



Using Direct Pipe for Landfall crossings reduces high risks on HSE, critical path and environmental issues significantly:

Landfalls has always been high risks in pipeline projects. Landfall activities sit on the critical path for the offshore pipeline construction, as well as the multiple stakeholders that give multiple interfaces, can be difficult to manage. The traditional Open Cut cofferdam shore crossing are more and more criticised and not accepted anymore because of environmental disturbance. New developments in the Direct Pipe technique gives an excellent alternative for the traditional Cofferdam and HDD solutions and reduces the interfaces and critical path risks, as well as environmental disturbance. With the limited footprint of the Direct Pipe technique it is been possible to reduce the carbon footprint by more than 50% as well.

Landfall Direct Pipe Drilling is, after two successful operations in Israel, a proven technique, usable all over the world: the two Israel operations are described in more detail in the section below. In summary this technique achieved:

- An environmentally friendly solution to a challenging pipeline construction project
- An identifiable step forward in technology/ construction process for Landfall Direct Pipe drilling
- Outstanding results on safety and environmental protection on an environmentally protected beach
- Never undertaken before solutions that were put in place to overcome difficulties found during the pipe-line construction
- Successful implementation of a new method in the way that pipelines are installed on Landfalls
- Positive feedback from the client and other important stakeholder in Israel
- Additional safety benefits in the reduction of high-risk diving activities



Israel: Respect mother nature, minimal impact on environment and increased safety

INTRODUCTION

Landfall trenchless Direct Pipe drilling had never done before at time of study and feasibility study. Until this project, Trenchless Direct Pipe was only done onshore, and innovations needed to be done to disconnect the Drilling Head offshore. In 2015 A.Hak received an invitation from Allseas for early involvement in their Project Leviathan gasfield development together with Noble Energy from Houston. A.Hak introduced Trenchless Direct Pipe, as there was no technology available to meet the environmental permitting criteria.

The shore of Israel near Dor, between Haifa and Tel Aviv, is the breeding ground for beautiful turtles that lay their eggs in the sand on the beach. As a result this area is an environmentally protected zone that does not allow any form of disturbance at the beach or near the shoreline. HDD's with near shore activities with jack up platforms and vessel transport movements, as well as Cofferdam

Open Cut shore approached were not allowed. However, a technically robust solution had to be developed to bring the 30" Concrete Weight Coated gas pipeline, including a 6" condensate pipeline, to the onshore facility.

Direct Pipe drilling would be the best solution, to limit disturbance for the animals and their habitat. This would be the second direct drilling (year 2019) from onshore to offshore that A.Hak had undertaken in Israel delivering 1110m of direct pipeline on the Leviathan project (year 2018), just 60m away from the new pipeline. This gave us the confidence that this Direct Pipe drilling would be achievable, and also valuable insight into the soil conditions and the speed of the of the drilling i.e. which sections would be faster and which would be slower depending on the ground conditions in particular sections along the pipeline route.

Having all this knowledge from a previous project in such close proximity helped us to create a robust time schedule and also manage any environmental risks, which ultimately provided a better value for money proposal for TechnipFMC.



CHALLENGES

1. One of the most important safety requirements that was needed was a pipe entry procedure, for inspection purposes of the TBM. This inspection was likely to be needed over the full length of the 1100m. of pipeline. A.Hak employees were trained to the highest level in confined space working and held internationally recognised certificates, with Allseas and TechnipFMC being totally satisfied on the certification held for this high-risk task.
2. A.Hak had the challenge of achieving outstanding environmental protection of the turtles and their habitat during the breeding season, along with keeping the beach open to the public during project execution for local people to spend their free time and holidays there

SOLUTIONS

1. The largest diameter (56") pipeline and TBM was designed to select the most powerful electrical motor into the TBM (285KNm) and therefore much more margin to deal with adverse geology. Due to this adverse geology, A.Hak installed all mixground cuttingwheel, which was suitable to handle this.

Usually the construction of a landfall requires many hours of diving, to disconnect the TBM after 'punch out'. Diving is per definition an unpredictable and hazardous activity, and as an employer A.Hak were focused on reducing risks for its personnel and subcontractors.

Main goal to achieve and the biggest challenge in the using the Direct Pipe for Landfall drillings was the fast and flawless disconnect of the TBM-drilling machine. Disconnecting a welded drilling machine and the pipe would be a too long diving operation when this traditionally should be done by a thermal lance. A.Hak and Herrenknecht developed a special offshore flange which was possible to disconnect by cutting hydraulically only 8 major bolts. This could be done with an umbilical hydraulic cutter within one hour of diving.

By limiting the diving operations to only the recovery of the TBM, and by making the disconnecting of the TBM as simple as possible A.Hak managed to reduce the diving scope to just 15% of what

would have been necessary in the original plan.

This development reduced the diving risks dramatically.

2. The technical solution also supported the achievement of the environmental protection and safety of the public accessing the beach as since it created a much safer working environment, which was proven successful by the fantastic health and safety records that showed zero environmental incidents throughout the project, leaving behind a clean and undisturbed environment where the turtles continued to thrive.

The successful delivery of this technical solution presents a major and very important step forward for landfall trenchless Direct Pipe drilling.

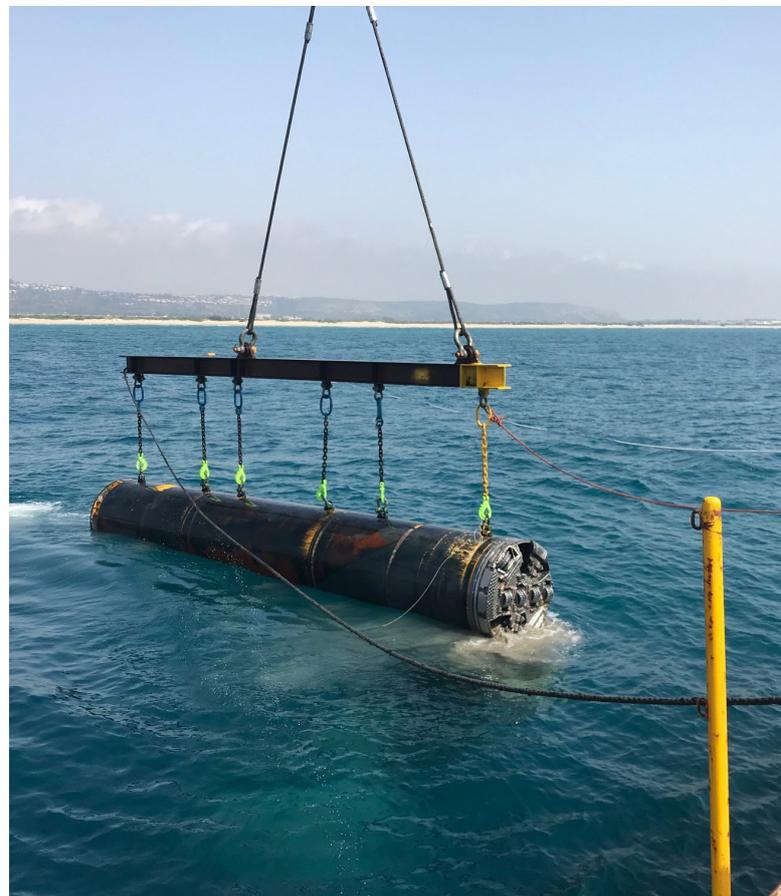
CONCLUSION

Before A.Hak's first project with Allseas there had never been a landfall trenchless Direct Pipe drilling, only in study or feasibility study. After this success A.Hak was appointed for the Karish project to protect the environment and to deliver work safely on the landfall connection. Trenchless Direct Pipe was only undertaken onshore, and innovations needed to be applied to disconnect the Drilling Head offshore.

This technique melts away the interface risks between offshore pipelay contractor and the Landfall operation. No blow out of drilling bentonite in the near shore habitat of the sea life. So we could ensure the protection of the turtles during breeding season and the natural habitat of the turtles. It also increased the safety of our employees as the innovative solution as described reduces the offshore diving activities with 80%, which are deemed high risk activities.

At the start of A.Hak's first involvement in 2015 with the Allseas project there were only studies and feasibility studies done on Trenchless Direct Pipe. There was no technology available to meet the environmental criteria. Therefore, Trenchless Direct Pipe was only undertaken for onshore jobs. The most innovative part of our technical solution is how to disconnect the Drilling Head offshore. The flange connection, which was easily disconnected, reduces the offshore diving activities.

The client continues to be very positive about the innovation A.Hak used on the Karish project. A.Hak received positive feedback from Israeli state owned NIGL, as well as investors Noble Energy Houston, Energean Greece. The positive feedback received from EPC contractors Allseas and TechnipFMC concluded that the project was also delivered: incident free, according schedule and in budget.





29th May 2020

A.Hak
T.a.v. Mr. W. Koop
Postbus 151
4190 CD Geldermalsen

Technip UK Ltd. Reference: 001-2020

Subject : **Project Reference Letter**
Project : **Karish Gas Development Project, Israel**

Dear Mr. Koop,

At time of writing, I hereby declare that all the work carried out by A.Hak for the project "Karish Gas Development Project, Israel" was carried out to our satisfaction.

Contract type: Design & Construct

The project included a Direct Pipe Landfall design solution of a 56inch steel pipe with a length of 1100m. The drilling crossed the following scenery: the shore of Israel near Dor, between Haifa and Tel Aviv, environmentally protected zone.

Methodology: Direct Pipe (Micro Tunnel)
Medium: Natural Gas
Pipe length: 1100 meters
Pipe diameter: 56 Inch
Pipe Material: Steel
Design pressure: n.a.

The project also included:

- Welding, NDT, civil works
- Early Contractor Involvement, stakeholder management, environmental protection, site security

The project was executed in the period from July 2018 to July 2019.

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Yours Sincerely,



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Project Manager

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CERTIFICATE OF PROFESSIONAL COMPETENCE

The undersigned,

Name: J.A.M. van Beek
Function (position): Project manager
Telephone/e-mail: _____
Company: Allseas Pipeline Contractors S.A.
Address: Route de Pra Plan 18, Chatel-Saint-Denis, Switzerland

Declares that A. Hak Drillcon B.V., Engelseweg 159 Helmond has performed the

project: Leviathan Development Project "Direct Pipe installation"
Engineering, Civil works, Welding, NDT, Direct Pipe Drilling

The work consisted of, or part of the work had been:

- Performing one or more Directional Drillings,
- Performing one or more Direct Pipe Drillings,
- Performing parts or complete engineering,

Where these functions were fulfilled by the specified persons:

Project manager: Maarten de Visser
Drilling Lead Raymond Bos
Site Manager: Armando van Dijk
Superintendent Mario Herpe
QHSE Nick Jaspers / Johannes Berends
Welding Supervisor Farid Reicher

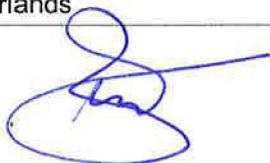
Time of performance: 15-06-2017 till 15-06-2018
Time of drilling 18-02-2018 till 23-04-2018

The project has been carried out satisfactorily in accordance with all requirements and conditions of the specifications, by skilled, experienced personnel.

Delft, Netherlands

(Place)

(Signature)



(Date)

10/01/2019

