Aggregates in UK Construction

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Aggregates are loose materials (usually sand, gravel and rock) widely used in the built environment. They can be mixed with cement to make concrete or used as a base material in foundations and under roads. This report summarises where aggregates come from, where they are used, and current issues and opportunities for this basic but essential material.

Breakdown of UK Aggregates

Types

- Primary aggregates are raw materials, mined from quarries or dredged from the seabed.
- Recycled aggregates are materials that have been used in construction previously, for example crushed concrete from demolished buildings.
- Secondary aggregates are by-products from other industries.

Sources

- 40% of aggregates used in London come from the sea and are brought in by barge up the Thames estuary [1].
- Land-sourced aggregates come mainly from the southwest and the Midlands by rail, but some granite comes from northwest Scotland by barge [1,2].
- The UK has some of the highest levels of recycled aggregate use in Europe:
  - This is due to the Landfill Tax (1994) and Aggregates Levy (2002) which make it too expensive to landfill crushed demolition waste, diverting it for use as aggregate instead [3].

Uses

- Aggregates are used in high-value bound forms such as cast concrete, as well as in loose form such as fill and compacted base material.
- Most of the UK's marine aggregates are used in the Southeast and London, in high-value applications like concrete [3].
- The UK is a net exporter of aggregates [1].

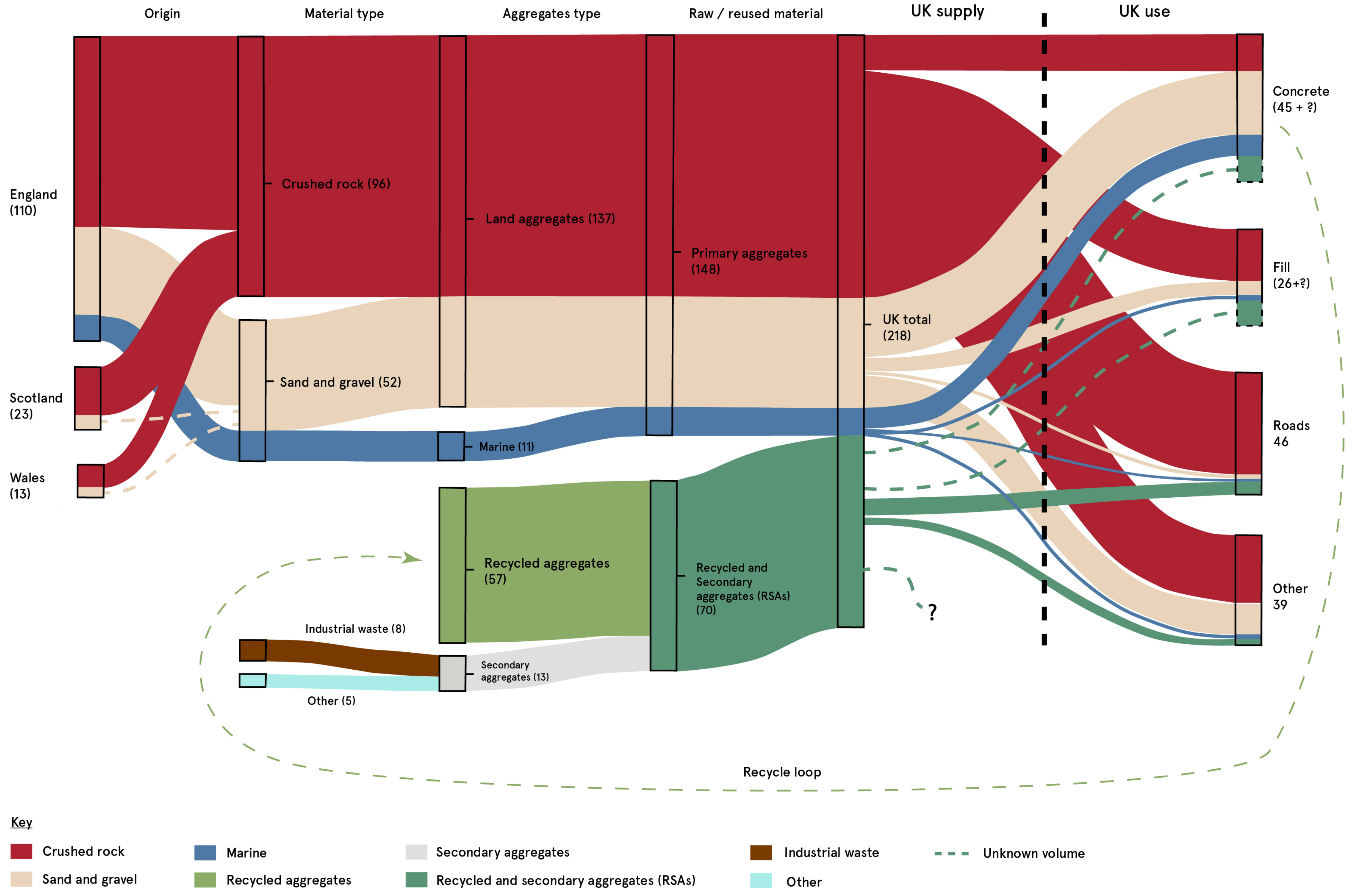

Figure 1 - Sankey diagram showing an approximate breakdown of the 2022 UK aggregates industry in million tonnes (using data from 2019 and 2022 from the MPA and the BGS [1,4,5]).

This diagram shows that we don't have enough clarity on where recycled and secondary aggregates are being used.

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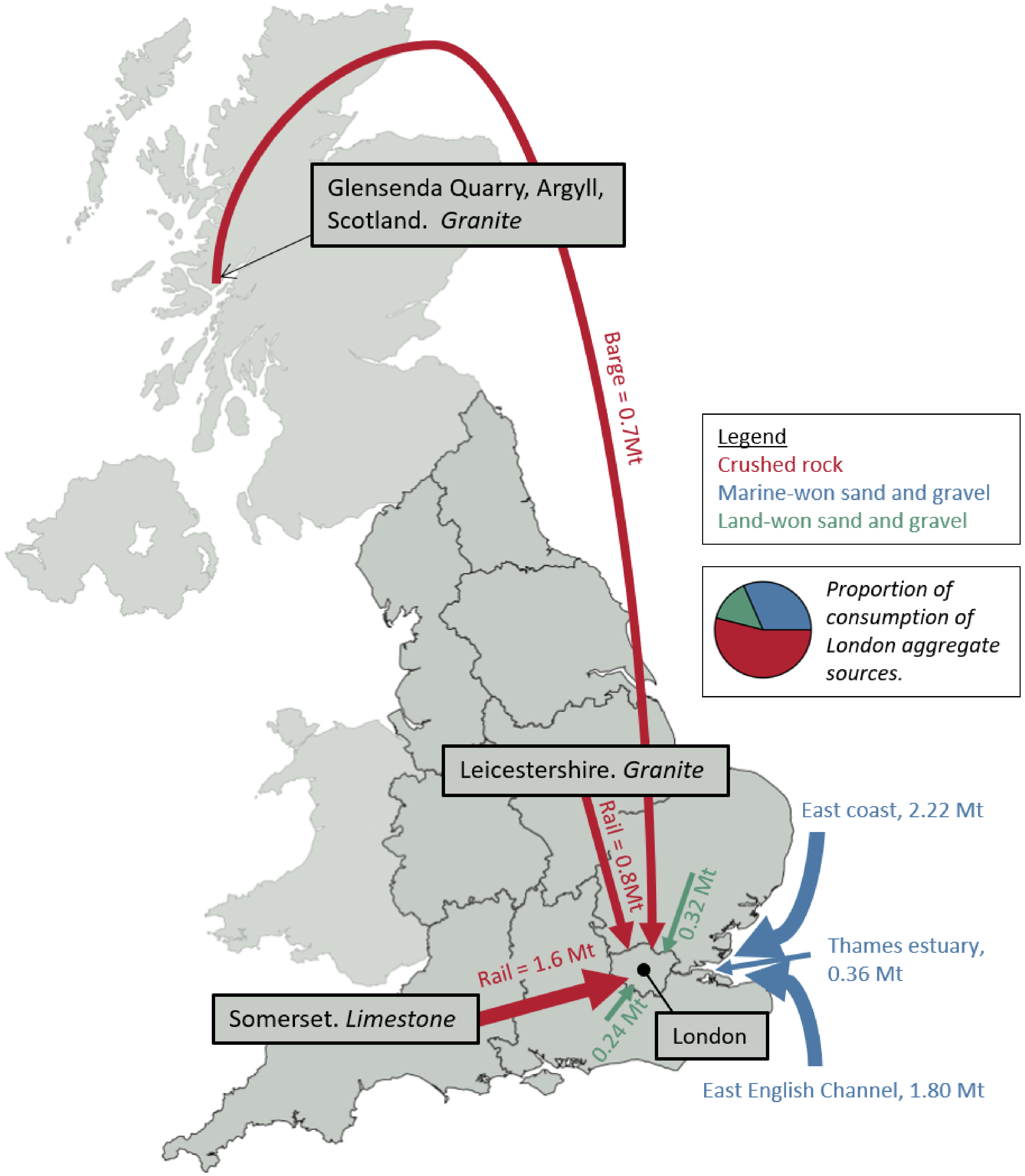

Figure 2 – Map showing where London's aggregates come from with approximate quantities [1,2].

Where London's aggregates come from

Figure 2 shows approximately where London's aggregate supply comes from. While mostly regionally sourced, about a third comes from marine sources, and a small proportion comes by barge from Scotland.

Current Issues

1. **Aggregates aren't renewable.**

    - The only way to obtain more primary aggregates is by finding and mining new reserves which damages local ecosystems, whether they be marine (dredging) or land based (quarries).[6–8]
    - The area of seabed licenced for dredging was 1068 km^2 in 2021 with 6km^2 dredged intensely.[3]
    - Quarries cover approximately 2,200 km^2 of land in the UK, with close to half near or in sensitive landscapes such as AONBs and National Parks.
    - It is very difficult to quantify the relative impact on biodiversity between land and marine aggregates, but land aggregates affect a much larger surface area.[9]

2. **Recycled and secondary aggregates are a limited resource.**

    - Recycled aggregate availability is likely to decrease as fewer buildings are demolished as the industry transitions to reuse of existing building stock.[3]
    - Secondary aggregate production is also limited by the production scale of the original product they come from.

3. **Aggregates must be used wisely.**

    - Recycled and secondary aggregates should not be used to reduce embodied carbon of concrete because their varying/unknown material properties usually require addition of more cement, negating the carbon savings. They may also have to travel further to site due to their location being restricted to certain locations.
    - Primary aggregates are sometimes used in low-value applications like fill. Recycled and secondary aggregates should be used here instead.[3]

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The Relative Importance of Transport

- The transport emissions (A4) of aggregates are generally twice that of their production (A1-A3) emissions.[3]
- Marine aggregates have approximately 30% greater A1-A3 emissions than quarries (depending on the efficiency and scale of the quarry), but this is overcome by the relative carbon efficiency of sea transport, as shown by the greater equivalent transport distance in Figure 3.

Equivalent Carbon Footprint

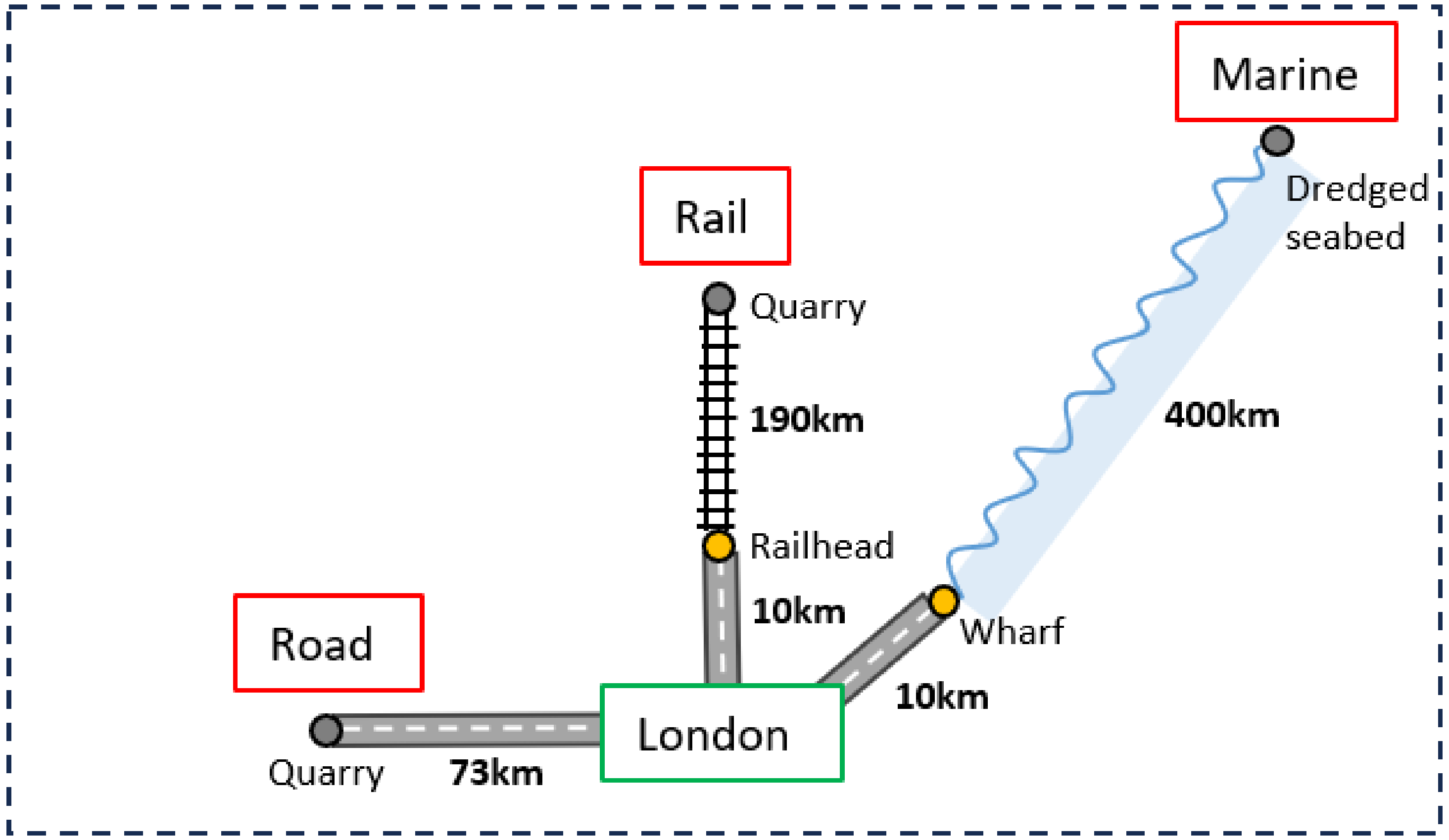

Figure 3 - Estimated equivalent carbon emissions for land and marine aggregates for a hypothetical London construction site or concrete batching plant (Adapted from [3])

Future Outlook

- Quarries are looking to AI to increase their efficiency with crushing and screening machines that can recognise the composition of rocks and monitor the particle size of the end-product.[3]
- New sources of less intensive secondary aggregate from agricultural waste are also being explored such as oil palm shell, coconut shell, rice husks and tobacco waste.[3]
- Waste plastic has also been explored as a new recycled fine aggregate source with mixed results.[3]

Key Takeaways

- Avoid using primary aggregates in low value applications (such as fill) where recycled or secondary aggregates could be used instead.
- Continue to use marine aggregates in concrete as they are high quality, and the relative seabed area affected is small compared to land-based aggregates.
- Reduce the overall volume of concrete by more efficient design, which also results in a reduction of aggregates used.
- The industry needs to better understand and record where recycled and secondary aggregates are used.
- Advocate for less intensive aggregates.

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