In this thesis, a method and system to find freight wagons on marshalling yards was researched and developed. The research was performed according to the intended planning and took eight months. The research took place at the IT company CGI located in Rotterdam. The fact that the research took place at a company meant that more stakeholders were involved than in a regular graduation project. Sometimes this was difficult to manage, as a balance had to be found between the practical applicability and the research aspect of the project. This was a challenge, but the added value of performing the graduation project at a company was also large, resources and motivation from the employees was always available.

In the master Geomatics, the geo-information chain is a methodical line that is often followed. This chain is visualised in Figure 1. In this project, all steps of the geo-information chain were implemented. The globe represents the real world, the actual situation. In this project, the actual situation consisted of freight wagons devices on a marshalling yard. Data capture in this project was done using GPS/GNSS to get measurements of the location of the freight wagons.

Data storage was done in several ways, the first step was in the database of Undagrid, where a REST endpoint could be queried to extract the result. During the processing of the data, feature services from ESRI were used to store intermediate data. The analysis that was done consisted of several processes that were invoked on the data, including median calculations and map matching algorithms. Another part of the analysis was determining whether the algorithms and map matching had effect on the data and how this would influence the accuracy of the result. This was done using visualisations and comparing the known distances to the distances that were calculated based on the data that was received and processed. Another step in the analysis was to see how the time aspect of the stationary vehicles was visible in the track to which they were matched over time. Visualisation was done using ArcMap, ArcGIS online and the operations dashboard. All aspects of the geo-information chain were implemented, following the methodical line of the Master Geomatics.

FIGURE 1 GEOINFORMATION CHAIN (LEMMENS, 2013)
Part of the research and application field of Geomatics is research towards tracking, tracing and localisation techniques. This project adds to that field of research, by investigating stationary GPS and methods to improve the generated location. Another interesting aspect of this research was the rail network that played an important role in determining the actual location. These two aspects combined result in a model were the location of the train will get better and better the more time passes and can be communicated between the stakeholders as a location, not a position.

The project fits in the wider social context by providing a more efficient ways of transporting goods. The transportation of goods is very important for the economy of any country. In the Netherlands, one of the main points in exporting and importing goods is the Rotterdam harbour. From this harbour, goods are transported all over Europe. With the environment and traffic congestions being an ever increasing problem, an alternative for transportation over roads is needed. Transportation using rails is a very good alternative, but is actually used less and less because of inefficiency in the process. This inefficiency is partly caused by the fact that trains and wagons can get lost for easily a week. The system that was researched and developed during this project, solves this problem and provides a way to always find the wagons when they are on a marshalling yard.