

# COMPOSITE REPAIR SPECIALIST



- **TYPE OF DEFECT :** Dent defect in subsea environment
- **PIPE DETAILS :** 24" OD – operating temp. 30°C – max. op. pressure 500 psi
- **LOCATION :** COLOMBIA, Cartagena
- **CLIENT :** ECOPETROL
- **3X PRODUCT :** REINFORCEKIT 4D SUBSEA (R4D-S)

## OVERVIEW

The objective of the repair performed in February 2016 by 3X ENGINEERING and its local distributor CPS was to **reinforce a damaged subsea pipe section over 1.6 meter length, due to dent defect situated at 4 meter depth (7.4 % dented depth).**

## SCOPE OF WORK

- After Finite Elements Analysis (FEA), 10 composite layers of **REINFORCEKIT 4D SUBSEA (R4D-S)** product have been determined to perform the reinforcement.

- Underwater, several preliminary operations (surface cleaning to get a suitable free span, removal of concrete and existing coating, marking of the surface to be wrapped) have been performed before the essential step of surface preparation (sandblasting) 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 defect, using a dispensing gun, to provide a good adhesion of the composite materials.

**2/** Two rigid composite plates recovered with F3XSS filler positioned over the dent and strongly fixed with ratchet belts during curing time of 2.5 hours.

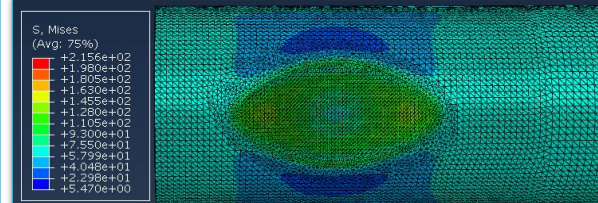
**3/** Second P3X32 application performed on the whole pipe surface to be repaired before wrapping.

**4/** Kevlar® tape pre-impregnated with R3X1050-S resin (using special 3X device called BOBIPREG) wrapped around the pipe. Ten layers were necessary to cover the dent (i.e. about 5 passes of 50% overlap).

- Finally, a neoprene soft cover has been applied to protect the repair from shells and other sea elements.

## RESULTS

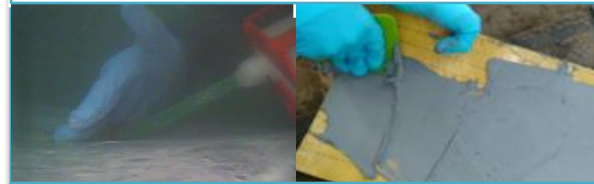
After several subsea repairs conducted recently in Viet-Nam, 3X ENGINEERING confirms its know-how in pipeline maintenance in underwater environment. A special thanks to ECOPETROL representatives and CPS team for their precious help to complete this project successfully within one day and in the best conditions.



Design of the repair by Finite Element Analysis



Surface preparation / Sandblasting



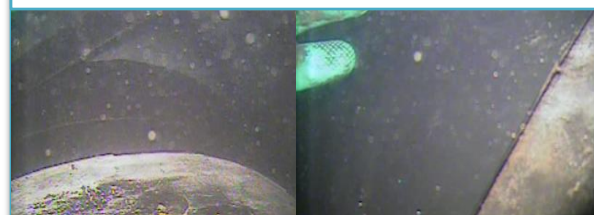
Primer & composite plates with filler applications (steps 1 & 2)



Composite plates fixing & second primer application (steps 2 & 3)



BOBIPREG (3X pre-preg machine)  
Kevlar® tape with 3X resin impregnation



R4D-S wrapping (step 4) & protective cover installation