universiti Teknologi PETRONAS

32610 Bandar Seri Iskandar

Perak Darul Ridzuan

SAMPLE OF CERTIFICATION OF APPROVAL

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A project dissertation submitted to the
Civil Engineering Programme
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(AP Dr. Dr. Noor Amila Wan Abdullah Zawawi)

ABSTRACT

In a time not far from now, there will be a significant increase in the decommissioning activities of fixed offshore platforms in Asia Pacific Region. The usual methods of decommissioning comprise the complete removal, partial removal, reefing or re-using of the offshore structure. The major challenges that encounter during the complete or partial removal decommissioning is the shortage of decommissioning yards for managing onshore disposal. Therefore, reefing or re-using of the structure has better aspect of sustainability rather than the complete removal and disposal method. Reusing of the old structure can be not only cost saving but also will much reduce the emission of carbon dioxide during the steel manufacturing process from iron ore. In this report, it will be focused on the jacket of the fixed offshore structure and there will be two parts to discuss; structural integrity assessment and structural analysis. Before the structure is being reused, a structural integrity assessment is carried out to determine the current integrity of the structure. Based on the integrity assessment, modifications and/ or refurbishing are made if there is any and structural analysis is carried out to assess the strength of the offshore structure for reuse purpose.

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CHAPTER 1

INTRODUCTION

1.1 Background

As of 2010, it is estimated that there are 1645 fixed offshore structure installations in Asia pacific region (Twomey, 2010). Among them, 300 shallow water fixed offshore structures are in Malaysian waters and about 48% of these structures has exceeded their 25-year old design life as well as reaching to the end of their productive live (Carolin, 2014). According to Malaysia Decommissioning schedule which is derived from PETRONAS Abandonment Masterplan study (PAMS) in year 1997 and updated by Petroleum Management Unit (PMU) in year 2000, the number of offshore structures needed to be decommissioned in year 2020 will be around 74 structures which are operated by various operators in three regions: namely Peninsular Malaysia Operation (PMO), Sarawak Operation (SKO) and Sabah Operation (SBO).

Due to the Brent Spar incident in 1995, operators aware that abandoning the structure in a sea can cause a serious environmental catastrophe which can damage the image of operator in the oil and gas industry and, it is, therefore, ‘sustainable’ decommissioning should be practiced.

1.2 Problem Statement

Decommissioning is a very challenging work in nature due to its complex regulatory structure and process as well as the involvement of high cost. Form the many researches and studies, complete removal option in decommission requires not only much more budget but also more energy consumption than reusing option. Therefore, it can be said that reusing and refurbishing the steel structure can save energy and materials required for building a new one for such a use, in the absence of the reused materials. Not only would that, reusing eliminate tones of streel from the waste stream.

When the platform (substructure and/or topside structure) is considered for reuse purpose, structural assessment should be carried out to ensure that it is in (or can be returned to) an acceptable condition (API, 2000).As jackets are mainly made of steel, the reuse of decommissioned platforms' jackets is a conceptually viable possibility (Lun, Zawawi, & Liew, 2012). Steel is renowned for its strength, durability and functionality. The sturdy design of jackets and the relatively tranquil conditions of local waters are a boon to the reusing of these jackets as an opportunity to derive economic and/or scientific benefits. During the reusing process, the main concern that can be encountered is the welded steel connections such as between jacket leg and bracings, because welding connections are known to be susceptible to fatigue damage (Ayob, Kajuputra, Mukherjee, & Wong, 2014)

Therefore, this paper will mainly focus on the structural integrity assessment and analysis of the jacket legs of the decommissioned structure, where the jacket legs are modified and refurbished, if there are any anomalies present during structural assessment process, for reuse purpose.

1.3 Objective

The objective of this research is

- To establish the structural inspection on the existing structure for reuse purpose.
- To conduct structural analysis on the structure to ensure its structural integrity.

1.4 Scope of Study

This project focuses mainly on the reuse of the jacket legs of the decommissioned fixed offshore structure. Structural steel has been long recognized and acclaimed for its strength, durability, functionality and dry construction method whilst the welded steel connections are being susceptible to fatigue damage. In this study, the jacket legs are refurbished with new welding technology and bracing system and analyzed for reuse purpose.

CHAPTER 2

LITERATURE REVIEW

2.1 Decommissioning

Decommissioning is the process which the operator of an offshore oil or gas installation and pipeline goes through in order to plan, gain approval for and implement the removal, disposal or re-use of an offshore installation when it is no longer needed for its current purpose (Bemment, 2001).

The decommissioning process involves closing down operations at the end of field life including permanently abandoning wells, properly disposing of hydrocarbons and chemicals, making the platform safe, and removing some or all of the facilities and reusing or disposing of them as appropriate (API, 2014). PETRONAS "Guideline for Decommission of Oil and Gas Installation" had identified four main phases: field review, pre-decommissioning and implementation and post-decommissioning.

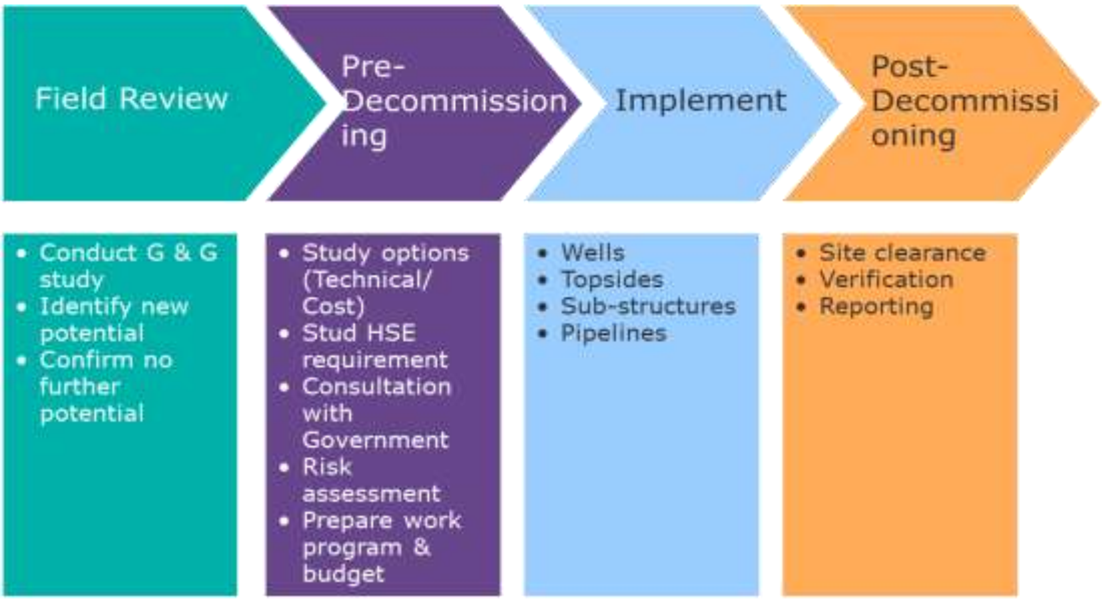

Figure 1. Decommissioning Process (Roslina Misman & Salamah Saad, 2004)

Decommissioning alternatives can be generally categorized into four categories: complete removal, partial removal, toppling (either as in-situ disposal of the structure or as artificial reefs), and reusing. According to International Maritime Organization (IMO) Guideline (1989), all structure installations require total removal with the exception of partial removal for some cases. More than 97% of Malaysia Platforms require total removal (R. Misman & S. Saad, 2004)The options for decommissioning of the various components of the offshore structure is show in Figure 2.

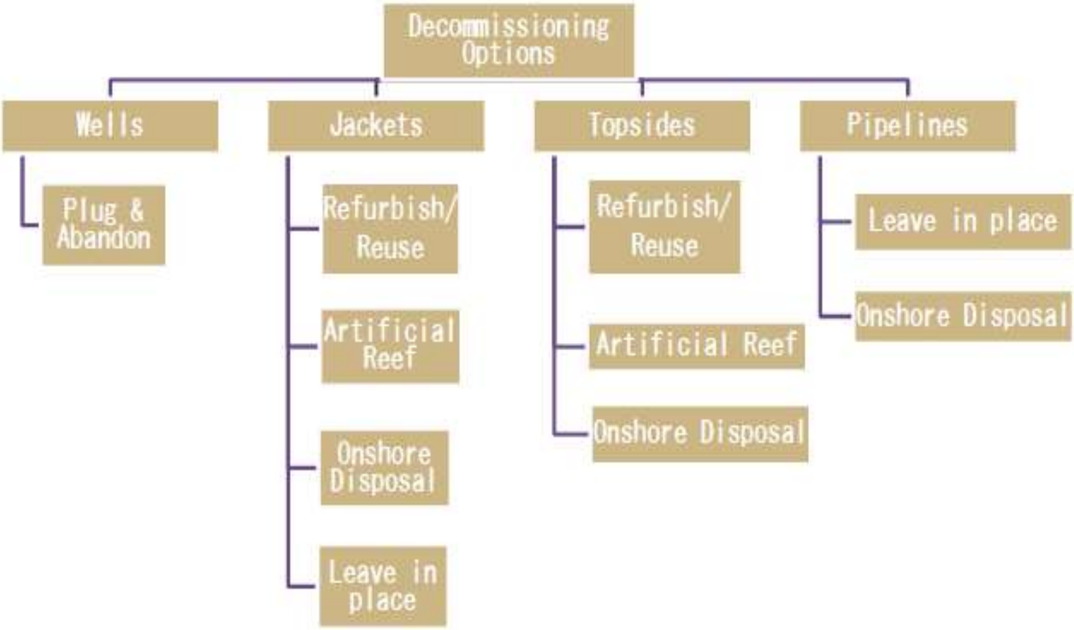

Figure 2. Decommissioning Options (Beheshti, 2014)

2.2 Structural Integrity Management

Structural integrity is one of the main concerns for platforms where the major modification is made or fatigue in jacket member or aging one (Soom et al., 2015).Structural integrity assessment for reusing the structure will be based on the re-evaluating the modified structure based on the inspection of current structural condition.

American Petroleum Institute (API) has developed a Structural Integrity Management (SIM) which is a continuous monitoring process to demonstrate the fitness-for-purpose of an offshore structure. SIM provides not only knowledge and understanding on the effects of deterioration, damage, changes in loading, and accidental overloading but also framework for inspection planning, maintenance, and repair of an offshore structure. Therefore, SIM has been used to provide decision making support from installation till decommissioning of the platform, to ensure the integrity of the offshore structure. The SIM process consist of (4) main processes as shown in Figure 3.

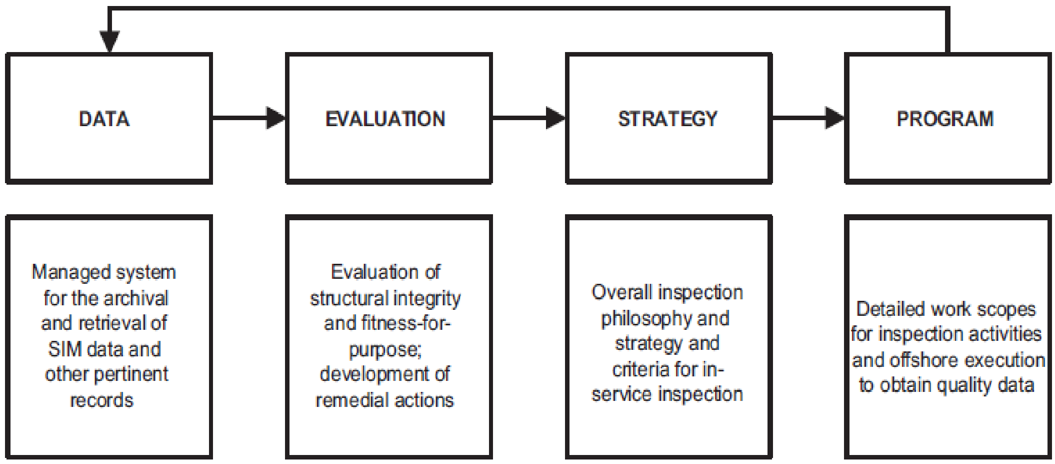

Figure 3. SIM Process (API)

In offshore structure, degradation mechanisms will occur overtime and can affect the safety and reliability of the structures. A comprehensive methodology for the survey and inspection of the offshore structure is needed to develop and based on the results obtained from these survey and inspection the structure can then be determined whether it is fit for service or reuse (Nezamian & Clarke, 2014) (Ayob et al., 2014).

As per API RP2A-WSD (2005), an assessment of used structures for reuse purpose should begin with the reviewing of existing documentation from the original construction of the structure, together with results of any past in-service surveys. Hence, structural integrity assessment for reusing the structure will be based on the survey and inspection result of the re-evaluating of the current structure condition.

2.3 Strength Degradation Mechanism

2.3.1 Fatigue on welds

Fatigue is one of the mechanisms that contribute to the degradation of the offshore structure (Nezamian & Clarke, 2014). Fatigue is a very local phenomenon, influenced by local geometry, weld defects induced by the fabrication process and corrosion wastage. (Dong, Moan, & Gao, 2012). The presence of fatigue cracks introduces a compromise on the integrity of the structure or its components. Fatigue cracks grow because of tensile stresses; corrosion of a metal is accelerated if the metal is subjected to tensile stress (El-Reedy, 2012). According to Dong, et al. (2012), crack growth normally starts from weld defects with a depth of say 0.1 mm and are driven by cyclic, tensile stresses. Cracks in jacket are confined to the tubular joints due to the large stress concentration in such joints (as show in Figure 4). It is noted that the crack size in a shell structure like the tubular joint, increases linearly with time. Hence, a significant reserve life remains when the crack has propagated through the thickness.

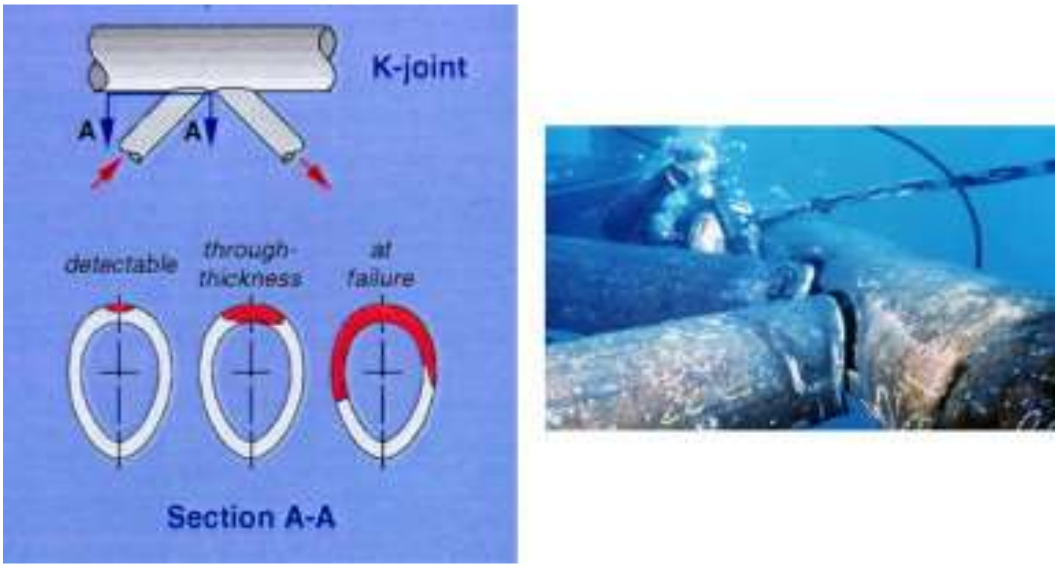

Figure 4. Crack growth stages and fracture in a tubular K-joint in a jacket platform (Dong, et al., 2014)

The critical components in an offshore steel platform are the steel tubular members and the associated joints, which are highly susceptible to fatigue, formed by welding the members (Rajasankar, Iyer, & Appa, 2003). Since fatigue load at weld tubular joints are the of high stress concentration, those locations should be estimated by evaluating the hot-spot stress range (HSSR) and using it as input into the appropriate S-N curve.

2.3.2 Corrosion Mechanism in the Jacket Structure

Another important strength degradation mechanism in offshore structure, especially on jacket legs, are the corrosion which is due to the effect of severe weather condition in the sea (Dong et al., 2012). Normally, the general corrosion rate for steel in sea water is approximately 0.1 mm/year. According to Moan, the corrosion rate may fluctuate between 0.04 to 1.2 mm/year, which exhibits a very large scatter depending upon location in the structure. Corrosion can be prevented by providing corrosion prevention coating for topside structure and cathodic protection system for underwater structure (Ayob et al., 2014). According to API RP2A WSD, corrosion protection should be designed in accordance with NACE RP-01-76 if it is not specified by the designer. Nominal stresses can be increased by corrosion wastage which causes the reduction of the cross-section‘s wall thickness, resulting in an earlier fatigue failure and also reducing the ultimate strength capacity of the structure (Dong et al., 2012).

2.3.3 Scouring Effect in the Jacket Structure

As per API RP2A-WSD, scouring is defined as the removal of seafloor soils caused by currents and waves. This phenomenon can either be due to the natural geological process or resulting from the interrupting the natural flow regime near the seafloor by the structural elements. Scouring can anticipate the problem of structural instability and therefore, it is essential to perform a scour protection to safeguard structure (Whitehouse, Harris, Sutherland, & Rees, 2011). In an offshore structure, both lateral and axial pile performance as well as pile capacity are affected by seabed scouring. According to Whitehouse et al. (2011), there is still high uncertainty on the potential scouring depth to the structure. But somehow, sediment transport studies can assist in defining scour to some extent and from industrial practice, ROV inspection is the best alternative to monitor the scouring (El-Reedy, 2012). Scour occurring around the offshores piles can be grouped into local and global scouring.

- General or global scour: In this case, the area of piles is affected by scouring and is usually twice of the area that is covered by the platform.
- Local scour: This type of scour can be found around the specific area of the structure, such as the piles.

Even though scouring does not have a problem for cohesive soil, scouring should be considered for cohesionless soil because during the scouring process, the later soil support is reduced and causing to increase in pile maximum bending stress (El-Reedy, 2012).

2.4 Basic Structural Analysis for Integrity Assessment

Structural assessment involved the evaluation of the platform using analytical methods, either performing a linear or nonlinear structural analysis, that compare the estimated performance of the platform against acceptance criterion (Salleh, 2014) . According to El-Reedy (2012), non-linear structural analysis, in-place analysis, is very important for defining the condition of the structure. Both linear and nonlinear structure analysis have been developed within the framework of two main categories, which are, the force (or flexibility) method and the displacement (or direct stiffness) method (Przemieniecki, 1985; Triantafyllou & Koumousis, 2014). From the study of El-Reedy (2012), in offshore structure, both the piles and joint of the structures are not comply with the code. Hence, survey should be concentrated on these connections with close visual inspection. El-Reedy (2012) also stated that determination of which of the main members and joints could affect structural reliability (e.g., a cantilever with a very high unity check ratio) can be sufficiently determined by in-place analysis.

2.5 Structural Inspection

In API RP2A_WSD (2007), it is stated that when the platform is considered to be reused, current structure condition is required to be inspected to ensure to be in an acceptable condition. Inspection of offshore structure has to be conducted to maintain the adequacy of corrosion protection system and evaluate the condition of platform to ensure it can ensure that structural integrity is maintained, safeguard human life and property, protect the environment and prevent from loss of natural resources (May, 2009).

For the PETRONAS operating platforms, there is a specific guidance for inspection plan, such as PETRONAS Carigali Inspection and Maintenance Guidelines (CIMG). The risk-based strategy optimized the future inspection requirements and focus valuable resources on the platforms “most at risk”. Such platforms will be inspected more frequently and using more detailed inspection surveys, whereas low risk ranking platform will have less frequent and less stringent inspections.

Inspection plan defines the frequency and scope of the inspection, the tools/techniques to be used and the deployment methods (API, 2014). It is also developed for the operated platforms and shall cover a number of years. This plan can be periodically updated throughout the platform's service life following receipt and evaluation of relevant SIM data (e.g. inspection data, results of platform assessments, etc.).

In recent years, risk based approaches to optimizing inspection requirements for offshore platforms has become more widespread, with companies such as Exxon-Mobil, BP and Shell pioneering the approaches that are now beginning to be documented and made available to the public. Using risk-based principles offshore oil and gas operators are able to optimize their inspection resources to be more cost effective and to reduce the operating cost (PCSB, 2014). To-date, implementation of a risk-based inspection program has been at the discretion of the oil and gas operator, with little industry guidance in the form of recommended practice or regulations available to the engineers.

By implementing Risked Based Underwater Structure Inspection (RBUI) for an offshore structure, minimized the risk, and cost for inspection can be minimized when compare with traditional underwater inspection plan. From RBUI, the risk of each platform can be identified and an appropriate inspection program can be designed to manage the risk so that it doesn't fail (Potty & Akram, 2011). The RBI process consists of performing risk assessment of structure; determine inspection frequency and scope of work. The risk assessment is done to determine the current and anticipated condition of the platform. The main results expected from risk based inspections are as follow (Nezamian & Clarke, 2014):

1. Identification of the areas or components where critical damages may occur;
2. Inspection campaign for each asset of the unit;
3. Specification of the inspection methods to be used;
4. Intervals during the operating life;
5. Methodology to review, update and optimize the program.

CHAPTER 3

METHODOLOGY

3.1 Project Work

Underwater Structure Inspection (Level 1,2,3,4)

Assessing existing strcutre condition.
(API RP2A-WSD, PETRONAS CIMG)

↓

Modification/refurbishing the structure (Jacket legs) if required. Based either on the Structue Insepction Result or on the basic structure analysis.

Redesigning or modifying the jacket legs.
(API RP 2A-WSD) , (Lun et al., 2012)

↓

Structure Analysis of the structure by using SACS software

Basic structural analysis to assess the current performance of the platform against acceptance criterion .
(API RP 2A-WSD), (Salleh, 2014), (Lun et al., 2012)

3.2 Platform Specification

The platform to be used in this project is the Yetagun-B, a production platform operated by PC Myanmar (Hong Kong) limited, located in Yetagun gas/condensate field of Adman Sea in Myanmar Water. The detail specification is as follow:

Table 1. Platform Specification

Particulars	Unit	Yetagun B
Design Safety Category		Manned
Installed		1999
Water Depth	m	103.63
Jacket Height	m	119.63
Air Gap	m	1.524
Deck Elevation	m	26.52
Long Framing		X
Tran Framing		X
No. of Legs		8
No. of Vertical Bay		6
Jacket Weight	MT	7300
Deck Weight	MT	11632
No. of Deck		4
No. of Cassions		8
No. of Riser		1
Base Length	m	67.616
Base Width	m	40.427
Manned		Yes
Cathodic Protection		Sacrificial Anode
Design Life	Years	25
Main Pile		None
Skirt Pile		12nos, (Dia. 84”), three skirt piles at each jacket corner legs

3.3 Structural Inspection

As per API RP2 SIM, structure inspection should be carried out to monitor known defects, damage, local corrosion, scour, or other conditions that could potentially affect the fitness-for-purpose of the platform structure, risers and J-tubes, conductors, or various appurtenances which is the key feature of selection of appropriate tools/techniques, work scope to define the objective. As discussed earlier, jacket leg, which are made of steel is renowned for its strength, durability and functionality, whilst welded steel connections between jacket leg and bracings, which are known to be susceptible to fatigue damage(Lun et al., 2012). Therefore, underwater structural inspection is conducted to assess the current condition of the structure. As per API RP2A, underwater structure inspection can be categorized into four levels as follow.

1. **Level I**

   In this level, the inspection consists of verification the performance of cathodic protection system as Underwater Structural Inspection and Visual Inspection of topside structure to find anomalies such as coating damage, corrosion on structure, and bent, missing, or damaged members. If the damage on topside structure is present, nondestructive testing (NDT) should be use when visual inspection cannot fully determine the extent of damage. When there is an indication of damage in Underwater Structural, Level II inspection should be conducted as soon as possible.

2. **Level II**

   Level II inspection is a general Underwater Structural visual inspection by means of the divers or remotely operated underwater vehicle (ROV) to find the presence of the following;

   1. Excessive Corrosion
   2. Accidental or environmental overloading.
   3. Scour seafloor instability, etc.
   4. Fatigue damage detectable in a visual swim-around survey.
   5. Design or construction deficiencies.
   6. Presence of debris.
   7. Excessive marine growth.

   Inspection on the measurement of cathodic potentials of pre-selected critical areas using the divers or ROV is also included. Any detection of structural damages during Level II inspection becomes the basis for initiation of Level III Inspection.

3. **Level III**

This level consists of Underwater Structural visual inspection on preselected area or based on the results of the Level II Inspection, known anomalies. Such area of known anomalies should be clean of marine growth to permit thorough inspection. Flooded Member Detection (FMD) is an acceptable alternative to close visual inspection (Level II) of preselected or selected areas.

4. **Level IV**

It consists of underwater nondestructive testing on preselected locations or based on Level III inspection. A Level III and/or Level IV survey of fatigue-sensitive joints and/or locations susceptible to cracking could be used to detect early stage fatigue cracking. If crack indications are reliably reported, they should be assessed by a competent engineer. Suspected false alarms may be resolved by a second inspection using a different method or by shallow surface grinding.

Since underwater structure inspection can cost a huge sum of budget, it is, therefore, 2014 underwater structure inspection result of Yetagun-B platform is used to conduct structural integrity assessment. The result is then compared with the Yetagun-B Design Data to check whether the current condition is complying with the design criteria.

If the structure condition meets the design criteria, a structural analysis can be directly carried out. Otherwise, a modification or refurbishing of the structure has to be made to ensure its integrity before the structural analysis.

3.4 Structure Analysis

Basic structure analysis, linear analysis with pile, is performed to strength of the current member. Through this analysis, main members and joints effect on structural reliability can be determined. Push-over analysis, to determine the reserved strength ratio (RSR), can be computed based on the in-place analysis. RSR provides the ultimate strength of the structure over 100 year environmental loading (Ayob et al., 2014).

In this structure analysis, since the type of reuse purpose is not known here and due to several constraints such as time, it is assumed that the topside loading is same as the loading before decommissioning. Based on the structure analysis results, structure can be determined whether there is potential for reuse purpose. If the analysis prove that the structure has sufficient strength, it can be considered for reuse otherwise refurbishing or modification is made and analysis has to be performed again on refurbished/modified structure.

3.4.1 Materials Properties

The material properties used in the analysis are as follows:

Table 2: Material Properties

PROPERTY	VALUE
Modulus of elasticity	200,000 N/mm^2
Shear modulus	76,900 N/mm^2
Poisson's ratio	0.3
Steel density	7850 kg/m^3
Seawater density	1020 kg/m^3
Marine growth density	1300 kg/m^3

3.4.2 Design data

The following arte the specific design data used for the structural analysis.

3.4.2.1 Water depth

Water depth relative at the Yetagun B platform location is as given in Table 3.

Table 3. Water Depth

Platform	Water Depth w.r.t. Mean Sea Level (MSL) (m)
Yetagun B	103.63

3.4.2.2 Tides

Tidal levels relative to MSL are given as given in Table 4.

Table 4. Tidal Levels

Tide		Level (m)
Lowest Astronomical Tide (LAT)		- 2.0
Highest Astronomical Tide (HAT)		2.0
Maximum Storm Surge (SS)	1 Year	± 0.4
	100 Years	± 0.6

3.4.2.3 Design Water Depth

The design still water depth used for in place analysis is given in Table 5.

Table 5. Design Water Depth

Item	MSL (m)
1 Year Minimum Water Depth	101.23
1 Year Maximum Water Depth	106.03
100 Years Minimum Water Depth	101.03
100 Years Maximum Water Depth	106.23

3.4.2.4 Wind Data

The wind force is assumed to act simultaneously and collinearly with wave and current forces. The wind speeds given in Table 6 are considered for the In place analysis.

Table 6. Wind Data

Description	Omni Directional	
	1 Year Operating Storm	100 Years Storm
1 Minute Mean Wind Speed (m/s) at 10m MSL	21	31

3.4.2.5 Wave Data

Stokes' fifth order theory shall be used for in-place analysis using the wave height and associated apparent period listed in Table 7.

.

Table 7. Wave Data

Description	Omni Directional	
	1 Year Operating Storm	100 Years Extreme Storm
Maximum Wave Height (m)	8.8	11.8
Associated Period (s)	8.9	10.8

3.4.2.6 Current Data

The maximum current speeds (m/s) that can occur simultaneously with the maximum wave are as given in Table 8.

Table 8. Current Data

Current	Omni Directional	
	1 Year Operating Storm	100 Years Extreme Storm
L_0 (103.63 m)	1.0	1.2
$L_{25\%}$ (77.72 m)	0.9	1.0
L_{MD} (51.82 m)	0.7	0.8
$L_{75\%}$ (24.91 m)	0.6	0.7
L_{1m} (1 m)	0.4	0.4

3.4.2.7 Marine Growth

For the purpose of calculating wave loading, the marine growth thickness given in Table 9 will be applied on the radius of all structural members and appurtenances below MSL.

Table 9. Marine Growth Data

Elevation (m)	Marine Growth Thickness (mm)
Surface to (-) 53.0	25
(-) 53.0 to (-) 85.0	50
(-) 85.0 to Mudline	25

3.4.3 Basic Load Cases (Operating Gravity Loads)

Even though this analysis is for the reuse of decommissioned jacket structure, the following basic load case before decommissioned condition is applied for the analysis as the new purpose of the use of structure is unknown. Therefore, an assumption is made that there is no difference in loading cases.

Table 10: Basic Load Cases

Load Case	Description	Load Case	Description
1	Computer Generated Structural Dead Load	33	10 Year Operating Wave + Current @ 0 Deg.
2	Non-Simulated Structural Dead Load	34	10 Year Operating Wave + Current @ 57 Deg.
3	Equipment Weights - Dry	35	10 Year Operating Wave + Current @ 60 Deg.
4	Equipment Weights - Operating	36	10 Year Operating Wave + Current @ 90 Deg.
5	Equipment Weights - Hydrotest	37	10 Year Operating Wave + Current @ 117 Deg.
6	Piping / Cabling Bulks	38	10 Year Operating Wave + Current @ 120 Deg.
7	Open Area Load – Sub-Cellar Deck (150PSF)	39	10 Year Operating Wave + Current @ 123 Deg.
8	Open Area Load – Cellar Deck (150 PSF)	40	10 Year Operating Wave + Current @ 180 Deg.
9	Open Area Load – Main Deck (150 PSF)	41	10 Year Operating Wave + Current @ 237 Deg.
10	Upper Deck Blanket Load (600 PSF)	42	10 Year Operating Wave + Current @ 243 Deg.
11	Spare Load Case	43	10 Year Operating Wave + Current @ 270 Deg.
12	Spare Load Case	44	10 Year Operating Wave + Current @ 300 Deg.
13	Spare Load Case	45	10 Year Operating Wave + Current @ 303 Deg.
14	LQ/HD Misc/Arch/Equip/Piping etc.	46	100 Year Monsoon Wave + Current @ 0 Deg.
15	LQ/HD Live Load	47	100 Year Monsoon Wave + Current @ 57 Deg.
16	LQ/HD Laydown Load / Roof Load	48	100 Year Monsoon Wave + Current @ 60 Deg.
17	Piping Load on Bridge (2300 Kg/m)	49	100 Year Monsoon Wave + Current @ 90 Deg.
18	Walkway Live Load Bridge (150 PSF)	50	100 Year Monsoon Wave + Current @ 117 Deg.

19	Flare Pip. Walkway Dead Load (Present)	51	100 Year Monsoon Wave + Current @ 120 Deg.
20	Flare Walkway Live Load (Present)	52	100 Year Monsoon Wave + Current @ 123 Deg.
21	Spare Load Case	53	100 Year Monsoon Wave + Current @ 180 Deg.
22	Spare Load Case	54	100 Year Monsoon Wave + Current @ 237 Deg.
23	Crane Moment – 0 Deg.	55	100 Year Monsoon Wave + Current @ 243 Deg.
24	Crane Moment – 90 Deg.	56	100 Year Monsoon Wave + Current @ 270 Deg.
25	10 Year Wind Load - 0 Deg.	57	100 Year Monsoon Wave + Current @ 300 Deg.
26	10 Year Wind Load - 90 Deg.	58	100 Year Monsoon Wave + Current @ 303 Deg.
27	10 Year Wind Load - 180 Deg.	59	Jacket Appurtenances Weight
28	10 Year Wind Load - 270 Deg.	60	Boat Landing live Load
29	100 Year Wind Load - 0 Deg.	61	CG Shift Reaction Towards Row B
30	100 Year Wind Load - 90 Deg.	62	Spare Load Case
31	100 Year Wind Load - 180 Deg.		
32	100 Year Wind Load - 270 Deg.		

3.5 Project Key Milestones

Project activities	Week													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Analyzing the underwater structure inspection result.					■									
Submission of Progress Report							■							
Conducting in-place analysis using SACS software									■					
Pre-Sedex											■			
Submission of Final Report											■			
Submission of Technical Report												■		
Final Viva & Submission of Hardbound Thesis														■

3.6 Gantt Chart

Project activities	Week													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Data findings		■	■											
Analyzing the underwater structure inspection result.				■	■									
Submission of Progress Report							■							
Conducting push over analysis using SACS software							■	■	■					
Finalizing the project									■	■				
Submission of Final Report											■			
Submission of Technical Report											■			
Preparing for Viva												■	■	
Final Viva														■

3.7 Tools Required

SACS V 5.7

It is used to perform in-place analysis of the offshore structures

Volo View 3/ AutoCAD

This tool is used to view the structural drawing files of Offshore Structure.

Abode Acrobat 6.0

This software is used to review digital documents and references such as manual, report and standards.

CHAPTER 4

RESULT AND DISCUSSION

4.1 Structural Integrity Assessment (Underwater Structure Inspection)

Underwater structure inspection 2014 report is studied to assess the current condition of the structure. From the report, anomalies are found and compared with the acceptance criteria as per design data book.

4.1.1 Underwater Inspection Result

The inspection findings result and acceptance criteria for each inspection are discussed in detail as below.

1. **Flooded Member Detection (FMD)**

   Inspection result: A Flooded Member Detection survey was performed on 58 members and leg sections. No members or leg sections were found to be flooded.

   Acceptance Criteria: All horizontal and vertical diagonal structural members have to be non-flooded.

2. **Cathodic Protection (CP)**

   Inspection result: Contact CP readings acquired during survey ranged from good to low with seven (7) anomalous readings reported. CP potentials acquired from the platform structure ranged from -881mV to -1011mV ref Ag/AgCl. The seven (7) anomalous potentials ranged from -623mV to -773mV ref Ag/AgCl. The anomalous CP potentials were acquired on B1/2 Skirt Pile and Catcher Plate and on B4/5 Skirt Pile. Two (2) areas of corrosion staining were reported on Skirt Piles B1/2 and B4/5. No corrosion pitting was observed.

   Acceptance Criteria: CP standard reading range with Ag/AgCl Reference Probe is -800mV to -1050mV.

3. **Anodes Inspection**

Inspection result: Most anodes observed on the platform were considered to be in good condition, securely attached. One (1) anode wastage anomaly was reported on Level 10 EL (-) 101.860m on member HD-A1L10-D5L10, where the anode appears to be 75% depleted. Ninety-seven (97) anodes were reported with depletions ranging from 0%-25%; One hundred and ninety-two (192) were reported with depletions ranging from 25%-50%; Sixty-four (64) anodes were reported with depletions ranging from 50%-75% with thirty-four (34) anodes reported obscured by marine growth.

Acceptance Criteria: Anode with wastage > 75%.

4. **Debris Survey**

Inspection result: Fifty-three (53) debris items were reported on or around the platform. None appeared to have caused any structural damage to the platform. Thirty-one (31) debris items were reported as anomalous; with metallic debris accounting for sixteen (16) anomalies.

Acceptance Criteria: - Debris related to other anomalies.
- Debris that constitutes a safety hazard for the underwater operations and cannot be removed immediately.

5. **Marine Growth**

Inspection result: Light marine growth coverage was reported from EL (-) 20m to the seabed elevation. Marine growth measurements were taken on Leg B1 at the 12 o'clock position of the node at each plan elevation and at the mid-point between each elevation from EL (-) 20m to seabed.

Average Marine growth coverage EL (-) 20.0m to EL (-) 65.0m:
Hard: Average 92% cover overall, 38mm in thickness.
Soft: Average 95% cover overall, 75mm in thickness

Average Marine growth summary EL (-) 65.0m to EL (-) 103.0m:

Hard: Average 21% cover overall, 9mm in thickness.

Soft: Average 88% cover overall, 11mm in thickness.

Acceptance Criteria: Marine Growth Allowance (Hard) as per design specification is

- 0-60 m is 10.1 cm
- 60-103 m is 5.2 cm

6. **Damage**

Inspection result: Six (6) areas of damage were reported on the structure. All six (6) areas of damage were reported as dents on the edge of Skirt Pile Catcher Plates A4/4, A4/5, A4/6, B4/4 and A1/1. One (1) Lack of Integrity anomaly was reported in relation to a disconnected grout pipe on Leg A2 at EL (-) 65m.

Acceptance Criteria: Exposed surface and structural steelwork exhibiting protective coating deterioration, corrosion pitting, or Physical Damage

7. **Scour**

Inspection result: Fourteen (14) scour measurements were taken along the mudline members and around the base of Legs and Skirt Piles. Ten (10) anomalous scour measurements were reported for scour around the base of Legs A1, A4, B1, B2, B3 & B4 and Skirt Piles A1/3, A4/4.

Acceptance Criteria: **-** Greater than 3.5 meter below the mudline members.

- Exposed piles.

4.1.2 Underwater Inspection Discussion

Based on the comparison between inspection report and design data, it has been found out that there are total of sixty-one (61) anomalies were recorded from Yetagun-B. Thirty-one (31) Debris anomalies were observed on or around the structure. Among them, sixteen (16) were metallic debris items, and none of them appeared to have caused any damage to the structure. Six (6) Lack of Integrity anomalies were observed; Two (2) were reported in relation to corrosion staining on Skirt Piles B1/2 and B4/5;

Three (3) were reported in regards to slipped liners on Skirt Piles A1/2, B1/3 & B4/4; One (1) was reported in relation to a disconnected grout pipe on Leg A2 at EL (-)65m. Six (6) Damage anomalies were reported; all six (6) anomalies were reported in relation to dents on the top of Skirt Pile Catcher Plates A4/4, A4/5, A4/6, B4/4 and A1/1. Ten (10) Scour anomalies were reported around the base of Legs A1, A4, B1, B2, B3 & B4 and Skirt Piles A1/3, A4/4. Seven (7) Cathodic Protection anomalies were reported for contact CP potentials acquired which fall outside the accepted range -800mV to -1050mV Ref Ag/AgCl. The anomalous CP potentials were acquired on B1/2 Skirt Pile and Catcher Plate and on B4/5 Skirt Pile ranged from -623mV to -773mV ref Ag/AgCl. One (1) Anode Wastage anomaly was reported on Level 10 EL (-) 101.860m on member HD-A1L10-D5L10.

Table 11. Anomaly Summary of Yetagun B

Anomaly Code	Description	Number
AW	Anode Wastage	1
CP	Cathodic Potential	7
SC	Scour measurement	10
LI	Lack of Integrity	6
DB	Debris	31
PD	Damage	6
Total		61

Based on the inspection findings, the anomalies present are mostly on a corrosion protection system such as cathodic protection (CP). There is no sever structure damage in the jacket. Other than CP and anode anomalies, all of the anomalies are within acceptance criteria.

For cathodic protection anomalies, it is found out that Yetagun B was receiving adequate cathodic protection; except for Skirt Piles B2 & B5 which are believed to be isolated case. There are two potential causes of this anomalies. The first one is, during the survey with ROV (remotely operated vehicle), it has been found out that skirt pile B2 and B5 are exposed above the sea bed, which is approximately about 1m. As per the cathodic protection design of Yetagun B, the cathodic protection for skirt piles are believed to be designed for sharing with jacket legs. It is, therefore, the cathodic protection current is shared by means of eelectrical continuity between the skirt piles and jacket legs, relying on the yoke plates which are welded between jacket legs and skirt sleeves.

Even though the corrosion protection anomalies are not abundant, it should not be less cared because the probability of corrosion on the structure can be increased with time when it is exposed to the sea without full protect. Redesigning the current sacrificial anode or using another type of cathodic protection such as hybrid, to achieve its acceptance criteria is the one of the option to rectify the anomalies. The another option is to provide the electrical continuity between the skirt sleeve or jacket leg to the skirt piles by means of welding or fusion bond or mechanically by clamp.

Therefore, other than few CP anomalies, the structure can be said to be in good integrity and reliability. A structural analysis, in place analysis, will be carried out to determine the strength of the structure for reuse purpose.

4.2 Structural Integrity Analysis

4.2.1 Structural Analysis Results

4.2.1.1 Jacket and Topside Operating Loadings

The total vertical load including dead load of the structure, operating loads of the equipments, piping and cable bulk load, bridge loads, jacket appurtenances and live loads is **172772.3 kN** based on SACS model. The vertical loads on the platform is shown in Table 12.

Table 12. Vertical Loads

Description	**Load including Contingency (kN)**
Computer Generated Structural Dead	59479.2
Non-Simulated Structural Dead Load	12109.6
Equipment Weights - Operating	46493.3
Piping/Cabling Bulks	13180.8
Open Area Load - Sub-Celllar Deck	467.9
Open Area Load - Cellar Deck	3835.7
Open Area Load - Main Deck	5379.4
Upper Deck Blanket Load	8288.5
Hook-up Piping Operating Load on New Deck Extension	89.9
Living Quarter / Heli Deck Miscellaneous / Equipment / Piping	3435.1
Living Quarter / Heli Deck Live Load	1528.8
Living Quarter / Heli Deck Laydown Load / Roof Load	4301.2
Piping Load On Bridge (2300 kg/m)	1838.5
Flare Walkway Dead Load	1334.6
Live Load On New Extension	222.8
New Piping Load On Existing Bridge	210.0
Jacket Appurtenances Weight	7417.8
Boat Landing Live Load	23.9
Crane Boom Rest Load	80.5
Yetagun C Bridge Loads	3055.0
Total Load	**172772.3**

4.2.1.2 Basic Load Case

The loads generated by the computer program for all the basic load cases are listed in Appendix-4.

4.2.1.3 Combined load case summary

The loads generated by the computer program for all the combined load cases are listed in Appendix-5.

4.2.1.4 Member Group Unity Check Ratio

The jacket structure is analyzed for the various load cases and load combinations. The members are checked for the combined axial and bending stresses against the AISC / API permissible stresses. The detail of Unity Check ration summary is described in Appendix-6.

Table 13. Members Group UC Ratio (> 0.80) Summary

Member	Group ID	Load Comb	UC	Remarks
685- 621	D12	75	0.86	O.K
785- 621	D41	68	0.90	O.K
605- 621	D42	68	1.02	Marginally Overstressed. *
785- 689	DA1	78	0.92	O.K
691- 595	DA2	78	0.91	O.K
495- 449	DA3	78	0.89	O.K
591- 514	DB3	78	0.95	O.K
485- 448	DD3	74	0.84	O.K
705- 751	H04	66	0.80	O.K
606- 717	H16	74	0.89	O.K
689- 691	H22	77	0.82	O.K
589- 591	H37	77	0.80	O.K
509- 511	H49	68	0.82	O.K
189- 107	H86	76	0.82	O.K
285- 384	LG3	75	0.86	O.K
385- 485	LG4	75	0.86	O.K
485- 585	LG5	75	0.88	O.K
664- 670	LGG	74	0.82	O.K
670-99AG	LGL	74	0.81	O.K

295- 396	LGR	77	0.92	O.K
384- 385	LGS	75	0.86	O.K

4.2.1.5 Joint Punching Shear Unity Check Ratio

The joint punching shear for all the tubular joints is checked based on API RP-2A. Joint punching shear for joints with UC > 0.50 are summarized in Table 14. The complete set of result is given in Appendix -7.

Table 14. Joint UC Ratio (> 0.50) Summary

Joint	**Member Size**		**Yield Stress (N/mm^2)**	**Load UC**	**Strength UC**	**Remarks**
	Diameter (cm)	**Thickness (cm)**				
189	222.5	8.5	325.0	0.674	0.317	O.K
751	61.0	2.5	345.0	0.603	0.263	O.K
109	222.5	8.5	325.0	0.601	0.317	O.K
591	220.5	7.5	325.0	0.560	0.338	O.K
409	219.5	7.0	325.0	0.457	0.546	O.K
411	219.5	7.0	325.0	0.451	0.546	O.K
489	219.5	7.0	325.0	0.497	0.546	O.K
491	219.5	7.0	325.0	0.495	0.546	O.K
191	222.5	8.5	325.0	0.546	0.317	O.K
111	222.5	8.5	325.0	0.507	0.317	O.K
495	219.5	7.0	325.0	0.506	0.307	O.K
511	220.5	7.5	325.0	0.504	0.338	O.K

4.2.1.6 Pile Foundation Summary

The piles are checked for the various load cases and load combinations and the UC ratios are within the allowable limit. The pile maximum UC summary is given in Appendix -8.

The foundation / pile loads obtained from SACS for Yetagun B jacket platform are given in Table 15 and the SACS output for maximum axial capacity summary is provided in Appendix-9.

Table 15. Maximum Pile Loads Summary (Design Environmental Conditions with appropriate production loads)

Joint	Pile Group	OD (mm)	Self-Weight of Pile (kN) *	Penetr-ation (m) *	Pile Capacity (kN) *	Pile Head Load (kN)	Total Load (kN)	Load Case	Safety Factor
181	PS1	2134	2922.5	100.5	51725	25033.0	27955.5	274	1.85
183	PS1	2134	2922.5	100.5	51725	27014.5	29937.0	275	1.73
148	PS1	2134	2922.5	100.5	51725	26400.4	29322.9	275	1.76
103	PS1	2134	2922.5	100.5	51725	24374.0	27296.5	270	1.89
101	PS1	2134	2922.5	100.5	51725	22306.7	25229.2	272	2.05
146	PS1	2134	2922.5	100.5	51725	23369.8	26292.3	270	1.97
199	PS2	2134	2638.1	93.5	48824	21291.3	23929.4	278	2.04
197	PS2	2134	2638.1	93.5	48824	23138.7	25776.8	277	1.89
149	PS2	2134	2638.1	93.5	48824	22187.8	24825.9	277	1.97
119	PS2	2134	2638.1	93.5	48824	19168.1	21806.2	267	2.24
117	PS2	2134	2638.1	93.5	48824	21138.0	23776.1	268	2.05
147	PS2	2134	2638.1	93.5	48824	19987.2	22625.3	268	2.16

4.2.1.7 Maximum Lateral Deflection

The maximum lateral deflections at the top of jacket leg EL (+) 7.620 m and mudline level EL (-) 103.63 m are given in **Error! Reference source not found.**. he detail output on maximum joint displacements is described in Appendix - 8.

Table 16. Maximum Lateral Deflection

Top of Jacket Node	Lateral Deflection (cm)		Mudline Node	Lateral Deflection (cm)		Effective Deflection (cm)	
	Global X	Global Y		Global X	Global Y	ΔX	ΔY
905	-9.70	-20.88	104	-4.16	-3.35	5.54	17.53
909	-9.82	-20.18	10	-3.65	-4.67	6.17	15.51
911	-9.87	-19.47	12	-2.91	-4.53	6.96	14.94
915	-9.95	-18.71	116	-1.87	-3.17	8.08	15.54
985	-9.53	-20.52	184	-4.26	-4.54	5.27	15.98
989	-9.68	-19.97	90	-3.66	-4.28	6.02	15.69
991	-9.80	-19.38	92	-2.91	-4.24	6.89	15.14
995	-9.93	-18.63	196	-1.79	-4.11	8.14	14.52

4.2.2 Structural Analysis Discussion

The basic structural analysis for Yetagun B jacket has been performed and the results are summarized in Table 13,14,15 and 16.

The jacket structure is analyzed for the various load cases and load combinations. The members are checked for the combined axial and bending stresses against the AISC / API permissible stresses. From the

Table 13, the analysis shows that the stresses in members of jacket structure are within permissible limit of UC <1 and except one member is marginally overstressed (UC is 1.02). Since the member having UC>1.02 is a secondary member, it is still acceptable. Therefore, it can be said that all the steel members are found out to be in satisfactory for in-service condition.

The joint punching shear for all the tubular joints is checked based on API RP-2A. Based on the results of the analysis, as in Table.14 and Appendix 7, show that all the joints have sufficient strength.

As per API RP2-A, Section 6.3.4, the factor of safety is 1.5 for Design Environmental Conditions with appropriate production loads. The factor of safety for all pile heads, as shown in Table 15 are greater than the factor of 1.5. Hence, it is meeting the requirement of the API RP2A.

Based on the result from Table 16, maximum lateral deflections at the top of jacket at EL (+) 7.620 m are 8.14 cm in global X direction and 17.53 cm in global Y direction.

Based on the discussion above, the members, joints and piles have sufficient strength and no modification is required . Hence, this structure has a potential for reuse purpose.

CHAPTER 5

CONCLUSION AND RECOMMENDATION

5.1 Conclusion

Out of several alternatives, reusing of the jacket leg is one of the options for decommissioning. Based on the researches, it has been proved that steel has been long recognized and acclaimed for its strength, durability, functionality and dry construction method. Rather than disposing the steel into metal scrap yards, or constructing the new offshore with new steel, the reuse of the disposed offshore steel can greatly reduce the amount of carbon emission during steel manufacturing process as well as cost. It can be said that reusing purpose has a significant effect on the sustainability aspect of decommissioning.

Based on the inspection findings, the anomalies present are mostly on a corrosion protection system such as cathodic protection (CP). There is no sever structure damage in the jacket. Even though the corrosion protection anomalies are not severe, it should not be less cared because the probability of corrosion on the structure can be increased with time when it is exposed to the sea without full protect. Therefore, redesigning the current sacrificial anode or using another type of cathodic protection such as hybrid, to achieve its acceptance criteria. Other than CP anomalies, all of the anomalies are within acceptance criteria. Therefore, the structure has good integrity and reliability. Since there is no structure modification is needed to be made based on the structural inspection result, a basic structural analysis is then performed. A basic structural analysis (in-place analysis) is carried out to define the condition of the structure (El-Reedy, 2012).

During the in-place analysis, all the members checked for the combined axial and bending stresses against the AISC / API permissible stresses, tubular joints are checked for punching shear and pile heads are checked for UC and maximum axial capacity. Based on the result, it can be concluded that all these members, joints and piles are within their limits and hence, it can be said that that they have sufficient strength and in satisfactory conditions.

Therefore, based on the assessment of current structure condition and basic analysis, the jacket leg has a potential for reuse purpose and objective of the research is achieved.

5.2 Recommendation

In this research, due to the constraints and unknowns, assumptions are made such as assuming the same top side loading for decommissioning case. To have a more precise results, the purpose of the reuse should be known so that the topside loading conditions can be figured out. Since the platform used in this research does not have structure damage based on under water inspection report and based on the analysis result, no modification of the structure is to be done here. Since only the basic structure analysis is performed here, further analysis such as ultimate strength analysis should be perform to ensure its structure integrity and reliability.

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APPENDICES

APPENDIX -1: Yetagun B Jacket in 3D Model View

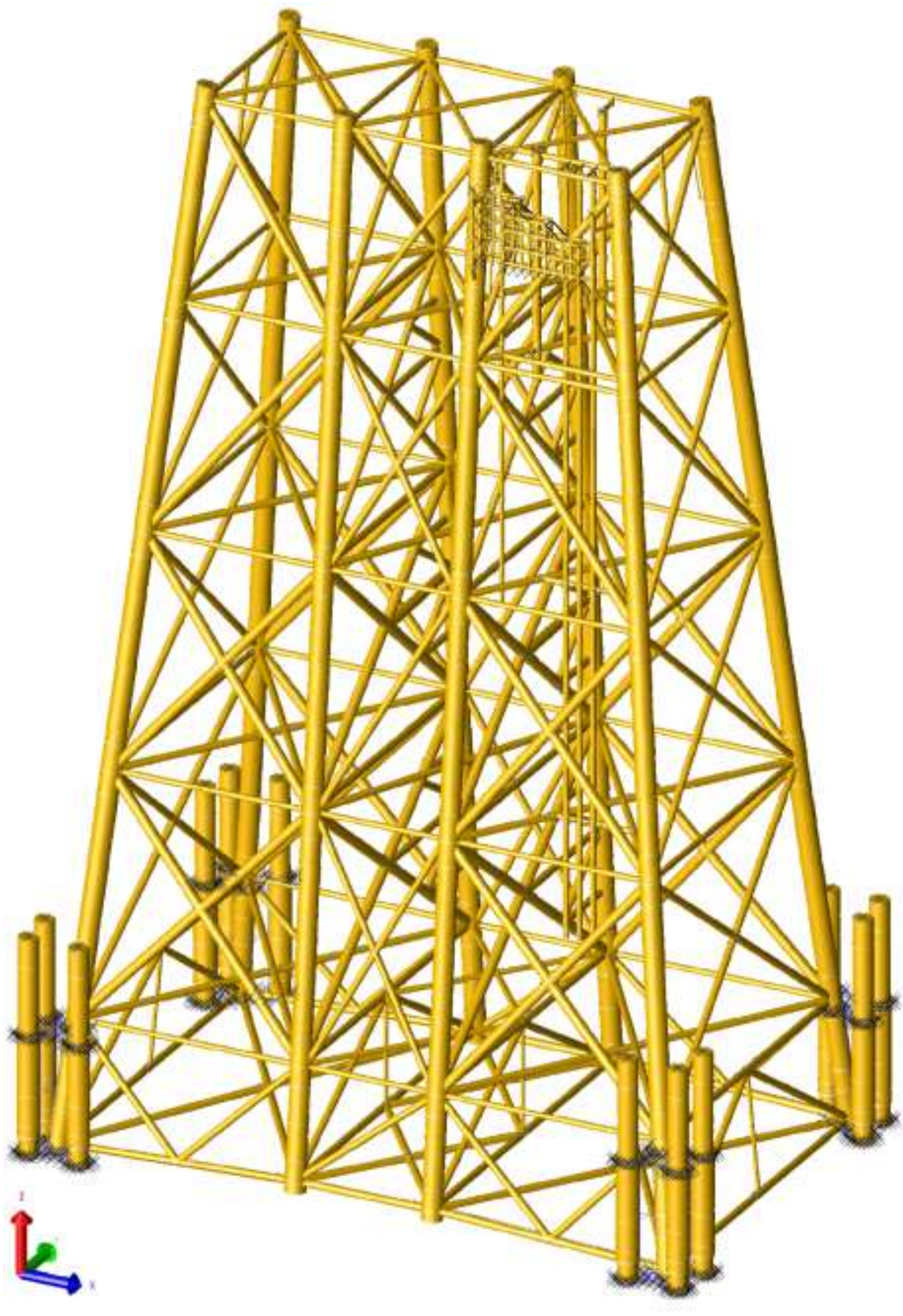


Figure 5 SACS 3D Model View - Yetagun B Jacket

APPENDIX -2: Underwater Structure Inspection Report (2014) of Yetagun-B

Figure 6. Anomalies Detail Report (2014) 1 of 4

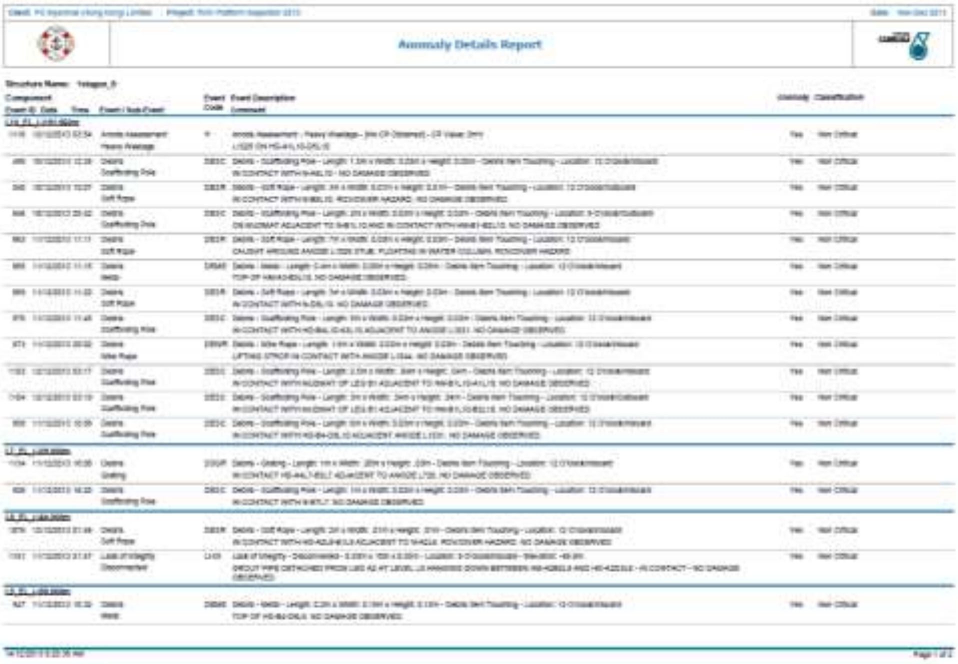

Anomaly Details Report

Figure 7. Anomalies Detail Report (2014) 2 of 4

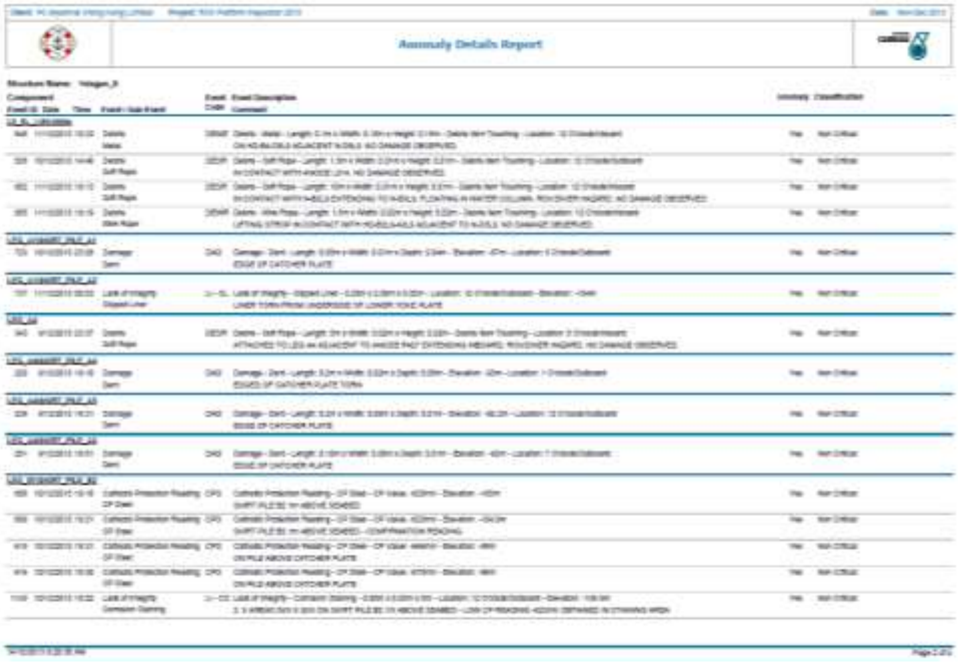

Anomaly Details Report

Figure 8. Anomalies Detail Report (2014) 3 of 4

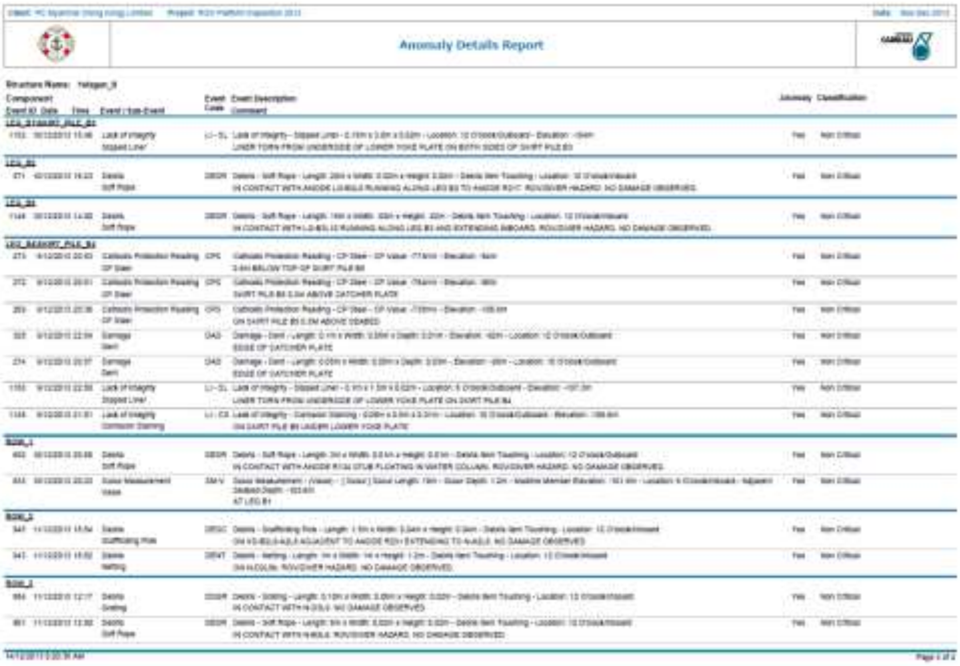
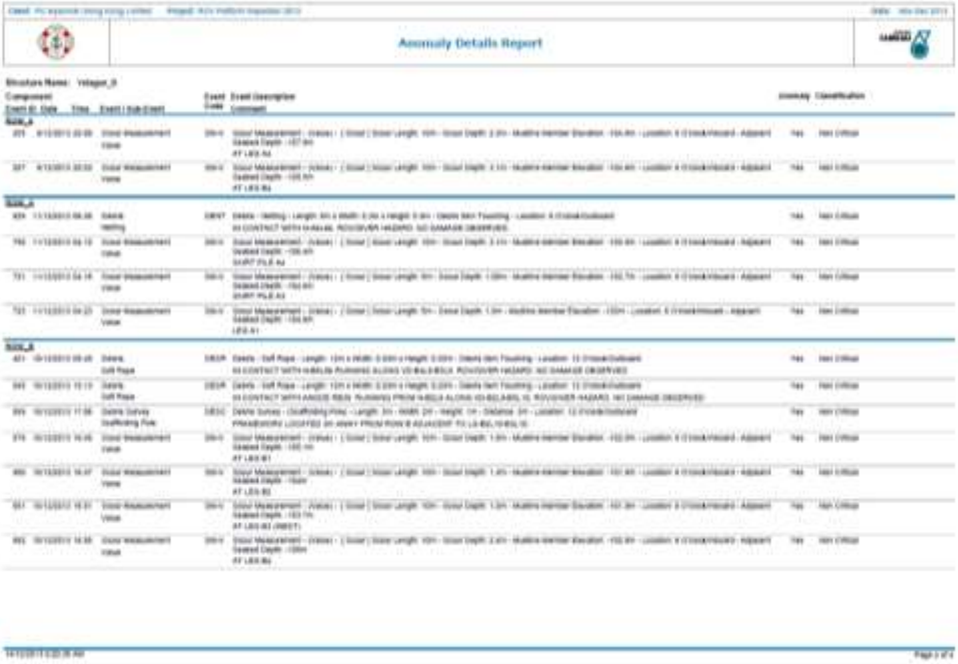


Figure 9. Anomalies Detail Report (2014) 4 of 4



APPENDIX -3: Detail Load Combination and Load Factor Applied

Load Case No.	Description	Contingency Factor
1	Computer Generated Structural Dead Weight	1.10
2	Non-simulated Structural Dead Load	1.15
3	Equipment Weights - Dry	-
4	Equipment Weights - Operating	1.00
5	Equipment Weights - Hydro Test	1.15
6	Piping / Cabling Bulks	1.00
7	Open Area Load - Sub-cellar Deck	0.75
8	Open Area Load - Cellar Deck	0.75
9	Open Area Load - Main Deck	0.75
10	Upper Deck Blanket Load	0.75
11	Hook-up Piping Operating Load on New Deck Extension	1.10
14	Living Quarter / Heli Deck Misc. / Arch. / Equipment / Piping etc.	1.15
15	Living Quarter / Heli Deck Live Load	0.40
16	Living Quarter / Heli Deck Laydown Load / Roof Load	0.75
17	Piping Load on Existing Bridge (2300 kg/m)	1.00
18	Walkway Live Load on Existing Bridge	1.00
19	Flare Piping / Walkway Dead Load	1.15
20	Flare Piping / Walkway Live Load	1.00
21	Live Load on New Deck Extension	1.00
22	Piping Operating Load on Existing Bridge	1.00
23	Crane Moment @ 0 Deg.	1.00
24	Crane Moment @ 90 Deg.	1.00
25	1 Year Wind Load @ 0 Deg.	1.00
26	1 Year Wind Load @ 90 Deg.	1.00
27	1 Year Wind Load @ 180 Deg.	1.00
28	1 Year Wind Load @ 270 Deg.	1.00
29	100 Years Wind Load @ 0 Deg.	1.00
30	100 Years Wind Load @ 90 Deg.	1.00
31	100 Years Wind Load @ 180 Deg.	1.00
32	100 Years Wind Load @ 270 Deg.	1.00

Load Case No.	Description	Contingency Factor
33	1 Year Wave + Current @ 0 Deg.	1.00
34	1 Year Wave + Current @ 57 Deg.	1.00
35	1 Year Wave + Current @ 60 Deg.	1.00
36	1 Year Wave + Current @ 90 Deg.	1.00
37	1 Year Wave + Current @ 117 Deg.	1.00
38	1 Year Wave + Current @ 120 Deg.	1.00
39	1 Year Wave + Current @ 123 Deg.	1.00
40	1 Year Wave + Current @ 180 Deg.	1.00
41	1 Year Wave + Current @ 237 Deg.	1.00
42	1 Year Wave + Current @ 243 Deg.	1.00
43	1 Year Wave + Current @ 270 Deg.	1.00
44	1 Year Wave + Current @ 300 Deg.	1.00
45	1 Year Wave + Current @ 303 Deg.	1.00
46	100 Years Wave + Current @ 0 Deg.	1.00
47	100 Years Wave + Current @ 57 Deg..	1.00
48	100 Years Wave + Current @ 60 Deg.	1.00
49	100 Years Wave + Current @ 90 Deg.	1.00
50	100 Years Wave + Current @ 117 Deg.	1.00
51	100 Years Wave + Current @ 120 Deg.	1.00
52	100 Years Wave + Current @ 123 Deg.	1.00
53	100 Years Wave + Current @ 180 Deg.	1.00
54	100 Years Wave + Current @ 237 Deg.	1.00
55	100 Years Wave + Current @ 243 Deg.	1.00
56	100 Years Wave + Current @ 270 Deg.	1.00
57	100 Years Wave + Current @ 300 Deg.	1.00
58	100 Years Wave + Current @ 303 Deg.	1.00
59	Jacket Appurtenances Weight	1.10
60	Boat Landing Live Load	1.00
98	Crane Boom Rest Load	1.00
99X	Existing Yetagun A Bridge Friction Loads in X-Direction	1.00
99Y	New Yetagun B-C Bridge Friction Loads in Y-Direction	1.00
99Z	New Yetagun B-C Bridge Vertical Loads in Z-Direction	1.00

APPENDIX -4: Basic Load Case Summary

SACS V8i SELECTseries 4 (v5.7) KK ID=
*********** SACS IV SEASTATE PROGRAM *********** DATE 23-MAR-2016 TIME 20:05:33 SEA PAGE 958

YETAGUN PHASE 4 DEVELOPMENT PROJECT: YETAGUN B JACKET INPLACE ANALYSIS

****** SEASTATE BASIC LOAD CASE SUMMARY ******
RELATIVE TO MUDLINE ELEVATION

LOAD CASE	LOAD LABEL	FX (KN)	FY (KN)	FZ (KN)	MX (KN-M)	MY (KN-M)	MZ (KN-M)	DEAD LOAD (KN)	MARINE METHOD BUOYANCY (KN)
1	1	0.00	0.00	-56646.86	12474.8	-182683.1	0.0	114458.96	57812.00
2	2	0.00	0.00	-11212.59	40269.1	-50601.3	0.0	0.00	0.00
3	3	0.00	0.00	-31960.14	121810.2	-297464.1	0.0	0.00	0.00
4	4	0.00	0.00	-42266.63	176115.7	-344233.2	0.0	0.00	0.00
5	5	0.00	0.00	-38348.77	161648.5	-344873.3	0.0	0.00	0.00
6	6	0.00	0.00	-17574.36	18538.1	-150570.4	0.0	0.00	0.00
7	7	0.00	0.00	-623.81	-4795.8	2062.5	0.0	0.00	0.00
8	8	0.00	0.00	-6392.77	9061.1	20618.0	0.0	0.00	0.00
9	9	0.00	0.00	-8965.60	61941.0	-107401.5	0.0	0.00	0.00
10	10	0.00	0.00	-11051.28	-18302.0	94485.8	0.0	0.00	0.00
11	11	9.50	7.20	-74.90	557.9	-1809.9	-106.2	0.00	0.00
12	12	0.00	0.00	0.00	0.0	0.0	0.0	0.00	0.00
13	13	0.00	0.00	0.00	0.0	0.0	0.0	0.00	0.00
14	14	0.00	0.00	-3122.81	1305.3	73579.2	0.0	0.00	0.00
15	15	0.00	0.00	-3822.09	3919.8	85147.4	0.0	0.00	0.00
16	16	0.00	0.00	-5734.92	-3444.3	137304.3	0.0	0.00	0.00
17	17	-544.00	-196.00	-1532.12	5284.8	-148122.5	17469.0	0.00	0.00
18	18	0.00	0.00	-363.00	-4441.5	-18999.8	0.0	0.00	0.00
19	19	0.00	0.00	-1112.13	-37591.1	-17000.6	0.0	0.00	0.00
20	20	0.00	0.00	-173.87	-8459.4	-2679.9	0.0	0.00	0.00
21	21	0.00	0.00	-222.81	4314.5	-8144.7	0.0	0.00	0.00
22	22	-21.00	-63.00	-210.00	5302.1	-14059.3	3687.6	0.00	0.00
23	23	0.00	0.00	0.00	0.0	7940.0	0.0	0.00	0.00
24	24	0.00	0.00	0.00	-7940.0	0.0	0.0	0.00	0.00
25	25	1087.42	0.00	-574.60	5257.6	155124.9	-4599.9	0.00	0.00
26	26	0.00	1520.90	0.00	-202730.7	0.0	-23339.0	0.00	0.00
27	27	-892.53	0.00	0.00	0.0	-124315.7	5871.8	0.00	0.00
28	28	0.00	-1393.73	0.00	184574.7	0.0	19518.6	0.00	0.00
29	29	2973.48	0.00	0.00	0.0	412151.0	-14906.9	0.00	0.00
30	30	0.00	4239.47	0.00	-564698.8	0.0	-64925.9	0.00	0.00
31	31	-2406.91	0.00	0.00	0.0	-335090.3	18700.6	0.00	0.00
32	32	0.00	-3882.70	0.00	513762.5	0.0	54209.1	0.00	0.00
33	33	6214.23	-1.76	-50.64	-2406.3	508831.7	731.5	0.00	0.00
34	34	4427.84	6672.79	-302.57	-583400.8	371017.7	21279.4	0.00	0.00
35	35	4084.98	6941.13	-300.46	-608083.2	343576.0	21658.4	0.00	0.00
36	36	-9.05	8006.15	-121.60	-700549.4	199.0	19962.9	0.00	0.00
37	37	-3764.83	7233.66	-126.31	-628467.5	-313608.0	16633.1	0.00	0.00
38	38	-4133.72	6978.34	-135.74	-605770.3	-344406.2	16340.8	0.00	0.00
39	39	-4482.90	6688.07	-146.12	-579711.2	-373387.2	15925.1	0.00	0.00
40	40	-7017.83	2.34	136.13	177.4	-591216.6	-5144.3	0.00	0.00
41	41	-4388.54	-6739.83	-158.14	588891.4	-371444.4	-18984.0	0.00	0.00
42	42	-3687.97	-7251.17	-120.06	633838.8	-313668.6	-19362.5	0.00	0.00
43	43	19.63	-7944.57	-396.44	706974.9	-303.1	-18665.3	0.00	0.00
44	44	3847.41	-6601.54	-229.01	571858.7	319925.5	-13986.6	0.00	0.00
45	45	4153.26	-6322.00	-244.30	546492.9	344421.2	-13733.6	0.00	0.00

SACS V8i SELECTseries 4 (v5.7) KK ID=
*********** SACS IV SEASTATE PROGRAM *********** DATE 23-MAR-2016 TIME 20:05:33 SEA PAGE 959

YETAGUN PHASE 4 DEVELOPMENT PROJECT: YETAGUN B JACKET INPLACE ANALYSIS

****** SEASTATE BASIC LOAD CASE SUMMARY ******
RELATIVE TO MUDLINE ELEVATION

LOAD CASE	LOAD LABEL	FX (KN)	FY (KN)	FZ (KN)	MX (KN-M)	MY (KN-M)	MZ (KN-M)	DEAD LOAD (KN)	MARINE METHOD BUOYANCY (KN)
46	46	11334.48	-7.76	-62.56	-1662.9	897871.2	2410.4	0.00	0.00
47	47	7348.68	10945.21	-139.26	-914760.9	587305.6	30707.8	0.00	0.00
48	48	6751.91	11376.23	-142.35	-951455.2	540042.6	31332.1	0.00	0.00
49	49	-12.37	13134.50	93.26	-1101755.4	-228.4	28297.5	0.00	0.00
50	50	-6196.35	11849.87	102.15	-987597.1	-493570.9	21149.1	0.00	0.00
51	51	-6821.68	11448.73	89.77	-953372.7	-543516.1	20154.8	0.00	0.00
52	52	-7425.95	11021.43	79.64	-917092.5	-591696.1	19043.5	0.00	0.00
53	53	-11947.70	4.35	295.21	147.8	-955548.9	-5516.7	0.00	0.00
54	54	-7336.96	-11015.91	280.03	916248.8	-589828.4	-26373.9	0.00	0.00
55	55	-6099.10	-11812.37	322.37	983191.2	-490944.8	-26876.3	0.00	0.00
56	56	6.56	-12916.53	63.69	1083013.1	-2485.6	-25661.7	0.00	0.00
57	57	6534.76	-11114.54	58.91	922016.4	518382.3	-21499.0	0.00	0.00
58	58	7113.44	-10693.04	51.98	886149.8	564162.4	-20704.9	0.00	0.00
59	59	0.00	0.00	-6868.35	-10909.2	860.5	0.0	0.00	0.00
60	60	0.00	0.00	-47.70	601.1	684.4	0.0	0.00	0.00
61	61	0.00	0.00	0.00	42181.5	-681.2	0.0	0.00	0.00
62	98	0.00	0.00	-80.50	1350.0	-3313.4	0.0	0.00	0.00
63	ML	990.82	0.00	0.00	0.0	108718.7	0.0	0.00	0.00
64	99X	450.00	0.00	0.00	0.0	54158.0	-5486.4	0.00	0.00
65	99Y	0.00	895.00	0.00	-125461.1	0.0	-32743.6	0.00	0.00
66	99Z	0.00	0.00	-3055.00	67271.1	-111550.5	0.0	0.00	0.00

APPENDIX -5: Combine Load Case Summary

SACS V8i SELECTseries 4 (v5.7) KK ID=
*********** SACS IV SEASTATE PROGRAM *********** DATE 23-MAR-2016 TIME 20:05:33 SEA PAGE 971

YETAGUN PHASE 4 DEVELOPMENT PROJECT: YETAGUN B JACKET INPLACE ANALYSIS

***** SEASTATE COMBINED LOAD CASE SUMMARY *****
RELATIVE TO MUDLINE ELEVATION

LOAD CASE	LOAD LABEL	FX (KN)	FY (KN)	FZ (KN)	MX (KN-M)	MY (KN-M)	MZ (KN-M)
67	63	328.42	-289.56	-172772.25	318576.6	-727132.9	24523.0
68	64	-662.40	-289.56	-172748.41	318276.1	-836193.9	24523.0
69	66	8080.07	603.68	-173397.48	238148.3	-1759.6	-17575.3
70	67	6380.67	8753.50	-173695.39	-574594.1	-130095.0	-20034.3
71	68	5942.11	9072.03	-173642.72	-606215.0	-171545.1	-20020.7
72	69	769.37	10132.48	-172893.86	-702224.5	-672776.0	-17083.1
73	70	-4689.69	9405.63	-172898.56	-637090.1	-1210387.9	-4855.6
74	71	-5140.69	9109.24	-172908.00	-609117.6	-1252988.4	-3977.6
75	72	-5568.41	8662.32	-172918.38	-562391.6	-1293206.4	-1472.6
76	73	-8031.94	607.78	-172636.12	235474.4	-1505444.5	-2006.6
77	74	-5474.05	-9276.31	-172930.39	1247488.4	-1292004.9	69043.6
78	75	-4694.94	-9871.27	-172892.31	1303095.4	-1222566.8	69319.5
79	76	798.05	-10522.85	-173168.69	1369828.8	-673959.3	52633.5
80	77	5704.55	-9184.01	-173571.25	1241545.9	-195870.8	52807.7
81	78	6106.09	-8858.48	-173637.11	1210706.1	-157372.8	52011.8
82	79	14095.56	597.68	-172810.97	233333.6	535245.1	-26203.5
83	80	10347.64	11550.65	-203889.00	-597128.4	-33820.0	901.3
84	81	9489.21	16233.86	-172890.75	-1318157.1	170830.5	-62283.3
85	82	-224.77	17979.41	-172655.14	-1465699.2	-782264.4	-50335.4
86	83	-9474.97	16821.97	-172646.25	-1369347.4	-1689108.9	-31628.2
87	84	-10321.73	16306.36	-172658.64	-1320074.6	-1770247.6	-29149.1
88	85	-11137.82	15739.16	-172668.77	-1265373.8	-1848272.8	-26472.1
89	86	-15467.01	609.79	-172455.20	235144.2	-2189612.5	10449.8
90	87	-11048.82	-15966.68	-172468.38	1893855.4	-1847086.4	109158.5
91	88	-9599.16	-16996.11	-172426.05	1991210.6	-1717992.2	110263.1
92	89	-205.84	-17983.79	-172684.72	2074754.4	-785202.8	80327.6
93	90	9272.06	-16193.45	-172689.48	1916362.9	148489.0	69865.3
94	91	10112.40	-15643.82	-172696.42	1863756.4	230895.7	67558.6

APPENDIX -6: Member Unity Check Summary

SACS V8i SELECTseries 4 (v5.7) KK ID=
YETAGUN PLATFORM INPLACE ANALYSIS DATE 23-MAR-2016 TIME 00:38:21 PST PAGE 13014

SACS-IV MEMBER UNITY CHECK RANGE SUMMARY

GROUP II - UNITY CHECKS GREATER THAN 0.80 AND LESS THAN 1.00

MEMBER	GROUP ID	MAXIMUM COMBINED UNITY CK	LOAD COND NO.	DIST FROM END	AXIAL STRESS N/MM2	BENDING STRESS Y N/MM2	BENDING STRESS Z N/MM2	SHEAR FORCE FY KN	SHEAR FORCE FZ KN	KLY/RY	KLZ/RZ	SECOND-HIGHEST UNITY CHECK	SECOND-HIGHEST LOAD COND	THIRD-HIGHEST UNITY CHECK	THIRD-HIGHEST LOAD COND
685- 621	D12	0.862	75	15.0	-84.48	34.03	-12.87	-4.99	48.32	45.2	45.2	0.849	74	0.823	88
785- 621	D41	0.904	68	2.7	-97.43	6.74	-16.66	28.59	5.43	54.1	54.1	0.903	67	0.862	81
785- 689	DA1	0.920	78	3.3	-93.58	17.10	-10.36	45.85	-40.93	56.1	56.1	0.914	77	0.817	80
691- 595	DA2	0.915	78	0.0	-86.00	23.98	-3.35	26.82	-68.73	65.8	65.8	0.908	77	0.818	66
495- 449	DA3	0.890	78	17.8	-105.50	14.96	-2.77	0.67	55.36	42.2	42.2	0.889	77	0.842	76
591- 449	DA3	0.848	78	0.0	-105.30	7.79	-0.24	6.83	-30.91	42.2	42.2	0.846	77	0.801	76
591- 514	DB3	0.946	78	0.0	-109.38	10.02	9.61	-13.24	-17.58	48.9	48.9	0.938	77	0.834	91
689- 514	DB3	0.932	78	0.0	-109.69	5.55	-9.81	21.42	-16.24	48.9	48.9	0.927	77	0.826	80
485- 448	DD3	0.838	74	0.0	-93.97	-22.25	0.19	8.56	49.79	42.1	42.1	0.836	75	0.785	76
606- 717	H16	0.895	74	1.5	-2.47	157.85	12.69	8.64	32.18	32.8	32.8	0.890	73	0.825	86
689- 691	H22	0.820	77	0.0	-80.58	20.90	-6.20	10.25	-16.16	57.7	57.7	0.818	78	0.799	76
509- 511	H49	0.820	68	0.0	-89.15	10.23	-0.20	-1.46	-7.41	58.0	58.0	0.820	67	0.789	69
189- 107	H86	0.824	76	2.1	143.37	33.37	5.49	-8.01	-55.80	38.1	76.2	0.810	77	0.807	75
285- 384	LG3	0.862	75	5.5	-123.99	-64.21	-4.66	-178.30	-2106.20	1.4	1.4	0.860	74	0.812	76
385- 485	LG4	0.859	75	2.9	-131.66	33.41	-9.85	135.06	-354.21	35.0	35.0	0.857	74	0.822	76
485- 585	LG5	0.875	75	22.8	-154.79	4.81	-6.05	-98.82	103.40	33.9	33.9	0.875	74	0.840	76
664- 670	LGG	0.821	74	6.6	-144.77	3.27	-10.84	-168.00	100.28	28.8	28.8	0.821	75	0.796	76
670-99AG	LGL	0.806	74	0.8	-144.53	4.07	-12.03	-170.46	118.48	23.3	23.3	0.806	75	0.782	76
215- 313	LGR	0.822	68	5.5	-111.59	-66.05	-6.09	-196.93	-1691.83	1.3	1.3	0.821	67	0.768	69
295- 396	LGR	0.923	77	5.5	-127.40	-71.59	8.57	277.00	-1815.47	1.3	1.3	0.922	78	0.882	76

SACS V8i SELECTseries 4 (v5.7) KK ID=
YETAGUN PLATFORM INPLACE ANALYSIS DATE 23-MAR-2016 TIME 00:38:21 PST PAGE 13015

SACS-IV MEMBER UNITY CHECK RANGE SUMMARY

GROUP III - UNITY CHECKS GREATER THAN 1.00 AND LESS THAN 999.00

MEMBER	GROUP ID	MAXIMUM COMBINED UNITY CK	LOAD COND NO.	DIST FROM END	AXIAL STRESS N/MM2	BENDING STRESS Y N/MM2	BENDING STRESS Z N/MM2	SHEAR FORCE FY KN	SHEAR FORCE FZ KN	KLY/RY	KLZ/RZ	SECOND-HIGHEST UNITY CHECK	SECOND-HIGHEST LOAD COND	THIRD-HIGHEST UNITY CHECK	THIRD-HIGHEST LOAD COND
605- 621	D42	1.025	68	15.6	-119.04	10.81	-12.66	3.39	23.13	45.2	45.2	1.023	69	1.022	67

APPENDIX -7: Joint Punching Shear Unity Check Summary

SACS V8i SELECTseries 4 (v5.7) KK ID=
YETAGUN PLATFORM INPLACE ANALYSIS DATE 23-MAR-2016 TIME 00:38:33 JCN PAGE 1122

* * J O I N T C A N S U M M A R Y * *
(UNITY CHECK ORDER)

	ORIGINAL					LOAD DESIGN				STRENGTH DESIGN			
JOINT	DIAMETER (CM)	THICKNESS (CM)	YLD STRS (N/MM2)	LOAD UC	STRN UC	DIAMETER (CM)	THICKNESS (CM)	YLD STRS (N/MM2)	LOAD UC	DIAMETER (CM)	THICKNESS (CM)	YLD STRS (N/MM2)	STRN UC
189	222.500	8.500	325.000	0.674	0.317	222.500	8.500	325.000	0.674	222.500	8.500	325.000	0.317
751	61.000	2.500	345.000	0.603	0.263	61.000	2.500	345.000	0.603	61.000	2.500	345.000	0.263
109	222.500	8.500	325.000	0.601	0.317	222.500	8.500	325.000	0.601	222.500	8.500	325.000	0.317
591	220.500	7.500	325.000	0.560	0.338	220.500	7.500	325.000	0.560	220.500	7.500	325.000	0.338
191	222.500	8.500	325.000	0.546	0.317	222.500	8.500	325.000	0.546	222.500	8.500	325.000	0.317
409	219.500	7.000	325.000	0.457	0.546	219.500	7.000	325.000	0.457	219.500	7.000	325.000	0.546
411	219.500	7.000	325.000	0.451	0.546	219.500	7.000	325.000	0.451	219.500	7.000	325.000	0.546
489	219.500	7.000	325.000	0.497	0.546	219.500	7.000	325.000	0.497	219.500	7.000	325.000	0.546
491	219.500	7.000	325.000	0.495	0.546	219.500	7.000	325.000	0.495	219.500	7.000	325.000	0.546
111	222.500	8.500	325.000	0.507	0.317	222.500	8.500	325.000	0.507	222.500	8.500	325.000	0.317
495	219.500	7.000	325.000	0.506	0.307	219.500	7.000	325.000	0.506	219.500	7.000	325.000	0.307
511	220.500	7.500	325.000	0.504	0.338	220.500	7.500	325.000	0.504	220.500	7.500	325.000	0.338
385	219.500	7.000	325.000	0.478	0.386	219.500	7.000	325.000	0.478	219.500	7.000	325.000	0.386
608	79.000	3.500	345.000	0.100	0.474	79.000	3.500	345.000	0.100	79.000	3.500	345.000	0.474
485	219.500	7.000	325.000	0.470	0.307	219.500	7.000	325.000	0.470	219.500	7.000	325.000	0.307
589	220.500	7.500	325.000	0.442	0.338	220.500	7.500	325.000	0.442	220.500	7.500	325.000	0.338
691	219.500	7.000	325.000	0.440	0.309	219.500	7.000	325.000	0.440	219.500	7.000	325.000	0.309
415	219.500	7.000	325.000	0.439	0.307	219.500	7.000	325.000	0.439	219.500	7.000	325.000	0.307
395	219.500	7.000	325.000	0.437	0.386	219.500	7.000	325.000	0.437	219.500	7.000	325.000	0.386
509	220.500	7.500	325.000	0.425	0.338	220.500	7.500	325.000	0.425	220.500	7.500	325.000	0.338
305	219.500	7.000	325.000	0.417	0.386	219.500	7.000	325.000	0.417	219.500	7.000	325.000	0.386
508	79.000	4.000	345.000	0.074	0.416	79.000	4.000	345.000	0.074	79.000	4.000	345.000	0.416
405	219.500	7.000	325.000	0.414	0.307	219.500	7.000	325.000	0.414	219.500	7.000	325.000	0.307
689	219.500	7.000	325.000	0.405	0.309	219.500	7.000	325.000	0.405	219.500	7.000	325.000	0.309
389	219.500	7.000	325.000	0.398	0.386	219.500	7.000	325.000	0.398	219.500	7.000	325.000	0.386
611	219.500	7.000	325.000	0.397	0.309	219.500	7.000	325.000	0.397	219.500	7.000	325.000	0.309
391	219.500	7.000	325.000	0.391	0.386	219.500	7.000	325.000	0.391	219.500	7.000	325.000	0.386
309	219.500	7.000	325.000	0.374	0.386	219.500	7.000	325.000	0.374	219.500	7.000	325.000	0.386
311	219.500	7.000	325.000	0.359	0.386	219.500	7.000	325.000	0.359	219.500	7.000	325.000	0.386
315	219.500	7.000	325.000	0.385	0.386	219.500	7.000	325.000	0.385	219.500	7.000	325.000	0.386
595	218.500	6.500	325.000	0.385	0.275	218.500	6.500	325.000	0.385	218.500	6.500	325.000	0.275
408	79.000	4.000	345.000	0.053	0.377	79.000	4.000	345.000	0.053	79.000	4.000	345.000	0.377
609	219.500	7.000	325.000	0.374	0.309	219.500	7.000	325.000	0.374	219.500	7.000	325.000	0.309
407	80.000	4.000	345.000	0.196	0.371	80.000	4.000	345.000	0.196	80.000	4.000	345.000	0.371
413	80.000	4.000	345.000	0.166	0.371	80.000	4.000	345.000	0.166	80.000	4.000	345.000	0.371
354	80.000	4.000	345.000	0.094	0.366	80.000	4.000	345.000	0.094	80.000	4.000	345.000	0.366
355	80.000	4.000	345.000	0.121	0.366	80.000	4.000	345.000	0.121	80.000	4.000	345.000	0.366
144	80.000	4.000	345.000	0.215	0.364	80.000	4.000	345.000	0.215	80.000	4.000	345.000	0.364
145	80.000	4.000	345.000	0.230	0.364	80.000	4.000	345.000	0.230	80.000	4.000	345.000	0.364
607	79.000	3.500	345.000	0.214	0.356	79.000	3.500	345.000	0.214	79.000	3.500	345.000	0.356
613	79.000	3.500	345.000	0.155	0.356	79.000	3.500	345.000	0.155	79.000	3.500	345.000	0.356
515	218.500	6.500	325.000	0.342	0.275	218.500	6.500	325.000	0.342	218.500	6.500	325.000	0.275
754	61.000	2.500	345.000	0.304	0.263	61.000	2.500	345.000	0.304	61.000	2.500	345.000	0.263
585	218.500	6.500	325.000	0.298	0.275	218.500	6.500	325.000	0.298	218.500	6.500	325.000	0.275
785	219.500	7.000	325.000	0.297	0.165	219.500	7.000	325.000	0.297	219.500	7.000	325.000	0.165
185	222.500	8.500	325.000	0.293	0.268	222.500	8.500	325.000	0.293	222.500	8.500	325.000	0.268
505	218.500	6.500	325.000	0.288	0.275	218.500	6.500	325.000	0.288	218.500	6.500	325.000	0.275
107	84.000	4.500	345.000	0.287	0.222	84.000	4.500	345.000	0.287	84.000	4.500	345.000	0.222
108	84.000	4.500	345.000	0.282	0.222	84.000	4.500	345.000	0.282	84.000	4.500	345.000	0.222
321	77.000	3.000	345.000	0.180	0.274	77.000	3.000	345.000	0.180	77.000	3.000	345.000	0.274

* * J O I N T   C A N   S U M M A R Y * *

(UNITY CHECK ORDER)

	ORIGINAL					LOAD DESIGN				STRENGTH DESIGN			
JOINT	DIAMETER (CM)	THICKNESS (CM)	YLD STRS (N/MM2)	LOAD UC	STRN UC	DIAMETER (CM)	THICKNESS (CM)	YLD STRS (N/MM2)	LOAD UC	DIAMETER (CM)	THICKNESS (CM)	YLD STRS (N/MM2)	STRN UC
324	77.000	3.000	345.000	0.166	0.274	77.000	3.000	345.000	0.166	77.000	3.000	345.000	0.274
105	222.500	8.500	325.000	0.271	0.268	222.500	8.500	325.000	0.271	222.500	8.500	325.000	0.268
705	219.500	7.000	325.000	0.271	0.165	219.500	7.000	325.000	0.271	219.500	7.000	325.000	0.165
507	80.000	4.000	345.000	0.194	0.271	80.000	4.000	345.000	0.194	80.000	4.000	345.000	0.271
513	80.000	4.000	345.000	0.135	0.271	80.000	4.000	345.000	0.135	80.000	4.000	345.000	0.271
115	222.500	8.500	325.000	0.208	0.268	222.500	8.500	325.000	0.208	222.500	8.500	325.000	0.268
195	222.500	8.500	325.000	0.219	0.268	222.500	8.500	325.000	0.219	222.500	8.500	325.000	0.268
113	84.000	4.500	345.000	0.268	0.222	84.000	4.500	345.000	0.268	84.000	4.500	345.000	0.222
114	84.000	4.500	345.000	0.259	0.222	84.000	4.500	345.000	0.259	84.000	4.500	345.000	0.222
1063	182.900	6.000	345.000	0.246	0.191	182.900	6.000	345.000	0.246	182.900	6.000	345.000	0.191
752	61.000	2.500	345.000	0.084	0.242	61.000	2.500	345.000	0.084	61.000	2.500	345.000	0.242
753	61.000	2.500	345.000	0.059	0.242	61.000	2.500	345.000	0.059	61.000	2.500	345.000	0.242
1067	182.900	6.000	345.000	0.242	0.191	182.900	6.000	345.000	0.242	182.900	6.000	345.000	0.191
605	219.500	7.000	325.000	0.242	0.221	219.500	7.000	325.000	0.242	219.500	7.000	325.000	0.221
1068	50.800	2.850	345.000	0.120	0.237	50.800	2.850	345.000	0.120	50.800	2.850	345.000	0.237
1071	50.800	2.850	345.000	0.124	0.237	50.800	2.850	345.000	0.124	50.800	2.850	345.000	0.237
1072	50.800	2.850	345.000	0.099	0.237	50.800	2.850	345.000	0.099	50.800	2.850	345.000	0.237
1073	50.800	2.850	345.000	0.124	0.237	50.800	2.850	345.000	0.124	50.800	2.850	345.000	0.237
789	219.500	7.000	325.000	0.237	0.167	219.500	7.000	325.000	0.237	219.500	7.000	325.000	0.167
707	61.000	3.000	345.000	0.093	0.236	61.000	3.000	345.000	0.093	61.000	3.000	345.000	0.236
713	61.000	3.000	345.000	0.091	0.236	61.000	3.000	345.000	0.091	61.000	3.000	345.000	0.236
708	61.000	3.000	345.000	0.113	0.236	61.000	3.000	345.000	0.113	61.000	3.000	345.000	0.236
615	219.500	7.000	325.000	0.129	0.221	219.500	7.000	325.000	0.129	219.500	7.000	325.000	0.221
685	219.500	7.000	325.000	0.180	0.221	219.500	7.000	325.000	0.180	219.500	7.000	325.000	0.221
695	219.500	7.000	325.000	0.156	0.221	219.500	7.000	325.000	0.156	219.500	7.000	325.000	0.221
1062	182.900	6.000	345.000	0.209	0.191	182.900	6.000	345.000	0.209	182.900	6.000	345.000	0.191
791	219.500	7.000	325.000	0.208	0.167	219.500	7.000	325.000	0.208	219.500	7.000	325.000	0.167
795	219.500	7.000	325.000	0.207	0.165	219.500	7.000	325.000	0.207	219.500	7.000	325.000	0.165
322	78.000	3.500	345.000	0.036	0.204	78.000	3.500	345.000	0.036	78.000	3.500	345.000	0.204
323	78.000	3.500	345.000	0.034	0.204	78.000	3.500	345.000	0.034	78.000	3.500	345.000	0.204
929	182.900	6.000	345.000	0.195	0.191	182.900	6.000	345.000	0.195	182.900	6.000	345.000	0.191
711	219.500	7.000	325.000	0.194	0.167	219.500	7.000	325.000	0.194	219.500	7.000	325.000	0.167
1064	182.900	6.000	345.000	0.183	0.191	182.900	6.000	345.000	0.183	182.900	6.000	345.000	0.191
1065	182.900	6.000	345.000	0.158	0.191	182.900	6.000	345.000	0.158	182.900	6.000	345.000	0.191
1069	182.900	6.000	345.000	0.113	0.191	182.900	6.000	345.000	0.113	182.900	6.000	345.000	0.191
1070	182.900	6.000	345.000	0.099	0.191	182.900	6.000	345.000	0.099	182.900	6.000	345.000	0.191
715	219.500	7.000	325.000	0.170	0.160	219.500	7.000	325.000	0.170	219.500	7.000	325.000	0.160
709	219.500	7.000	325.000	0.111	0.167	219.500	7.000	325.000	0.111	219.500	7.000	325.000	0.167
124	80.000	4.000	345.000	0.023	0.159	80.000	4.000	345.000	0.023	80.000	4.000	345.000	0.159

APPENDIX- 8: Pile Maximum Unity Check Summary

SACS V8i SELECTseries 4 (v5.7) KK ID=
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YETAGUN PLATFORM INPLACE ANALYSIS

* * * P I L E M A X I M U M U N I T Y C H E C K S U M M A R Y * * *

PILE JT.	GRUP	LOAD CASE	******* PILEHEAD FORCES ******* AXIAL KN	LATERAL KN	MOMENT KN-M	* PILEHEAD DISPLACEMENTS * AXIAL CM	LATERAL CM	ROTATION RAD	*********** STRESSES AT MAX. UNITY CHECK *********** DEPTH M	AXIAL N/MM2	FBY N/MM2	FBZ N/MM2	SHEAR N/MM2	COMB. N/MM2	UNITY CHECK
181	PS1	66	-15133.85	253.65	3255.8	1.52	0.36	0.000599	4.0	-38.95	8.36	9.12	1.19	-51.32	0.237
		67	-13880.24	436.55	2531.9	1.40	1.34	0.001129	16.1	-38.08	11.52	-0.11	0.86	-49.61	0.230
		68	-13962.34	470.58	2790.2	1.41	1.39	0.001140	16.1	-38.30	11.85	-0.08	0.87	-50.16	0.233
		69	-15530.80	827.90	5806.7	1.56	1.73	0.001093	16.1	-42.53	14.28	0.29	0.87	-56.81	0.263
		70	-17420.23	1213.95	8831.4	1.76	2.29	0.001001	0.0	-41.23	33.27	25.04	5.80	-82.87	0.306
		71	-17603.63	1245.44	9088.0	1.78	2.34	0.000982	0.0	-41.67	35.07	24.62	5.95	-84.52	0.312
		72	-17810.59	1273.60	9333.1	1.81	2.37	0.000951	0.0	-42.16	36.91	23.96	6.08	-86.17	0.318
		73	-19986.07	1528.98	11364.8	2.09	2.78	0.000642	0.0	-47.32	52.95	8.22	7.30	-100.91	0.371
		74	-21720.56	1718.43	12038.4	2.33	3.45	0.001052	0.0	-51.41	55.50	-11.89	8.25	-108.17	0.398
		75	-21635.76	1701.87	11852.3	2.32	3.44	0.001079	16.1	-58.93	-27.60	0.70	0.63	-86.54	0.395
		76	-20185.03	1423.95	9744.9	2.11	2.86	0.000984	16.1	-55.05	-22.96	0.98	0.57	-78.03	0.358
		77	-18338.98	1126.51	7539.9	1.87	2.23	0.000879	16.1	-50.10	-18.02	0.93	0.54	-68.15	0.314
		78	-18141.69	1090.88	7300.4	1.85	2.15	0.000859	16.1	-49.57	-17.37	0.90	0.53	-66.97	0.309
		79	-13167.80	572.36	2656.7	1.34	1.53	0.001045	16.1	-36.17	12.86	0.13	0.66	-49.04	0.170
		80	-16257.67	602.31	1587.0	1.63	2.17	0.001640	16.1	-44.49	18.43	-0.36	1.06	-62.92	0.217
		81	-11292.24	1066.85	3830.2	1.16	3.25	0.002009	16.1	-31.15	27.03	-0.44	0.95	-58.18	0.194
		82	-14550.82	1298.25	7465.6	1.46	3.34	0.001902	16.1	-39.89	27.57	-0.09	1.03	-67.46	0.227
		83	-17816.22	1789.07	12083.1	1.81	3.97	0.001788	16.1	-48.70	32.22	-0.04	1.07	-80.92	0.273
		84	-18151.39	1832.30	12496.8	1.85	4.02	0.001759	0.0	-42.96	50.52	30.33	8.80	-101.88	0.278
		85	-18477.64	1873.94	12895.0	1.89	4.07	0.001728	0.0	-43.73	52.90	29.97	8.99	-104.53	0.285
		86	-22165.93	2128.04	15447.3	2.39	4.32	0.001190	0.0	-52.46	72.37	8.18	10.21	-125.30	0.342
		87	-25033.52	2411.44	16635.9	2.81	5.59	0.001952	16.1	-68.00	-44.84	0.51	0.83	-112.84	0.381
		88	-24879.87	2382.55	16276.3	2.79	5.56	0.001991	16.1	-67.59	-44.65	0.56	0.79	-112.24	0.379
		89	-22217.56	1964.06	12694.5	2.40	4.52	0.001786	16.1	-60.48	-36.58	0.93	0.58	-97.08	0.329
		90	-18830.15	1565.48	9391.8	1.94	3.67	0.001617	16.1	-51.42	-29.94	0.84	0.49	-81.37	0.276
		91	-18419.95	1518.71	9053.6	1.88	3.57	0.001583	16.1	-50.32	-29.08	0.81	0.48	-79.41	0.270
183	PS1	66	-13340.49	352.96	4191.8	1.35	0.27	0.000601	4.0	-34.36	7.01	12.84	1.66	-48.99	0.224
		67	-9633.45	393.06	1284.6	1.01	1.36	0.001123	16.1	-26.71	11.67	-0.14	0.80	-38.38	0.176
		68	-9609.29	414.44	1419.5	1.01	1.40	0.001140	16.1	-26.65	12.00	-0.11	0.81	-38.65	0.177
		69	-10764.21	629.76	3691.9	1.12	1.65	0.001198	16.1	-29.73	13.86	0.22	0.85	-43.59	0.199
		70	-13038.99	980.12	6672.1	1.33	2.10	0.001227	16.1	-35.83	-17.28	-0.26	0.90	-53.11	0.242
		71	-13340.20	1016.45	6997.7	1.35	2.14	0.001217	16.1	-36.64	-17.57	-0.24	0.91	-54.21	0.247
		72	-13722.08	1054.27	7363.6	1.39	2.17	0.001195	16.1	-37.66	-17.78	-0.21	0.91	-55.44	0.253
		73	-18269.78	1516.02	11501.0	1.87	2.72	0.000822	0.0	-43.26	50.59	19.53	7.23	-97.49	0.356
		74	-22493.69	1955.37	14772.5	2.44	3.63	0.000759	0.0	-53.24	69.45	-5.33	9.35	-122.89	0.448
		75	-22549.43	1951.18	14719.3	2.45	3.63	0.000778	0.0	-53.37	69.02	-7.23	9.33	-122.77	0.448
		76	-21289.60	1684.89	12717.9	2.27	3.05	0.000735	0.0	-50.39	58.00	-15.22	8.05	-110.35	0.404
		77	-19348.75	1343.32	10145.1	2.00	2.36	0.000751	0.0	-45.80	42.91	-21.14	6.41	-93.63	0.345
		78	-19088.45	1300.00	9832.4	1.97	2.27	0.000743	0.0	-45.18	41.10	-21.45	6.20	-91.54	0.338
		79	-11411.29	463.58	2343.2	1.18	1.31	0.001021	16.1	-31.47	11.16	0.13	0.74	-42.63	0.148
		80	-10856.36	649.34	968.1	1.12	2.21	0.001573	16.1	-29.98	18.63	-0.27	0.92	-48.61	0.165
		81	-4687.51	1195.90	4833.4	0.56	3.36	0.001886	16.1	-13.57	27.66	-0.27	0.69	-41.23	0.132
		82	-7189.48	1127.05	4399.0	0.79	3.29	0.001972	16.1	-20.21	27.31	0.10	0.88	-47.52	0.155
		83	-11014.69	1389.69	7531.8	1.14	3.67	0.002073	16.1	-30.40	30.26	0.16	1.03	-60.67	0.201
		84	-11574.87	1427.48	7996.2	1.19	3.70	0.002063	16.1	-31.90	30.49	0.12	1.04	-62.40	0.207

YETAGUN PLATFORM INPLACE ANALYSIS

* * * P I L E M A X I M U M U N I T Y C H E C K S U M M A R Y * * *

PILE JT.	GRUP	LOAD CASE	******* PILEHEAD FORCES ******* AXIAL KN	LATERAL KN	MOMENT KN-M	* PILEHEAD DISPLACEMENTS * AXIAL CM	LATERAL CM	ROTATION RAD	*********** STRESSES AT MAX. UNITY CHECK ************ DEPTH M	AXIAL	FBY	FBZ N/MM2	SHEAR	COMB.	UNITY CHECK
		85	-12152.85	1468.42	8481.2	1.24	3.74	0.002051	16.1	-33.45	-30.74	-0.08	1.05	-64.20	0.214
		86	-20448.83	2073.76	15184.7	2.15	4.19	0.001375	0.0	-48.40	67.68	23.35	9.94	-120.00	0.327
		87	-26952.38	2690.38	20382.8	3.12	5.84	0.001522	0.0	-63.79	95.77	-7.98	12.96	-159.90	0.435
		88	-27014.77	2679.02	20238.5	3.13	5.82	0.001553	0.0	-63.94	94.82	-10.70	12.90	-159.36	0.434
		89	-24878.60	2294.41	16829.4	2.79	4.78	0.001458	0.0	-58.89	76.58	-20.80	11.03	-138.24	0.378
		90	-21475.72	1782.53	12436.6	2.30	3.76	0.001514	16.1	-58.50	-30.43	-0.10	0.98	-88.93	0.303
		91	-20997.72	1712.75	11876.2	2.23	3.63	0.001504	16.1	-57.22	-29.38	-0.12	0.97	-86.61	0.296
148	PS1	66	-16434.73	422.13	4111.0	1.65	0.38	0.000477	4.0	-42.28	-1.34	12.97	1.91	-55.31	0.256
		67	-12585.27	410.34	1246.5	1.28	1.39	0.001124	16.1	-34.61	11.94	-0.09	0.79	-46.55	0.215
		68	-12449.95	444.24	1454.0	1.27	1.45	0.001139	16.1	-34.25	12.40	-0.07	0.78	-46.65	0.215
		69	-12236.04	736.42	3947.7	1.25	1.82	0.001131	16.1	-33.68	15.17	0.18	0.68	-48.85	0.223
		70	-13082.81	1035.16	6342.4	1.33	2.27	0.001093	16.1	-35.95	18.52	0.33	0.57	-54.46	0.248
		71	-13260.27	1057.51	6538.3	1.35	2.30	0.001081	16.1	-36.42	-18.72	-0.33	0.56	-55.15	0.251
		72	-13526.87	1075.35	6721.6	1.37	2.31	0.001059	16.1	-37.14	-18.80	-0.32	0.55	-55.94	0.255
		73	-17513.22	1301.97	8756.8	1.77	2.62	0.000883	16.1	-47.90	-21.03	0.38	0.45	-68.93	0.316
		74	-22456.52	1682.71	11338.7	2.44	3.52	0.001139	16.1	-61.12	-28.35	0.90	0.42	-89.49	0.409
		75	-22649.94	1691.39	11402.3	2.46	3.54	0.001146	16.1	-61.64	-28.51	0.92	0.42	-90.17	0.412
		76	-22339.10	1533.92	10511.5	2.42	3.10	0.000947	16.1	-60.81	-24.86	0.93	0.46	-85.69	0.393
		77	-21358.98	1326.56	9291.0	2.28	2.54	0.000739	16.1	-58.19	-20.32	0.68	0.52	-78.52	0.363
		78	-21191.56	1294.98	9101.0	2.26	2.46	0.000711	16.1	-57.74	-19.64	0.65	0.53	-77.40	0.358
		79	-16104.59	656.03	4582.8	1.62	1.36	0.000924	16.1	-44.08	11.33	0.25	0.75	-55.41	0.194
		80	-15319.48	601.38	471.5	1.54	2.18	0.001627	16.1	-41.96	18.56	-0.24	1.01	-60.52	0.208
		81	-8541.26	1156.30	4295.5	0.91	3.41	0.002010	16.1	-23.81	28.22	-0.34	0.84	-52.03	0.171
		82	-8505.38	1382.76	6939.9	0.91	3.64	0.001922	16.1	-23.71	29.85	0.03	0.71	-53.56	0.176
		83	-9850.63	1700.29	9941.0	1.03	4.08	0.001854	16.1	-27.29	33.18	0.32	0.57	-60.47	0.199
		84	-10174.28	1719.79	10160.1	1.06	4.10	0.001833	16.1	-28.15	33.29	0.33	0.55	-61.44	0.202
		85	-10521.68	1738.56	10370.5	1.09	4.11	0.001812	16.1	-29.08	33.39	0.34	0.54	-62.47	0.206
		86	-18259.73	1830.32	11881.2	1.86	4.05	0.001479	16.1	-49.89	-32.69	0.28	0.39	-82.58	0.279
		87	-26083.65	2367.68	15805.3	2.97	5.68	0.002058	16.1	-70.80	-45.71	0.84	0.53	-116.52	0.394
		88	-26400.47	2374.83	15874.6	3.02	5.71	0.002066	16.1	-71.65	-45.90	0.84	0.54	-117.56	0.398
		89	-25709.57	2143.98	14330.7	2.92	4.89	0.001728	16.1	-69.80	-39.46	0.74	0.48	-109.27	0.372
		90	-24111.92	1897.23	12762.5	2.67	4.13	0.001443	16.1	-65.54	-33.35	0.13	0.54	-98.89	0.338
		91	-23795.06	1856.17	12497.9	2.63	4.01	0.001402	16.1	-64.69	-32.40	0.06	0.55	-97.10	0.332
103	PS1	66	-11683.16	553.17	4440.4	1.20	0.79	0.000592	4.0	-30.12	-0.70	-13.13	2.47	-43.27	0.198
		67	-16325.11	1249.56	9121.6	1.64	2.28	0.000804	0.0	-38.64	-37.98	-20.18	5.96	-81.65	0.300
		68	-16608.15	1292.26	9443.4	1.67	2.36	0.000810	0.0	-39.31	-39.83	-19.91	6.16	-83.83	0.308
		69	-18480.68	1614.83	11954.8	1.89	2.98	0.000773	0.0	-43.75	-54.58	-14.09	7.71	-100.12	0.366
		70	-19691.33	1867.34	13898.5	2.05	3.49	0.000778	0.0	-46.61	-65.36	-4.75	8.93	-112.14	0.408
		71	-19685.29	1873.57	13954.5	2.05	3.50	0.000772	0.0	-46.59	-65.69	-3.68	8.95	-112.39	0.409
		72	-19586.43	1868.40	13929.4	2.04	3.48	0.000758	0.0	-46.37	-65.63	-2.38	8.93	-112.04	0.407
		73	-16569.24	1519.10	11430.5	1.67	2.69	0.000657	0.0	-39.22	51.99	-14.19	7.24	-93.12	0.339
		74	-10672.77	1008.27	6539.8	1.11	2.20	0.001233	16.1	-29.49	-18.06	0.70	0.83	-47.56	0.215
		75	-10140.81	949.03	5974.3	1.06	2.14	0.001253	16.1	-28.06	-17.65	0.68	0.82	-45.73	0.206
		76	-7988.63	593.24	2982.4	0.86	1.61	0.001154	16.1	-22.34	-13.57	0.33	0.77	-35.91	0.162
		77	-7026.97	423.53	946.0	0.77	1.38	0.001069	16.1	-19.78	-11.71	-0.25	0.72	-31.50	0.142

YETAGUN PLATFORM INPLACE ANALYSIS

* * * P I L E M A X I M U M U N I T Y C H E C K S U M M A R Y * * *

PILE JT.	GRUP	LOAD CASE	******* PILEHEAD FORCES ******* AXIAL KN	LATERAL KN	MOMENT KN-M	* PILEHEAD DISPLACEMENTS * AXIAL CM	LATERAL CM	ROTATION RAD	********** STRESSES AT MAX. UNITY CHECK ********** DEPTH M	AXIAL N/MM2	FBY N/MM2	FBZ N/MM2	SHEAR N/MM2	COMB. N/MM2	UNITY CHECK
		78	-7059.09	404.60	881.2	0.78	1.33	0.001050	16.1	-19.87	-11.36	-0.29	0.71	-31.24	0.142
		79	-9857.17	688.84	3454.9	1.03	1.73	0.001083	16.1	-27.31	14.39	0.32	0.63	-41.70	0.142
		80	-18678.79	1487.65	10531.1	1.92	3.02	0.001259	0.0	-44.21	-42.49	-25.70	7.12	-93.86	0.259
		81	-19076.14	1798.18	12103.9	1.97	3.95	0.001649	16.1	-52.08	31.96	-0.10	0.91	-84.04	0.285
		82	-22343.42	2268.27	16330.9	2.42	4.81	0.001542	0.0	-52.88	-74.34	-20.08	10.90	-129.88	0.354
		83	-24370.61	2620.49	19529.8	2.71	5.67	0.001544	0.0	-57.68	-91.70	-8.37	12.60	-149.77	0.406
		84	-24375.12	2632.20	19653.7	2.71	5.70	0.001533	0.0	-57.69	-92.42	-6.80	12.66	-150.36	0.408
		85	-24348.74	2640.69	19746.7	2.71	5.71	0.001523	0.0	-57.63	-92.96	-5.19	12.70	-150.74	0.409
		86	-18729.36	2081.89	15145.3	1.92	4.18	0.001286	0.0	-44.33	68.46	-20.30	9.97	-115.74	0.314
		87	-9253.00	1491.81	8143.0	0.98	3.87	0.002110	16.1	-25.70	-31.82	0.44	0.98	-57.53	0.189
		88	-8281.46	1428.96	7360.3	0.89	3.82	0.002129	16.1	-23.12	-31.45	0.44	0.96	-54.57	0.178
		89	-4702.35	1101.20	4196.6	0.56	3.18	0.001882	16.1	-13.61	-26.33	0.13	0.80	-39.94	0.128
		90	-2341.62	1190.19	5064.7	0.35	3.23	0.001768	16.1	-7.34	-26.58	-0.45	0.60	-33.92	0.106
		91	-2331.74	1188.42	5120.1	0.34	3.21	0.001742	16.1	-7.31	-26.35	-0.48	0.58	-33.66	0.106
101	PS1	66	-12365.81	498.13	3384.1	1.26	0.87	0.000579	16.1	-34.02	7.24	0.25	0.51	-41.27	0.193
		67	-14921.13	1064.83	6778.6	1.50	2.19	0.000891	16.1	-40.88	17.72	0.56	0.42	-58.62	0.269
		68	-15150.14	1097.18	7006.3	1.52	2.26	0.000910	16.1	-41.50	18.30	0.58	0.43	-59.80	0.274
		69	-17071.48	1362.77	9053.4	1.72	2.80	0.001002	16.1	-46.70	22.52	0.49	0.48	-69.23	0.316
		70	-18717.47	1628.45	11174.1	1.92	3.31	0.001057	0.0	-44.30	-51.75	-9.90	7.81	-96.99	0.355
		71	-18791.01	1641.32	11300.5	1.93	3.33	0.001048	0.0	-44.48	-52.45	-9.40	7.87	-97.76	0.358
		72	-18803.47	1645.32	11377.0	1.93	3.32	0.001025	0.0	-44.52	-52.93	-8.73	7.89	-98.16	0.360
		73	-17656.08	1473.36	10708.0	1.79	2.71	0.000628	0.0	-41.80	50.34	-3.83	7.04	-92.28	0.338
		74	-15174.65	1252.52	8855.6	1.52	2.41	0.001005	0.0	-35.92	34.38	-23.70	5.98	-77.67	0.285
		75	-14814.10	1199.13	8404.5	1.49	2.34	0.001041	0.0	-35.06	31.40	-24.18	5.73	-74.69	0.274
		76	-12623.94	768.85	5066.7	1.29	1.68	0.001067	16.1	-34.72	-13.91	0.31	0.79	-48.63	0.223
		77	-11120.01	447.59	2183.6	1.15	1.35	0.001076	16.1	-30.69	-11.49	-0.35	0.78	-42.18	0.194
		78	-11037.63	417.72	1929.1	1.14	1.30	0.001061	16.1	-30.47	-11.15	-0.41	0.77	-41.62	0.192
		79	-10343.75	839.28	4424.1	1.08	1.97	0.001035	16.1	-28.61	16.20	0.20	0.46	-44.80	0.152
		80	-16724.00	1327.12	8114.0	1.68	2.99	0.001300	16.1	-45.75	24.33	0.35	0.48	-70.08	0.239
		81	-15674.12	1624.34	9456.2	1.57	3.89	0.001717	16.1	-42.91	31.68	0.58	0.38	-74.60	0.251
		82	-19355.47	1946.34	12250.4	2.00	4.56	0.001853	16.1	-52.83	36.99	0.51	0.50	-89.82	0.303
		83	-22051.01	2326.82	15677.4	2.38	5.42	0.001961	16.1	-60.04	43.54	0.09	0.70	-103.57	0.348
		84	-22190.64	2348.58	15919.8	2.40	5.45	0.001946	16.1	-60.41	43.77	0.04	0.73	-104.19	0.350
		85	-22307.22	2368.12	16144.1	2.41	5.48	0.001929	16.1	-60.72	43.96	-0.01	0.75	-104.68	0.352
		86	-19971.50	2095.26	14967.8	2.09	4.29	0.001206	0.0	-47.27	70.35	-5.58	10.05	-117.84	0.321
		87	-16141.61	1905.58	12829.3	1.62	4.21	0.001794	0.0	-38.21	52.96	-29.24	9.14	-98.70	0.268
		88	-15502.22	1831.16	12094.3	1.56	4.12	0.001848	0.0	-36.69	48.83	-29.45	8.78	-93.72	0.255
		89	-11754.60	1235.21	6787.1	1.21	3.21	0.001829	16.1	-32.39	-26.50	-0.15	0.94	-58.89	0.197
		90	-8452.30	1043.08	3654.9	0.90	3.12	0.001894	16.1	-23.57	-25.88	-0.79	0.85	-49.46	0.163
		91	-8236.55	1036.50	3567.5	0.88	3.09	0.001877	16.1	-23.00	-25.69	-0.82	0.83	-48.70	0.161
146	PS1	66	-14913.96	676.83	5072.2	1.50	0.97	0.000433	4.0	-38.39	-6.88	-10.88	3.07	-51.26	0.236
		67	-18554.26	1292.36	8899.2	1.90	2.50	0.000757	16.1	-50.68	20.03	0.56	0.47	-70.72	0.325
		68	-18711.73	1320.33	9066.9	1.92	2.57	0.000783	16.1	-51.10	20.63	0.56	0.46	-71.73	0.330
		69	-19434.49	1489.36	10034.3	2.02	3.04	0.000963	16.1	-53.05	24.40	0.54	0.40	-77.46	0.354
		70	-19542.94	1618.09	10734.7	2.03	3.41	0.001134	16.1	-53.33	27.43	0.34	0.36	-80.76	0.368

YETAGUN PLATFORM INPLACE ANALYSIS

* * * P I L E M A X I M U M U N I T Y C H E C K S U M M A R Y * * *

PILE	GRUP	LOAD	******* PILEHEAD FORCES *******			* PILEHEAD DISPLACEMENTS *			*********** STRESSES AT MAX. UNITY CHECK ***********						
JT.		CASE	AXIAL	LATERAL	MOMENT	AXIAL	LATERAL	ROTATION	DEPTH	AXIAL	FBY	FBZ	SHEAR	COMB.	UNITY
			KN	KN	KN-M	CM	CM	RAD	M	----------------		N/MM2	-------------		CHECK
		71	-19448.69	1616.71	10718.9	2.02	3.41	0.001135	16.1	-53.08	27.42	0.31	0.36	-80.50	0.366
		72	-19265.19	1604.69	10637.3	1.99	3.38	0.001124	16.1	-52.59	27.18	0.27	0.35	-79.77	0.363
		73	-15707.32	1279.84	8526.4	1.58	2.55	0.000830	16.1	-43.00	-20.51	0.46	0.37	-63.52	0.290
		74	-10191.02	1087.22	6520.0	1.06	2.39	0.001096	16.1	-28.20	-19.40	0.78	0.48	-47.61	0.214
		75	-9872.06	1053.68	6203.1	1.03	2.35	0.001121	16.1	-27.34	-19.15	0.73	0.50	-46.51	0.209
		76	-9256.50	717.78	3556.4	0.98	1.80	0.001107	16.1	-25.71	-14.99	0.34	0.62	-40.70	0.184
		77	-9608.78	449.08	1120.7	1.01	1.43	0.001085	16.1	-26.65	-12.14	-0.24	0.71	-38.79	0.177
		78	-9747.19	417.64	882.6	1.02	1.37	0.001067	16.1	-27.01	-11.67	-0.29	0.72	-38.69	0.177
		79	-14717.14	947.10	6306.2	1.48	1.90	0.000924	16.1	-40.34	15.43	0.58	0.64	-55.78	0.193
		80	-21611.77	1641.56	11290.0	2.32	3.37	0.001111	16.1	-58.86	27.08	0.06	0.60	-85.95	0.295
		81	-21744.16	1962.89	13041.3	2.33	4.35	0.001546	16.1	-59.22	35.07	0.15	0.50	-94.29	0.320
		82	-23085.67	2142.66	14119.9	2.53	4.94	0.001787	16.1	-62.80	39.84	0.41	0.43	-102.65	0.347
		83	-23370.04	2321.54	15264.6	2.57	5.57	0.002054	16.1	-63.56	44.80	0.38	0.45	-108.36	0.365
		84	-23216.80	2321.89	15257.6	2.54	5.57	0.002056	16.1	-63.15	44.82	0.36	0.45	-107.97	0.364
		85	-23037.54	2320.35	15236.3	2.52	5.57	0.002056	16.1	-62.67	44.79	0.32	0.44	-107.46	0.362
		86	-16236.38	1812.65	11649.0	1.63	4.01	0.001465	16.1	-44.43	-32.35	0.50	0.32	-76.79	0.258
		87	-7256.48	1809.07	10716.6	0.79	4.29	0.001861	0.0	-17.18	48.38	-14.58	8.63	-67.70	0.179
		88	-6702.57	1777.43	10345.9	0.74	4.27	0.001900	16.1	-18.92	-34.59	0.56	0.49	-53.51	0.173
		89	-5820.58	1347.71	6648.1	0.66	3.53	0.001854	16.1	-16.58	-28.92	0.09	0.65	-45.49	0.147
		90	-6028.19	1131.30	4225.7	0.68	3.28	0.001915	16.1	-17.13	-27.12	-0.61	0.77	-44.26	0.144
		91	-6240.01	1104.36	4019.7	0.70	3.22	0.001898	16.1	-17.69	-26.67	-0.66	0.78	-44.37	0.144
199	PS2	66	-16717.67	1466.48	10747.8	1.74	2.68	0.000605	0.0	-39.57	-50.46	4.71	7.00	-90.24	0.330
		67	-14820.36	1300.36	9340.1	1.53	2.45	0.000918	0.0	-35.08	-38.13	22.03	6.20	-79.12	0.289
		68	-14612.81	1270.05	9092.1	1.51	2.40	0.000934	0.0	-34.59	-36.43	22.59	6.06	-77.46	0.283
		69	-12580.88	899.06	6183.7	1.32	1.79	0.001000	15.0	-34.79	14.67	0.05	0.88	-49.46	0.227
		70	-10800.61	550.43	3211.4	1.15	1.42	0.001066	15.0	-30.00	12.52	0.04	0.74	-42.53	0.195
		71	-10702.01	514.93	2943.9	1.14	1.37	0.001055	15.0	-29.74	12.16	0.04	0.73	-41.90	0.192
		72	-10658.78	473.79	2691.8	1.13	1.29	0.001031	15.0	-29.62	11.62	0.04	0.72	-41.24	0.190
		73	-11495.01	242.57	2661.9	1.21	0.45	0.000561	3.7	-29.67	-6.60	8.22	1.12	-40.21	0.185
		74	-14968.25	1014.62	6856.4	1.55	1.89	0.000706	15.9	-41.09	-15.02	-1.66	0.52	-56.20	0.259
		75	-15348.32	1089.37	7348.0	1.59	2.07	0.000757	15.9	-42.12	-16.46	-1.69	0.53	-58.66	0.270
		76	-17337.71	1434.80	9850.0	1.82	2.83	0.000921	0.0	-41.04	43.85	15.30	6.87	-87.48	0.321
		77	-18539.51	1682.51	11773.5	1.98	3.34	0.000883	0.0	-43.88	-54.39	-11.10	8.06	-99.39	0.363
		78	-18589.63	1694.91	11889.1	1.99	3.36	0.000976	0.0	-44.00	-55.07	-10.49	8.12	-100.06	0.366
		79	-18341.41	1939.74	13907.5	1.96	3.86	0.001042	0.0	-43.42	-65.38	5.08	9.28	-108.99	0.296
		80	-18180.61	1820.97	13035.1	1.93	3.70	0.001391	0.0	-43.03	-55.00	27.43	8.72	-104.49	0.285
		81	-14483.15	1678.34	11250.3	1.50	3.65	0.001606	0.0	-34.28	-45.12	27.90	8.03	-87.32	0.237
		82	-10722.70	1206.75	6595.6	1.14	3.13	0.001788	15.0	-29.79	26.15	0.51	0.85	-55.95	0.187
		83	-7588.58	1115.76	4183.7	0.85	3.29	0.001969	15.0	-21.39	27.88	0.39	0.48	-49.27	0.161
		84	-7390.08	1108.54	4074.9	0.83	3.28	0.001957	15.0	-20.86	27.75	0.36	0.45	-48.60	0.159
		85	-7215.76	1102.27	4000.4	0.81	3.26	0.001942	15.0	-20.39	27.58	0.33	0.43	-47.97	0.157
		86	-9086.32	730.07	3243.3	0.99	1.89	0.001118	15.0	-25.40	-15.98	0.44	0.41	-41.39	0.140
		87	-14608.31	1337.02	7774.6	1.51	3.12	0.001422	15.0	-40.26	-25.26	-0.97	0.61	-65.53	0.222
		88	-15363.44	1427.70	8409.4	1.59	3.33	0.001497	15.0	-42.30	-26.91	-1.05	0.66	-69.23	0.234
		89	-18701.03	1838.63	11742.4	2.01	4.17	0.001667	15.9	-51.13	-33.60	-1.52	0.60	-84.76	0.286

YETAGUN PLATFORM INPLACE ANALYSIS

* * * P I L E M A X I M U M U N I T Y C H E C K S U M M A R Y * * *

PILE JT.	GRUP	LOAD CASE	******* PILEHEAD FORCES ******* AXIAL KN	LATERAL KN	MOMENT KN-M	* PILEHEAD DISPLACEMENTS * AXIAL CM	LATERAL CM	ROTATION RAD	*********** STRESSES AT MAX. UNITY CHECK *********** DEPTH M	AXIAL	FBY	FBZ N/MM2	SHEAR	COMB.	UNITY CHECK
		90	-21172.35	2255.71	15327.9	2.37	5.11	0.001792	0.0	-50.11	70.38	16.43	10.86	-122.38	0.334
		91	-21292.16	2279.90	15576.3	2.39	5.15	0.001781	0.0	-50.40	71.72	15.81	10.98	-123.84	0.337
197	PS2	66	-15370.94	1451.76	10800.6	1.59	2.63	0.000734	0.0	-36.38	-48.68	14.95	6.92	-87.30	0.318
		67	-10922.35	1069.09	7132.1	1.16	2.24	0.001154	15.0	-30.33	18.19	0.44	0.94	-48.52	0.219
		68	-10617.65	1034.30	6819.7	1.13	2.20	0.001163	15.0	-29.51	17.92	0.38	0.91	-47.43	0.214
		69	-8366.94	695.41	3982.8	0.92	1.69	0.001114	15.0	-23.47	14.44	-0.06	0.71	-37.91	0.171
		70	-6873.00	480.08	1704.5	0.78	1.43	0.001065	15.0	-19.47	12.69	-0.06	0.59	-32.16	0.145
		71	-6872.64	457.41	1544.1	0.78	1.38	0.001047	15.0	-19.47	12.32	-0.05	0.59	-31.79	0.143
		72	-6963.47	426.15	1408.5	0.79	1.31	0.001018	15.0	-19.71	11.76	-0.03	0.60	-31.47	0.142
		73	-10354.24	311.22	3491.2	1.11	0.34	0.000544	3.7	-26.76	-5.85	11.18	1.47	-39.37	0.179
		74	-16049.10	1217.36	9141.7	1.66	2.05	0.000560	0.0	-37.99	39.24	17.84	5.79	-81.09	0.298
		75	-16533.90	1302.46	9739.3	1.72	2.25	0.000592	0.0	-39.13	42.56	17.25	6.20	-85.05	0.312
		76	-18449.28	1664.31	12370.1	1.97	3.04	0.000684	0.0	-43.67	57.32	10.79	7.94	-101.99	0.372
		77	-19212.10	1871.22	13880.1	2.08	3.51	0.000777	0.0	-45.47	-65.41	-2.17	8.94	-110.92	0.403
		78	-19183.93	1875.52	13913.5	2.07	3.52	0.000781	0.0	-45.41	-65.59	-1.18	8.96	-111.01	0.403
		79	-17076.20	1889.54	13648.6	1.79	3.75	0.001175	0.0	-40.42	-61.70	18.28	9.03	-104.78	0.284
		80	-13495.25	1491.98	9744.3	1.40	3.41	0.001723	15.0	-37.25	27.68	1.19	1.22	-64.96	0.218
		81	-8304.59	1303.55	7014.6	0.91	3.37	0.001861	15.0	-23.30	27.97	0.26	0.80	-51.27	0.169
		82	-4199.64	1096.50	4314.6	0.53	3.12	0.001817	15.0	-12.31	26.25	-0.21	0.39	-38.56	0.123
		83	-1597.28	1268.90	5611.9	0.28	3.42	0.001824	15.0	-5.34	28.28	-0.04	0.10	-33.62	0.104
		84	-1572.70	1268.21	5661.1	0.28	3.40	0.001804	15.0	-5.28	28.09	-0.01	0.09	-33.37	0.104
		85	-1585.26	1264.51	5687.9	0.28	3.37	0.001781	15.0	-5.31	27.86	0.02	0.09	-33.17	0.103
		86	-8013.04	584.91	2108.4	0.89	1.64	0.001095	15.0	-22.52	-14.23	0.37	0.48	-36.75	0.124
		87	-17510.11	1519.48	10389.2	1.84	3.19	0.001344	15.9	-47.94	-25.69	-0.28	0.89	-73.63	0.251
		88	-18320.97	1651.82	11393.4	1.95	3.45	0.001381	0.0	-43.36	47.49	25.10	7.92	-97.08	0.266
		89	-21323.43	2149.47	15477.2	2.39	4.44	0.001372	0.0	-50.47	70.35	19.39	10.31	-123.44	0.336
		90	-23139.08	2515.24	18575.5	2.67	5.36	0.001444	0.0	-54.77	87.23	7.84	12.08	-142.35	0.386
		91	-23131.90	2527.60	18693.7	2.67	5.39	0.001442	0.0	-54.75	87.91	6.35	12.14	-142.89	0.387
149	PS2	66	-14585.61	1262.38	8415.7	1.51	2.52	0.000807	15.9	-40.06	20.08	0.56	0.43	-60.15	0.274
		67	-10531.88	1132.01	7098.1	1.12	2.39	0.000992	15.9	-29.20	19.24	-0.40	0.46	-48.44	0.218
		68	-10337.63	1111.17	6919.3	1.10	2.36	0.001001	15.9	-28.68	19.01	-0.43	0.46	-47.69	0.215
		69	-9387.70	824.86	4664.0	1.01	1.87	0.001016	15.0	-26.21	15.52	-0.04	0.55	-41.73	0.189
		70	-9260.75	546.20	2249.8	1.00	1.51	0.001050	15.0	-25.87	13.19	-0.03	0.55	-39.05	0.178
		71	-9372.60	510.59	1996.0	1.01	1.45	0.001036	15.0	-26.17	12.73	-0.03	0.56	-38.89	0.177
		72	-9564.22	466.02	1738.3	1.03	1.36	0.001009	15.0	-26.68	12.05	-0.04	0.57	-38.73	0.177
		73	-13472.73	403.16	3544.0	1.40	0.46	0.000436	3.7	-34.74	0.57	11.31	1.86	-46.06	0.213
		74	-17771.88	1161.68	7900.8	1.88	2.21	0.000674	15.9	-48.64	-17.58	-1.34	0.46	-66.27	0.306
		75	-18058.05	1226.84	8286.6	1.92	2.39	0.000744	15.9	-49.41	-19.00	-1.38	0.45	-68.46	0.315
		76	-18962.18	1471.26	9749.0	2.04	3.04	0.001005	15.9	-51.83	-24.31	-1.53	0.43	-76.19	0.348
		77	-18834.73	1606.14	10552.8	2.02	3.41	0.001156	15.9	-51.49	27.27	1.47	0.42	-78.79	0.358
		78	-18733.72	1607.15	10559.4	2.01	3.41	0.001156	15.9	-51.22	27.29	1.45	0.42	-78.54	0.357
		79	-15053.96	1673.94	10848.1	1.56	3.62	0.001275	15.9	-41.33	28.98	0.39	0.41	-70.31	0.237
		80	-12198.10	1621.47	10214.6	1.28	3.62	0.001475	15.9	-33.66	29.17	-0.10	0.56	-62.82	0.210
		81	-7278.27	1614.32	9569.7	0.82	3.76	0.001643	15.9	-20.51	30.39	-0.53	0.48	-50.91	0.166
		82	-5676.46	1327.05	6674.4	0.67	3.43	0.001788	15.0	-16.26	28.29	0.11	0.48	-44.56	0.144

YETAGUN PLATFORM INPLACE ANALYSIS

* * * P I L E M A X I M U M U N I T Y C H E C K S U M M A R Y * * *

PILE GRUP JT.	LOAD CASE	******* PILEHEAD FORCES ******* AXIAL KN	LATERAL KN	MOMENT KN-M	* PILEHEAD DISPLACEMENTS * AXIAL CM	LATERAL CM	ROTATION RAD	*********** STRESSES AT MAX. UNITY CHECK ************ DEPTH M	AXIAL	FBY	FBZ N/MM2	SHEAR	COMB.	UNITY CHECK
	83	-5385.25	1215.72	4900.7	0.64	3.46	0.001967	15.0	-15.49	28.99	0.25	0.32	-44.48	0.143
	84	-5566.87	1189.53	4677.5	0.66	3.41	0.001955	15.0	-15.97	28.62	0.24	0.32	-44.60	0.144
	85	-5776.94	1162.78	4464.4	0.68	3.35	0.001939	15.0	-16.53	28.21	0.22	0.33	-44.75	0.145
	86	-13036.40	740.67	4468.1	1.36	1.69	0.001017	15.0	-36.02	-14.18	0.89	0.68	-50.22	0.173
	87	-20103.51	1653.62	10771.1	2.21	3.60	0.001331	15.9	-54.87	-28.98	-0.47	0.51	-83.86	0.286
	88	-20603.04	1736.16	11263.9	2.28	3.83	0.001422	15.9	-56.20	-30.83	-0.60	0.49	-87.04	0.296
	89	-21962.39	1987.08	12845.6	2.49	4.56	0.001699	15.9	-59.83	-36.66	-1.26	0.46	-96.50	0.327
	90	-22187.67	2208.99	14332.4	2.52	5.25	0.001963	15.9	-60.42	-42.08	-1.48	0.51	-102.53	0.346
	91	-22038.39	2213.76	14367.7	2.50	5.26	0.001965	15.9	-60.03	-42.17	-1.48	0.51	-102.23	0.344
119 PS2	66	-14969.84	1475.07	10612.3	1.55	2.75	0.000666	0.0	-35.43	-49.81	-4.74	7.04	-85.47	0.311
	67	-16239.21	1655.13	11352.6	1.69	3.36	0.001043	0.0	-38.44	-52.75	9.10	7.92	-91.97	0.335
	68	-16173.50	1641.03	11221.0	1.68	3.34	0.001050	0.0	-38.28	-52.02	9.65	7.85	-91.19	0.332
	69	-14614.77	1369.01	9109.6	1.51	2.78	0.000960	0.0	-34.59	-41.00	12.79	6.55	-77.54	0.284
	70	-12554.26	1062.24	6752.4	1.31	2.15	0.000844	15.9	-34.61	17.24	-1.28	0.41	-51.89	0.236
	71	-12343.74	1025.71	6500.9	1.29	2.06	0.000820	15.9	-34.05	16.57	-1.28	0.40	-50.67	0.231
	72	-12093.33	981.07	6205.4	1.27	1.96	0.000786	15.9	-33.38	15.72	-1.26	0.40	-49.15	0.224
	73	-9512.50	326.18	2618.7	1.03	0.54	0.000496	3.7	-24.60	-3.65	-8.37	1.47	-33.73	0.155
	74	-7954.80	399.85	1606.7	0.88	1.21	0.000974	15.0	-22.37	-10.97	0.27	0.62	-33.34	0.152
	75	-8111.72	450.48	2088.3	0.89	1.29	0.000997	15.0	-22.79	-11.50	0.22	0.63	-34.29	0.156
	76	-10067.98	803.62	5322.3	1.08	1.63	0.000952	15.0	-28.03	-13.53	-0.15	0.78	-41.57	0.190
	77	-12103.94	1150.36	8083.8	1.27	2.15	0.000857	0.0	-28.65	-31.52	-21.43	5.48	-66.76	0.243
	78	-12308.13	1179.54	8321.2	1.29	2.20	0.000841	0.0	-29.13	-33.14	-21.00	5.62	-68.37	0.249
	79	-16796.76	1976.81	14024.5	1.75	3.99	0.001115	0.0	-39.76	-65.89	-5.54	9.46	-105.88	0.287
	80	-19170.12	2177.31	15013.9	2.07	4.76	0.001558	0.0	-45.37	-69.91	11.14	10.46	-116.16	0.315
	81	-19040.33	2233.43	14953.9	2.05	5.11	0.001837	0.0	-45.07	-68.99	14.53	10.74	-115.57	0.314
	82	-16234.36	1821.96	11328.3	1.68	4.22	0.001728	15.9	-44.51	34.02	-1.21	0.50	-78.55	0.264
	83	-12579.48	1515.77	8647.6	1.32	3.62	0.001623	15.9	-34.68	29.40	-1.28	0.33	-64.11	0.214
	84	-12144.55	1479.06	8387.7	1.28	3.54	0.001589	15.9	-33.51	28.70	-1.24	0.32	-62.24	0.208
	85	-11713.07	1443.76	8142.8	1.23	3.45	0.001555	15.9	-32.36	28.01	-1.19	0.30	-60.39	0.202
	86	-6994.69	823.90	4026.8	0.79	2.00	0.001068	15.0	-19.80	-16.59	0.02	0.33	-36.39	0.122
	87	-4582.55	1102.81	4155.9	0.56	3.17	0.001838	15.0	-13.34	-26.64	0.58	0.31	-39.99	0.128
	88	-4892.15	1097.83	4068.3	0.59	3.18	0.001868	15.0	-14.16	-26.84	0.60	0.36	-41.01	0.132
	89	-8368.69	1134.32	5898.8	0.92	2.98	0.001717	15.0	-23.48	-24.95	0.45	0.75	-48.44	0.160
	90	-12194.71	1609.50	10558.1	1.28	3.53	0.001576	0.0	-28.86	42.08	26.59	7.69	-78.64	0.213
	91	-12599.57	1657.06	10998.7	1.32	3.59	0.001548	0.0	-29.82	-44.56	-26.52	7.92	-81.68	0.221
117 PS2	66	-13701.67	1468.30	10724.3	1.42	2.70	0.000761	0.0	-32.43	-48.33	-14.86	7.00	-83.00	0.300
	67	-17130.51	1849.20	13542.8	1.79	3.51	0.000823	0.0	-40.55	-63.84	1.43	8.83	-104.41	0.378
	68	-17155.73	1843.40	13496.7	1.80	3.50	0.000821	0.0	-40.61	-63.59	2.46	8.80	-104.24	0.377
	69	-16143.31	1604.98	11736.7	1.67	2.98	0.000730	0.0	-38.21	-54.26	10.86	7.66	-93.55	0.340
	70	-14243.78	1267.97	9160.8	1.47	2.29	0.000713	0.0	-33.71	-39.36	17.79	6.04	-76.91	0.281
	71	-13964.48	1223.41	8833.6	1.45	2.20	0.000701	0.0	-33.05	-37.51	18.10	5.83	-74.70	0.273
	72	-13604.62	1168.88	8440.5	1.41	2.08	0.000681	0.0	-32.20	-35.33	18.31	5.57	-72.00	0.263
	73	-8788.51	383.96	3529.8	0.96	0.46	0.000485	3.7	-22.75	-2.76	-11.41	1.77	-34.49	0.156
	74	-4603.94	408.06	713.1	0.56	1.25	0.000951	15.0	-13.39	-11.21	0.01	0.51	-24.60	0.110
	75	-4554.67	438.56	988.4	0.56	1.32	0.000983	15.0	-13.26	-11.76	-0.06	0.51	-25.02	0.111

YETAGUN PLATFORM INPLACE ANALYSIS

* * * P I L E M A X I M U M U N I T Y C H E C K S U M M A R Y * * *

PILE JT.	GRUP	LOAD CASE	******* PILEHEAD FORCES ******* AXIAL KN	LATERAL KN	MOMENT KN-M	* PILEHEAD DISPLACEMENTS * AXIAL CM	LATERAL CM	ROTATION RAD	*********** STRESSES AT MAX. UNITY CHECK ************ DEPTH M	AXIAL	FBY	FBZ N/MM2	SHEAR	COMB.	UNITY CHECK
		76	-6040.04	619.20	3259.0	0.70	1.54	0.001047	15.0	-17.24	-13.32	-0.40	0.63	-30.56	0.137
		77	-8377.47	931.56	6024.2	0.92	1.95	0.001056	15.0	-23.50	15.96	0.30	0.80	-39.46	0.177
		78	-8669.15	965.25	6325.0	0.95	1.99	0.001046	0.0	-20.52	-20.15	-21.99	4.60	-50.34	0.183
		79	-15466.07	1921.53	13678.9	1.60	3.87	0.001241	0.0	-36.61	-61.70	-18.79	9.18	-101.10	0.273
		80	-20451.44	2401.80	17767.3	2.26	4.95	0.001259	0.0	-48.41	-83.76	1.29	11.51	-132.18	0.357
		81	-21138.18	2498.87	18275.0	2.37	5.36	0.001486	0.0	-50.03	-85.88	7.00	11.99	-136.20	0.368
		82	-19297.07	2133.48	15129.6	2.09	4.48	0.001444	0.0	-45.67	-68.71	19.19	10.23	-117.01	0.318
		83	-16469.98	1701.75	11323.8	1.71	3.71	0.001544	15.9	-45.15	29.86	-0.42	0.86	-75.01	0.253
		84	-15996.93	1637.80	10795.8	1.66	3.59	0.001534	15.9	-43.87	28.96	-0.43	0.84	-72.83	0.246
		85	-15493.77	1572.07	10255.5	1.60	3.47	0.001523	15.9	-42.51	28.05	-0.44	0.82	-70.56	0.238
		86	-6509.05	653.50	2616.4	0.74	1.74	0.001085	15.0	-18.50	-14.85	0.10	0.42	-33.34	0.112
		87	493.71	1273.33	5996.5	0.08	3.29	0.001684	15.0	0.26	-27.04	0.15	0.11	27.30	0.082
		88	551.83	1274.10	5908.6	0.08	3.33	0.001720	15.0	0.41	-27.36	0.06	0.10	27.77	0.084
		89	-2114.12	1059.18	4083.8	0.33	2.99	0.001733	15.0	-6.73	-25.12	-0.37	0.33	-31.85	0.100
		90	-6136.18	1248.39	6446.9	0.71	3.25	0.001811	15.0	-17.50	-27.05	-0.26	0.71	-44.54	0.145
		91	-6680.30	1285.53	6888.0	0.76	3.29	0.001802	15.0	-18.95	-27.24	-0.20	0.76	-46.20	0.151
147	PS2	66	-12536.55	1275.95	8341.9	1.31	2.59	0.000857	0.0	-29.67	-39.12	-4.10	6.10	-69.00	0.252
		67	-16496.25	1583.32	10244.9	1.72	3.40	0.001189	15.9	-45.22	27.24	-0.75	0.37	-72.47	0.328
		68	-16610.95	1582.19	10238.8	1.73	3.40	0.001188	15.9	-45.53	27.22	-0.79	0.37	-72.75	0.329
		69	-16622.23	1433.79	9365.0	1.73	2.99	0.001015	15.9	-45.56	23.94	-1.07	0.38	-69.52	0.316
		70	-16028.23	1241.03	8225.5	1.66	2.47	0.000806	15.9	-43.96	19.72	-1.16	0.40	-63.71	0.291
		71	-15880.09	1209.80	8037.8	1.64	2.39	0.000773	15.9	-43.55	19.04	-1.16	0.41	-62.63	0.287
		72	-15657.83	1168.36	7786.6	1.62	2.28	0.000731	15.9	-42.96	18.16	-1.15	0.41	-61.15	0.280
		73	-11638.87	486.06	3719.2	1.23	0.61	0.000374	3.7	-30.04	2.74	-10.23	2.23	-40.63	0.187
		74	-7231.86	420.93	934.7	0.81	1.29	0.000979	15.0	-20.43	-11.57	0.05	0.53	-32.00	0.145
		75	-6986.26	477.20	1416.9	0.79	1.40	0.001007	15.0	-19.77	-12.33	-0.01	0.51	-32.09	0.145
		76	-6984.27	758.04	4046.7	0.79	1.75	0.000981	15.0	-19.77	-14.59	-0.42	0.48	-34.36	0.154
		77	-8056.47	1008.64	6125.3	0.89	2.12	0.000924	15.9	-22.59	-17.08	-1.13	0.41	-39.70	0.178
		78	-8242.49	1028.03	6295.1	0.91	2.14	0.000914	15.9	-23.09	17.27	1.14	0.40	-40.39	0.181
		79	-12820.75	1712.94	10969.2	1.34	3.74	0.001343	0.0	-30.35	-51.65	-2.78	8.20	-82.07	0.222
		80	-19301.90	2077.92	13512.5	2.09	4.78	0.001743	15.9	-52.73	38.35	-0.56	0.48	-91.08	0.306
		81	-19986.93	2194.66	14073.0	2.19	5.24	0.001994	15.9	-54.56	42.09	-0.98	0.46	-96.66	0.324
		82	-19851.59	1993.64	12753.5	2.17	4.61	0.001741	15.9	-54.20	37.07	-1.00	0.42	-91.29	0.308
		83	-18907.94	1840.07	11863.3	2.03	4.12	0.001532	15.9	-51.68	33.13	-0.71	0.46	-84.82	0.287
		84	-18659.91	1806.79	11663.3	2.00	4.02	0.001492	15.9	-51.02	32.34	-0.67	0.47	-83.37	0.282
		85	-18393.76	1772.04	11451.4	1.96	3.92	0.001452	15.9	-50.31	31.53	-0.64	0.48	-81.84	0.277
		86	-11357.76	849.59	5176.5	1.20	1.84	0.000981	15.0	-31.50	-15.17	-0.19	0.64	-46.67	0.160
		87	-3793.74	1143.27	4397.1	0.49	3.27	0.001879	15.0	-11.22	-27.42	0.47	0.29	-38.65	0.123
		88	-3373.64	1180.62	4650.5	0.45	3.35	0.001907	15.0	-10.10	-28.07	0.43	0.27	-38.17	0.121
		89	-3487.12	1276.46	6249.1	0.46	3.31	0.001735	15.0	-10.40	-27.30	-0.05	0.41	-37.70	0.120
		90	-4974.75	1570.23	9147.2	0.60	3.66	0.001614	0.0	-11.77	40.72	14.20	7.47	-54.90	0.144
		91	-5288.20	1591.83	9381.0	0.63	3.68	0.001592	0.0	-12.52	41.94	14.05	7.58	-56.75	0.149

APPENDIX -9: Pile Head Load Summary

SACS V81 SELECTseries 4 (v5.7) KK ID=
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* * * S O I L M A X I M U M A X I A L C A P A C I T Y S U M M A R Y * * *

PILE JT	GRP	********* PILE ********* PILEHEAD O.D. CM	THK. CM	WEIGHT KN	PEN. M	*************** COMPRESSION *************** CAPACITY (INCL. WT) KN	MAX. LOAD KN	CRITICAL CONDITION LOAD KN	LOAD CASE	SAFETY FACTOR	*************** TENSION *************** CAPACITY (INCL. WT) KN	MAX. LOAD KN	CRITICAL CONDITION LOAD KN	LOAD CASE	SAFETY FACTOR	*MAXIMUM* UNITY CHECK	LOAD CASE
181	PS1	213.40	6.50	2922.5	100.5	-49766.7	-25033.5	-25033.5	87	1.99	53684.8	0.0	0.0	66	100.00	0.87	74
183	PS1	213.40	6.50	2922.5	100.5	-49766.7	-27014.8	-27014.8	88	1.84	53684.8	0.0	0.0	66	100.00	0.01	75
148	PS1	213.40	6.50	2922.5	100.5	-49766.7	-26400.5	-26400.5	88	1.89	53684.8	0.0	0.0	66	100.00	0.01	75
103	PS1	213.40	6.50	2922.5	100.5	-49766.7	-24375.1	-24375.1	84	2.04	53684.8	0.0	0.0	66	100.00	0.79	70
101	PS1	213.40	6.50	2922.5	100.5	-49766.7	-22307.2	-22307.2	85	2.23	53684.8	0.0	0.0	66	100.00	0.76	72
146	PS1	213.40	6.50	2922.5	100.5	-49766.7	-23370.0	-23370.0	83	2.13	53684.8	0.0	0.0	66	100.00	0.79	70
199	PS2	213.40	6.50	2638.1	93.5	-45474.1	-21292.2	-21292.2	91	2.14	48834.2	0.0	0.0	66	100.00	0.82	78
197	PS2	213.40	6.50	2638.1	93.5	-45474.1	-23139.1	-23139.1	90	1.97	48834.2	0.0	0.0	66	100.00	0.84	77
149	PS2	213.40	6.50	2638.1	93.5	-45474.1	-22187.7	-22187.7	90	2.05	48834.2	0.0	0.0	66	100.00	0.83	76
119	PS2	213.40	6.50	2638.1	93.5	-45474.1	-19170.1	-19170.1	80	2.37	48834.2	0.0	0.0	66	100.00	0.71	67
117	PS2	213.40	6.50	2638.1	93.5	-45474.1	-21138.2	-21138.2	81	2.15	48834.2	551.8	551.8	88	88.50	0.75	68
147	PS2	213.40	6.50	2638.1	93.5	-45474.1	-19986.9	-19986.9	81	2.28	48834.2	0.0	0.0	66	100.00	0.73	69