



Kvarken Fixed Connection Preliminary Study

Transport demand

Transport demand

Scope and methods

- The study utilized Sweden's national freight transport forecasting model, **Samgods**, as well as the national passenger transport model, **Sampers**. The Finnish transport forecasts were adapted to be compatible with the Swedish models. The transport forecasts were made for year 2045.
- The study examined two different transport demand forecasts ranging from "**normally used national growth expectancy**" to a scenario where growth is bigger due to "**increased capacity in the Swedish railway network**". These growth scenarios were analysed using five separate sensitivity cases, including situations such as:
 - Transport using only road
 - Transport using only road with road user fee
 - Freight being transported solely by rail
 - Freight being transported solely by rail with 2 hours delay due rail gauge change
 - The Baltic Sea maritime operations have a major disruption and is "closed" and Gulf of Bothnia is open

Transport demand

Outcomes for the fixed link

- **Road traffic volumes are comparable to those between medium-sized regional centres in Finland.** Predicted traffic volumes year 2045 are 2700-3000 cars/day and 500-600 trucks/day.
- **Rail transport demand for passenger traffic corresponds to the demand between Finnish regional centres.** Rail passenger demand is 1300-1400 trips/day. The freight traffic demand corresponds to low-traffic railway sections, with logistic volumes of approximately 200 000 tons/year in both scenarios.
- Overall, transport demand is more focused on road transport than rail, and more on passenger traffic than freight.
- A disruption in maritime traffic, in which the the Baltic Sea is closed, would significantly increase the traffic volumes of the fixed connection compared to normal conditions. However, a larger share of freight traffic would cross the Gulf of Bothnia by sea.

The image shows a wide-angle view of a large suspension bridge, likely the Svanen Bridge in Ålesund, Norway, stretching across a body of water. In the foreground, two people, a woman in a red jacket and a man in a dark jacket, stand on a narrow, moss-covered concrete pier, looking out towards the bridge. The sky is overcast and grey. A semi-transparent blue horizontal band is overlaid across the middle of the image, containing the title text.

Kvarken Fixed Connection Preliminary Study

Feasibility Study – Studied options

Feasibility study

- This feasibility study focuses on assessing and comparing different implementation possibilities. Both road and rail connections are examined, along with several technical implementation options.
- Planning assumptions and boundary conditions were taken into consideration.
 - Natural habitats (Archipelagos, Nature reserves, Unesco World Heritage sites, etc.)
 - Land use plans and transport systems in both countries
 - Ice conditions, hydrology, wind
 - Geological and geotechnical conditions
- International benchmarking with several cases
- The shipping lanes were taken into account in the design of the fixed connection
- The fixed link must integrate with the existing road and rail networks. At the end of Umeå, the most logical connection point is near the Umeå port. On the Finnish side, additional infrastructure is required to establish a road or rail connection with sufficient capacity.
- The feasibility study resulted in six fixed link options, representing three different alignments; road, rail only or combined rail-road, and rail tunnel

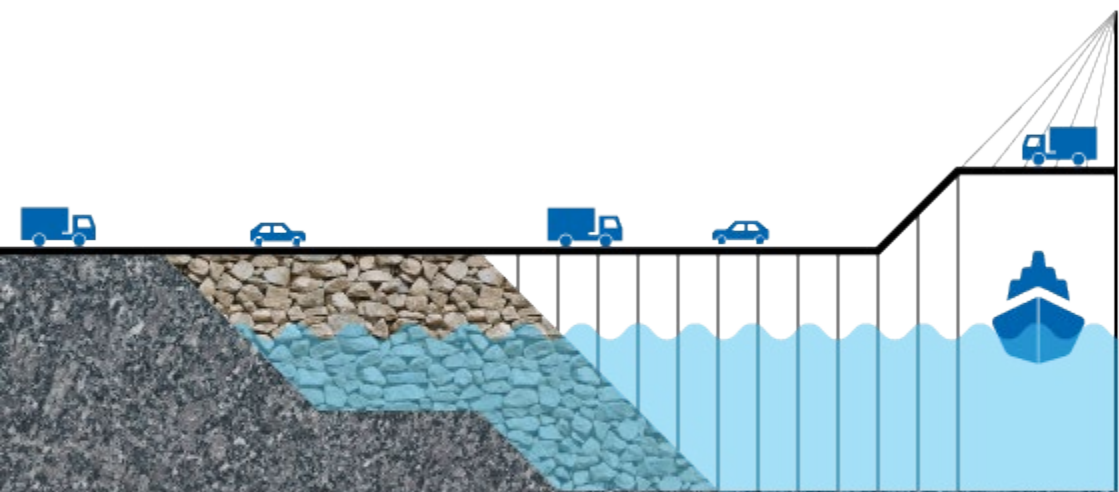
Option 1: Road

Mainland: 30km

Embankment: 18km

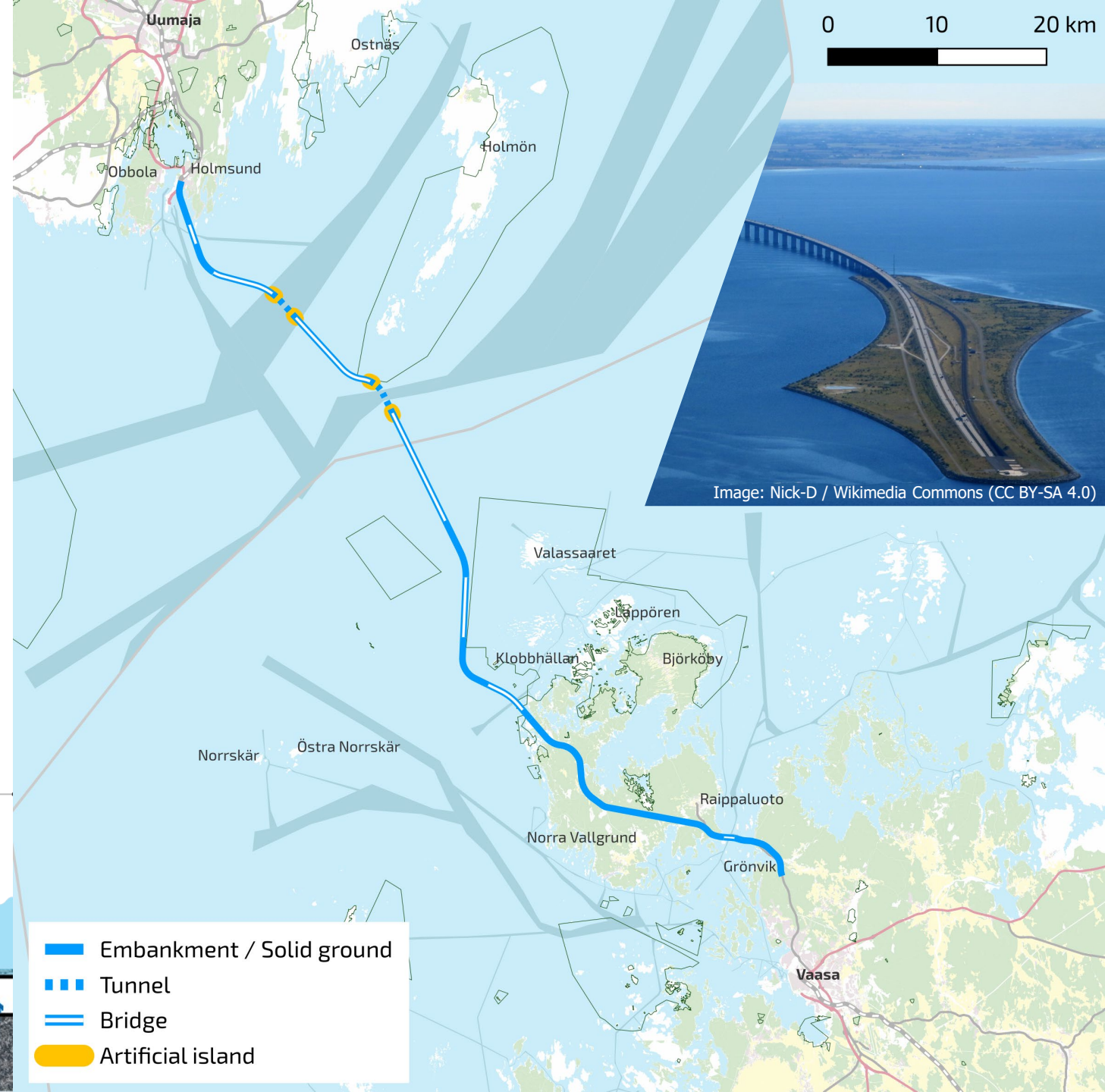
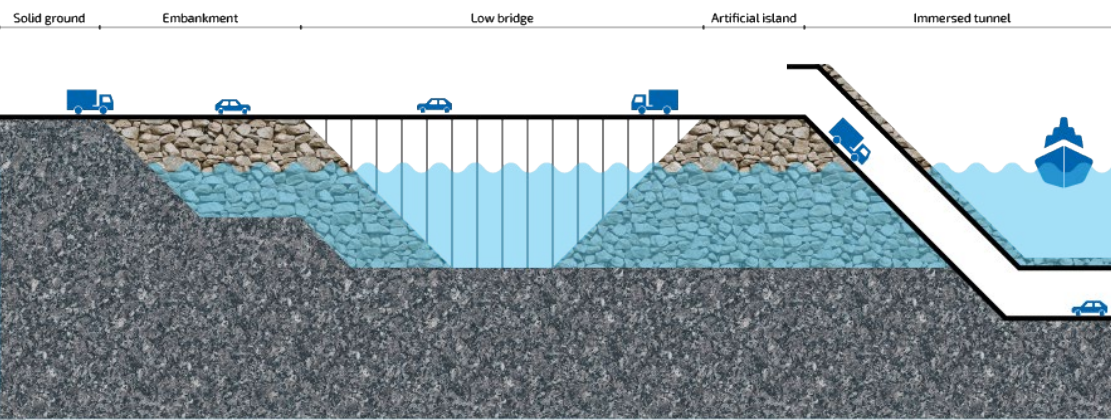
Bridge: 46km

Solid ground Embankment Low bridge Tall bridge



Option 2: Road partially in tunnel

Mainland: 30km
Embankment: 18km
Bridge: 39km
Tunnel: 7km



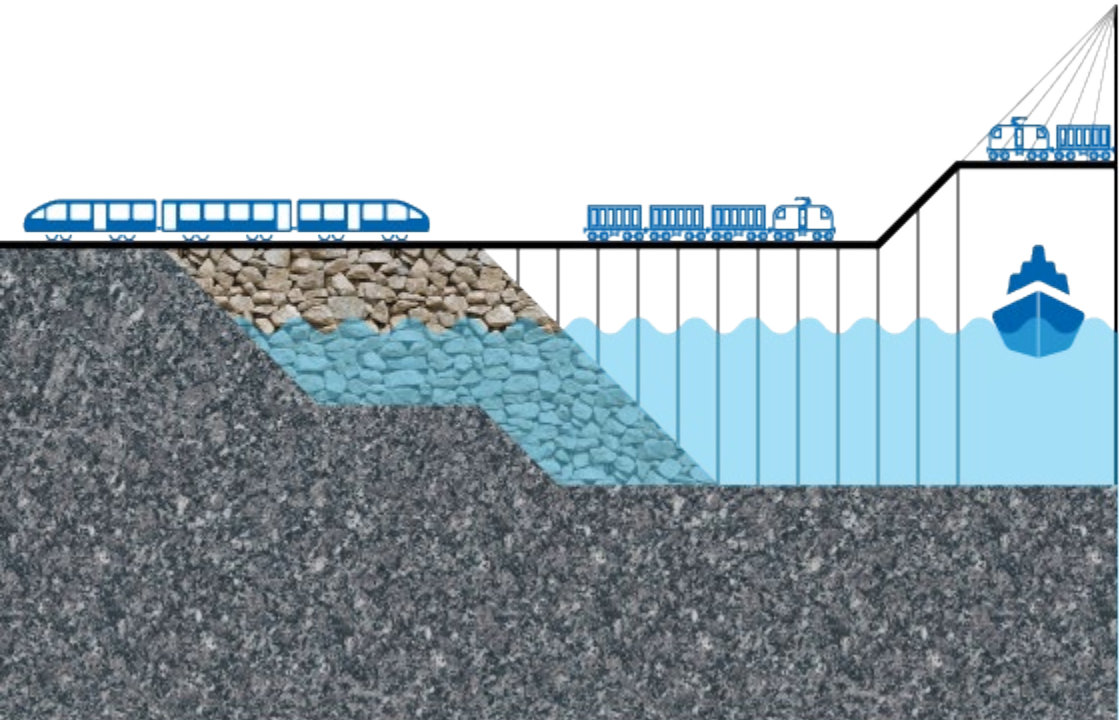
Option 3: Railway

Mainland: 53km

Embankment: 14km

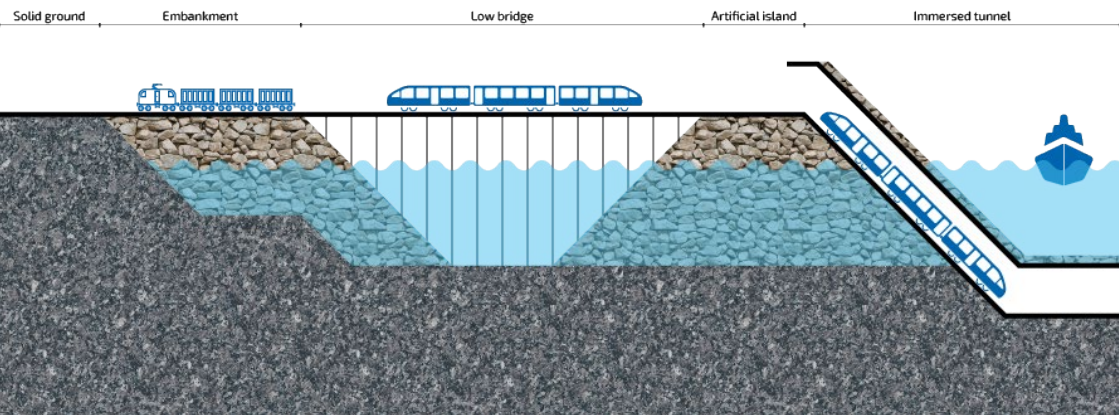
Bridge: 47km

Solid ground Embankment Low bridge Tall bridge



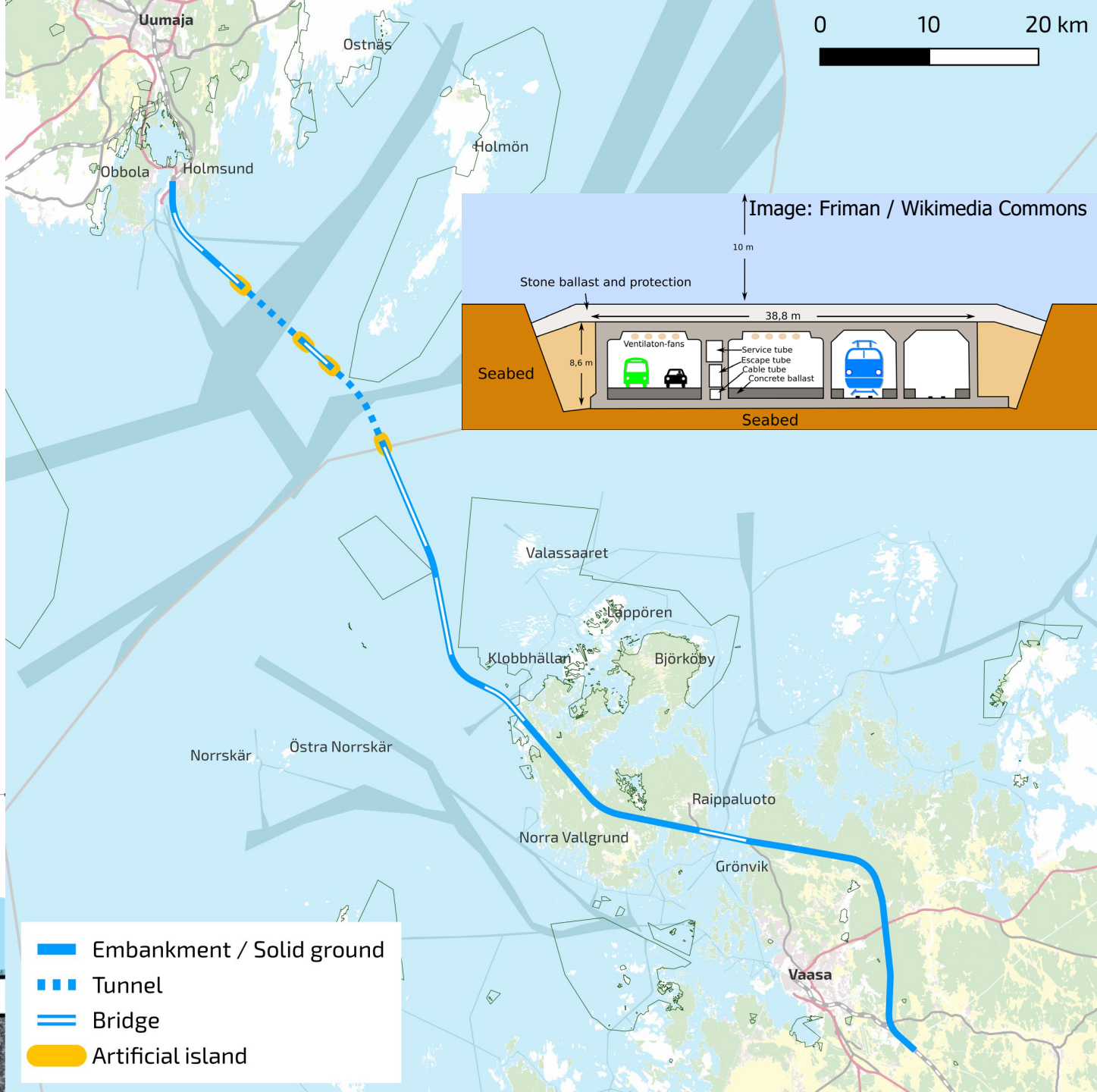
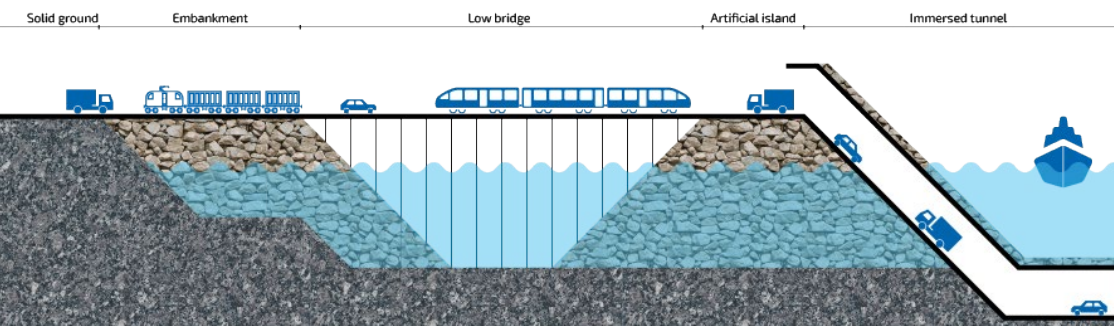
Option 4: Railway partially in tunnel

Mainland:	53km
Embankment:	7km
Bridge:	39km
Tunnel:	15km



Option 6: Rail-Road combination

Mainland:	53km
Embankment:	7km
Bridge:	39km
Tunnel:	15km

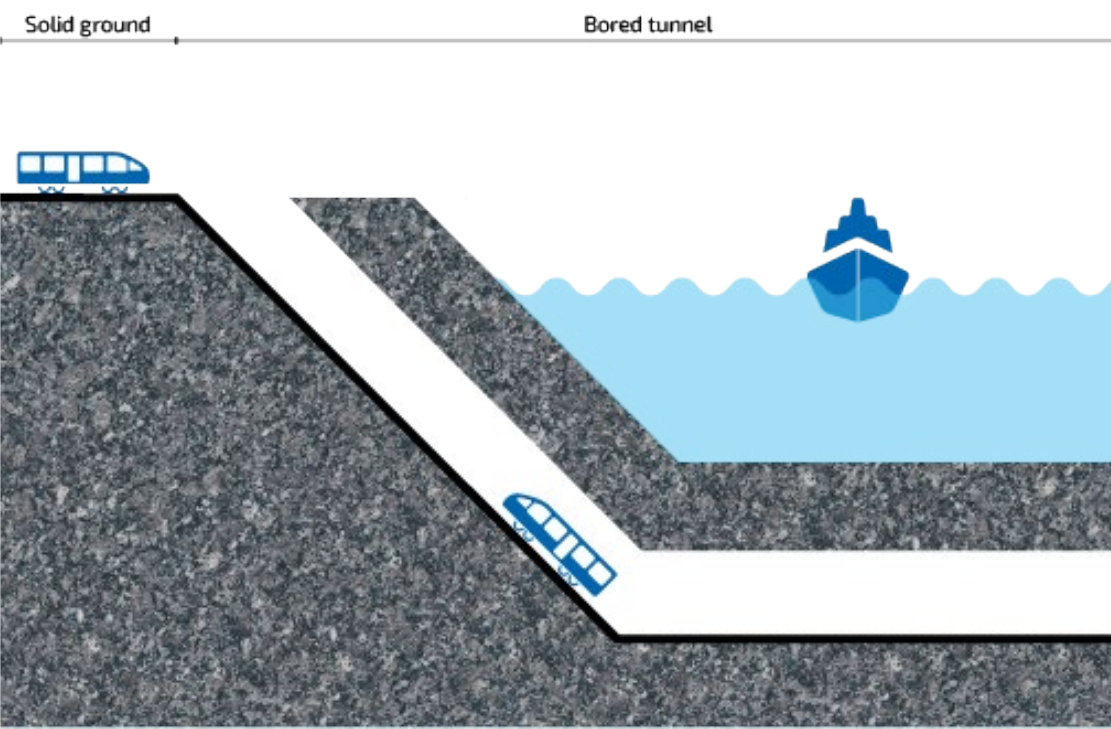


Option 5: Long railway tunnel

Mainland: 2km

Tunnel: 103km

Underground station in Vaasa



Implementation options

	VE 1: Road	VE 2: Road partly in a tunnel	VE 3: Railway	VE 4: Railway partly in a tunnel	VE 5: Railway completely in a tunnel	VE 6: Rail-road combination
Mainland (km)	30	30	53	53	2	53
Embankment (km)	18	18	14	7	-	7
Bridge (km)	46	39	47	39	-	39
Tunnel (km)		7		15	103, underground station	15
Rail	-	-	✓	✓	✓	✓
Road	✓	✓	-	-	-	✓
Artificial islands	-	4	-	4	2	-
Crossing with shipping lanes	2 high bridges	2 tunnels	2 high bridges	2 tunnels	1 tunnel cross the Kvarken	2 tunnels
Construction costs (bil. €) cost index MAKU 145, 2020=100	4,9–8,4	6,2–10,5	5,5–9,3	10,3–17,5	17,0–28,9	16,7–28,3

Fixed link options

- The implementation of a **fixed connection** to the Kvarken **is technically possible**. There are several feasible solutions.
- The studied implementation options have their own advantages and disadvantages:

User Perspective

- A combination of road and rail offers the greatest flexibility and is the most attractive option for users.

Cost Perspective

- The most economical would be a surface-level road throughout the entire route.

Environmental Perspective

- A long railway tunnel connecting both shores would have the lowest environmental impact.
- The implementation schedule depends on the investment in the project. With rapid progress, the connection could be available in the early 2040s.