



## Vortrag

Freitag, 06. Oktober 2023, 11:40 Uhr

### Chira Flusskreuzung, Peru: Rekordverdächtiges HDD-Projekt

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## Lecture

Friday, 06<sup>th</sup> October 2023, 11:40 am

### Chira River Crossing, Peru: Record-setting HDD project

Speakers: Carsten Brueckner, Maxime Aera

Company: BM Drilling, OPTIMUM

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# Vorträge

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## Lectures

Friday, 6<sup>th</sup> October 2021, 11:40 am

The logo for OPTIMUM, consisting of the word "OPTIMUM" in white, uppercase, sans-serif font on a dark blue rectangular background.

The Chira River crossing project, comprising 2 x 2000m HDD crossings under the vast river delta in the north of Peru, is the longest HDD ever completed in the country. The gas pipeline installation forms part of the country's energy transition policy, but was subject to various constraints, both environmental and technical.

OPTIMUM flew a trenchless specialist to Peru to see the site context and constraints first hand and to supervise the ground surveys. Engineers then monitored the ground investigations, formulated the working protocols, determined the geotechnical / geological base model and developed a drilling profile. Given the jobsite environment and the potential for surface breakouts, specific modelling and hydrofracture analysis was also conducted to mitigate against potential risks and ensure smooth drilling operations.

The HDD parameters and equipment were validated, and specific drilling recommendations established, given the project and site specifications.

BM Drilling supervised all the HDD works onsite, providing personnel, expertise, as well as a drilling fluid and guidance service. Working in close collaboration with Conveca Peru, the specific challenges relating to the length of the crossings, the soft soil conditions and the COVID related restrictions in place at the time were all overcome to finish the project ahead of schedule.

### Project summary:

- Project: Gasoducto GASNORP – Chira River crossing
- Drilling contractor: Conveca Peru SAC
- Drilling supervisor, personnel and onsite support: BM Drilling
- Feasibility studies, design engineering and hydrofracture analysis: OPTIMUM
- Total HDD length: 4000 m (2 x 2000 metres: 1 x 6" HDPE and 1 x 10" steel pipe)
- Pilot hole diameter: 12-1/4 9" (311 mm)
- Reaming diameter for 10" pipeline: 18"
- Rig: Herrenknecht HK300T, upgraded to 120-kNm torque
- Geology: Sand, Clay

Maxime AERA (OPTIMUM), Carsten Brueckner (BM Drilling)



Drilling Contractors Association (DCA-Europe)

# Chira River Crossing

## Record-setting HDD project in Peru

Maxime AERA (OPTIMUM)

Carsten BRUECKNER (BM Drilling)

OPTIMUM



# At a glance

- Within the framework of Peru's energy transition policy
- Installation of a natural gas pipeline
- Under the vast Chira River delta in northern Peru
- Limited access / infrastructure
- Key players
  - Project owner : GASNORP
  - Drilling contractor : Conveca Peru SAC
  - Rig manufacturer : Herrenknecht
  - Geotechnical analysis and HDD engineering : OPTIMUM
  - HDD onsite supervision, guidance and fluid service : BM Drilling

# Project constraints

- Environment
  - Hydrology and hydrogeology of the Chira River delta
  - Proximity of the Pacific Ocean and its ecosystem
  - Soft soil conditions inherent to the job site
- Pipeline construction
  - 4000m HDD (2 x 2000m)
  - No breakouts !
  - No intersect !



Energy transition, yes, but not at any cost !

# Project context



Location



Existing pipeline

# New pipeline construction

## Why HDD ?

- To limit the environmental impact of the pipeline

## Why OPTIMUM & BM Drilling ?

- CONVECA's bid needed specialists whose analysis, engineering and execution could make the difference
  - Expertise, legitimacy, process

# New pipeline construction



Entry point



Exit point



# Analysis and design engineering

- Site visit to see conditions and soil investigations first-hand
- Conceptual study (G1 PGC)
  - Analysis of existing project, geological and bibliographic data
  - Definition and supervision of additional soil investigations
  - Definition of the general construction guidelines



Geotechnical / geological base model

# Analysis and design engineering

- Detailed feasibility study (G2 PRO)
  - Definition of a soil model :
    - Sand with clay layers (swelling and clogging)
    - Monogranular sands with potential liquefaction
    - Clay formations underneath to be avoided
  - Hydrofracture analysis :
    - Risk of ground distortion from 1250m
    - Risk of breakouts from 1850m
  - Formulation of protocols and modus operandi :
    - Geotechnical risk mitigation : Hydrofracture and soft ground conditions

# Analysis and design engineering

- Design of the crossing profile :
  - Limit hydrofracture risk, ensure a secure and stable drill path
  - Total HDD length: 4000 m (2 x 2000m : 1 x 6" HDPE SDR9 and 1 x 10" steel pipe)
- Validation of HDD parameters and equipment :
  - Rig: Herrenknecht HK300T, upgraded to 120-kNm torque
  - Pilot hole diameter: 12-1/4 9" (311 mm)
  - Pilot hole tooling: Milled tooth tricone bit on jetting BHA, IDS 16-in. Titan casing
  - Reaming diameter for 10" pipeline: 18"
  - Reaming tooling: IDS-hybrid reamer
  - Guidance: Paratrack 2 + Pressure module
  - Fluid: MI-Swaco, AMC

# Analysis and design engineering

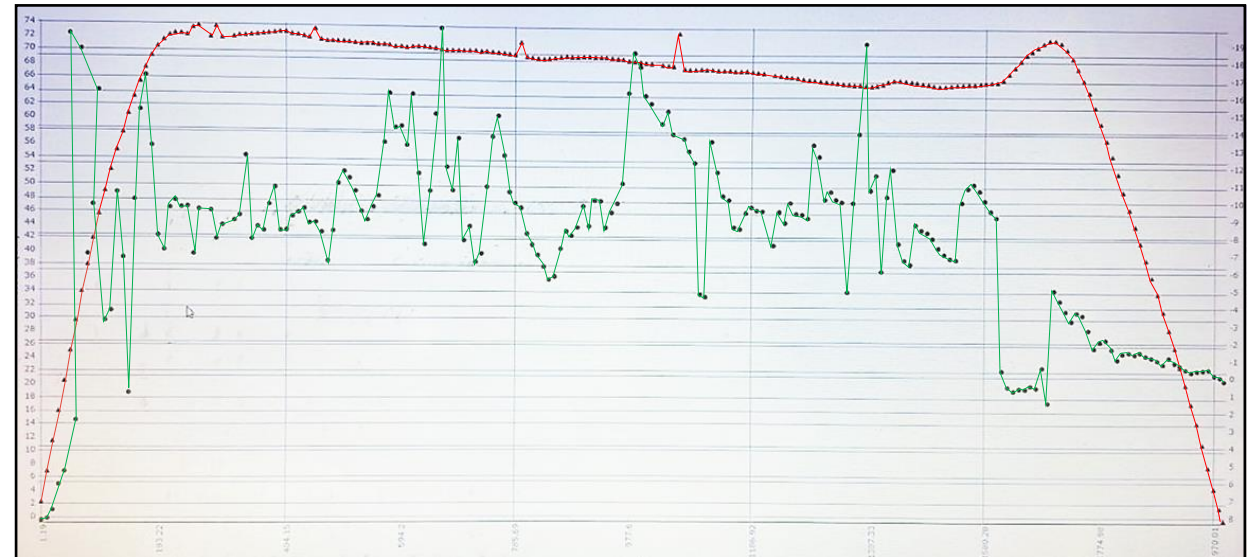
- Specific drilling recommendations
  - Constant monitoring of downhole pressure
  - Use of a lightweight downhole assembly
  - Installation of a steel casing at entry point
  - Use of a hybrid drill string
  - Use of weeper subs with horizontally directed nozzles

# Works phase



# Works phase - Downhole pressure

- Soft ground conditions > poorer ground stability > high breakout risk
- Solution ?
  - Constant monitoring of downhole pressure
  - Hydrofracture calculations prior to drilling works
    - Permissible downhole pressure calculated for each drill pipe
  - Downhole pressure module placed in the downhole assembly
  - Constant monitoring of bore hole stability and comparison with calculated permissible levels



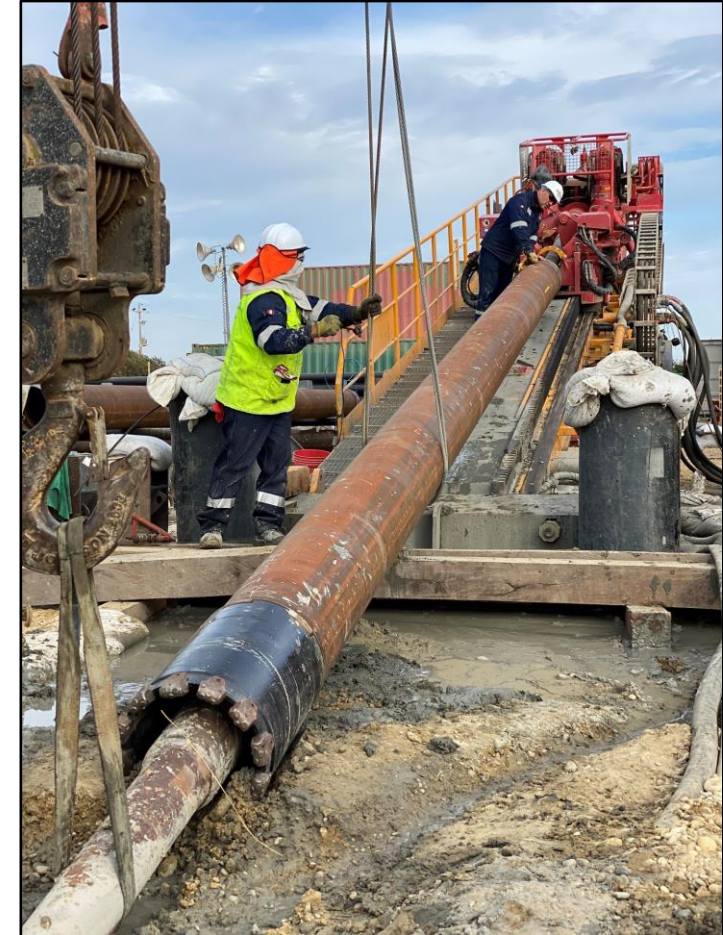
# Works phase - Lightweight downhole assembly

- Soft ground conditions > risk of drill bit sinking
- Solution ?
  - Use of a modified and lightweight downhole assembly
  - Outer diameter partially reduced from 8" to 6"



# Works phase - Casing installation

- Long length and soft ground conditions  
> breakout risk, pipe twist
- Solution ?
  - Installation of 16" Titan HDD casing (IDS)
  - Quick coupling system reduced assembly time of the casing pipes to approx. 5 minutes per joint
  - Even first time HDD riggers successfully ran the casing





# Works phase - Hybrid drill string

- Long crossing length > high push forces > risk of buckled drill string
- Solution ?
  - Diameter of the last 50 drill pipes was increased from 6<sup>5</sup>/<sub>8</sub>" to 7<sup>5</sup>/<sub>8</sub>"
  - Stiffen the section of the string where risk of buckling and bending is higher



# Works phase - Weeper subs

- Long crossing length > more difficult to clean the borehole
- Solution ?
  - Installation of weeper subs with horizontal jet alignment in the drill string
  - TC jet nozzles accelerated returns flow and improved borehole clean



# Conclusion

- Completion of the longest HDD ever drilled in Peru
- Completion six days ahead of the schedule
- No breakouts, environment preserved
  
- Keys to success ?
  - Excellent preparation and planning
  - Risk mitigation protocols were all implemented
  - Teamwork and crew commitment

# Mission complete !



# Questions / Discussion





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