



PERSONALIZED ENGINEERING SOLUTIONS



LPG FSO PETROSTAR PETROCHINA MARINE TERMINAL (INDONESIA)

PIPELINE ENGINEERING CAPABILITY STATEMENT

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**ZEE ENGINEERING SDN BHD
ZEE ENGINEERING CONSULTANTS PTE LTD
PT ZEE ENGINEERING INDONESIA**

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CONTENTS

1.0	Introduction.....	4
1.1	Objective.....	4
2.0	Overall Organization.....	5
3.0	ZEE Product Portfolio.....	6
4.0	ZEE Scope of Service.....	7
4.1	General.....	7
4.2	Off-Shore Pipelines.....	8
4.3	On-Shore Pipelines.....	10
4.4	Flexible Pipelines.....	10
4.5	Transportation Studies.....	11
4.6	Mooring Design.....	11
5.0	Codes and Standard.....	12
6.0	Software.....	13
7.0	Significant Recently Completed Projects.....	14
8.0	Brief CV's of Personnel (Pipeline Engineering).....	16

1.0 INTRODUCTION

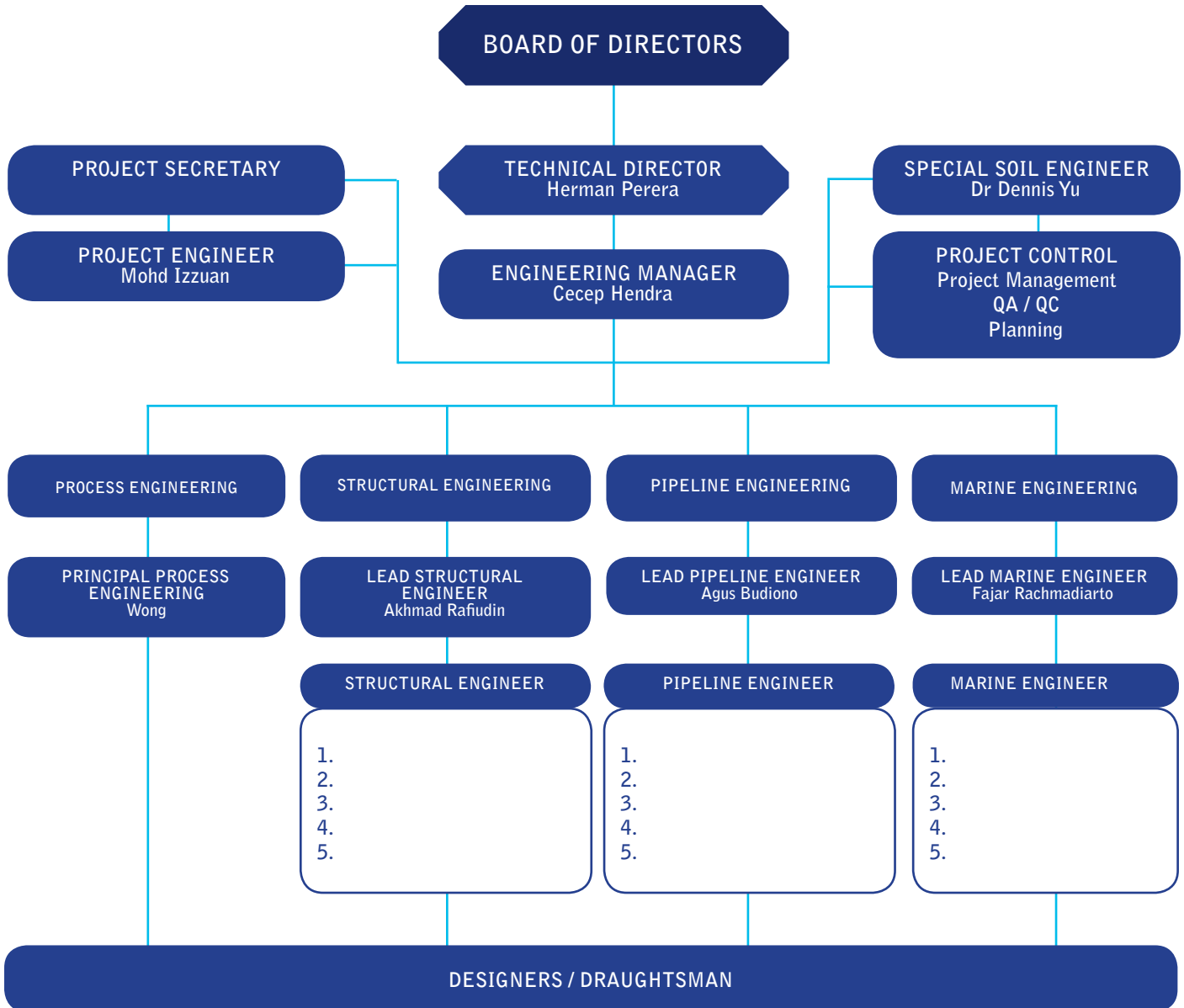
ZEE Engineering Consultants (ZEE) was established in 1986 to provide engineering consultancy services to the Oil/Gas industry in the South East Asia region. At the inception ZEE specialized in offshore transportation and installation (T&I) engineering, offering conceptual and detail engineering services to the contractors. The services offered included the engineering involved for the installation of jackets, top sides and pipelines.

Over the years ZEE has evolved to a multi-disciplinary engineering company engaged in conceptual studies, detail design and contract supervision of complete Oil/Gas related projects.

1.1 OBJECTIVE

The objective of this document is to demonstrate the capabilities of ZEE related to or Pipelines (Rigid, flexi, on-shore, off-shore) design, both in service and pre service. Up to date ZEE has successfully completed approximately 300 pipelines.

2.0 OVERALL ORGANIZATION (PIPELINE ENGINEERING)



3.0 ZEE PRODUCT PORTFOLIO

- » On-Shore Pipelines
- » Off-Shore Rigid Pipelines
- » Off-Shore Flexible Pipelines
- » Mooring Systems
- » Flow Analysis (Off-Shore / On-Shore)
- » Corrosion Control
- » Transportation & Installation (T&I)
- » Pipeline End Manifold

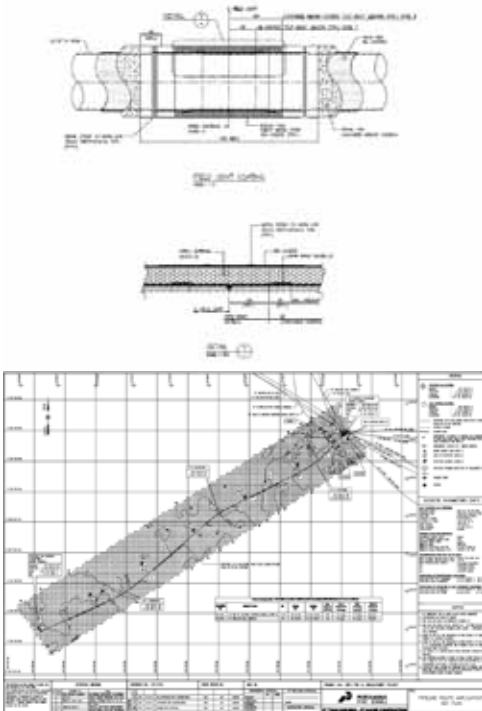
4.0 ZEE SCOPE OF SERVICE

4.1 General

- » Conceptual / FEED / Detail Engineering,
- » Hydraulic / Flow assurance / Line sizing,
- » Design Basis Definition,
- » Compiling specifications,
- » Compiling of Bid documents (RFQ),
- » Supervise field survey and data processing,
- » Compiling purchase specifications,
- » MTO,
- » Identification of long lead items,
- » Constructability Studies,
- » Cost Analysis,
- » Vendor selection,
- » Leasing with third parties for certification of new pipelines and re-certification of existing lines,
- » Rehabilitation and Repair,
- » Construction Management & Supervision.

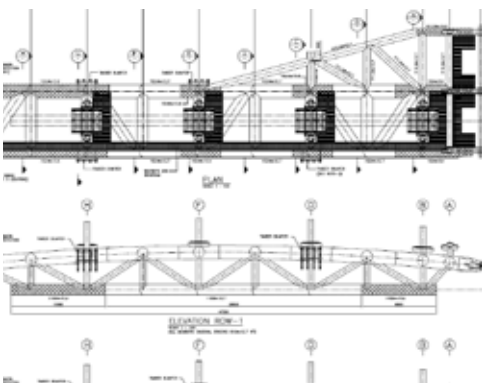
4.0 ZEE SCOPE OF SERVICE (continued)

4.2 Off-Shore Pipelines



IN-SERVICE DESIGN

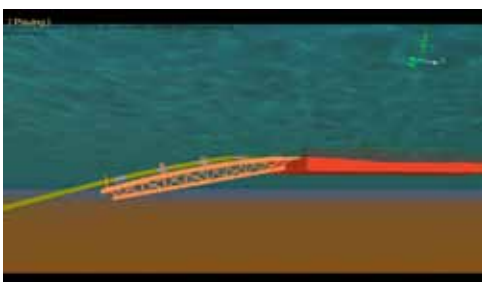
- » Develop route selection,
- » Perpetration of route drawings,
- » Design basis definition,
- » Wall thickness and material selection,
- » On-bottom stability calculations for swamp crossing,
- » Upheaval buckling assessment,
- » Crossing design (Road, Stream river),
- » Support design,
- » Riser design,
- » Expansion Calculation,
- » Corrosion Protection Design assessment.



PRE-SERVICE DESIGN

• Traditional DLB

- » DLB suitability studies,
- » Compiling of Anchor patterns,
- » Mooring studies for DLB stability and
- » Pipeline integrity under various sea conditions,
- » Barge modification for pipelay mode,
- » Stinger Design.



- **Pipelay Analysis Static, Dynamic & Time Domain**
 - » Lay Start Up and Lay Down studies for various methods,
 - » Pipelay analysis,
 - » Termination Analysis,
 - » Abandonment and retrieval,
 - » Wet and Dry buckle repair analysis
 - » Weld repair analysis,
 - » Design for Contingency

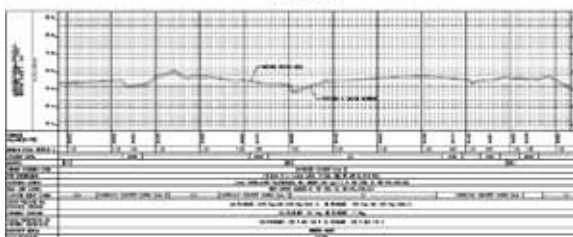


- **Floating Pipelines**
 - » Surface, on-bottom, off-bottom tow analysis
 - » Various installation techniques



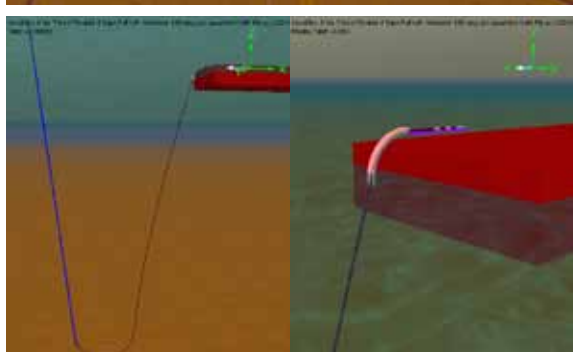
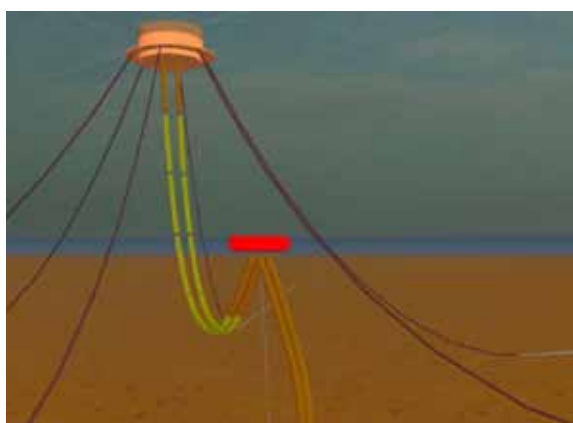
- **Method Statements & Supervision**
 - » Compiling method statements for various phases of pipeline installation
 - » Construction Supervision

4.0 ZEE SCOPE OF SERVICE (continued)



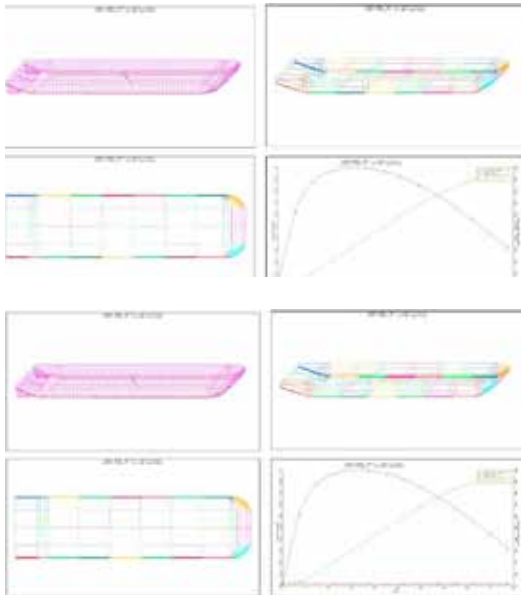
4.3 On-Shore Pipelines

- » Develop route selection,
- » Perpetration of route drawings,
- » Design basis definition,
- » Wall thickness and material selection,
- » On-bottom stability calculations for swamp crossing,
- » Upheaval buckling assessment,
- » Crossing design (Road, Stream river),
- » Support design,
- » Corrosion Protection Design assessment.



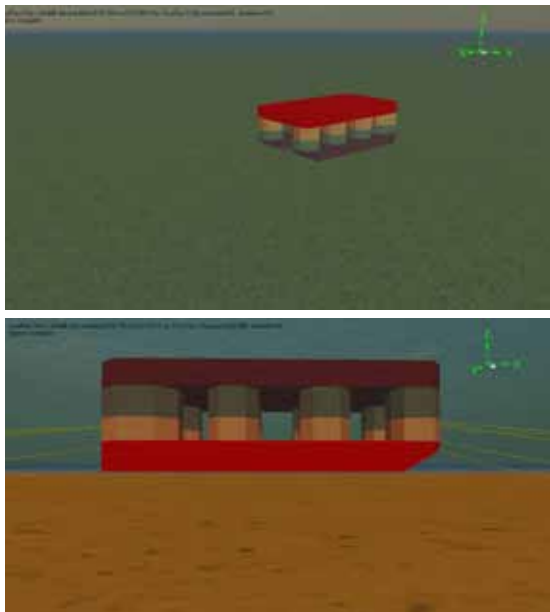
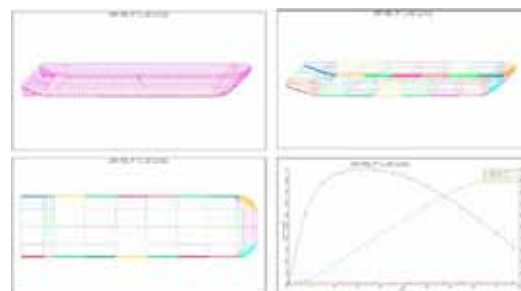
4.4 Flexible Pipelines

- » Under Buoy Hose (SPM),
- » Floating Hose,
- » Risers,
- » Dynamic time domain analysis,
- » Simulation & complete hose systems,
- » Fatigue assessment,
- » Installation Engineering,
- » "J" Tube Pull Analysis.



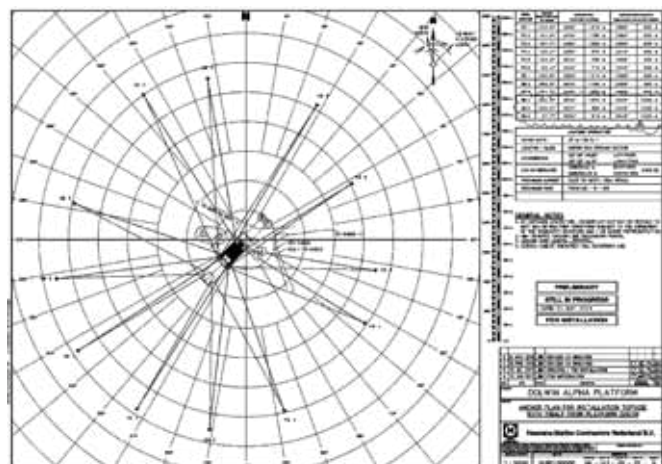
4.5 Transportation Studies

- » Sea fastening design
- » Stability (Intact / Damaged)



4.6 Mooring Design

- » Anchor pattern development
- » Mooring Design
- » Anchor Assessment



5.0 CODES AND STANDARD

Familiar with international codes such as

DnV-OS-F101	Submarine Pipeline System
DnV 1981	Rules for Submarine Pipeline Systems
DnV RP B401 (1993)	Cathodic Protection Design
DnV RP F103 (Oct 2003)	Cathodic Protection of Submarine pipelines by Galvanic Anodes
API 5L 2004	Specification for line pipe
API Std 1104	Standard for welding Pipelines and related facilities
API RP 5LW	Recommended Practice for Transportation of Line Pipe on barges and Marine vessels
ASME B31.4	Pipeline transportation systems for liquid hydrocarbons and other liquids
ASME B31.8	Gas transmission and distribution piping systems
API Spec 5L	Specification for Line pipe
API Spec 6D	Pipeline Valves (gate, Plugs, Ball, Check Valves)
API RP 2P	Recommended Practice for the Analysis of spread Mooring Systems for floating Drilling units
API RP110	Recommended Practice for Pressure Testing of Liquid Petroleum Pipelines
ISO 9001-2000	Quality Management Systems- requirements.

And other international codes such as BOSS, BS, etc.

6.0 SOFTWARE

ZEE has in-house, a wide range of software required for the design of submarine pipelines, which include the following:



ORCAFLEX

Dynamic coupled time domain analysis of floating and moored systems including detail pipelay analysis



OFFPIPE

Static and Dynamic analysis of Pipelay

AutoPIPE



AutoPIPE

Piping analysis software in small to high-end piping projects



PIPE

ZEE In-house Suite of programs for the in-service design of pipeline for DnV 1981 and DnV-OS-F101



MOSES

Naval Architect Software for Vessel/Barge Motion, RAO Generation, Hydrostatic, Stability Analysis, etc



SACS

Structural Analysis static and dynamic



Aspen HYSYS

HYSYS

Process design (flow design).

7.0 SIGNIFICANT RECENTLY COMPLETED PROJECTS

Heera Redevelopment Project (India)

» **Operator ONGC, EPCC Contractor Punj Lloyd**

Design of 4 new Well Head Platforms and modifications to 8 existing platforms. The project included infield 8 no rigid pipelines and 3 no flexible lines. The scope included the detail and installation engineering. Also included the stinger modification to DLB Ganesh.

Betara Complex Development (Indonesia)

» **Operator PetroChina International, EPCC Contractor Sembcorp (Singapore)**

Design of 2 offshore loading terminals for condensate and gas. The project included 3 pipelines (6", 9" & 12") shore to loading facilities. The scope included detail and installation engineering.

Colombo Port Expansion Project (Sri Lanka)

» **Operator Colombo Port Commission, EPCC Contractor Leighton**

The project involved the installation of SPM and import 36" line from SPM to shore. The scope included installation engineering and supervision.

Labuan Water Pipeline Project (Malaysia)

» **Operator Labuan water authority, EPCC Contractor Leighton**

The project involved the installation of 36" pipeline to transport water from the mainland to the Labuan Island. The scope included installation engineering and supervision.

KLO Pipeline Replacement (Indonesia)

» **Operator Chevron Indonesia, EPCC Contractor Dwisatu Mustika Bumi**

The project involved the replacement various segment of corroded infield pipelines form 4" to 12". Scope included detail design and Installation engineering.

Pipeline from BPCR to BPCL Uran (India)

» **Operator M/s Bharat Petroleum Corporation, EPCC Contractor Punj Lloyd**

The project involved the installation of 10" pipeline with 2 shore approaches and a sector in shallow water subjected to heavy currents. Scope included detail and Installation engineering.

Tanzania SPM Replacement (Tanzania)

» **Operator Tanzania & Zambian Government, EPCC Contractor Leighton**

The project involved the installation of SPM and 2 lines 28" & 24" from SPM to shore with over 2 km of shore approach. Scope included the installation engineering including conceptual shore pull design.

7.0 SIGNIFICANT RECENTLY COMPLETED PROJECTS (continued)

Rerouting of 18km of pipeline (Indonesia)

» **Operator PT Pertamina Hulu Energy West Madura Offshore**

The 24" pipeline had to be rerouted to be away from the shipping line. The scope included, Concept development and FEED.

KE Field Development (Indonesia)

» **Operator PT Pertamina Hulu Energy West Madura Offshore**

The project included the FEED study for 4 new Well Head Platforms and modifications to the Process Platform and the related pipelines.

UL Field Development (Indonesia)

» **Operator PT Pertamina Hulu Energy West Madura Offshore**

The Project included FEED study.

Filanovsky Field Development (Russia)

» **EPCC Contractor Bumi Armada (Malaysia)**

The project included the installation of 8 pipelines from 12" to 20" in very shallow waters. Scope Installation Engineering.

A.P.H. Offloading Facilities (Malaysia)

» **Operator Asian Petroleum Hub, EPCC Contractor Kencana KL**

The project involved the installation of an SPM and offloading lines 2 nos 48" from SPM to shore. Scope included Conceptual and FEED.

7.0 BRIEF CV'S OF PERSONNEL (PIPELINE ENGINEERING)

HERMAN PERERA

» **CEng M.I Structure E. Chartered Structural Engineer (U.K), Senior Engineering Consultant and Technical Director ZEE Engineering**

25 years experience in Design, Project Management and Construction. Including 20 years in offshore structures. Experience includes detail design and engineering, computer simulation, design verification, fabrication engineering and Recertification Engineering.

CECEP HENDRA

» **MSc Civil, Engineering Manager**

12 years experience in Structural, Pipeline and Marine Engineering covering range of activities in the Offshore and Onshore Oil & Gas industry, and general Civil, Structural Engineering. Experience also includes the design of Floating Structures, Umbilicals and Flexi Lines.

DENNIS YAO YU

» **Ph.D. Soil Specialist, Geotechnical and Foundation Engineering**

29 years experience in Consultancy and engineering design for onshore and offshore foundations and geotechnical issues including e.g. earth stability, building settlement, retaining wall, excavation, tunnelling, railway tracks, soil structure interaction, suction piles, gravity bases, drag anchors and bored/driven piles.

WONG LOONG CHING

» **MEng Chemical & Process, Chartered Engineer (U.K), Lead Process Engineer**

Over the last 13 years, has been exposed to all aspect of process and safety engineering. He has been significantly involved in process design/simulation and safety. Wong has also been involve in various stages of work from project feasibility studies, conceptual /basic engineering, detailed design, pre-commissioning and commissioning including flow assurance.

AGUS BODIONO

» **BEng Naval Architecture & Shipbuilding, Lead Pipeline/Marine Engineer**

10 years experience as a Pipeline and Marine Engineer in the Oil and Gas Industry. Attended extensive training courses in Jakarta and Kuala Lumpur on theoretical and computer simulation of submarine pipelines and mooring systems.

MOHD IZZUAN B. ZAHARUDIN

» **CEng, Project Engineer**

5 years experience in Civil, Structural, Pipeline and Marine Engineering covering range of activities in the Offshore and Onshore Oil & Gas industry. Other experiences include Project Management, Proposal Preparation (Technical & Commercial), Client Communication and Engineering Team Coordination and Trouble Shooting.

7.0 BRIEF CV'S OF PERSONNEL (CONTINUED)

AKHMAD RAFIUDIN

» **CEng, Structural Engineer**

6 years experience in Structure, Pipeline and Marine Engineering. He also has a wide range of knowledge in structural analysis software's and design and has completed many projects for Zee in structure analysis.

FAJAR RACHMADIARTO

» **BEng Ocean Engineering, Lead Naval Architect/Marine Engineer**

6 years experience in Naval Architecture and Marine Engineering, with vast experience in design of Floating structures, Umbilicals and Flexi lines, also experience in Pipeline and Mooring Design.

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