

DELFT UNIVERSITY OF TECHNOLOGY

ANALYSIS AND MODELLING OF ALIGNMENT ACCURACY IN HORIZONTAL DIRECTIONAL DRILLING
OPERATIONS

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Instructions and Motivation for Data Acquisition

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Introduction

General Motivation Throughout the years the process of moving infrastructure into the subsurface has become more costly due to the fact that progressively more of the underground space is being occupied by new installations. As the underground domain is step by step becoming more filled, there is room for new developments in order to accommodate for future needs. As such, one of possible solutions to the general problem would be to boost the accuracy of already existing navigational systems or be able to better predict the inaccuracies in borehole alignment based on certain soil or pipe parameters. In order to assess the influence of aforementioned parameters on the deviations in borehole alignment, the last phase of the HDD process will be analysed, namely, the pullback phase. Based on data from previously conducted HDD projects, uncovering potential relations between certain parameters and the borehole alignment accuracy might result in minimising the risk of damaging already existing subsurface infrastructure in place, which is a pivotal issue. Through damage to the surrounding installations the the timeline, costs and disturbances in the vicinity of conducted projects increase.

Main Research Questions

Can HDD accuracy be improved?

- (a) How does recorded borehole alignment influence the pipeline pullback force?
- (b) How can the borehole alignment accuracy be assessed based on pipeline pullback force models?
- (c) Which soil and pipe parameters impact the HDD accuracy through the pullback force, which parameters are most influential?
- (d) How much influence do the navigational devices entail?
- (e) Can the HDD procedure be adjusted with regard to the most influential parameters?

Instructions In order to find potential answers to the questions mentioned beforehand, data has to be analysed and certain numerical models have to be created. For that reason it would be very beneficial if contacted contractors could follow guidelines and instructions specified in this document. For privacy reasons, it would be best to omit including contractor names along with installation locations. In general it is not my intention to disclose any private information in my thesis as it should be considered as academic research focusing on analysing the received data and drawing conclusions based on observation of the outcomes. In case any confidential pieces of information are disclosed, I am ready to sign a non-disclosure agreement upon request, such measures should provide sufficient confidence in data security.

1 Instructions on naming and formatting of PDF files (e.g. appendices to the geotechnical report)

1. All drawings, along with appendices to the geotechnical report like, CPT (cone penetration test data), SPT (standard penetration test data), along with subsurface geological interpretations (if available) should be attached to an email as PDF files and sent to email address **a.lisowski@student.tudelft.nl** .
2. Names of the PDF files should correspond with worksheet names in the excel file, e.g. if the name of the worksheet with current installation is "Installation_02", the names of PDF appendices to the email providing additional data for that particular installation should be named "Installation_02.**file_type**", where **file_type** should be chosen based on what kind of information is provided within the file, it could be SPT, CPT, geological interpretation data (GI) or additional drawings (DRAW).
3. Any additional PDF files with pieces of information concerning installations are very welcome, the naming scheme for such files remains the same as mentioned previously, however if the name of the file would prove too long, for convenience it can be just named as "Installation_02.**other**".

2 Instructions on how to fill in the excel workbook

1. The supplied excel workbook consists of multiple worksheets,
 - (a) ,The first worksheet "Parameter list" contains the list of 28 parameters.
 - (b) The second worksheet "Data example" shows a general example of how the worksheet describing an installation should be filled in.
 - (c) All the following worksheets are to be filled in with consecutive installation data by the contractors. Each worksheet should consist of data from a single installation.
2. Out of the 28 parameters visible in the first worksheet, 5 have a drop down list of choices in Column D where just one option should be chosen, the remaining 23 parameters should be filled in with numerical data as shown in the "Data Example" worksheet. The horizontal length of sheets filled with data will differ from the example sheet based on the amount of data points gathered during installations.
3. The required parameters were subdivided into stages indicating from which moment in the timeline of an installation the data should be supplied, mentioned stages are: "pilot phase", "pre-installation phase (only if available)", "pullback phase and finally", "post-installation phase".
4. Dependent on the numerical parameter, for certain cells only one number is required, for example for cells that regard the unit weights or dimensions of objects, while, other fields regarding thrust force, pulling forces and borehole alignment coordinates require a range of values to be pasted in.
 - (a) In case of a single value, it should either be typed in or copied from source material and pasted in the appropriate cell as shown in the "Data Example" worksheet.
 - (b) In case of a range of numbers being required, the entire range should be copied from source material, then an appropriate cell should be right clicked within the excel worksheet, in the drop down menu "paste special" option should be selected. After going into the paste special window, at the bottom right, a "transpose" option should be chosen. This procedure guarantees the data will be pasted in appropriately.
5. Upon completing the first "Installation_01" worksheet, the following worksheet "Installation_02" should then be filled in with data from another installation. In such manner each installation should have its own number and not be pasted in one worksheet.