INTERSHIP REPORT

From 06/01/2025 to 31/01/2025

NINA PERRET

Internship supervisor: Baptiste Pelletier, Geotechnical Engineer

Teacher: Adele Frachon

Mission: Development of a Python program to analyze soil settlement beneath French nuclear power facilities.

A/ Presentation of the company

EDF is a leading multinational energy company. The division TEGG (Technology and Civil Engineering Expertise) is based in Aix-en-Provence, France.

It operates within EDF's Technical Management area, contributing to the company's engineering and supply chain activities. The department provides expertise and testing services in geology, geotechnics, and civil engineering materials, supporting EDF's projects both in France and internationally.

The area offers a wide range of services, including:

- Expertise in materials for civil engineering and geosciences.
- Laboratory testing and analysis of materials such as concrete, cement, mortars, and coatings.
- Evaluation and qualification of industrial solutions for EDF projects.
- Support in drafting technical specifications and overseeing construction projects.
- Conducting studies related to polluted sites, soil analysis, and hydrogeology.
- Development and maintenance of testing protocols and standards.

TEGG primarily serves various divisions within the EDF Group, including nuclear, hydraulic, and thermal sectors. It also collaborates with external partners - such as engineering firms and research laboratories - to support EDF's infrastructure projects and maintenance activities.

As an internal department of EDF, TEGG does not engage in traditional sales and marketing activities. Its expertise is primarily used by EDF’s nuclear, hydraulic, and thermal divisions while collaborating with external partners - like engineering firms and research laboratories - to develop innovative solutions and uphold industry standards.

B/ Description of my job

Soil settlement beneath nuclear facilities is a crucial issue for safety. Indeed, several buildings are pipe-connected. Yet, if these buildings settle at different paces, these pipes could

break, leading to nuclear disasters. Hence the relevance of carrying out studies on soil settlement.

My mission was to enhance an existing Python program developed by my internship supervisor. It was divided into the development of two codes: post-processing and pre-processing.

The initial phase involved generating analyzable graphs and comparison tables (see Appendices 1 and 2). I worked on ten nuclear facilities, each typically consisting of two to four units. For each unit, three parameters related to soil settlement were studied: vertical settlement, tilting, and dip. I plotted graphs for each nuclear unit, resulting in a total of about 100 graphs. Using Python to plot them therefore saved a significant amount of time. The Python code outputs graphs showing the evolution of relevant parameters. All buildings of the unit are displayed on the same graph for easy comparison. Furthermore, I generated extrapolation curves. The goal is to forecast soil settlement over the coming decades.

The subsequent objective was to automate raw data processing. Up until that point, this step had been performed manually. However, manual processing is time-consuming and leads to numerous errors. Indeed, a full raw data table is about a few thousand rows (see Appendix 3). This is due to about 20 sensors per building, each necessary to gather the required data. I have therefore developed an independent pre-processing Python script. It concatenates raw data, corrects non-standard sensor labels, and reads factual data – such as coefficients and dates – from an Excel file.

C/ Observations from the internship

[Content removed for confidentiality reasons]

Furthermore, I noticed a lack of effective management regarding the workforce and remote work policies. On Wednesdays and Fridays, the office was almost empty, while on Mondays it was crowded. This imbalance caused issues during lunch breaks, as the cafeteria was too small to accommodate everyone on the busier days. I think that working remotely can be efficient as long as people actually work. I think that waiting many hours for an answer while a person’s schedule appears as free is unacceptable. Moreover, some collaborators have noted a decline in team-building activities since remote work became more common. With fewer people attending, the company has scaled back the number of events and activities it

organizes. I therefore think it would be beneficial to strike a better balance in the remote workforce management.

D/ Personal analysis

The assigned mission was successfully completed within the short timeframe of a one-month internship, which required quick adaptation. Efficient adjustment was essential. I managed to master the technical vocabulary of geotechnics and understood the key objectives of the mission within the first week. I firmly believe there are no stupid questions. I therefore did not hesitate to ask even the obvious things. The team underscored how my proactivity and dynamism contributed to the successful achievement of the project.

My supervisor granted me a high degree of autonomy in carrying out my mission. From the beginning, I was encouraged to take initiatives, and I managed my tasks independently. This allowed me to develop problem-solving skills. Although I had the freedom to explore different approaches, my supervisor remained available for guidance and support whenever needed. This balance between autonomy and mentorship created an ideal learning environment, enabling me to enhance both my technical and organizational skills.

Nevertheless, if I were to start the internship again, I would make sure to introduce myself to everyone - not only on the first day but also in the following weeks. I have realized that people don't typically approach you when they don't know who you are, which is completely understandable. Although it might seem simple, I found it challenging. Indeed, when I arrived on January 6th, many people were either on vacation or working remotely. On the one hand, it was tricky to remember whom I had already met. On the other hand, I didn't want to interrupt those who were focused on their work. However, in hindsight, I would have preferred to introduce myself twice to the same person or briefly interrupt someone rather than risk them not knowing who I am.

I would recommend this internship to a fellow student. The project was captivating, it's simulating to work on a real mission, especially about such a crucial topic. I have improved my skills in Python a lot, especially about two important technical aspects: data frames and classes. My supervisor had prepared the project for my arrival. What is more, the team was very welcoming.

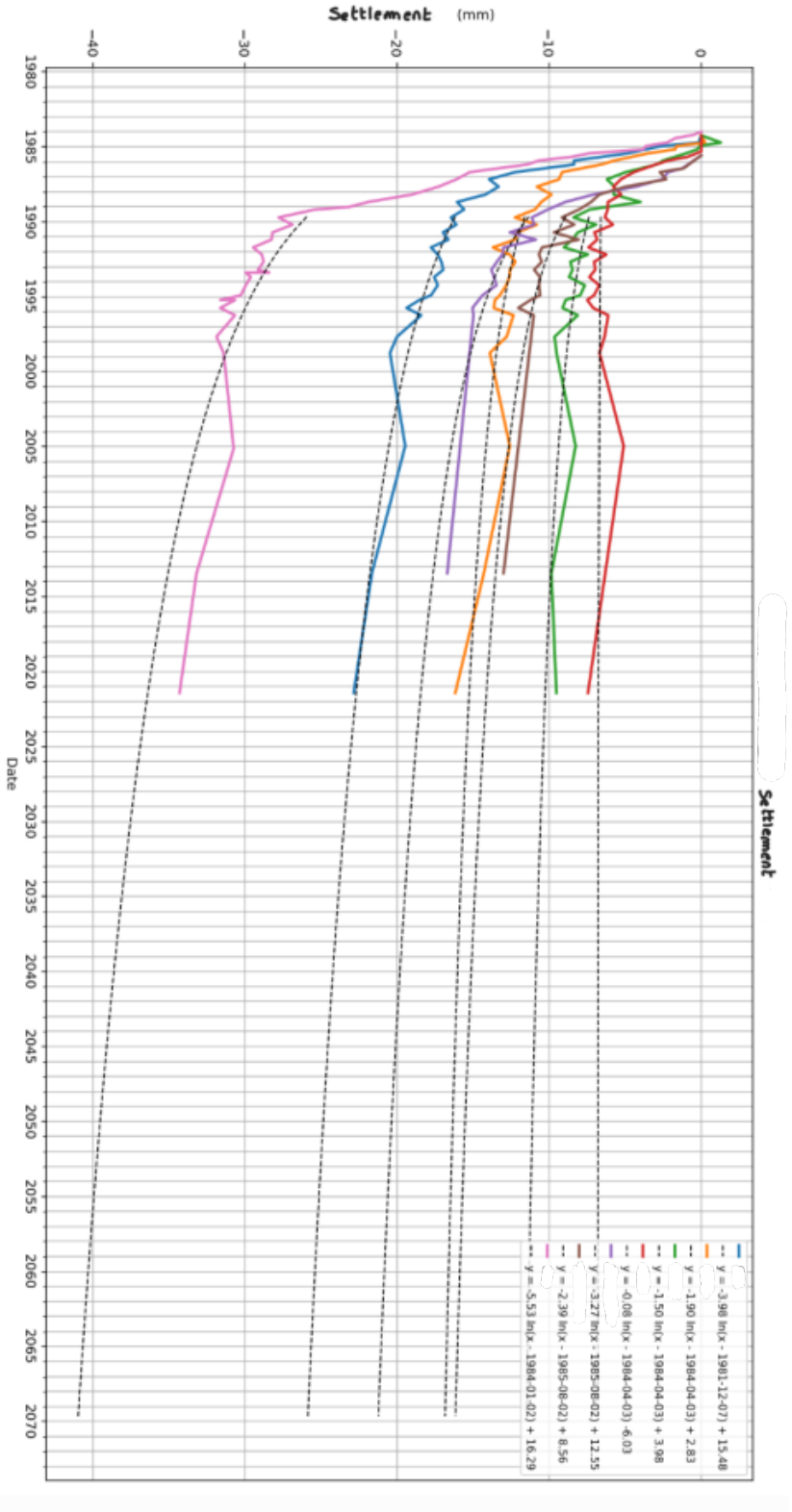
Acknowledgments:

I would like to express my gratitude to the entire TEGG team for their availability and the opportunity to learn. I would like to thank particularly my supervisor, Baptiste Pelletier, for his continuous support.

Appendix 1:

Example of a graph:

Interpolated settlement values and extrapolated values up to 80 years after the starting date – including equations of the extrapolated curves



Appendix 2:

Example of a comparison table:

Measured values at the initial date vs extrapolated values 80 years later

Unit	Building	Initial date		
		Settlement (mm)	Tilting (mm/m)	Dip (gd)
		-16.37	0.04	56.91
		-12.12	0.10	346.04
		-8.30	0.06	48.18
		-6.31	0.05	183.46
		-11.04	0.81	329.14
		-9.06	0.16	197.44
		-27.56	0.17	97.02
		-29.91	0.50	398.21
		-23.64	0.08	339.33
		-12.48	0.08	395.51
		-25.24	0.44	211.87
		-41.88	1.52	369.26
		-20.24	0.60	111.25
		-44.68	0.32	87.98

Unit	Building	80 years later		
		Settlement (mm)	Tilting (mm/m)	Dip (gd)
		-25.86	0.06	39.99
		-16.84	0.24	335.93
		-11.50	0.18	55.67
		-6.81	0.20	308.89
		-21.23	1.66	320.54
		-16.16	0.10	258.52
		-40.97	0.31	68.03
		-40.41	0.68	378.12
		-34.89	0.16	363.04
		-16.05	0.14	364.85
		-32.72	0.63	234.06
		-53.66	0.87	369.22
		-29.80	1.11	111.97
		-60.08	0.37	45.34

Appendix 3:

Extract of a raw data table

NB: A full raw data table is about a few thousand similar rows

[redacted]	[redacted]	01/01/1981 08:00:01 - 31/12/2999 00:00:00	-	Coord centre	501.0	59.0
[redacted]	[redacted]	01/01/1981 08:00:01 - 31/12/2999 00:00:00	5101	[redacted]	488.5	70.3
[redacted]	[redacted]	01/01/1981 08:00:01 - 31/12/2999 00:00:00	5102	[redacted]	499.9	71.3
[redacted]	[redacted]	01/01/1981 08:00:01 - 31/12/2999 00:00:00	5103	[redacted]	503.5	71.3
[redacted]	[redacted]	01/01/1981 08:00:01 - 31/12/2999 00:00:00	5104	[redacted]	513.2	70.3
[redacted]	[redacted]	01/01/1981 08:00:01 - 31/12/2999 00:00:00	5105	[redacted]	502.5	58.5
[redacted]	[redacted]	01/01/1981 08:00:01 - 31/12/2999 00:00:00	5106	[redacted]	513.2	58.5
[redacted]	[redacted]	01/01/1981 08:00:01 - 31/12/2999 00:00:00	5107	[redacted]	498.88	56.8
[redacted]	[redacted]	01/01/1981 08:00:01 - 31/12/2999 00:00:00	5108	[redacted]	492.9	51.2
[redacted]	[redacted]	01/01/1981 08:00:01 - 31/12/2999 00:00:00	5110	[redacted]	498.7	47.2
[redacted]	[redacted]	01/01/1981 08:00:01 - 31/12/2999 00:00:00	5111	[redacted]	512.2	45.0
[redacted]	[redacted]	01/01/1981 08:00:01 - 31/12/2999 00:00:00	5112	[redacted]	494.13	74.05
[redacted]	[redacted]	01/01/1981 08:00:01 - 31/12/2999 00:00:00	5113	[redacted]	506.53	74.21
[redacted]	[redacted]	01/01/1981 08:00:01 - 31/12/2999 00:00:00	-	Coord centre	541.7	96.9
[redacted]	[redacted]	01/01/1981 08:00:01 - 31/12/2999 00:00:00	5201	[redacted]	527.9	110.0
[redacted]	[redacted]	01/01/1981 08:00:01 - 31/12/2999 00:00:00	5202	[redacted]	557.6	110.0
[redacted]	[redacted]	01/01/1981 08:00:01 - 31/12/2999 00:00:00	5203	[redacted]	542.05	97.8
[redacted]	[redacted]	01/01/1981 08:00:01 - 31/12/2999 00:00:00	5204	[redacted]	558.6	84.3
[redacted]	[redacted]	01/01/1981 08:00:01 - 31/12/2999 00:00:00	5205	[redacted]	526.7	84.3
[redacted]	[redacted]	01/01/1981 08:00:01 - 31/12/2999 00:00:00	5206	[redacted]	522.2	84.3