YRKESHÖGSKOLAN NOVIA

Navigating through Saimaa Canal

From observations and common verbal knowledge to written form of information

Antti Tasala

Degree Thesis

Bachelor of Maritime Management

Degree Programme in Maritime Management, Captain

Turku 2021

DEGREE THESIS

Author: Antti Sakari Tasala

Degree Programme and place of study: Maritime Management, Novia

Specialisation:

Supervisor(s): Peter Björkroth, Ritva Lindell and Tony Karlsson

Title: Navigating through Saimaa Canal

Date: 29.10.2021 Number of pages: 59

Abstract

The aim was to describe the Saimaa Canal voyage with empirical data and experience. Basic maneuvering theories were expected to support these findings. MV Nina's voyage was being mapped with important details from the lock of Mälkiä in Lappeenranta to the lock of Brusnitchnoe (Juustila). Materials were based on vessel information and publications from Finnish Transport Infrastructure Agency (Väylävirasto) and basic chart data (Wärtsilä iSailor). Empirical parts are supported by author's photos. The whole voyage requires a pilot or pilot exemption certificate (PEC) and the author holds the latter. As a result, this thesis could be used as a guide book for instance future officers to learn all the unwritten rules and common practices that need to be internalized for safe voyages through Saimaa Canal and ultimately leading to PEC-license – hence the unwritten became written in this thesis.

Canal voyages were not studied in Maritime Management studies at any meaningful level; therefore, this thesis could give also some insight for possible future elective studies at Novia.

Language: English
Key Words: Saimaa, Saimaa Canal, Maneuvering, Pilot Exemption

OPINNÄYTETYÖ

Tekijä: Antti Sakari Tasala

Koulutus ja paikkakunta: Maritime Management, Novia

Suuntautumisvaihtoehto:

Ohjaaja(t): Peter Björkroth, Ritva Lindell ja Tony Karlsson

Nimike: Navigointi Saimaan kanavan läpi

Päivämäärä 29.10.2021 Sivumäärä 59

Tiivistelmä

Tutkimuksen tarkoitus oli kuvata matka Saimaan kanavan läpi empiiriseen tietoon ja kokemukseen perustuen. Tavalliset teoriat laivan ohjailusta odotettiin tukevan tutkimuksen lopputulosta. Alus Ninan matka kartoitettiin tärkeillä yksityiskohdilla alkaen Lappeenrannassa sijaitsevalta Mälkiän sululta ja päättyen Brusnitchnoen (Juustila) sulkuun. Tutkimuksen materiaaleina on käytetty laivan yksityiskohtaisia tietoja, Väyläviraston julkaisuja ja karttatietoja (Wärtsilä iSailor). Tutkimuksen empiirinen osuus sisältää tutkijan omia valokuvia. Kanavan läpikulku vaatii luotsin kyseessä olevalta aluskoolta. Opinnäytetyön tekijällä on luotsauserivapaus Saimaan kanavaan. Tätä lopputyötä voisi käyttää tulevaisuuden vahtipäälliköiden koulutuksessa, jotta kaikki kirjoittamattomat säännöt ja tavat olisivat helpommin sisäistettävissä turvallista kanavanavigointia varten. Tässä lopputyössä kirjoittamaton muuttui kirjoitetuksi.

Kanava-ajoa ei opiskeltu merkittävällä tasolla Maritime Management -koulutuksessa, joten tämä lopputyö voisi myös antaa näkökulmia vaikka mahdollisiin valinnaisiin kursseihin.

Kieli: Englanti
Avainsanat: Saimaa, Saimaan kanava, Ohjailu, Luotsauserivapaus

Table of Contents

Abbreviation glossary

AIS	Automatic Identification System
GT	Gross Tonnage
OOW	Officer On Watch
PEC	Pilot Exemption Certificate
ROT	Rate of Turn
RPM	Rounds/Revolutions Per Minute
Traficom	Finnish Transport and Communications Agency
VHF	Very High Frequency (Radio Communication)
VTS	Vessel Traffic Service

1 Introduction

The author received watch officer's licence in Spring 2019 and has been working ever since on the same vessel owned by Mopro Oy. The vessel is a "saimax" size vessel and currently recognized under the name of MV Nina and the author is currently working as a chief officer. Saimax is possibly not a commonly used vessel size description nevertheless it is derived from the maximum allowable vessel size for the Saimaa Canal (cf. Panamax, Suezmax, etc.). Maximum allowable size for vessels in meters: length 82,50, width 12,60 and depth 4,35 with a maximum air clearance of 24,50. (Väylävirasto, retrieved on 24.10.2021). MV Nina has the following measures: maximum length 81,83, width 12,60 and air clearance 22,10 masts up. Other details of the vessel will be covered in the following section.

Figure 1: Horizontal lock clearance of a Saimax vessel. Picture from starboard side where port side is leaning against the lock wall. (Antti Tasala, 2021)

1.1 Research question and motivation

The research question is: How to navigate safely through Saimaa Canal with a Saimax vessel?

Subquestion: Maneuvering safely through Saimaa Canal without a pilot.

Motivation for such a portfolio study was derived from author's personal experience and also in pursue for the future needs of Mopro Oy. The regular operations of Mopro Oy are dependent on deck officers capable of acquiring a pilot exemption certificate (PEC) for the canal, lake and the Gulf of Finland including Turku Archipelago (i.e. PEC-license covering following VTS-sectors: Saimaa, Saimaa Canal, Kotka, Helsinki Sector 1 & 2, Hanko and Archipelago.) Saimaa Canal is not a VTS-sector by definition but instead its own separate pilotage area with a separate exemption license.

The author had to learn all the special circumstances and local habits from the ground up which meant a long list of notes and simply memorizing certain spots to avoid or rules for maneuvering. Therefore, this thesis is an answer to questions the author was missing in 2019.

1.2 MV Nina Pilot Card and Ship Particulars

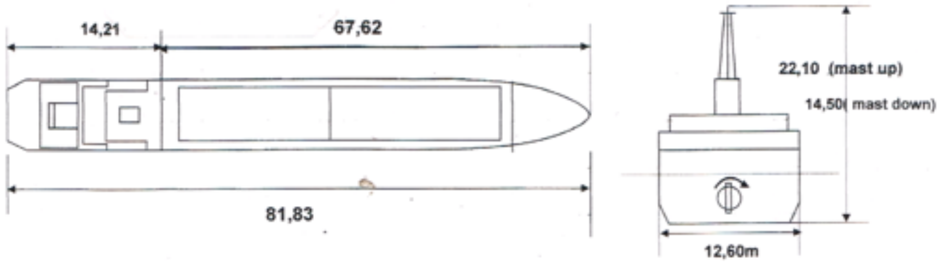
MOPRO OY

PILOT CARD

Ship name:	m/v NINA	**Call sign:**	OJNV
port of registry:	Savonlinna	**MMSI:**	230681000
Flag:	Finland	**IMO no.:**	8618035
Owner:	Mopro Oy	**Type:**	Dry cargo

Ships particulars

Length overall:	81,83	**Depth:**	6,0 m
Breadth:	12,6	**Summer DWT:**	2723
NRT:	1096 nrt	***Anchor chain:***	
GRT:	2006 grt	Port:	8 shackles
Summer draught:	4,52	starboard	8 shackles
Air draught:	14,50 (+ mast 7,6)	1 shackle= 27,5m / 15,0 fath. / 90,2 feet	



Engine particulars

Engine power: 1185 kw **Type engine:** diesel

Manouvering Engine Orders	**RPM**	**Speed**	
		Loaded	**Ballast**
FULL AHEAD	860	10	10,5
MANOUVER AHEAD	740	8,5	9,0
HALF AHEAD	600	7,5	8
SLOW AHEAD	500	6,0	6,5
DEAD SLOW AHEAD	350	4,0	4,5
FULL ASTERN	700		

Type of rudder:	Flap rudder	**Max angle:**	40 deg.
Hard over to hard over:	19 sec.		

CHECKED AND READY FOR USE:

Anchor	Speed log
Whistle	Engine telegram
Radar	steering gear
Indicators rudder	Compass
Gyro	VHF

Draft dF=___4,5____ dA=___4,5 m____

PILOT CARD COMPLETED BY DATE:____15.02.2020___________

Signed by Master:________________________ Pilot: ________________________

Figure 2: Pilot card (Mopro Oy, MV Nina's public documents, 2021)

MOPRO OY

SHIPS PARTICULARS

Vessel name:	Nina
Call sign:	OJNV
Flag:	Finland
Port of Registry:	Savonlinna
IMO no.	8618035
MMSI no.	230681000
gsm	+358 40 025 1610
Owner	Mopro Oy
Email	nina@mopro.fi
Gross tonnage	2006 GRT
Net Tonnage	1096 NRT
Summer Deadweight	2723 mt (1,025)
Max Displacement	3768 mt (winter 3670)
LOA	81,83 m
Lpp	78,45 m
Beam	12,60
Moulded Depth	6,00 m
Moulded Draught	4,75 m
Summer Draught	4,52 m
Fresh Water Draught	4,62 m
Top of Deck Mark	5,771 m
Top of Board	6,09 m
Aft Top of Board	8,58 m
Lightship	1061,2 mt
Bulkhead (2 psc)	16 mt
Total Lightship	1077,2 mt
Frame Spacing	0,6/0,65 m
Distance to the Perpendiculars	Aft=-1,25 m Fore=-0,8m
ME power	1189 kW (1589 hp)
Max Speed	Loaded 10,5 kn / ballast 11,0 kn
Bow Thruster	162 kW
Hold Dimensions	51,34 x 10,15 x 6,975 in meters
Hold Capasity	3436 cbm (122322 cbf)
Builder	H. Brandt Schiffwerft GmbH & Co.KG Oldenburg Germany 1987

Figure 3: Ship’s particulars (Mopro Oy, MV Nina’s public documents, 2021)

Figure 4: MV Nina leaving Mälkiä lock and bound for Mustola lock (Antti Tasala, 2021)

1.3 Overlook of the voyage

This portfolio thesis is constructed with the idea of following a regular outbound voyage of MV Nina from the Lake Saimaa to the Baltic Sea. The canal entrance is located in Lappeenranta Finland at Lake Saimaa and the exit is on the Russian side at a lock called Brusnitchnoe and in Finnish hereafter: Juustila. After Juustila the voyage to open water Baltic Sea continues with Russian pilots via Gulf of Vyborg and through Vihrevoy harbour basin.

There are eight locks in the following order when starting from the Lake Saimaa: Mälkiä, Mustola, Soskua, Pälli, Ilistoe, Cvetotchnoe, Iskrovka and Juustila. The following picture gives an overlook of the voyage and the heights from sea level are also mentioned measured at lock high-water.

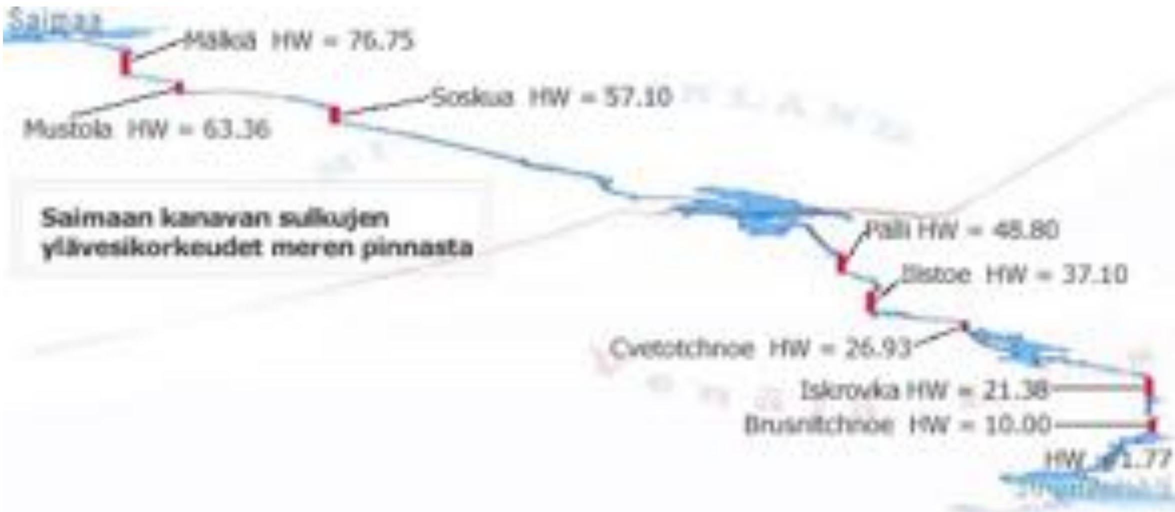


Figure 5: Saimaa Canal voyage overlook (Väylävirasto, retrieved on 24.10.2021)

Russian border control is at the lock of Pälli and the actual state border is at the lake of Nuijamaa shortly after Pälli. Finnish border control is on the northern part of Nuijamaa lake.

Total canal voyage is 43 kilometers and total ascent is 75,7 meters varying from 5,5 to 12,4 meters per lock (Väylävirasto, retrieved on 24.10.2021). Kilometers are used in the Canal instead of nautical miles and this is something to consider when seeing the "milestones" at the banks or agreeing with a suitable meeting point with other ships. There are seven opening bridges, six fixed bridges and only one bridge must be called on VHF upon arrival (Väylävirasto, retrieved on 24.10.2021).

2 Short history of the Canal

The history of Saimaa Canal dates back to 16th century and grounds for building has varied between commercial and military purposes when Finland was under the Swedish rule. The first attempts of clearing a waterway to Lake Saimaa from the Gulf of Vyborg between 16th and 17th century failed due to rocky grounds and insufficient tools. It has been argued that this was a lucky incident since it could have drained eventually the whole Saimaa Lake area to the Baltic Sea due to missing dams. Later under the Russian rule in the 19th century there was significant lumber mill industry in the Saimaa area which required cost effective logistics for goods to enter to the Vyborg area and finally Nikolai I made the decision in 1844 to build the Canal. This early version of the Canal consisted of 28 locks but the capacity was already limited by the end of the 19th century and the World War I and II prevented the plans to enlarge the Canal. After WW II the land areas of Karelia were lost to Russia in peace negotiations and the current divide of the land areas around the Canal achieved its current form. Finally the actual re-build started after almost 20 years later when Kekkonen, the president of Finland negotiated a 50-year land-lease agreement with Russia. The work started in 1963 and finished in 1968 and the Canal reached its current form. (Navisaimaa, Retrieved on 24.10.2021)

3 Maneuvering

Maneuvering will form the theoretical framework of this thesis and these theories are expected to support the author's practical findings and experiences in canal maneuvering. It could be possible to make calculations for squatting for instance, but this is seen irrelevant firstly due to the fact that it is a canal where a box shaped vessel is moving within a somewhat box shaped pool of water hence squatting should be considered a three-axis phenomenon. Secondly referring to the latter of canal being *somewhat* box shaped pool of water where a calculation could work for a very short canal stretch but the canal's bottom shape varies a lot with several irregularities with low angle sloped banks, high angle banks up to perfectly vertical walls, irregular rock cuts, bends with accumulated silt etc. Baudu (2014) supports this conclusion by stating the following:

In some individual cases, when passing a port sill or bar for instance, "dynamic" squat can reach values greater than those forecast. Conversely, soft silt bottoms can reduce the effect of phenomena associated with squat. The behaviour of a vessel in confined water therefore remains a serious problem for navigation, which requires perfect knowledge of the topography of the channel and the nature of the bottom. It is also noted that the determination of the limit conditions for the passage of a ship depending on the particular circumstances is specific to each channel. It cannot be determined theoretically. It actually requires great experience, and is normally decided by the port authority in consultation with local pilots. (Baudu, *2014, p. 170)*

Maneuvering in the Saimaa Canal is a mixture of capabilities to maneuver in confined spaces, river, shallow water and in port. It is clear that mastering these skills need firstly the basic understanding of maneuvering theory and secondly a ship specific understanding how it behaves in general and thirdly the knowledge of the canal's features in detail.

Baudu (2014) sums up the following list of effects that are to be considered in confined waters:

- *Reduced turning rate (going into a turn more quickly with an increase in radius of turn)*
- *Increased sensitivity to swing (reduction in directional stability)*

- *Vibration of the ship linked to disturbance of the water flow under the keel and especially around the propeller*
- *Increased emergency stop distance, together with greater propeller thrust effect, in ships with a shaft line*
- *Increased hull resistance associated with squat and change of trim*
- *Presence of restrictions (banks, wharves, etc.) causing lateral effects that tend to move the whole ship closer to the side when it is moving parallel to it (bank effects) or move it away when approaching at an angle (cushion effect)*
- *Presence of other ships nearby, increasing confinement phenomena and creating a lateral force whose amplitude and moment vary with the relative position of the ships.*

Baudu (2014, p. 181)

3.1 Speed

Baudu (2014, p. 170) states that speed is a component of squat effect – and this can be seen and felt on MV Nina throughout the Canal voyage. There are naturally several different speeds used depending on the situation, but it is possible to make some general rules for safe maneuvering. Baudu (2014, p. 170) is also talking about a braking phenomenon which is caused by the Venturi effect (water flowing faster in confined space). In the Canal the Venturi effect is around the whole hull in confined sections thus it will not only slow down the vessel from below the keel but also on the sides. This leads to a forced constant speed where it makes no sense to increase main engine RPM since it will only lead to hull and propeller vibrations. On MV Nina the optimal RPM is around 600 and in confined waters this means approximately 4,5 to 5 knot speeds in loaded condition. When talking about optimal it is basically the limit where no significant hull or propeller vibrations are present and also on the limit where less RPM would decrease speed. In ballast condition MV Nina could reach 5 to 5,5 knots in the same sections. If the RPM is increased to 650 it could give a 0,1 to 0,2 knot increase in speed but it will also deteriorate directional stability, vibrate the hull and start suction effects in various spots where it would not do so with lower RPM’s.

It is essential to stress that the above-mentioned speeds relative to RPM do not apply in several parts where the water can flow away from the hull or if the depth increases. Therefore, the speed must be monitored especially when approaching bends or locks. There is hardly any space to make crash stops so the speed must be foreseen with an active control of the main engine RPM. It is also very common to reduce speed by stopping engine and “glide” ahead since MV Nina is known for its behavior to keep her speed for relatively long distances.

The speed while entering the lock is more of a personal preference but in general the optimal speed could be argued to be between one to two knots. However, it must be kept in mind that a Saimax vessel has about 40 centimeters of space to maneuver on both sides so the speed must be in proportion to his/her maneuvering skills. Especially when fully laden the Venturi effect is also relevant here and as the bow reaches the lock, the speed will drop drastically and if the engine is stopped during the first meters of entering the lock the vessel will stop in water due to the Venturi effect.

3.2 Using thrust, rudder and bow thruster

MV Nina has a right-handed propeller with a fixed-pitch. Baudu (2014, pp. 52-53) explains that a right-handed propeller with a fixed pitch has a tendency to turn the stern to starboard while moving ahead and when reversing it is an adverse movement and the stern moves to port due to the drag force and the center of gravity. This is also called the propeller walk. There is also the deadwood effect in force on MV Nina on reverse and according to Baudu (2014, p. 53) it is apparent for ships with one shaft line as the keel line next to the propeller is almost vertical for some distance. The following figures reveal this phenomenon.

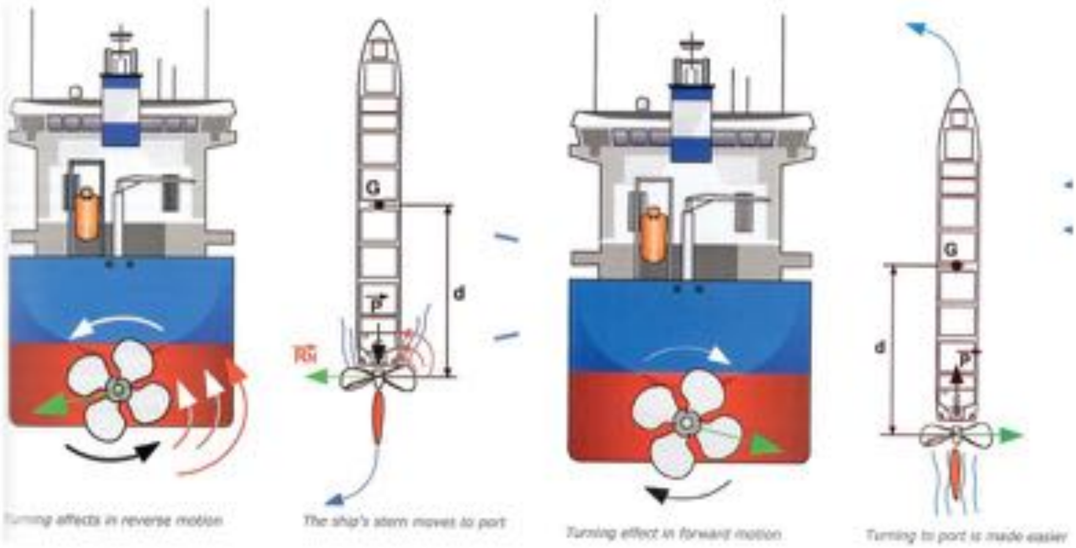


Figure 6: Turning effects for single shaft fixed right-hand propeller vessels (Baudu, 2014, pp. 52-53)

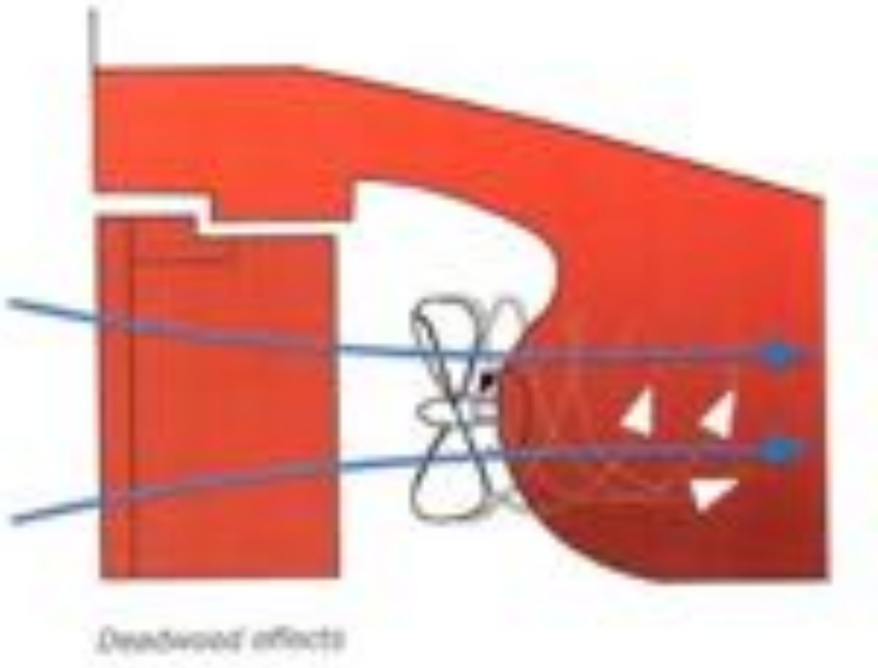


Figure 7: Deadwood effect on a single shaft vessel (Baudu, 2014, p. 53)

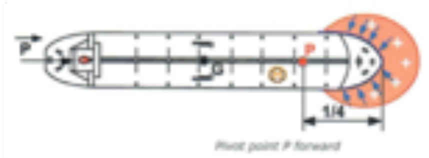
Figure 8: MV Nina's right-handed fixed pitch propeller and flap-rudder (Antti Tasala, 2020)

As seen on the picture above MV Nina has a single shaft line thus there is also a significant deadwood effect in place on reverse i.e., turning stern to port.

On MV Nina the rudder is called a Becker flap rudder which makes especially canal maneuvering a lot easier. Baudu (2014, p. 38) states that a flap rudder could be even compared to a stern thruster due to the high maximum angle. On the figure above the rudder is turned to a maximum angle (40° on MV Nina) to starboard but as seen the fin is at a 90-degree angle which means agile maneuverability. Additionally, the rudder is highly effective in decreasing speed by increasing drag with constant hard over to hard over steering while engine is stopped and gliding ahead.

MV Nina has a powerful 162 kW electro-hydraulic tunnel bow thruster which is effective at speeds under 4 knots. With the combination of a highly effective Becker rudder and powerful bow thruster the vessel can be maneuvered with precision.

Understanding the theory of pivot point is important for canal maneuvering. Baudu (2014, p. 92) explains in short that the pivot point is shifting towards the direction of movement and the center of rotation is combined with the center of gravity. The following figures explain this theory for a stationary, ahead and astern moving ship.



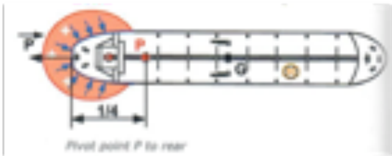


Figure 9: Theory of pivot point (Baudu ,2014, p. 92)

For canal maneuvering the most common situation is close to a stationary ship as the speeds are low especially when maneuvering to a lock.

A perfect example of a combination of all of the above-mentioned theories is a situation of approaching to a lock with too much speed and where is very limited space for maneuvering. Firstly, one must decide whether it is even reasonable to start slowing down with the engine or is the only option to proceed with the current speed, but if there is enough space for putting the engine astern: The stern will start moving sharply to port due to propeller walk and the bow to starboard. The effect is even worse with the deadwood effect and also due to the pivot point being almost in the center of gravity. Since there is quite often not enough space for the bow to move freely to starboard, it must be compensated with the bow thruster in order to keep the vessel aligned with the lock. However, it is quite likely that the vessel is not perfectly aligned with the lock after using the engine astern and then one must use powerful but short forward thrust with hard over rudder to push the stern back in the middle and again consider the pivot point being in the center of gravity and compensate with bow thruster.

3.3 Bank reflection

Baudu (2014, p. 182) discusses the term bank reflection where a bank effect and a cushion effect are under the same term. Bank reflection causes a squatting effect with a lateral suction where the water in front of the bow must pass towards the rear in order to balance the prevailing pressure and the negative pressure at the rear is even increased with propeller thrust. This leads to a loss of rudder efficiency and the stern is being sucked towards the bank. Speed is affecting this phenomenon so it is possible to prevent by decreasing speed but if the loss of control needs to be adjusted immediately by rapid maneuvering a powerful kick-ahead might be needed to enhance the rudder efficiency.

Figure 10: Bank reflection on starboard side (Baudu 2014, p. 182)

Bank reflection is in place throughout the canal voyage and Baudu's presented theories support the author's findings in practice. However, as seen in the figure above the bank effect is simplified in order to understand the phenomenon but in reality the canal has most of the time obstructions on both sides and as discussed earlier the bottom shapes are not uniform which leads to a highly unpredictable maneuvering. In practice on MV Nina the flap rudder is almost always enough to keep the stern away from the bank but if the suction is continuous for a longer stretch and the rudder needs to be constantly kept for example at 10 degree angle the whole ship will drift slowly closer and closer to the bank. That is the point where the engine RPM must be reduced or as Baudu (2014, p. 182) suggested to shortly increase the thrust with more rudder angle in order to push the stern back in the middle.

4 Pilotage and PEC-license for the canal

Pilotage is compulsory in the canal for all vessels and vessel combinations exceeding 35 meters or when a towed vessel is over 35 meters in length excluding log driving. (Luotsauslaki 2003/940 §5) The Finnish state-owned pilotage company Finnpilot provides piloting services for vessels where the master or the OOW does not hold a PEC-license.

It is possible to acquire a PEC licence for the Saimaa Canal and the requirements are as follows:

1) *Has experience of navigating the ship obtained in the last five years in the channel(s) the application concerns as a master or officer of the watch;*

a) *for a minimum of 12 months, of which no less than 6 months in the ship concerned in the application or referred to in subsection 2; or*

b) *for a minimum of 8 months in the ship concerned in the application or referred to in subsection 2, and has completed as a minimum one training voyage in a ship simulator in parts of the channels concerned in the application; and*

c) *ten training voyages in the Saimaa Canal in both directions if the application concerns the Saimaa Canal;*

2) *Holds the deck officer qualification required to serve as master or officer of the watch;*

3) *meets the medical fitness requirements for service in the deck department of merchant ships;*

4) *has a certificate attesting to completion of the parts of the pilot examination referred to in section 11a, subsection 1, paragraphs 2 and 3 or a part referred to in paragraph 2 of this subsection where, in the last five years preceding the submission of their application, the applicant has completed an examination for some other channel which included the examination module referred to in subsection 3, or the applicant has previously completed a simulator test referred to in provisions laid down by virtue of section 21 valid before the entry into force of this Act; and*

5) has an adequate command of Finnish and Swedish

(Luotsauslaki 2003/940 §16)

In section 1c it is stated that Saimaa Canal has a separate definition for minimum navigation experience of ten training voyages in both directions and in theory it is possible to achieve in a short period of time. However, in practice it took one and a half years for the author to attain all the required voyages firstly due to the fact that nobody is working all the time, secondly there are often changes in cargo schedules and thirdly the canal is closed from traffic during the Winter because of ice. On MV Nina it was possible to calculate one one-way voyage per week and under optimal circumstances it could be possible to achieve two training voyages during one seagoing work period.

Even after the ten training voyages in both directions are fulfilled it does not fulfill the general navigational requirements since also the section 1a or 1b must be completed.

4.1 Pilotage exemption in general

Traficom has the possibility to grant a PEC license for a master or an officer that fulfills the requirements mentioned in the previous paragraph. The license is both holder and vessel specific and the GT must be under 3700. Although it is vessel specific it can be transferred to another vessel which is in all essential respects comparable by technical features and size. (Luotsauslaki 2003/940 §16) MV Nina's GT is 2006 and as it is already a saimax class vessel it is clear that the GT is not at least a limiting factor for obtaining a PEC licence for the canal.

PEC license does not require a blank chart test. Referring to the previous chapter where the Pilotage Act states in section 4: *"Has a certificate attesting to completion of the parts of the pilot examination referred to in section 11a, subsection 1, paragraphs 2 and 3 ---".* Section 11a, subsection 1, paragraph 1 mentions blank chart tests but as seen this is not mentioned in the requirements but instead only paragraphs 2 and 3.

To fulfill the requirements of paragraph 2 and 3 one must fulfill the following:

2) *A written test consisting of questions about the conditions in the channel(s) concerned, traffic, VTS, the icebreaking service and port conditions and about this Act and the provisions issued under it and the Vessel Traffic Service Act.*

3) *A test conducted in a ship simulator intended to assess the candidate's capability to navigate the ship optically and by means of radar in accordance with the passage plan he or she has compiled; capability to handle and steer the ship in the channel(s) and the port that the test concerns; capability to react adequately to meeting or transverse traffic; capability to liaise with the bridge team, other ships and the VTS, and the capability to act in emergencies.*

(Luotsauslaki 2003/940 §11a Sections 2 and 3)

The written test mentioned in section 2 can vary slightly depending on the maritime center where the test is conducted but in general the following must be studied at minimum: Pilotage Act, Vessel Traffic Service Act, Act on Environmental Protection in Maritime Transport, Water Traffic Act, Master's Guide regarding the area under review and Ice Breaking services.

The author applied for a pilot exemption certificate on several different areas at the same time and on some of the VTS areas was lacking channel experience, therefore under §16 section 1b the missing training was supplemented in a simulator environment.

5 General knowledge of canal navigation

Saimax class vessel will go through the canal from Mälkiä to Juustila in approximately seven hours. Smaller vessels are naturally faster and some variation is due to condition i.e., loaded or ballast. Additionally, one has to consider oncoming traffic and agree on safe meeting points. The maximum time spent on canal voyage on author's personal experience was almost 11 hours due to traffic or ice blocking the locks and fastest being six hours without any traffic and in light ballast condition.

Other common reasons for delayed passage time are due to poor visibility. The ambient temperature differences in land-locked water masses can be fairly high during Spring and Autumn thus creating fog on the water surface. Due to being an inland location it is also prone for a windless environment and the fog is unable to escape from the higher canal banks and rock cuts. It has to be stated that it is practically impossible to safely navigate through the canal in poor visibility as the maneuvering is solely based on visual aids.

Figure 11: Land locked fog in the Canal in September (Antti Tasala, 2021)

The latter notations reveal that the only things that can be affected are the amount of ballast water and scheduling for the traffic.

Other navigational limitations arise from physical barriers for transmitting and receiving radio signals that affect VHF-communication and AIS-data. Common practice is to call the next lock upon departure from the current lock or at certain generally known spots. The main reason is to make sure the lock is ready, i.e., lock full / empty and gates operational but also to give other vessels within the VHF-range a notation of passage progress. However, it must be noted that lock masters do not operate as disciplined as VTS-centers by repeating one’s message and quite often they might speak with ambiguous volume and / or local customary dialect. The author has been several times in a situation where the message was not clear even after several requests of repeating.

Saimaa Canal VHF-working channel is 11 and lock masters are responsible for operating the locks. Lock and bridge operations are done remotely from the Mälkiä Water Traffic Center and at Juustila it is also possible to control the last three locks and bridges on the Russian side: Juustila, Iskrovka and Ilistoe (Väylävirasto, retrieved on 25.10.2021).

On MV Nina there is Furuno ECDIS system installed and Admiralty operate as a chart supplier. Admiralty does not supply charts for the canal on the Russian side consisting of an area starting from lake Nuijamaa and ending to the Juustila lock, therefore one must either use for example a mobile device and an application called iSailor by Wärtsilä. However, canal being a piloted channel one has to simply remember all the curves and hazardous spots at some point. After all safe maneuvering is the biggest concern – not getting lost in the canal.

On MV Nina there is a schedule scheme where to check the overall progress in order to get an overview of passage progress and agree meeting points with other vessels. The next chapter presents the schedule, meeting points and common communication.

Maximum draft is 4,35 meters in the canal and when a vessel is fully laden up to the maximum it affects a lot for instance entering and exiting the locks. With a saimax vessel it can take 5 to 10 minutes to exit the lock because it takes time to displace the water from outside or inside the lock. The current water level must be noted at Mälkiä and Juustila because those are the locks where the water level is not constant.

The speed limit for vessels with a draft over 3,90 meters is 9 km/h throughout the canal. For vessels with draft under 3,90 meters there are different speed zones varying from 9 to 18 km/h. (Väylävirasto, retrieved on 26.10.2021) The author has never seen a speed restriction sign of 18 km/h at the canal so this information could be arguable, however the speed is limited naturally with canal’s hydrodynamic restrictions and basic safe maneuvering requirements. There are signs of 12 km/h speed limit but there has never been any speed control on behalf of the authorities or the lock masters and normally vessels are using the speed that is simply suitable for their current passage.

5.1 Steering, stopping and leaving the lock

As mentioned earlier the optimal speed while steering into the lock is around one to two knots. One must constantly bear in mind all the external hydrodynamic forces affecting the maneuvering and the vessel's own steering capabilities.

The vessel is moored to the lock's floating bollard with a single spring line. There are three floating bollards in each lock and they follow the water level as the vessel goes up or down. The floating bollard in the middle of the lock is the one to use for saimax vessels.

The spring line is pre-measured to a certain length and the engine is kept on dead-slow ahead during the whole time in the lock in order to keep the vessel in place. The following picture shows an aft view of a saimax vessel when in place and ready to be hoisted (or lowered when outbound). The dashed white line on the lock wall presents the limit which cannot be crossed because of the lock's gates' arc when closing.

Figure 12: Limits of a vessel in a lock for a saimax vessel. MV Nina inbound at low-water. (Antti Tasala, 2021)

As seen on the picture above there is approximately half a meter of available space to the limit. However, since the vessel is moored with a spring line and the engine is constantly on dead-slow ahead the untying needs all this space as the vessel must move astern in order to let go from the bollard.

Another important notation is to monitor the vessel's movement inside the lock while being hoisted or lowered. As the lock is emptied i.e., on outbound voyage the vessel barely moves while on dead-slow ahead but on inbound voyage as the lock is filled the water currents can move the vessel backwards quite drastically and this must be compensated by adding more thrust. At worst there are locks that have so much current that even full-ahead is needed. The effect peaks in the middle of filling the lock.

5.2 Planning ahead

Timing is the key since in some cases it would be required to decrease speed but the next passing might require to even stop the vessel in the lock and wait for the other vessel to reach certain point of the Canal. There are only limited number of places to actually tie the lines ashore so the best option is generally to wait in the lock for the right time to leave for the agreed meeting point. Other alternative is naturally to reduce speed which requires understanding of the whole canal's traffic situation relative to own passage time. Reducing speed and even stopping in water is easy at larger water areas such as Lake Nuijamaa or Lake Chvetotchnoe which is also known as Rättijärvi.

The following excel sheet gives an overview of the passage. Each lock will take approximately 15 to 20 minutes to pass through and the given times are rough estimates.

Table 1: MV Nina Canal Schedule Scheme

MV Nina Canal Schedule						
Tulo	**Lähtö**	**Paikka**		**Tulo**	**Lähtö**	**Paikka**
0:00	0:15	**MÄLKIÄ**		0:00	0:15	**JUUSTILA**
0:35	0:50	**MUSTOLA**		0:40	0:55	**ISKROVKA**
1:00		Hiilisatama		1:25		Taipale
1:35	1:55	**SOSKUA**		1:50	2:05	**CVETOTCHNOE**
2:25		Kansola		2:25	2:40	**ILISTONE**
2:40		Suikinlampi pohjoinen		3:00	3:15	**PÄLLI**
2:50		Diktaali 26 km		3:45		Torpan kapea
3:00		Suikinlampi etelä		4:05		Raja
3:05		Suikin laituri		4:10		Nuijamaan laituri
3:15		Nuijamaan kallioleikkaus		4:20		Nuijamaan kallioleikkaus
3:25		Nuijamaan laituri		4:35		Suikin laituri
3:30		Raja		4:40		Suikinlampi etelä
3:50		Torpan kapea		4:45		Diktaali 26 km
4:20	4:35	**PÄLLI**		4:55		Suikinlampi pohjoinen
4:55	5:10	**ILISTONE**		5:10		Kansola
5:35	5:45	**CVETOTCHNOE**		5:40	6:00	**SOSKUA**
6:10		Taipale		6:35		Hiilisatama
6:45	7:00	**ISKROVKA**		6:45	7:00	**MUSTOLA**
7:25	7:40	**JUUSTILA**		7:20	7:35	**MÄLKIÄ**

(Derived from MV Nina's documents, 19.10.2021)

5.3 Places to meet other vessels

The knowledge of places to meet in the Canal is the essence of a safe and fluent passage. The OOW must communicate with other piloted or pilot exempted vessels well in advance what is their planned arrival to certain locks or certain passing points. Lock masters are also very helpful in relaying information if there are problems in VHF communication or AIS data is missing.

Canal traffic is considered inbound towards the Lake Saimaa and outbound towards the Baltic Sea. High-water and low-water terms are used to depict the vessel location in regards to the lock. Outbound passage was chosen for an example on this thesis and inbound passage is taken into consideration where applicable. Provided pictures are from both inbound and outbound voyages.

The next chapter explains all the meeting points used on MV Nina. The edited chart views and pictures consist of blue, black and red dashed lines. Blue line presents the outbound vessel's recommended track, black is for inbound vessel and red is showing the suggested limits of the meeting point or other significant information.

It must be noted that this list is not exhaustive thus there are also other possibilities for example if one of the meeting vessels is moored or if a pilot decides to make a risky meeting.

Vessel speeds are kept low since there is very limited space on most meeting points – usually from two to four knots depending on the place. At the lakes vessels try to keep up with the schedule and meetings are done normally close to full-ahead speeds.

5.3.1 Canal Entrance

Before entering the Saimaa Canal the common practice is to call the lock of Mälkiä on VHF-channel 11 approximately half an hour before. If the lock is not ready or if there is some unforeseen inbound traffic (ship, pleasure boats or smaller work boats for instance) it is better to wait on the Saimaa Lake side than to continue towards the lock. Of course, commercial traffic and larger vessels are prioritized in the canal but keeping in mind basic seamanship rule is important where one should be able to consider the view from the pleasure boat's helm station also in regards to the narrow fairway ahead.

Entering the Saimaa Canal starts with a risky rock cut bend where it is important to maintain constant ROT i.e., not to stop the turn completely but rather trying to maintain some ROT due to the fact that if the turn is stopped and the vessel is on a straight course even for a short period of time it will require a lot more space to start the turn again. A saimax vessel will require all the available space especially at the stern.

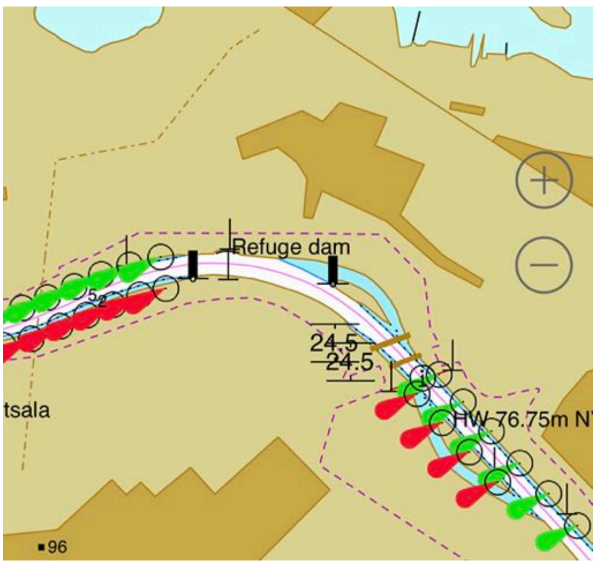


Figure 13: Narrow bend at the canal entrance on chart (Wärtsilä iSailor, 2021)

Figure 14: Rock cut bend on Mälkiä approach. Avoid extra maneuvers. (Antti Tasala, 2021)

It is often a joke that one should not look back while steering in the canal – but in this bend there is also a point to it since the proximity of the vertical rock cut at the stern during the turn might scare some first-time canal navigators and could end in a slight panic reaction by adding too much counter rudder thus leading into stopping the ROT. The preferred speed in the bend is from 3,5 to 5 knots. Beware of the bridge columns that create even narrower entrance towards the lock of Mälkiä. The turn must be stopped by the time the stern reaches the section under the bridge.

5.3.2 Mälkiä - Mustola

It is theoretically possible to pass another vessel in the high-water section of Mälkiä but this should be avoided as far as possible as there is very limited space for two vessels. Best and safest option would be to wait on the lake since it takes only 15 to 20 minutes from the Canal entry to the Mälkiä lock. Most common meeting point is between Mälkiä and Mustola. The meeting must be timed so that the vessel from Mälkiä leaves a few minutes earlier than the inbound vessel leaving from Mustola. Beware of the greens' side of the bank. High risk of suction effect.

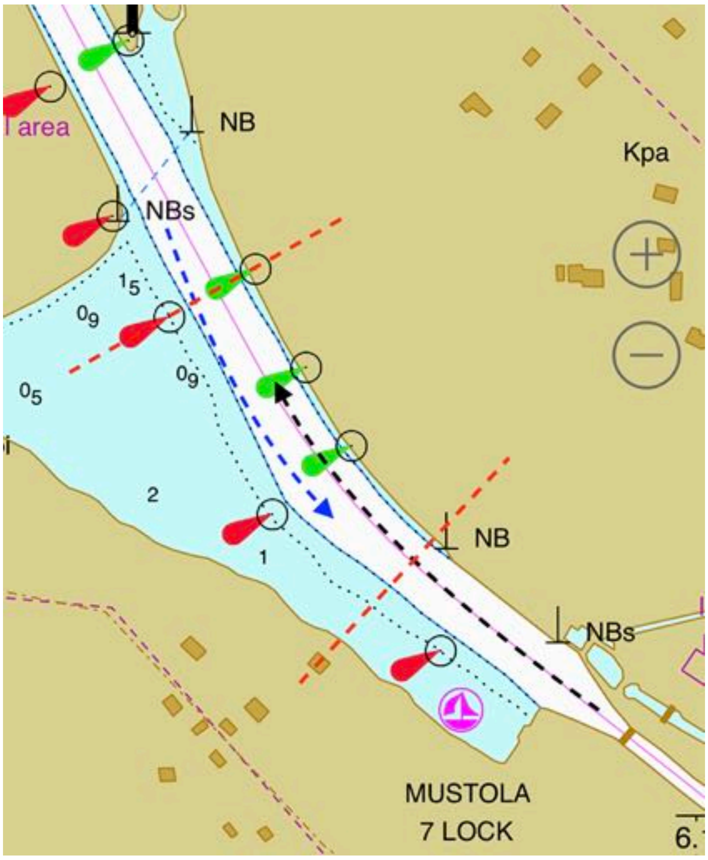


Figure 15: Suggested safe meeting point. (Wärtsilä iSailor, edited by author, 2021)

Figure 16: Edited picture of the meeting point. OOW view leaving from Mälkiä (Antti Tasala, 2021)

Figure 17: Aft view of Mälkiä-Mustola meeting point. (Antti Tasala, 2021)

5.3.3 Mustola – Soskua

After Mustola there is a considerable amount of space at the Mustola harbour basin. There is an unwritten rule for a maximum speed of four knots within the harbor basin area if there are any moored vessels in port. This is the case in figure 19 below as MV Lianne is moored.

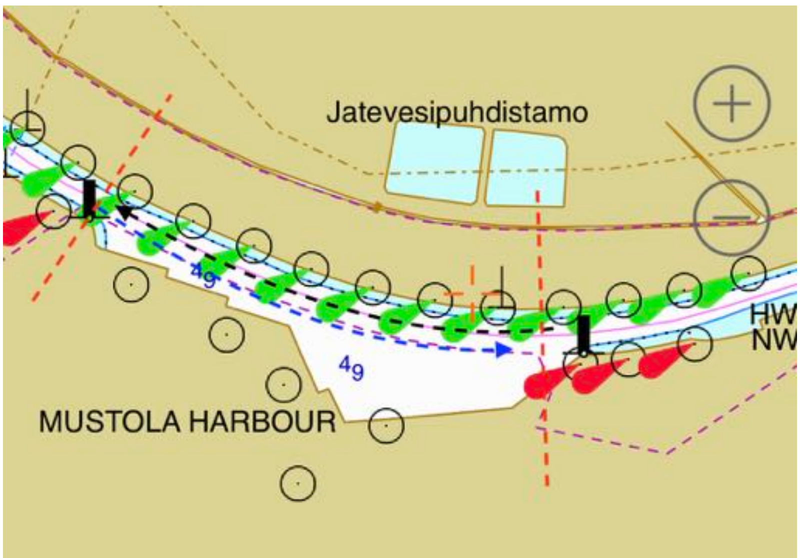


Figure 18: Mustola harbor meeting point. (Wärtsilä iSailor, edited by author, 2021)

Figure 19: Entering Mustola harbour basin. Moored vessel Lianne ahead. (Antti Tasala, 2021)

If meeting it not possible at Mustola harbor then the next possible meeting point is at Soskua low-water. Timing is the key here also since after departing from Mustola lock it will take an hour to reach the next possible meeting point at Soskua low-water. This means for instance if an inbound vessel has already left from Soskua it makes no sense to even leave the Mustola lock for at least the next half an hour.

Generally recognized calling point for Soskua lock is either “Punainen torppa” or “Sähkölinjat” shortly after Mustola harbour and it takes about 20 to 15 minutes respectively to reach the lock from there.

Figure 20: “Punainen torppa” radio calling point. (Antti Tasala, 2021)

5.3.4 Soskua – Pälli

First meeting is possible at the Soskua lock low-water section. The challenge in this meeting is to firstly exit the lock in time and secondly keep the vessel as close as possible to the low-water pier on starboard side (West). When an inbound vessel i.e., lock entering vessel is pushing water against the hull it must be actively controlled with bow thruster and rudder to keep the vessel aligned with the low-water pier since there is no room for any other position. Also, the propeller wash of the inbound vessel must be noted as they might need more thrust when displacing the lock water while entering the lock, thus affecting the outbound vessel’s maneuvering. It is also possible to tie the lines ashore for the time the vessels pass each other in case the OOW does not feel confident on passing while moving ahead.

Again, here the schedule of other vessels must be checked since if a vessel has already arrived to Suikin lampi there are no possibilities to meet between Soskua and Suikin lampi, thus the only option is to wait in the lock and meet at the low-water section.

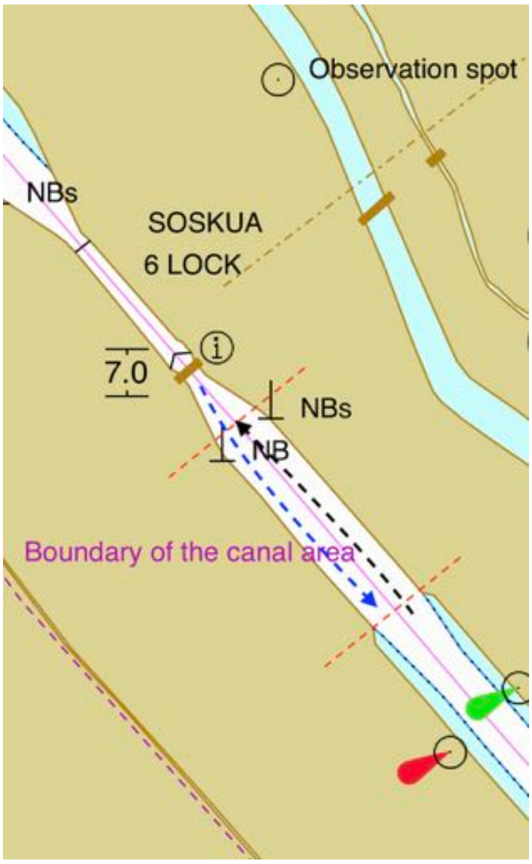


Figure 21: Soskua low-water meeting. (Wärtsilä iSailor, edited by author, 2021)

Figure 22: Soskua low-water meeting (Antti Tasala, 2021)

After Soskua there is a bascule bridge that needs to be called upon arrival. The bridge is called Kansola and arrival is to be announced at the sign i.e., calling in on VHF channel 11: “Kansola – Nina, taululla”. There is a similar sign on the southern side of the bridge and the procedure is the same for inbound vessels. At Kansola bridge there is a possibility to tie the lines on a short pier on both sides of the bridge. Between May 2019 and October 2021, the author has been twice in a situation where the visibility was significantly reduced for safe passage and the vessel was moored for a few hours at Kansola bridge.

Figure 23: Kansola bascule bridge radio calling point. (Antti Tasala, 2021)

Figure 24: Kansola northern pier on starboard side for temporary mooring. Similar pier at southern side after bridge. Visible on port side forward quarter. (Antti Tasala, 2021)

As mentioned earlier the next available meeting point is called Suikin lampi which is also referred often only as lampi. This is to be noted since a pilot might call on VHF and suggest: “Kohdataan lammella”. Suikin lampi is a good place to meet since it takes about 20 minutes from the northern part to the southern part thus it is easy to match schedules for both vessels. Suikin lampi is wide enough for two vessels and there is also room for water to flow towards the eastern banks therefore passing vessels have more freedom to displace the water around the hull which leads to easier and more predictable maneuvering.

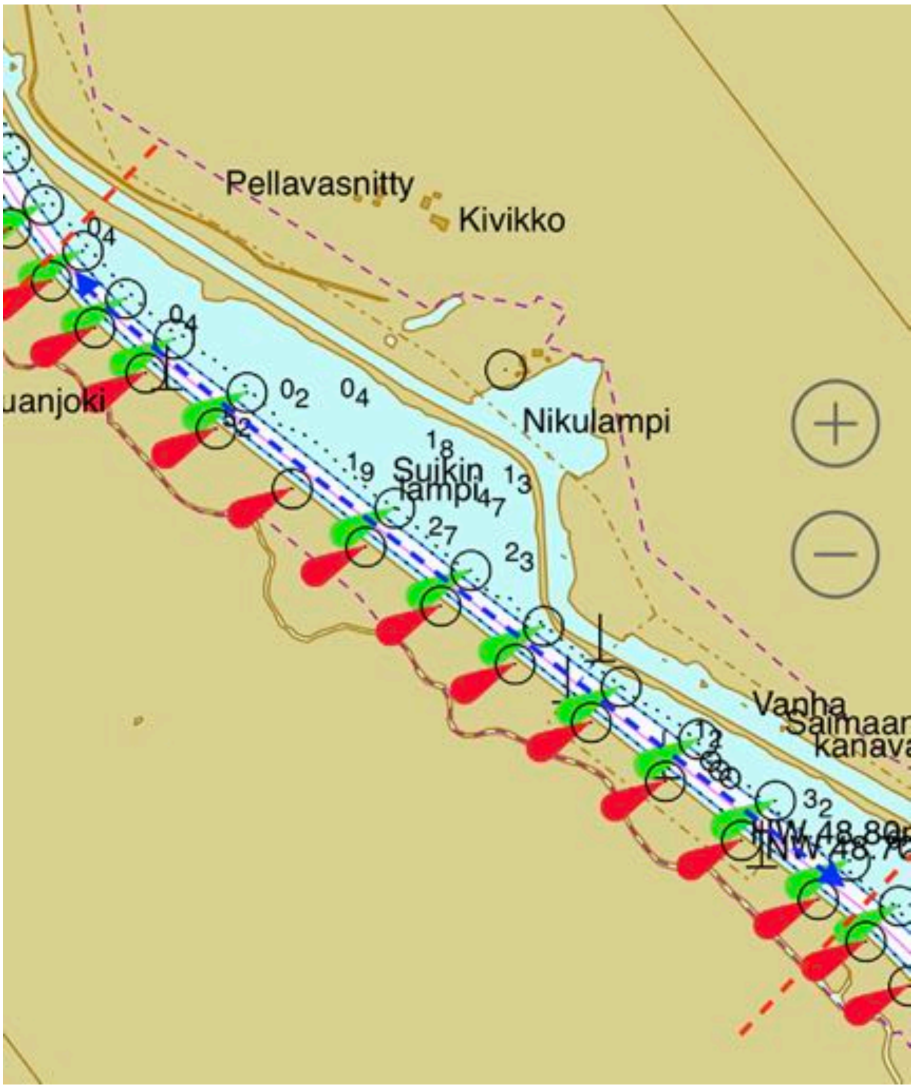


Figure 25: Suikin lampi meeting point. (Wärtsilä iSailor, edited by author, 2021)

Figure 26: Arriving at Suikin lampi North at night. (Antti Tasala, 2021)

Figure 27: Arriving at Suikin lampi North day time. (Antti Tasala, 2021)

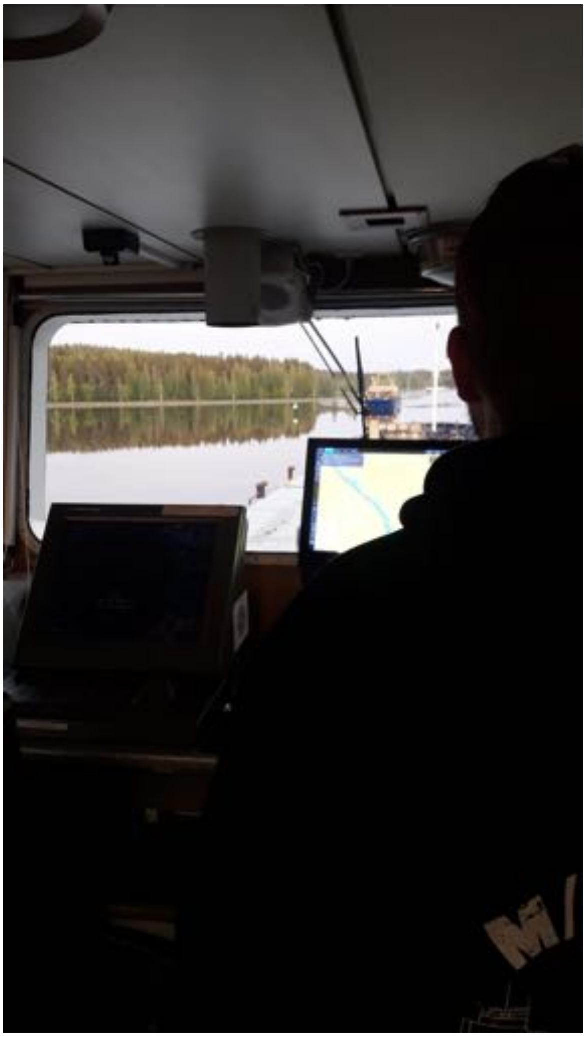


Figure 28: Meeting at Suikin lampi. Author hand steering at helm. (Antti Tasala, 2021)

At Suikin lampi there are three pillars that can be used for mooring but they are in really bad condition thus only to be used if there are no other possibilities or in emergency and with extreme caution. Pillars are found at the Southern part of Suikin lampi.

After Suikin lampi the next available meeting point is 20 to 30 minutes away at the Lake Nuijamaa. However, before Lake Nuijamaa there is the Nuijamaan kallioleikkaus where OOW needs to steer carefully as there is a bridge with narrow columns and after the rock cut there is strong suction on starboard (Western) side of the bank. At the rock cut bend of Nuijamaa it is again important to maintain ROT just like at the canal entrance before Mälkiä.

Figure 29: Nuijamaa kallioleikkaus at night (Antti Tasala, 2021)

Figure 30: Maintain ROT through the bend after rock cut. Suction on starboard side highly probable. (Antti Tasala, 2021)

Lake Nuijamaa has a speed limit of 9 km/h but this is not enforced in any means therefore all ships keep full ahead with a speed of 9 to 11 knots through the lake (16 to 20 km/h). Nevertheless, Lake Nuijamaa is also a good place to wait instead of speeding through. If an inbound vessel has already left from the lock of Pälli there is no other option than to wait since inbetween the lake and the lock there are no places to meet safely. Lake Nuijamaa is also a radio calling point for Pälli approach – calling in: “Pälli – Nina, järvellä.”

5.3.5 Pälli – Ilistoe

It is possible to meet at Pälli high-water and both starboard to starboard and port to port meetings are possible which are however to be agreed well in advance due to the approach angle relative to the lock angle. Port to port is better for the outbound vessel since the track follows the normal lock entry maneuvering i.e., entering the lock without other traffic – because right before the last turn towards the lock the ship’s true movement over the ground towards port must be stopped. Starboard to starboard could be considered if an outbound vessel is too early at the high-water section and if it is possible to stop in the water the lock entering vessel but this is rarely the case. Starboard to starboard is a natural choice if an inbound vessel is about to moor or already moored to the pier outside the lock on Western side on high-water section.

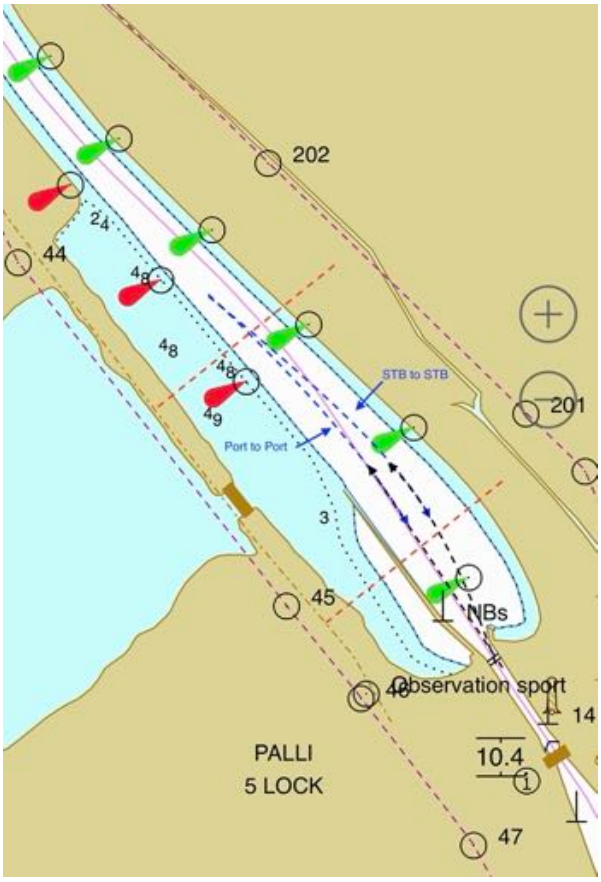


Figure 31: Approach to Pälli (Wärtsilä iSailor, edited by author, 2021)

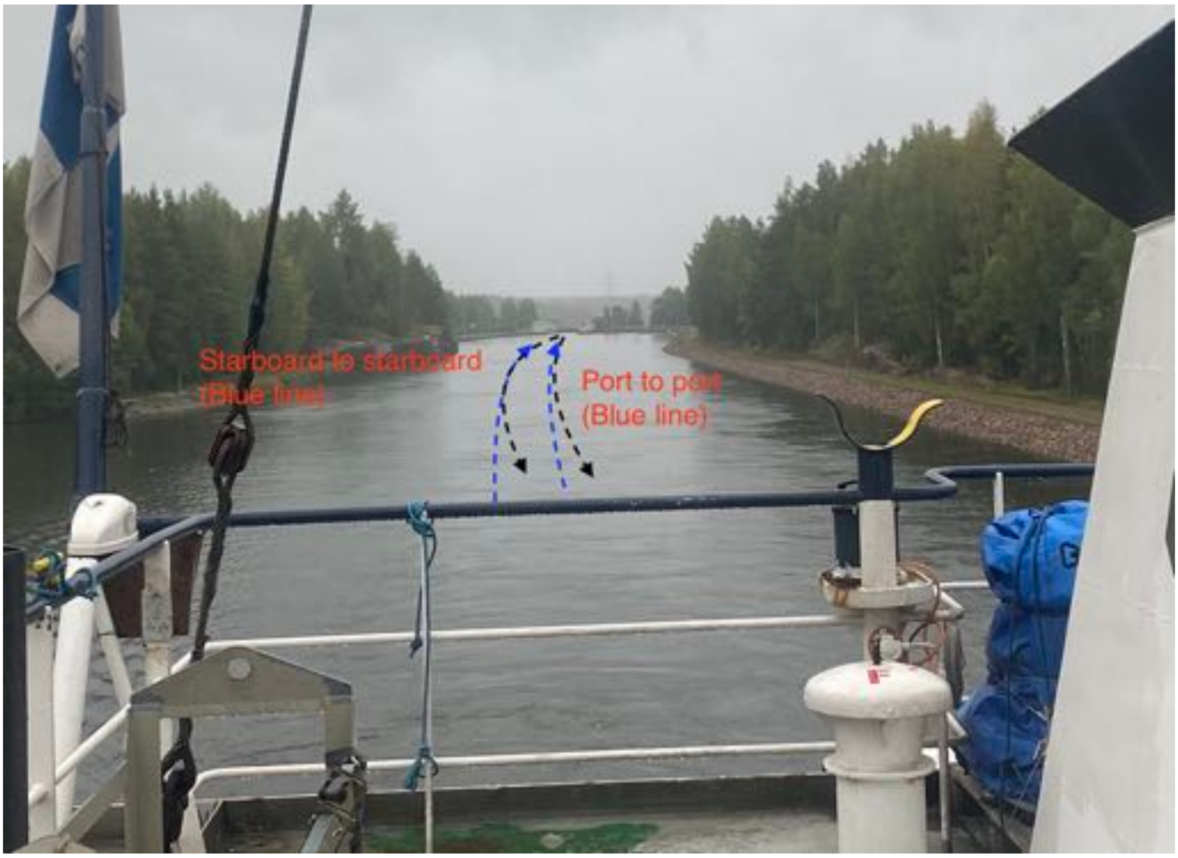


Figure 32: Approach to Pälli. MV Nina inbound, aft perspective. (Antti Tasala, 2021)

It must be taken into consideration that the border formalities might take a long time every now and then and therefore it cannot be simply calculated that a vessel will pass through the lock in approximately 20 to 30 minutes. In some cases, a vessel could be asked to moor on the high-water section for more throughout inspection if there is for example a lot of traffic expected. Outbound vessels must report on VHF channel 11 when their border control is completed and allowed to be lowered. This is done by calling the lock: “Pälli – Nina, rajatarkastus valmis - voi laskea”. There is also a possibility to moor on the low-water section and this is done mostly due to border control not for meeting with other vessels.

The distance between Pälli and Ilistoe is really short and there is no room for meeting other vessels. Next safe meeting point is at Ilistoe low-water. Approach to Ilistoe is quite straight forward but there are some odd currents and suction right before the lock most probably due to the old lock which is used as a siphon next to the new lock and the close proximity of the Western pier. As a side note it must be stated that in most cases it is not clear what is the definite reason for unexpected vessel behavior and the latter is purely a suggestion. However, it is more important to be noted for safe maneuvering into the lock rather than knowing the reason why it is so.

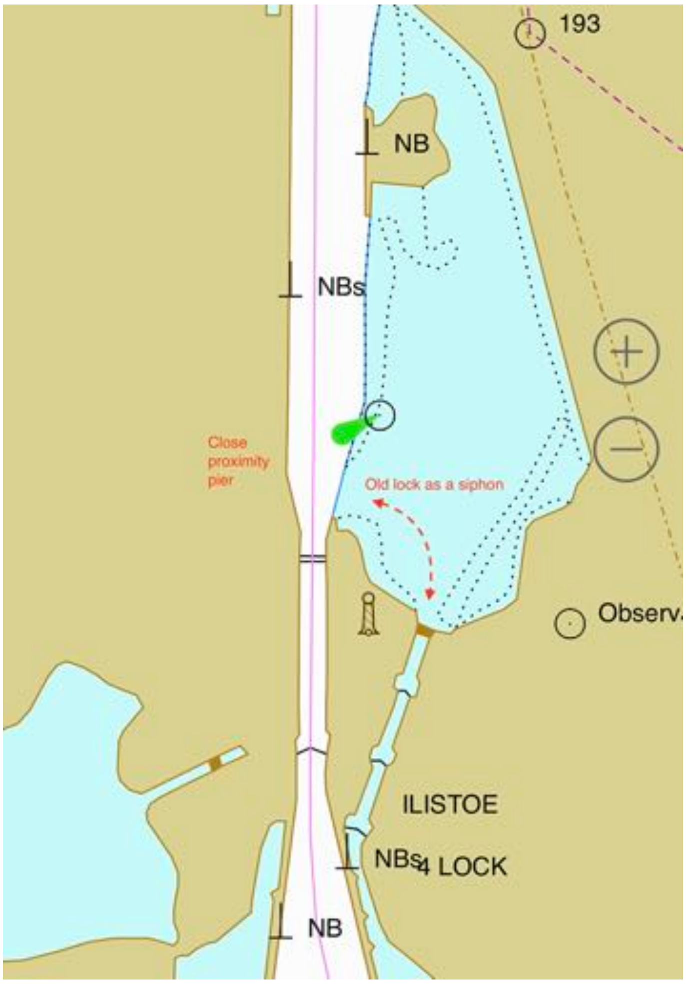


Figure 33: Vessel maneuvering disturbances at Ilistoe approach. (Wärtsilä iSailor, edited by author, 2021)

Figure 34: Ilistoe high water approach at Winter (Antti Tasala, 2021)

5.3.6 Ilistoe – Cvetochnoe

There is plenty of room to maneuver at the Ilistoe low-water section and this is a good place to meet other vessels.

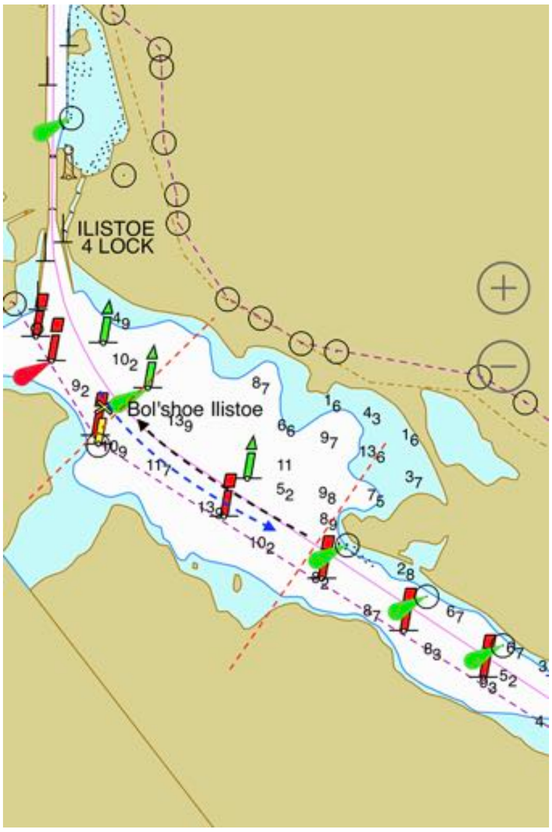


Figure 35: Meeting at Ilistoe low-water. (Wärtsilä iSailor, edited by author, 2021)

Figure 36: Ilistoe low-water meeting at dusk. MV Nina inbound. (Antti Tasala, 2021)

Figure 37: Ilistoe low-water approach at daylight. Plenty of space for maneuvering the approximately 70-degree turn into the lock. MV Nina inbound in the picture. (Antti Tasala, 2021)

This section is a natural lake close to Ilistoe lock and the water depth is up to 14 meters in some parts. This is to be noted especially for inbound voyages since deeper water means also faster speed therefore it is important to pay close attention to the speed as the vessel can accelerate quite fast and the approach to Ilistoe lock will become more dangerous. The usual mistake is to start from the lock of Cvetotchnoe (pronounced *'svetosnoi'* among pilots) with a constant throttle and at first the speed does not increase but as the depth increases towards Ilistoe the end speed might quite easily double with the same amount of thrust. On outbound voyage the narrowing channel towards Cvetotchnoe lock will reduce the speed hydrodynamically but it must be still monitored due to the lock misalignment.

Ilistoe low-water is also a common place to give shipping agent / Russian pilots a two-hour notice of arrival to Juustila lock.

It is recommended to start turning towards the Cvetotchnoe lock entry rather later than too soon as the lock is not aligned with the approach track and there is not that much space for any extra maneuvers. The following figure shows this misalignment.

Figure 38: Note Cvetotchnoe lock entrance angle in outbound traffic. MV Nina inbound in the picture. (Antti Tasala, 2021)

5.3.7 Cvetotchnoe – Iskrovka

Cvetotchnoe lock is often referred as “Rättäri” among Finnish pilots. The name Rättäri comes from the lake right after Cvetochnoe lock which is called Rättijärvi. The whole Rättijärvi area is a good place to either wait or meet other vessels. There is again a speed limit of 9 km/h (or 12 km/h for vessels of less than 3,90 meters of draft) at the lake but it is not enforced and all ships keep full ahead when applicable.

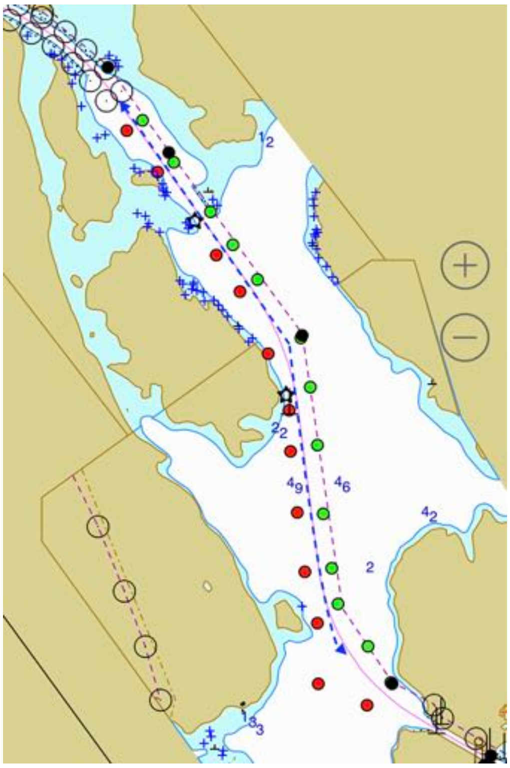


Figure 39: Rättijärvi is a spacious place to meet or wait for other vessels. (Wärtsilä iSailor, edited by author, 2021)

Figure 40: Bol'shoe Cvetochnoe is called Rättijärvi among pilots. MV Nina inbound. (Antti Tasala, 2021)

After Rättijärvi comes an open canal called Taipale – Taipaleen avokaivanto in Finnish. There is a speed limit of 9 km/h and it is not even possible to pass through any faster due to width and depth limitations which create hydrodynamic counterforces.

Figure 41: Taipale open canal before entering Rättäri. MV Nina inbound. (Antti Tasala, 2021)

There is also a small lake Malyy Cvetochnoe and it is referred as “Pikku-Rättäri” which comes after Taipale. The water depth and canal width allow safe meeting on a rather long stretch although there is not much room for maneuvering between the red and green buoys. Again, here it is possible to gain too much speed if the OOW does not pay close attention on thrust versus speed. However, on both ends of Pikku-Rättäri there are areas with limited depth and width and the speed will go down regardless of the thrust (Taipale in North and end of Pikku-Rättäri in South), but if the shallower parts are approached with high speed the maneuvering will become much more unpredictable and more importantly less controllable as the vessel tries to push water masses away from the bow.

Figure 42: Pikku-Rättäri meeting. (Wärtsilä iSailor, edited by author, 2021)

Figure 43: Malyy Cvetochnoe / Pikku-Rättäri at night. MV Nina inbound. (Antti Tasala, 2021)

Referring to the latter notation of speed, the narrow part after Pikku-Rättäri has a bend which needs to be steered carefully with low speed as there is again no room for extra maneuvers.

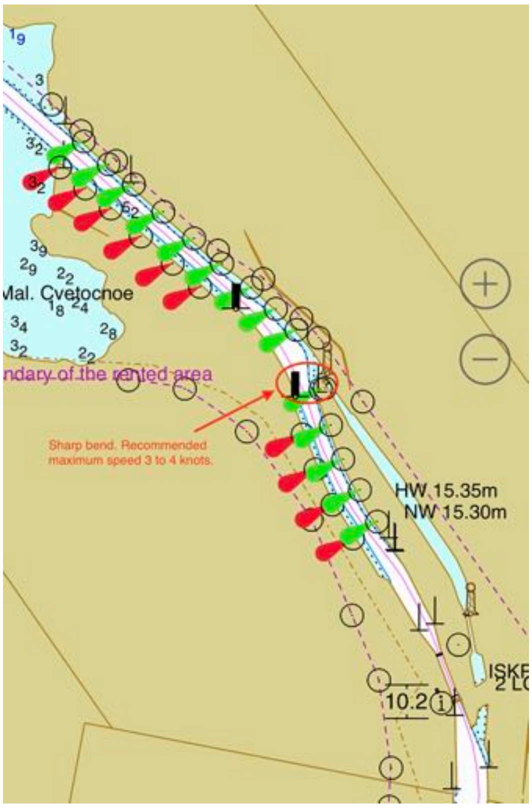


Figure 44: Sharp bend at the end of Pikku-Rättäri before Iskrovka. (Wärtsilä iSailor, edited by author, 2021)

Figure 45: Lock misalignment and sharp bend visible. MV Nina inbound and MV Panta Rhei moored to the Western pier. (Antti Tasala, 2021)

The approach to the lock of Iskrovka is again not aligned with the approach track, thus low speed and active steering with both propulsion accompanied with bow thruster needed. On the high-water section it is possible to meet if either one of the vessels is moored to the Western pier but not while both vessels moving ahead.

5.3.8 Iskrovka – Brusnitschnoe (Juustila)

On outbound voyage the departure from the lock of Iskrovka is quite straightforward except one must bear in mind lock misalignment with the track. The vessel cannot start the turn while the aft part is still inside the lock, thus active bow thruster operation is needed.

On inbound voyage steering into the lock involves a lot more active steering as the space between the Eastern pier (North to South aligned) and the lock entrance is really short. The following figure reveals the distance with an embedded measurement tool showing an absolute distance of 0,1 nm which means 185 meters. This is naturally an end-to-end measurement and since a saimax vessel is around 82 meters long and the bow and/or aft needs to be kept clear from the pier the usable space is approximately one and a half ship's length. Within this space the vessel must be firstly aligned with the lock, secondly the sideways movement must be stopped and thirdly the vessel should be kept preferably in motion in order to keep the maneuverability.

Figure 46: Iskrovka low-water section. (Wärtsilä iSailor with embedded measurement, edited by author, 2021)

This is an approach where it is important to start the turn rather later than too soon because it is really hard to get the bow aligned with the lock. Additionally, if there is an idea to take advantage of the propeller walk effect with engine astern in order to keep the bow aligned i.e, move bow more to starboard and move the stern to port – the close proximity of the eastern pier creates a counter-effect by sucking the stern towards the pier thus making the situation even worse – so that is not an option. The only option to control the vessel at this point is to use hard forward thrust and force the bow inside the lock. It is needless to say that these maneuvers are the last resort maneuvers and the most important thing while approaching this lock is to keep the speed as low as possible.

The picture below shows the optimal track to the lock. The Eastern pier will be only a few meters away from the stern while inbound and the pier should be monitored throughout the turn – again not to be afraid in order to avoid panic maneuvers but simply to keep in check.

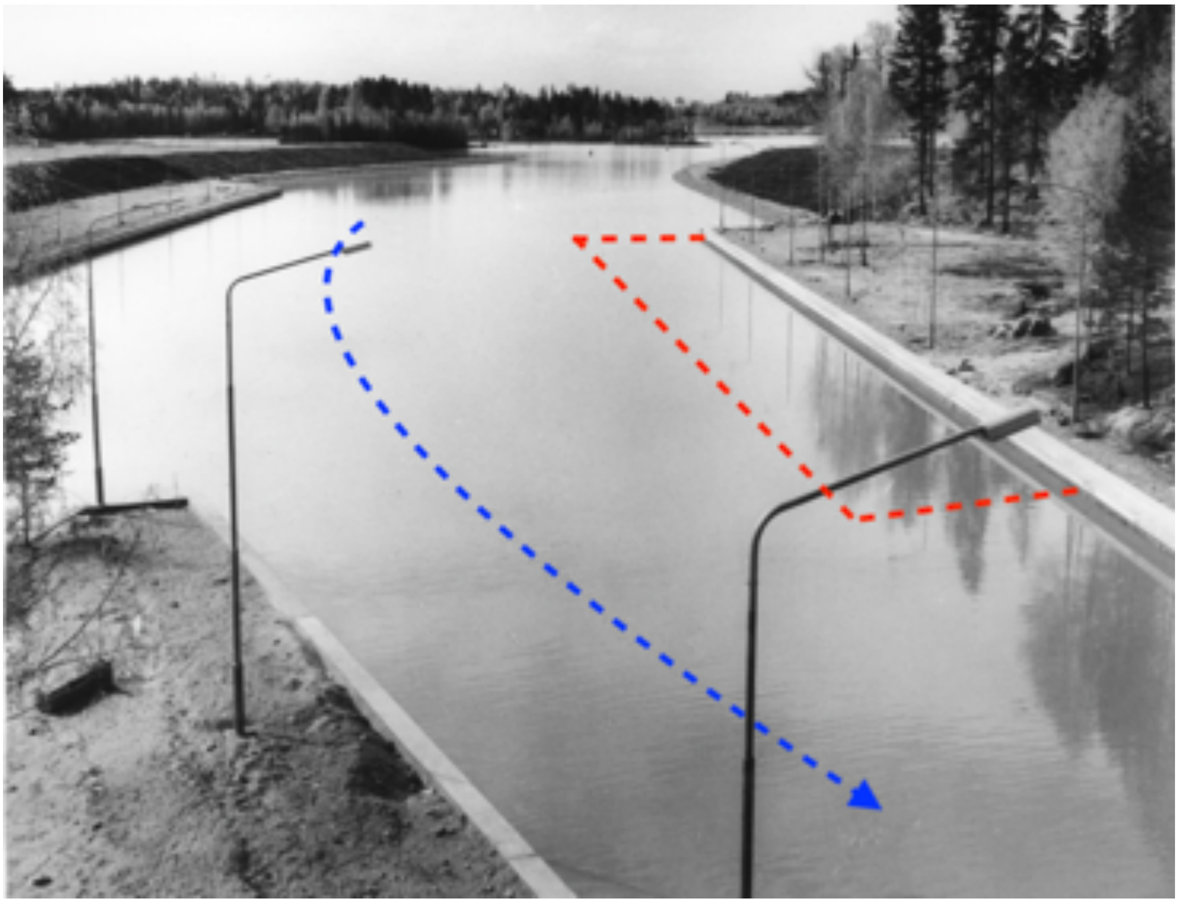


Figure 47: Iskrovka low-water section. (Roos, Karl-Gustav, 1968, retrieved on 26.10.2021 from Kansallisarkisto web site, edited by author)

There is also a possibility to meet at the low-water section but this is rarely the case. However, if this happens either one of the vessels should be moored and most importantly at the very Southern end of the pier due to the required maneuvering space in the turn. On outbound voyage there should be no issues if the moored vessel is also outbound, hence a taking over situation – but if the moored vessel is inbound then there are some extra maneuvers to be done for her in order to enter the lock i.e., probably reversing and making the vessel go sideways etc. The suggested place for mooring is drawn with a red dashed rectangle in figure 46.

This type of meeting has happened once during author's voyages and it was because the other vessel was having some technical issues. The next more viable meeting point is after the curve so due to the difficult meeting at Iskrovka low-water and since there is a better option only five to ten minutes away it makes no sense to proceed all the way to the lock entrance before the other vessel has left the lock of Iskrovka.

As mentioned in the previous chapter the next optimal meeting place is very close and called "Three greens" or "Kolme vihreää". As one might expect there are three green buoys at the meeting point.

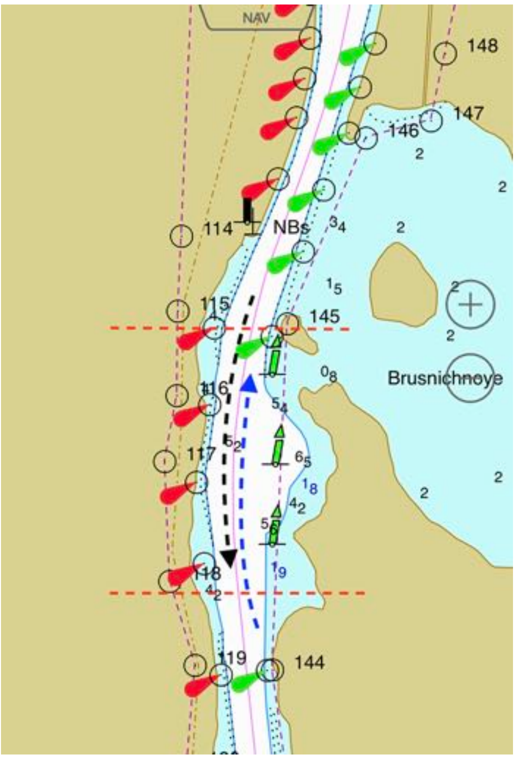


Figure 48: Meeting point called "Three greens" inbetween Iskrovka and Juustila. (Wärtsilä iSailor, edited by author, 2021)

Figure 49: Iskrovka – Juustila "Three greens". Green buoys highlighted with red circles. MV Nina inbound. (Antti Tasala, 2021)

The 'three greens' meeting point is a spacious and safe place to meet other vessels due to the available draft and width. Even faster speed at meeting is possible without significant effect on maneuvering and normal port to port meeting is recommended.

The next and last available meeting points are possible at either Juustila high-water or low-water depending much on which order the vessels arrive at the lock. There is a radio calling point approximately half an hour before Juustila called 'Lavola' for inbound vessels so outbound vessels are normally informed well before approaching Juustila i.e., if there is a need to adjust departure from Iskrovka for instance or is it possible to clear the canal without any incoming traffic in the canal per se.

There is nothing special worth noting in the low-water meeting other than if a vessel has reported or about to report shortly at Lavola one should wait in the lock and meet the inbound vessel at low-water since there is no space to meet before Lavola. As mentioned earlier a Russian pilot will come onboard at Juustila and they will provide important information on water level and possible inbound traffic.

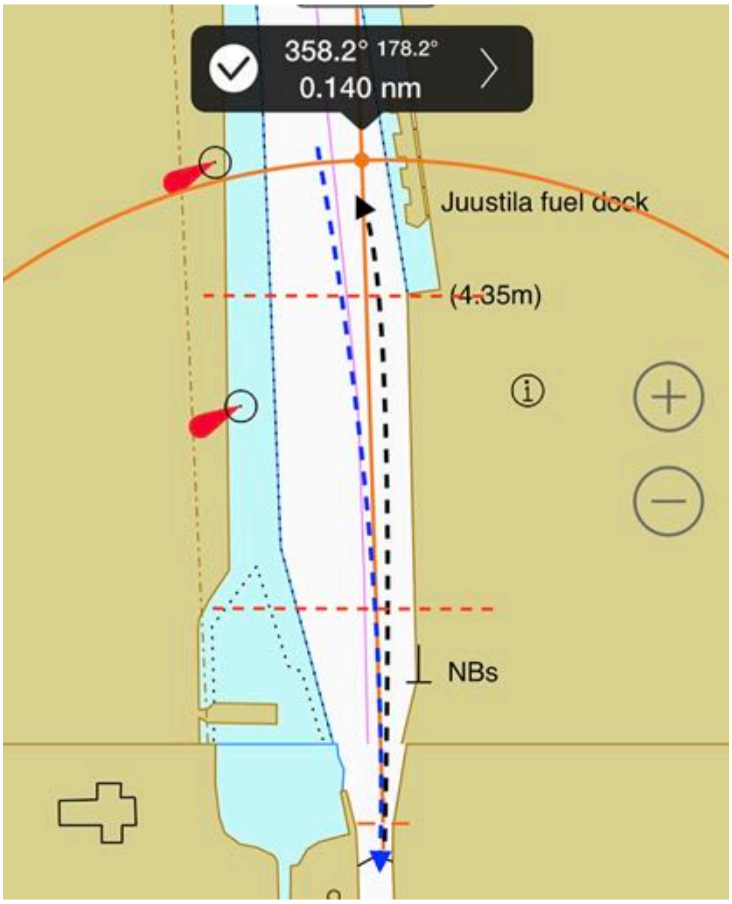


Figure 50: Juustila (Brusnitchnoe) high-water meeting. (Wärtsilä iSailor, edited by author, 2021)

At high-water meeting point however, timing is everything as the vessel leaving the lock must be well clear of the lock but still not too far on the canal's track as there would not be enough room for the outbound vessel. The furthest limit where the inbound vessel's bow should be would be roughly at the fuel docks.

This meeting is very sensitive to available space versus timing. There is again the embedded measurement tool added on the chart from which one can calculate that if the available space is 0,14 cables it translates to approximately 260 meters. One should fit two saimax size vessels within that space so that would take approximately 164 meters. When adding a dynamic component to the equation and make both vessels moving ahead from one to two knots while trying to match both vessels within that approximately 100-meter gap what is left – without forgetting that there is still a lock ahead where the vessel should fit – all that above is the essence of canal maneuvering.

6 Conclusions and future research

The Saimaa Canal is over 50 years old and both vessels and shipping industry in general has changed a lot ever since. Last time the canal was rebuilt was due to the cargo capacity and insufficient space for vessel maneuvering. Today the situation is again the same and there are already plans how to increase capacity and also discussions on how to make the canal accessible throughout the year.

Open water season at the Southern Saimaa and at the canal is 211 days a year on average and since most vessels are capable for winter navigation the canal is capable of operating approximately 9,5 to 10 months a year. Regular season starts in the beginning of April and ends by the end of January. (Väylävirasto, retrieved on 29.10.2021) During this time there are ice breaking services available in the canal and on the lake.

There are plans to lengthen the locks from 82,5 meters to 93,2 meters and / or rise the water level in the canal from 4,35 meters to 4,45 meters in order to increase the weakened competitiveness of inland water-way transportation. (Lapp, 2020, p.3) The plans are already at the stage of competitive tendering and the canal will be closed both in Autumn 2022 and 2023 with a total down time of eight months from October to June per year. (Väylävirasto, retrieved on 29.10.2021)

All this means that the current research should be reviewed and updated fairly soon. However, the locks are still going to be aligned as they are now because their possible lengthening is made at high-water sections – the lakes are going to be intact and the basic maneuvering theories still apply. It will be interesting to see what is the shape of the canal by Summer 2023.

Nevertheless, the current research was interesting since it involves the author's day-to-day routine work on MV Nina and it will be a great help in preparing future officers for their PEC-licenses. There were no major problems during this research. The only challenge was to find enough pictures and specifically the right pictures where the angle is right and suitable for this research. Hopefully this research opens some discussions for Finnish inland waterway studies also at Novia / Aboa Mare.

List of tables

List of figures

References

Baudu, H., Ship Handling, Enkhuizen (NL), Dokmar, 1st edition, 2014.

Kansalliskirjasto - Väyläviraston kokoelma, ’Iskrovkan sulun alasatama’, Foto-Roos; Roos Karl-Gustav, 1968, https://www.doria.fi/handle/10024/153784 (retrieved on 26.10.2021)

Lapp, T., 2020, ’Saimaan kanavan sulkujen pidentäminen – Hankearviointi’, Väylävirasto, Väyläviraston julkaisuja 31/2020.

Luotsauslaki 2003/940 §5

Luotsauslaki 2003/940 §11a

Luotsauslaki 2003/940 §16

Navisaimaa, ’Saimaan kanavan historia’ [http://www.navisaimaa.fi/saimaan_kanavan-historia], (retrieved on 24.10.2021)

Väylävirasto, ‘Saimaan kanavan kauttakulkuohjeet’ [https://vayla.fi/vaylista/vesivaylat/kanavat/saimaan-kanava/kauttakulkuohjeet], (retrieved on 24.10.2021)

Väylävirasto, ’Saimaan kanava’ [https://vayla.fi/vaylista/vesivaylat/kanavat/saimaan-kanava], (retrieved on 25.10.2021)

Väylävirasto, ’Liikennöinti Saimaan kanavassa’ [https://vayla.fi/vaylista/vesivaylat/kanavat/saimaan-kanava/liikennointi-saimaan-kanavassa], (retrieved on 26.10.2021)

Väylävirasto, ’Saimaan kanavan uudistus parantaa sen kilpailukykyä’ [https://vayla.fi/-/saimaan-kanavan-uudistus-parantaa-sen-kilpailukykya], (retrieved on 29.10.2021)