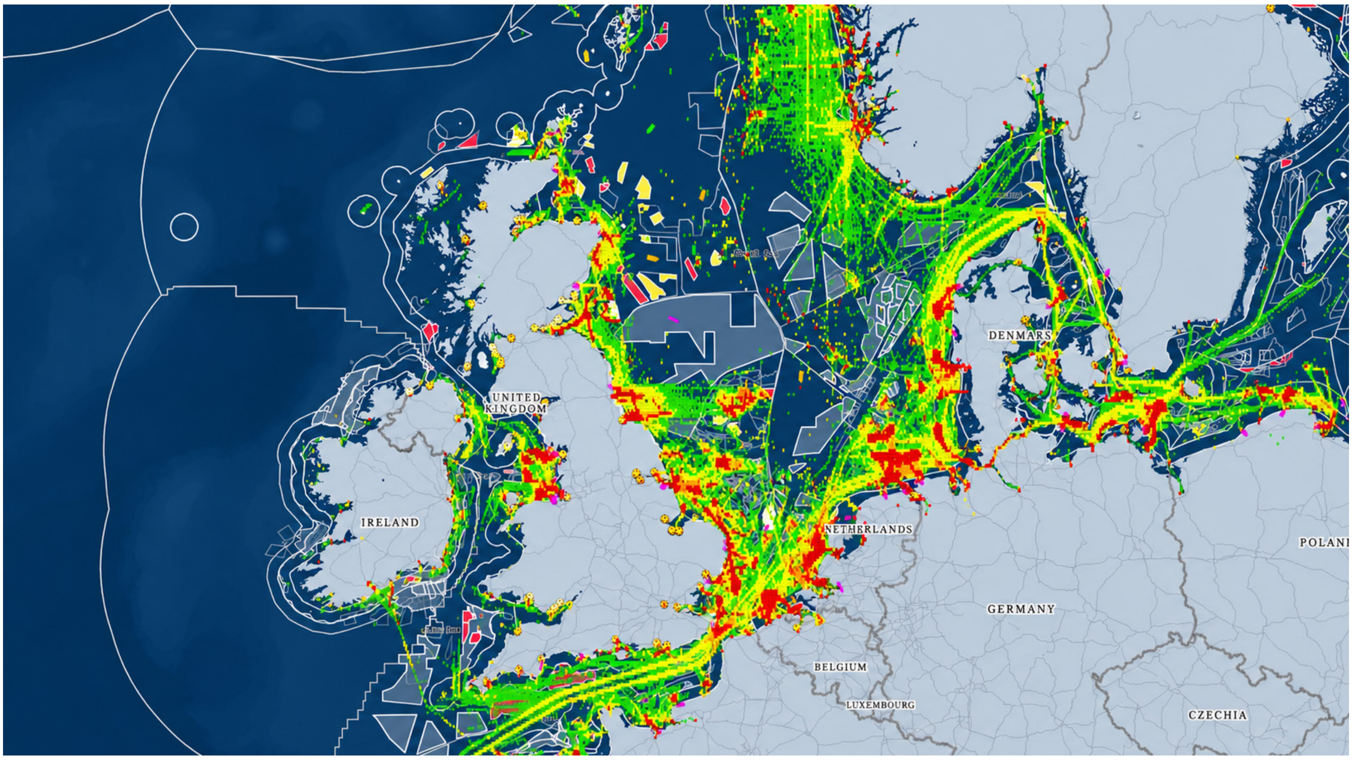
How offshore infrastructure shapes vessel traffic: a GIS-based case study

Words: Nikhar Parikh, GIS Manager, TGS | 4C

Offshore vessel traffic may appear random at a glance, but beneath the surface, it is tightly structured by infrastructure and project timelines. Using GIS to combine AIS data with development records, this case study reveals how major wind farms like Dogger Bank B, Dogger Bank C and Sofia actively reshape marine activity, transforming scattered vessel movements into organised patterns driven by construction phases and spatial design.



To a casual observer, vessel movements offshore can look scattered and unremarkable. In reality, activity is shaped by a range of factors. As offshore wind projects become larger and more complex, they are playing an increasingly influential role in how vessels operate.

That focus is not always obvious from a single map or a single vessel track. It becomes clearer when historical AIS data (VesselTracker Wood Mackenzie, 2026) is combined with GIS and viewed alongside a project's development timeline. When those datasets are brought together, the sea reveals a detailed story.

For developers, planners and regulators, this matters because it shows how the construction and installation phases reshape vessel traffic around wind farms and export corridors.

This case study examines Dogger Bank B, Dogger Bank C and Sofia, focusing on vessel activity within the wind farm areas and along their export cable corridors (TGS | 4C, 2026). The aim was not simply to map where vessels were present, but to understand how GIS can be used to interpret the different phases of offshore wind development through changes in spatial activity patterns.

The first step was to define a tight study area. Rather than looking at a very broad offshore region and risking the inclusion of unrelated passing traffic, the analysis focused on three zones:

- Wind farm footprints
- A narrow ring around the wind farm boundaries
- A corridor around the export cables

That approach matters. It keeps the analysis tied to the infrastructure and avoids confusing project-related activity with wider North Sea traffic.

Once the study area was defined, the AIS records (VesselTracker Wood Mackenzie, 2026) were filtered and analysed over time. Even at a basic level, the results showed a very clear pattern. Within the wind farm footprints, summed AIS activity (total AIS records captured within the study zones) was relatively modest in 2021 and 2022, with totals of 861 and 741, respectively. In 2023, that rose to 1,947. By 2024, activity had increased sharply to 10,369, and by 2025 it had risen again to 20,125.

That is not a subtle change. It strongly suggests a major shift in what vessels were doing in the area and how frequently they were operating there.

On its own, however, an increase in AIS records does not explain very much. More activity could mean more survey work, more transits, more installation campaigns, or simply more reporting. This is where GIS becomes especially useful. It allows vessel activity to be interpreted spatially and not just counted.

Within the wind farm areas, the pattern shifts from relatively limited, scattered activity in the early years to a denser, more concentrated operational footprint over time. Activity also begins to organise itself around specific parts of the sites and along the cable routes, producing concentrated clusters and corridors rather than diffuse movement.

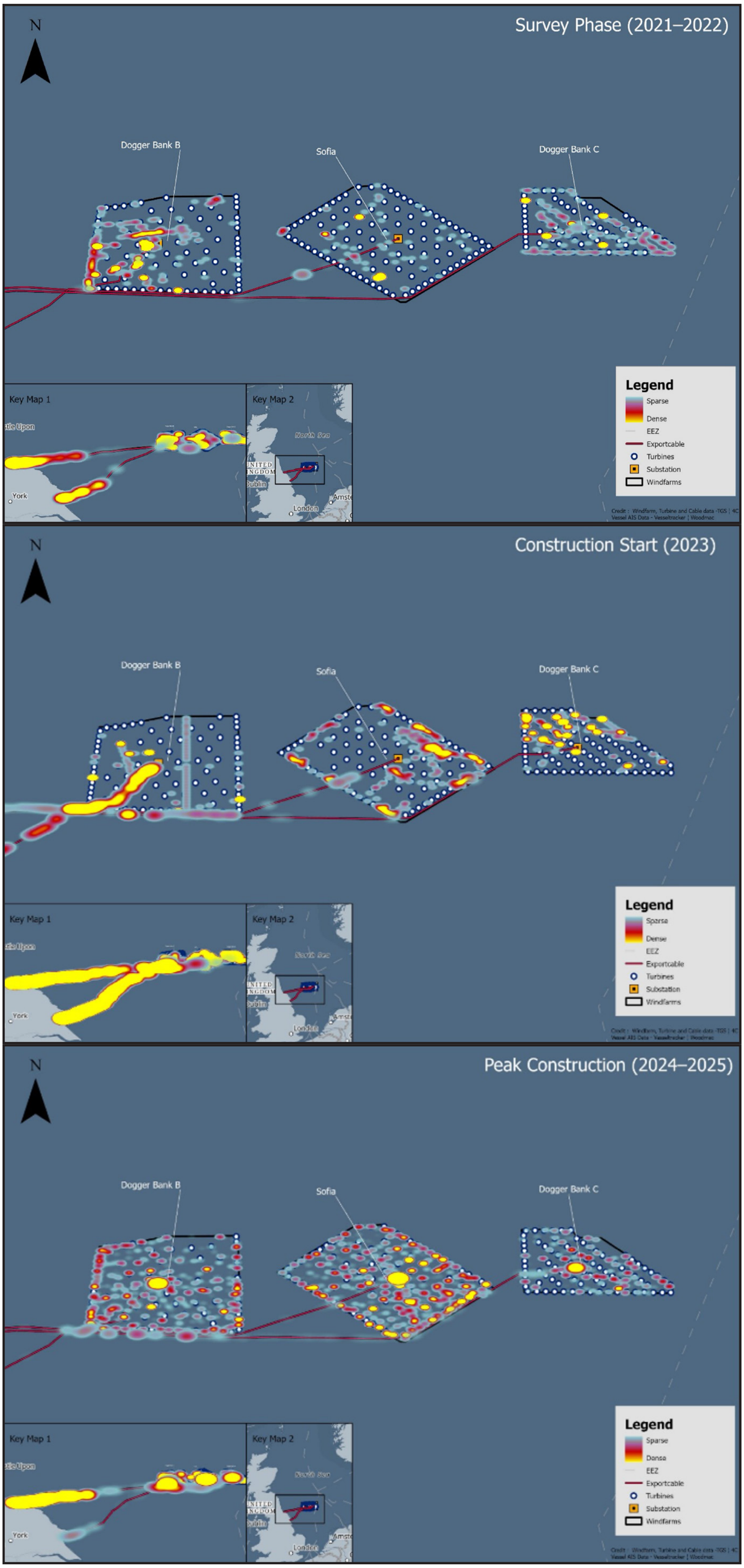
That pattern also aligns closely with the project event timeline (TGS | 4C, 2026).

The event data helps explain why vessel activity remains comparatively low in 2021 and 2022. These years are better understood as a pre-construction and early works phase. The project records show survey activity, enabling works, early fabrication steps, and preparatory onshore and offshore works. In practical terms, that kind of phase tends to involve specialist vessels operating intermittently, rather than a sustained offshore construction fleet. The AIS signal is present, but it is not yet intense.

Nikhar Parikh

From 2023 onwards, the picture changes. The project events show the start of much heavier activity, including export cable installation, offshore construction, foundation-related work, substation and platform activity, and the beginning of more sustained marine operations. This is exactly what the spatial data starts to show as well. The increase in AIS activity is no longer marginal; it becomes one of the defining characteristics of the site.

By 2024 and 2025, the signal is stronger still. The event records point to ongoing foundation installation, cable works, offshore platform activity and, in the case of Sofia, the first turbine installation. In GIS terms, this is where vessel activity becomes unmistakably infrastructure-led. It is no longer just that



vessels are nearby. Their movement is being organised by the shape, location and stage of development of the infrastructure itself.

That is one of the most useful insights from this work. Offshore wind farms do not simply occupy marine space. They reshape activity around them. They create operational hotspots, corridor effects (for example, repeat transits along export cable routes) and changing patterns of speed and repetition. In that sense, they function as spatial organisers.

This is also where offshore wind starts to differ from the traditional offshore oil and gas model. A single fixed platform often creates a more localised cluster of activity around a point. A large wind farm, by contrast, spreads influence across an area. Add export cables, substations and phased construction into the picture, and the result is a much broader operational footprint.

The value of GIS here is not just in producing attractive maps. It is in connecting multiple types of information into one coherent interpretation. AIS data (VesselTracker Wood Mackenzie, 2026) provides the movement record. Infrastructure layers provide the spatial framework. Event timelines provide the project context. Taken together, they allow analysts to gain a deep understanding of the underlying causes of vessel movement.

That has practical value. For developers, this type of analysis can help explain how construction and installation activity unfold spatially over time. For planners and regulators, it supports a better understanding of how major offshore developments alter marine traffic patterns in specific locations. For the wider sector, it shows that vessel data is not only useful for real-time monitoring but also for interpreting project phases and infrastructure influence over the life of a development.

The Dogger Bank B, Dogger Bank C and Sofia case study shows this clearly. In the early years, the AIS picture is relatively light and consistent with survey and preparatory activity. From 2023 onwards, the activity curve rises sharply, and the maps begin to show a much more intensive, construction-led marine pattern. The event data confirms that transition.

That is possibly the most important conclusion from this work. GIS is not simply a backdrop for offshore wind analysis. It is the tool that turns separate datasets into a readable story. Without it, AIS is just a mass of timestamps and coordinates. With it, vessel movement becomes evidence of how offshore projects and infrastructure change the use of marine space.

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