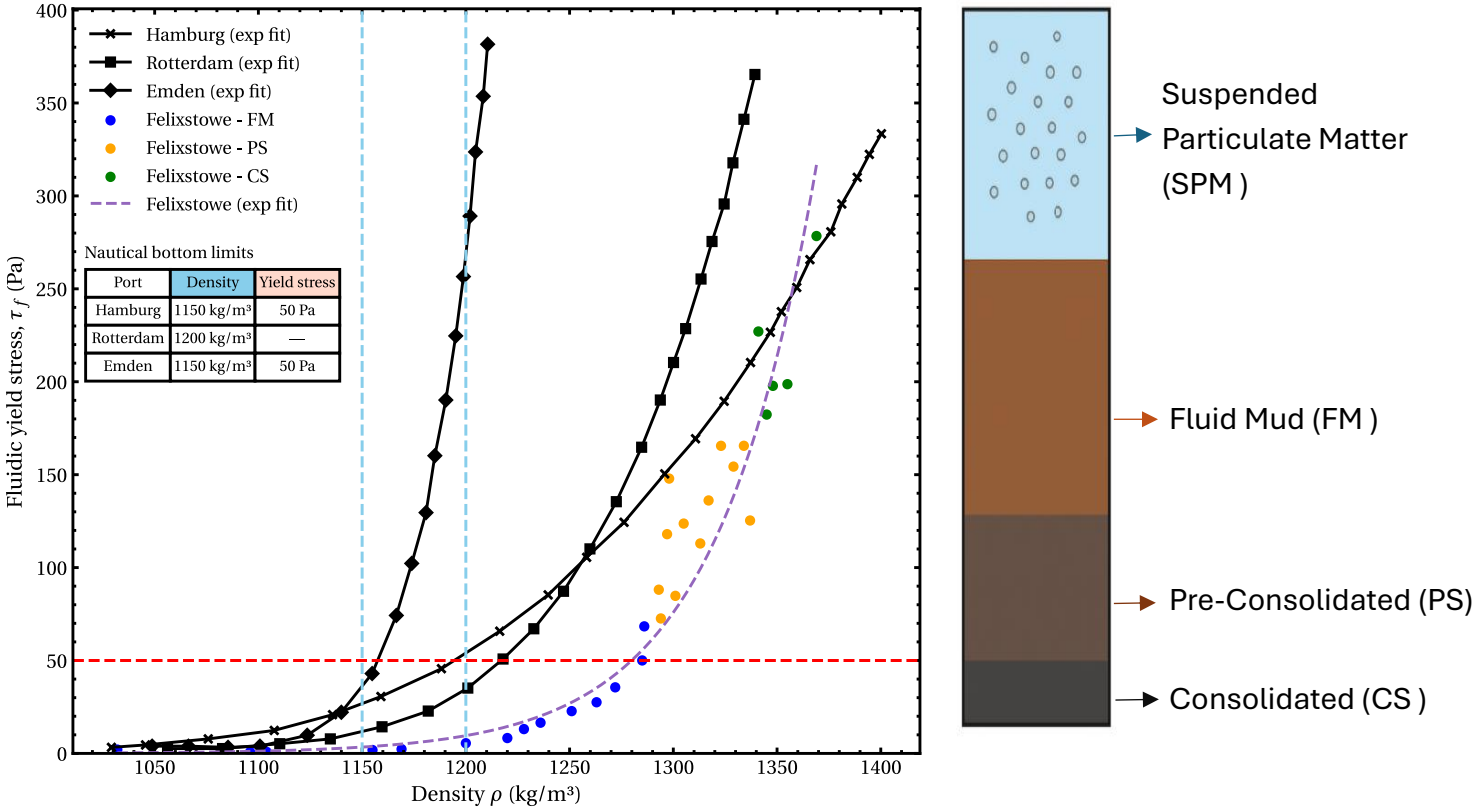
Understanding Sediment Dynamics in Port of Felixstowe

The UK's largest container port, Felixstowe, faces sedimentation challenges, with approximately 2.4 million m^3 of sediment requiring management annually [1]. To optimize their maintenance strategies and enhance navigability, Harwich Haven Authority is exploring the implementation of PIANC's nautical bottom concept [2], which relies on understanding the rheological and settling behavior of the muddy bed in the port. Rheological behavior of muddy bed differs from port to port, therefore it is necessary to characterize the mud locally to understand mud behavior. Some key indicators for this is to know the density and its corresponding strength (yield stress) of mud within the port . The relationship between density and yield stress of mud from several European ports including port of Felixstowe is shown in the below figure. While all ports exhibit an exponential increase in yield stress with density, the thresholds vary widely [3,4]. This indicates that a given density criterion does not correspond to a specific yield stress across different ports. For example the suspended particulate matter (SPM) limit (1100 kg/m^3) at Felixstowe corresponds to the fluid-mud limit in the Port of Emden. This is an ongoing research project and will answer research questions pertaining to navigability , maintenance strategies and optimization.



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References

[1] Spearman and Benson (2022) WODCON XXIII; [2] PIANC (2014) Harbor Approach Channels - Design Guidelines; Kirichek et al (2018) . How navigable are fluid mud layers? ; [3] Kirichek, A., Shakeel, A., Chassagne, C., & Gebert, J. (2022). Why do settling and yield stress of mud differ in European ports? In Proceedings of WODCON XXIII. World Dredging Congress; [4] Kirichek and Rutgers (2020) Terra et Aqua 160:16-26; [5] Shakeel et al. (2020) J. Soil and Sed. 20: 2553–2562.