

# COMPOSITE REPAIR SPECIALIST



- **TYPE OF DEFECT :** Dent damage in subsea environment
- **PIPE DETAILS :** 18" OD – design temp. 60°C – design pressure 138 barg
- **LOCATION :** VIET-NAM, Ca Mau
- **3X PRODUCT :** REINFORCEKIT 4D SUBSEA (R4D-S)

## OVERVIEW

The objective of the repair performed in June/July 2016 by 3X ENGINEERING (3X) and its local distributor PETROENERTECH was to **reinforce a damaged subsea pipe section over 1.5 meter length, due to dent defect situated at 48-meter depth (3.8 % dented depth).**

## SCOPE OF WORK

- Finite Elements Analysis (FEA) simulation has been performed by 3X to determine the number of layers necessary to perform the reinforcement → 60 composite layers of **REINFORCEKIT 4D SUBSEA (R4D-S)** product have to be implemented.

- Underwater, several preliminary operations have been performed (identification of the defected area, removal of concrete and existing concrete). Then surface preparation by sandblasting has been done by divers to get a good surface roughness (60-micron surface profile).

- 3X wrapping reinforcement has been performed following several stages :

**1/** Primer (P3X32) application on the whole defect to provide a good adhesion of the filler.

**2/** A rigid composite plate coated with F3XSS filler to rebuild the pipe shape has been positioned over the dent and strongly fixed with ratchet belts during few hours.

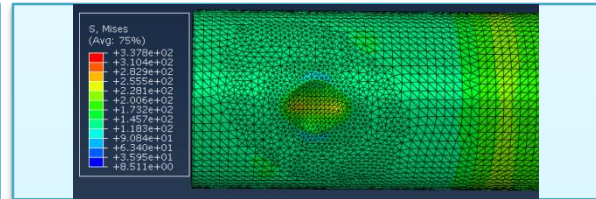
**3/** Second P3X32 application performed on the whole pipe surface to be repaired before wrapping.

**4/** Kevlar® tape pre-impregnated with R3X1050-S resin (using special 3X device called BOBIPREG) wrapped around the pipe. Sixty layers of composite materials were applied over the dent (i.e. 30 passes of 50% overlap).

- Finally, various measurements (total length of the repair, repair circumference and hardness measurements) have been made to make sure the repair was done following requirements.

## RESULTS

The 18" gas sea line was successfully completed within 4 days. The total length of the repair was 1.53m. This project was a big challenge because of the 48-meter depth and the huge number of layers of composite to be applied. Thanks to our experience in subsea repairs added to the efficient collaboration between PETROENERTECH, client representatives and PVMTC divers, this subsea repair was a big success.



Design of the repair by FEA (stress distribution after repair)



Pipe before surface preparation



Sandblasting in progress



Primer & composite plate with filler application (steps 1 & 2)



Composite plate application & second primer application (steps 2 & 3)



Tape impregnation using BOBIPREG & R4D-S wrapping (step 4)



Repair overview & measurements

