# Vessel Traffic Analysis and Route Optimization

## Introduction

This document provides a step-by-step explanation of the Vessel Traffic Analysis and Route Optimization project. The objective of the project is to analyze vessel traffic density, identify high-traffic zones, potential bottlenecks, or dangerous intersections, and provide insights to optimize routes and enhance safety.

## Step 1: Data Preparation

The data used for this project was AIS (Automatic Identification System) data stored in a Postgres database. It was imported into QGIS for visualization and analysis. Key steps included filtering and preparing the data.

- Imported AIS data into QGIS using the DB Manager tool.  
- Filtered data by relevant attributes such as vessel type, speed, and timestamp.

## Step 2: Creating Density Maps

Density maps (heatmaps) were created to visualize the concentration of vessel routes. This highlights areas with high traffic density.

- Used the Heatmap renderer in the Symbology tab.  
- Adjusted radius and color ramp for effective visualization.  
- Created separate heatmaps for overall traffic and specific vessel types.

## Step 3: Time-Based Analysis

SQL queries were used to segment the data into time intervals, such as morning (06:00–12:00), afternoon (12:00–18:00), evening (18:00–00:00), and night (00:00–06:00).

- Example SQL query:   
 SELECT \* FROM vessel\_ais\_data WHERE EXTRACT(HOUR FROM timestamp) BETWEEN 6 AND 12;

Separate density maps were created for each time segment to analyze temporal patterns.

## Conclusion

This project successfully analyzed vessel traffic density and patterns using QGIS and SQL. The insights gained can help optimize vessel routes, improve safety, and inform navigation policies. The project's workflow and outputs were documented and shared on GitHub for further exploration and collaboration.