Guide for using the Excel file in the attachments

The Excel file contains the calculations conducted throughout the thesis.

There are a total number of 38 sheets in this file that shows different parts of the calculations. The description for all these sheets is presented in this guide. The guide will follow the sheets one by one from the beginning:

1. "road timings"

This sheet shows the time that each of the route will take in minutes. Cell A2 shows the main route 1. Cells A3-9 shows the parts that will build alternative route 2. Cells A10-11 shows the time that it will take for the trucks to reach each of the custom stations. Cells A12-13 shows the timing of Bjørnfjell to Stockholm via main route 3 and alternative route 4. Cells A14-15 shows the timing of Helligskogen to Stockholm via main route 5 and alternative route 6. Cell A16 shows the timing for the train route from Narvik to Stockholm.

2. "Route sets gross times"

This sheet is meant for the calculation of resting times which will be explained in the following sheets. Column A shows the route sets. Column B shows the gross time (without any delays) for these route sets. Column C shows the gross time with the exclusion of route 2 from the route sets that have route 2 in them because the drivers will rest in the ferries and there is no need for extra rest for them.

3. "Route Set (1,3)"

This sheet shows the calculation of time to delivery for route set (1,3). Column A shows the uniform dispatch time distribution. Column B shows the arrival times at Bjørnfjell with respect to the uniform dispatch time in hours. Column C shows the arrival times at Bjørnfjell with respect to the uniform dispatch time in Clock. Column D shows the arrival times at Stockholm with respect to the Bjørnfjell arrivals in hours. Column E shows the arrival times at Stockholm with respect to the Bjørnfjell arrivals in Clock. Column F shows the respective time to delivery for each of the dispatch times. The figure shows the distribution of time to delivery with respect to dispatch times which is presented in the main file as well. Different colors for the numbers show different days. Black is the 1st day (the day that each dispatch times have occurred). Red shows the 2nd day. Brown shows the 3rd day. The waiting times at Bjørnfjell due to it being closed at certain times is apparent at the calculation.

4. "Route set (1,4)"

The description for this sheet is the same as Sheet "route set (1,3)".

5. "Route set (1,5)"

The description is the same as Sheet "Route set (1,3)" with the difference that Columns B and C shows arrival time at Helligskogen instead of Bjørnfjell.

6. "Route set (1,6)"

The description is the same as Sheet "Route set (1,3)" with the difference that Columns B and C shows arrival time at Helligskogen instead of Bjørnfjell.

7. "Route set (2,3)"

This sheet shows the calculation time for time to delivery for route set (2,3). Column A shows the uniform dispatch time distribution. Column B shows the arrival times at Narvik with respect to the uniform dispatch time in hours. Column C shows the arrival times at Narvik with respect to the uniform dispatch time in Clock. Column D shows the arrival times at Bjørnfjell with respect to the Narvik arrivals in hours. Column E shows the arrival times at Bjørnfjell with respect to the Narvik arrivals in Clock. Column F shows the arrival times at Stockholm with respect to the Bjørnfjell arrivals in hours. Column G shows the arrival times at Stockholm with respect to the Bjørnfjell arrivals in Clock. Column H shows the respective time to delivery for each of the dispatch times. Different colors for the numbers show different days. Black is the 1st day (the day that each dispatch times have occurred). Red shows the 2nd day. Brown shows the 3rd day.

8. "Route set (2,4)"

The description for this sheet is the same as Sheet "route set (2,3)".

9. "Route set (2,5)"

This sheet shows the calculation of time to delivery for route set (2,5). Column A shows the uniform dispatch time distribution. Column B shows the arrival times at Narvik with respect to the uniform dispatch time in hours. Column C shows the arrival times at Narvik with respect to the uniform dispatch time in Clock. Column D shows the arrival times at Stockholm with respect to the Narvik arrivals in hours. Column E shows the arrival times at Stockholm with respect to the Narvik arrivals in Clock. Column F shows the respective time to delivery for each of the dispatch times. The figure shows the distribution of time to delivery with respect to dispatch times which is presented in the main file as well. Different colors for the numbers show different days. Black is the 1st day (the day that each dispatch times have occurred). Red shows the 2nd day. Brown shows the 3rd day.

10. "Route set (2,6)"

The description for this sheet is the same as Sheet "route set (2,5)".

11. "Route set (1,7)"

The description for this sheet is the same as Sheet "route set (2,5)". The only difference is this is the train route. The waiting times due to the train only leaves once a day is apparent in the calculations. Different colors for the numbers show different days. Black is the 1st day (the day that each dispatch times have occurred). Red shows the 2nd day. Brown shows the 3rd day.

12. Route set (2,7)"

The description for this sheet is the same as Sheet "route set (2,5)". The only difference is this is the train route. The waiting times due to the train only leaves once a day is apparent in the calculations. Different colors for the numbers show different days. Black is the 1st day (the day that each dispatch times have occurred). Red shows the 2nd day. Brown shows the 3rd day. Blue shows the 4th day.

13. "Comparison Chart"

This sheet is for the comparison of all the time to deliveries that have been calculated in Sheets 3-12. Column A shows the uniform dispatch time distribution. Column B shows the time to delivery for route set (1,3). Column C shows the time to delivery for route set (1,4). Column D shows the time to delivery for route set (1,5). Column E shows the time to delivery for route set (1,6). Column F shows the time to delivery

for route set (2,3). Column G shows the time to delivery for route set (2,4). Column H shows the time to delivery for route set (2,5). Column I shows the time to delivery for route set (2,6). Column J shows the time to delivery for route set (1,7). Column K shows the time to delivery for route set (2,7). The chart shows the distribution of time to delivery with respect to dispatch times for all route sets.

14. "Baseline P calculations"

This sheet is for the baseline probability calculations with the usage of the formulas in chapter 3. Column A shows the route sets. Column B shows the mean time to delivery for each route set. Column C shows the normalized mean time to delivery for the purpose of making the probabilities more sensible. Column D shows the utility function for each route set. Column E shows the exponential utility function. Column F shows the baseline probability (when all route sets are in the mix) for each route set.

15. "Baseline P 2 by 2"

This sheet shows the baseline probability if the decision maker wants to choose from two specific route set options. There is a Matrix in this sheet that shows each route sets probability against all the other routes when there are only these 2 options in the pool.

16. "Rest calculations"

This sheet is for the initial rest calculations with respect to only mean time to deliveries in each route set. For these calculations the timing in route 2 has been excluded since the drivers will rest in the ferries.

17. "Actual MTTD (Without Delay)"

This sheet is for calculation of actual mean time to delivery based on the baseline mean time to delivery that has been calculated previously. In this sheet the effects of weather that will cause delays in main route 1 will be neglected. Column A shows the route sets. Column B shows the baseline MTTD for each route set. Column C shows the rest timings for the truck routes. Column D and E shows the loading and unloading times for train. Column F shows the delay effect added times that in this section is neglected. Column G shows the final actual mean time to delivery for all route sets.

18. "Actual P (without delay)"

This sheet is for calculating the actual probability without the delay effect of the weather. The description is the same as Sheet "Baseline P calculation".

19. "Actual P 2 by 2"

The description is the same as Sheet "Baseline P 2 by 2". Only this time for the actual probability without the effect of weather.

20. "Delay function"

This sheet shows the normal distribution that have been used to generate the random numbers for the weather delay effects. The numbers are randomized around a normal distribution with a mean of 8 and standard deviation of 2.

21. "(1,3) with delay"

This sheet shows the time to delivery calculation for route set (1,3) with weather effects delay. Column A shows the uniform dispatch time distribution. Column B shows the arrival times at Bjørnfjell with respect to the uniform dispatch time in hours. Column C shows the arrival times at Bjørnfjell with respect to the

uniform dispatch time in Clock. Column D shows Delay timings generated by the delay function. Column E shows the arrival times at Bjørnfjell with delay effects in hours. Column F shows the arrival times at Bjørnfjell with delay effects in Clock. Column G shows the arrival times at Stockholm with respect to the Bjørnfjell arrivals in hours. Column H shows the arrival times at Stockholm with respect to the Bjørnfjell arrivals in Clock. Column I shows the respective time to delivery for each of the dispatch times with the weather delay effect. The figure shows the distribution of time to delivery with respect to each dispatch time. Different colors for the numbers show different days. Black is the 1st day (the day that each dispatch times have occurred). Red shows the 2nd day. Brown shows the 3rd day. The waiting times at Bjørnfjell due to it being closed at certain times is apparent at the calculation.

22. "(1,4) with delay"

The description for this sheet is the same as Sheet "(1,3) with delay".

23. "(1,5) with delay"

The description of this sheet is the same as Sheet "(1,3) with delay". The only difference is in Columns B, C, E and F there is arrival times at Helligskogen instead of Bjørnfjell.

24. "(1,6) with delay"

The description of this sheet is the same as Sheet "(1,3) with delay". The only difference is in Columns B, C, E and F there is arrival times at Helligskogen instead of Bjørnfjell.

25. "(1,7) with delay"

The description of this sheet is the same as Sheet "(1,3) with delay". The only difference is in Columns B, C, E and F there is arrival times at Narvik instead of Bjørnfjell. And the transport mode will change to train.

26. "Rest calculations (new)"

This sheet shows the rest calculations after the effects of delay have been implemented in the system. In this sheet for each respective dispatch time and time to delivery a singular rest time will be calculated. Column A shows the uniform dispatch time. Column B shows the time to delivery with delay for route set (1,3). Column C shows the time to delivery with delay for route set (1,4). Column D shows the time to delivery with delay for route set (1,5). Column E shows the time to delivery with delay for route set (1,6). Column F shows the time to delivery for route set (2,3). Column G shows the time to delivery for route set (2,4). Column H shows the time to delivery for route set (2,5). Column I shows the time to delivery with delay for route set (2,6). Column J shows the resting times for each respective dispatch time and time to delivery for route set (1,3). Column K shows the resting times for each respective dispatch time and time to delivery for route set (1,4). Column L shows the resting times for each respective dispatch time and time to delivery for route set (1,5). Column M shows the resting times for each respective dispatch time and time to delivery for route set (1,6). Column N shows the resting times for each respective dispatch time and time to delivery for route set (2,3). Column O shows the resting times for each respective dispatch time and time to delivery for route set (2,4). Column P shows the resting times for each respective dispatch time and time to delivery for route set (2,5). Column Q shows the resting times for each respective dispatch time and time to delivery for route set (2,6). Column R shows the time to delivery with the resting time and weather delay effects for route set (1,3). Column S shows the time to delivery with the resting time and weather delay effects for route set (1,4). Column T shows the time to delivery with the resting time and weather delay effects for route set (1,5). Column U shows the time to delivery with the resting time and weather delay effects for route set (1,6). Column V shows the time to delivery with the resting time and weather delay

effects for route set (2,3). Column W shows the time to delivery with the resting time and weather delay effects for route set (2,4). Column X shows the time to delivery with the resting time and weather delay effects for route set (2,5). Column Y shows the time to delivery with the resting time and weather delay effects for route set (2,6).

27. "TTD for the delay"

This sheet is like the "Comparison chart" sheet except for the fact that its only for the route sets that are using main route 1. To show how these route sets behave after the implementation of delay. The chart shows the distribution of time to delivery with respect to dispatch times for route sets (1,3), (1,4), (1,5), (1,6) and (1,7).

28. "TTD Special delay case"

This sheet shows all time to deliveries for all route sets after the implementation of the weather delay effect, resting times, and loading and unloading times into time to deliveries. The description of this sheet is the same as Sheet "Comparison Chart".

29. "P estimations (Special case)"

This sheet is for calculating the probability in when the weather effect is present in the system. (which is 15% of the days in winter and 3% of the days in summer). The description is the same as Sheet "Baseline P calculations"

30. "Special case P 2 by 2"

The description of this sheet is the same as Sheet "Baseline P 2 by 2". Only for the special weather delay case.

31. "Summer final MTTD"

This sheet is for the calculation of the final mean time to delivery for summer which is based on the equation in section 5.9. Column A shows the route sets. Column B shows the actual mean time to delivery without the weather delay effect. Column C shows the actual mean time to delivery with the weather delay effect. Column D shows the Final mean time to delivery for summer.

32. "Winter final MTTD"

The description of this sheet is the same as Sheet "Summer final MTTD". only needs to change the summer with winter!

33. "Final Probability for Summer"

The description of this sheet is the same as Sheet "baseline P calculations". The only difference is here instead of the baseline mean time to delivery, the Final mean time to delivery for summer has been used.

34. "Final P (S) 2 by 2"

The name of this sheet means final probability for summer 2 by 2. The description for this sheet is the same as Sheet "Baseline P 2 by 2".

35. "Final Probability for Winter"

The description of this sheet is the same as Sheet "Baseline P calculations". The only difference is here instead of the baseline mean time to delivery, the Final mean time to delivery for Winter has been used.

36. "Final P (W) 2 by 2"

The name of this sheet means final probability for winter 2 by 2. The description for this sheet is the same as Sheet "Baseline P 2 by 2".

37. "Effects of Bjørnfjell (no rest)"

This sheet wants the examine the effects of the Bjørnfjell custom stations being closed all the time against its normal operating conditions on route set (1,3). The weather delay effects will be neglected here. The resting times have not been considered in this sheet. Column A shows the uniform dispatch time distribution. Column B shows the arrival times at Bjørnfjell with respect to the uniform dispatch time in hours. Column C shows the arrival times at Bjørnfjell with respect to the uniform dispatch time in Clock. Column D shows the arrival times at Stockholm with respect to the Bjørnfjell arrivals in hours when the Bjørnfjell is at its normal operating conditions. Column E shows the arrival times at Stockholm with respect to the Bjørnfjell arrivals in Clock when the Bjørnfjell is at its normal operating conditions. Column F shows the time to delivery with respect to dispatch times when Bjørnfjell is at its normal operating conditions. Column G shows the arrival times at Stockholm with respect to the Bjørnfjell arrivals in hours when the Bjørnfjell is always open. Column H shows the arrival times at Stockholm with respect to the Bjørnfjell arrivals in Clock when the Bjørnfjell is always open.

38. "Effects of Bjørnfjell (rest)"

This sheet shows the effects of Bjørnfjell customs station being always open with the rest timings added. Column A shows the uniform dispatch time distribution. Column B shows the time to delivery for each respective dispatch time with Bjørnfjell at its normal operations without rest timings. Column C shows the time to delivery for each respective dispatch time with Bjørnfjell at its normal operations with rest timings. Column D shows the time to delivery for each respective dispatch time with Bjørnfjell always being open without rest timings. Column E shows the time to delivery for each respective dispatch time with Bjørnfjell Being always open with rest timings. The chart shows the distribution of time to delivery with respect to dispatch times for the Bjørnfjell at normal operation with rest timings and Bjørnfjell being always open with rest timings.