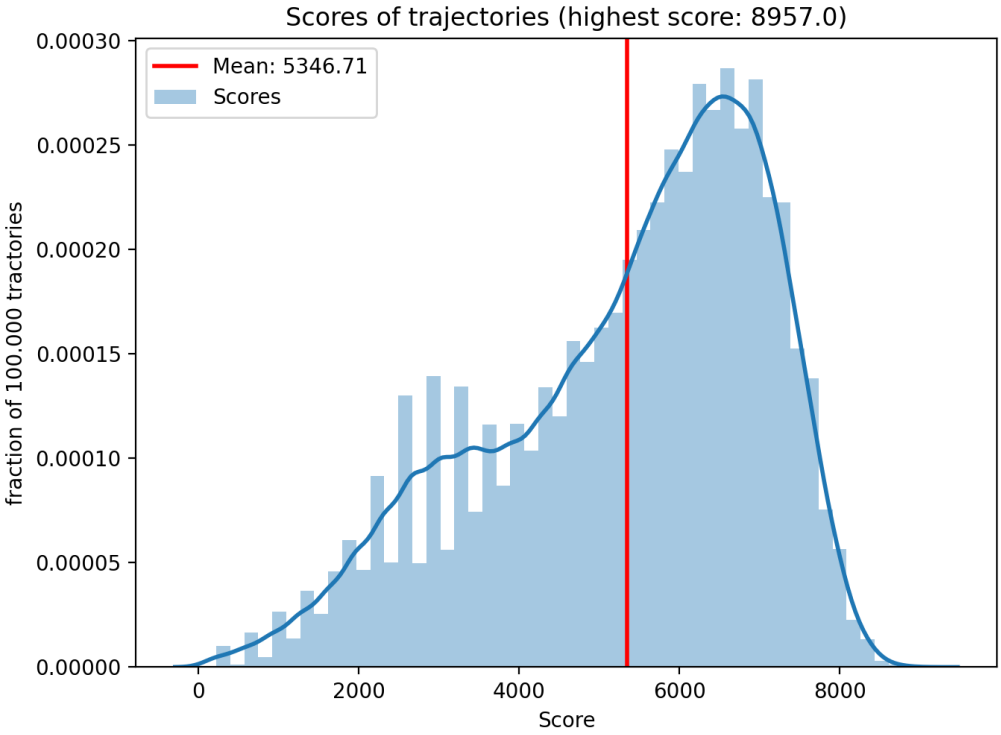
Baseline

When searching for a good solution to the RailNL case, one must ask itself a few things; what kind of solutions are feasible? What contributes to a good solution? Or how can one know that a solution is optimal? To investigate these questions, it is useful to generate some solutions randomly to see what sort solutions come up.
To start off, the case was analyzed by creating 100.000 random solutions. The assignment was: find a combination of at most seven trajectories that covers all connections in North- and South-Holland, where every trajectory takes up at most 2 hours. The second assignment was to choose the trajectories in such a way that the following function (which defines the quality of the solution) is maximized: k = p*10.000 – (100*T - Min), p stands for percentage of connections used, T is the number of trajectories and Min is the total time spend in all trajectories.
The following graph summarizes the results of the random track generator:



Before analyzing this graph, first some things to keep in mind. This is not a uniform sample from the state space, some constraints have been applied to the random trajectory generator. The first constraint is that a trajectory can at most take up 2 hours. The second constraint is that in the solution there are at most 7 trajectories. We constrained the random trajectory generator, because other solutions are not feasible for the problem stated in the case and are not worthwhile investigating.

First notice that the average of the simulation lies about 5300 points, which is about half the score one could possibly obtain. Secondly, all “low” scores (<5000) are mostly solutions with 1 or 2 trajectories. This is due to the fact that with 1 or 2 trajectories of at most 2 hours only very little connections are used, which is the largest contributor to amount of points scored.

Thirdly, observed was that almost all high scores (>8000) seemed to have more than 4 trajectories. So what amount of trajectories is optimal? Looking at the objective function, it can be seen that the number of trajectories should be minimal (every extra trajectory yields -100 points) while using all connections (using a connection yields an increase in the score of (1/28)*10.000=357.14). Thereby, the total time of all connections is 381 min, meaning that at least 4 trajectories of 2 hours are necessary if one intends to use all connections. All this combined yields a maximum score of 10.000-100*4-381=9219 points (all connections used, no connections used twice). The random simulation however, almost never surpasses the 9000 points, therefore other algorithms should and can do better (one of our algorithms already reached a score of 9180).