



Final Report RS 2014:01e

Serious accident at sea on 15 October 2012 involving the vessel Liva Greta at Nockeby Bridge in the County of Stockholm, Sweden.

Diary No: S-165/12
2014-03-12

SHK investigates accidents and incidents from a safety perspective. Its investigations are aimed at preventing a similar event from occurring again, or limiting the effects of such an event. The investigations do not deal with issues of guilt, blame or liability for damages.

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Contents

General observations.....	4
The investigation.....	4
Summary	5
1. FACTUAL INFORMATION.....	7
1.1 Information on the vessel and the incident	7
1.2 Course of events	8
1.3 Personal injury.....	12
1.4 Damage to the vessel	12
1.5 Other damage.....	12
1.6 The crew	13
1.7 Sea chart corrections.....	13
1.8 Meteorological information	14
1.9 Navigation aids, trip and sound registrators	14
1.10 Vessel Traffic Service (VTS)	14
1.11 Scene of the accident	15
1.11.1 Channel	15
1.11.2 Nockeby Bridge	16
1.12 Rescue operations	18
1.13 Miscellaneous	18
1.13.1 Statistics	18
2. ANALYSIS.....	20
2.1 Preconditions	20
2.1.1 Planning and performance of bridge repairs	20
2.1.2 Vessel Traffic Service (VTS)	21
2.1.3 Notices to Mariners (Ufs)	21
2.2 The part of the journey from Landsort – Hässelby.....	21
2.3 Previous incidents in connection with bridges in the County of Stockholm	23
3 CONCLUSIONS.....	24
3.1 Results of the Investigation	24
3.2 Causal factors	24
4. RECOMMENDATIONS	25
Enclosure	26

General observations

The Swedish Accident Investigation Authority (Statens haverikommission – SHK) is a national authority with the task of investigating accidents and incidents with the aim of improving safety. SHK accident investigations are intended to clarify, as far as possible, the sequence of events and their causes, as well as damage and other consequences. The results of an investigation shall provide the basis for decisions aiming at preventing a similar event from occurring again, or limiting the effects of such an event. The investigation shall also provide a basis for assessment of the performance of rescue services and, when appropriate, for improvements to these rescue services.

SHK accident investigations thus aim at answering three questions: *What happened? Why did it happen? How can a similar event be avoided in the future?*

SHK does not have any supervisory role and its investigations do not deal with issues of guilt, blame or liability for damages. Therefore, accidents and incidents are neither investigated nor described in the report from any such perspective. These issues are, when appropriate, dealt with by judicial authorities or e.g. by insurance companies.

The task of SHK also does not include investigating how persons affected by an accident or incident have been cared for by hospital services, once an emergency operation has been concluded. Measures in support of such individuals by the social services, for example in the form of post crisis management, also are not the subject of the investigation.

The investigation

The Swedish Accident Investigation Authority (SHK) was informed on 15 October 2012 at 12.35 hours that an accident had occurred at Nockeby Bridge on Lake Mälaren in the County of Stockholm, on the same day at 12.00 hours.

The accident has been investigated by SHK represented by Mikael Karanikas, Chairman, Ylva Bexell, Investigator in Charge up to and including 15 January 2013 and thereafter Richard Blomstrand up to and including 3 May 2013. Jörgen Zachau, Investigator in Charge from 22 November 2013; Fred Hansson, Marine Engineering Investigator and Rikard Sahl, Marine Operative Investigator.

The investigation is limited to primarily concern the prerequisites for safe shipping and infrastructure protections at the time that involved authorities are responsible for.

The Investigation has been followed by the Swedish Transport Agency (Transportstyrelsen), initially by Jörgen Zachau and later by Erik Sandberg.

The investigation has been led by SHK but has been conducted jointly with the Transport Accident and Incident Investigation Bureau of Latvia, which is the investigative authority in the flag state, National Nr: 6-02/08/2012, represented by Aigars Krastins.

Summary

En route from Liepaja – Hässelby via Landsort/Södertälje, the Latvian vessel Liva Greta collided with dolphins just before passing Nockeby Bridge on 15 October at 12.02 hours local time. A construction worker fell into the water at the time of the accident but was not injured. No damage was caused to the actual bridge structure, but two dolphins that were intended to hold the fendering in place were damaged. The fendering – which is a form of collision protection intended to protect the bridge structure from damage if a passing vessel should for some reason deviate from its intended course and collide with the bridge construction – had been dismantled at the time of the collision.

The master, who didn't know about the construction work in the channel below the bridge, came rather fast and made a fairly ample speed reduction, followed by reversing engine, which led to loss of steering. The vessel veered and subsequently turned into and damaged two dolphins. The vessel then continued to its berth in Hässelby, where damage to the bow was discovered above the water line.

At the time of the accident, work was in progress on replacing the fendering between the dolphins. There was no pilot on board the vessel at any time during the just over 6.5 hour-long journey within the Stockholm Archipelago before the incident, and the vessel was not subject to compulsory pilotage. VTS did not inform the vessel of the repair work that was in progress on Nockeby Bridge. An announcement had been inserted in Ufs (Swedish Notices to Mariners) concerning ongoing bridge repairs and an indication that caution should be observed when negotiating the bridge. The weather was semi-overcast, the temperature +9°C, visibility >10 km with south-easterly winds of approximately 3 meters per second.

The Swedish Transport Administration (Trafikverket) had noted that the fendering on Nockeby Bridge was in considerable need of renovation. Procurement of the work was initiated with the Transport Administration's Bill of Quantities as a basis. There had been a certain amount of contact between the Transport Administration and the Swedish Maritime Administration (Sjöfartsverket) prior to procurement, but no real risk analysis had been conducted in connection with planning of the repair work.

Over the course of time, there have been a number of incidents in which vessels have had contact with bridges that have caused SHK to issue recommendations concerning the review of bridge safety in the general navigation channels.

Causal factors

- The vessel had no knowledge of the work in progress on the bridge fendering owing to lack of information from VTS and an absence of NtM from the producer of the sea charts.
- The vessel failed to observe current speed restrictions in the area around Nockeby Bridge.

- The turn made by the vessel into the bridge hole was unsuccessful and going astern with the engine resulted in an uncontrolled turn to starboard that was not corrected.

Recommendations

The United Kingdom Hydrographic Office is recommended to:

- Secure its routines regarding the introduction of Ufs notices from the Swedish Maritime Administration to the British Notices to Mariners. *(RS2014:01 R1)*

The Swedish Transport Agency (Transportstyrelsen) is recommended to:

- In consultation with the Swedish Maritime Administration take action for a national, fully covering, legislation concerning VTS. *(RS2014:01 R2)*

The Swedish Maritime Administration (Sjöfartsverket) is recommended to:

- Ensure that relevant VTS information is given. *(RS2014:01 R3)*

The Swedish Transport Administration (Trafikverket) is recommended to:

- In consultation with the Swedish Maritime Administration, make sure that bridges in the large navigation fairways have sufficient protection to avoid serious damage as a consequence of collision. *(RS2014:01 R4)*

The Swedish Maritime Administration and the Swedish Transport Administration are recommended, individually and in consultation, to:

- Review routines and regulations regarding construction work in, or in connection to, fairways to ensure that involved actors have sufficient information, that relevant risk are assessed, and that adequate safety measures are taken in order to maintain safety for shipping, infrastructure and others concerned. *(RS2014:01 R5)*

1. FACTUAL INFORMATION

1.1 Information on the vessel and the incident

<i>Flag state/Ships' register</i>	Latvia
<i>Identity</i>	
<i>IMO identification/ call sign</i>	8801072 / YLCJ
<i>Ship's data</i>	
<i>Type of vessel</i>	Dry Cargo
<i>Year of construction</i>	1988
<i>Gross tonnage</i>	851 gross
<i>Length, over all</i>	64.33 m
<i>Beam</i>	10.5 m
<i>Draught, max</i>	3.4 m
<i>Deadweight at max. draught</i>	1 248 tonne
<i>Main engine, output</i>	638 kW
<i>Propulsion arrangement</i>	Propeller, right-handed
<i>Bow thruster</i>	No
<i>Service speed</i>	9.2 knots
<i>Ownership and operation</i>	Delta products Ltd / Aquarius Ship Management Ltd
<i>Classification society</i>	Bureau Veritas
<i>Minimum safe manning</i>	5-man crew
<i>Ports of call</i>	Liepaja – Hässelby via Landsortsleden
<i>Type of voyage</i>	International sea passage
<i>Cargo information/no. of passengers</i>	Wooden pellets in bulk
<i>Crew</i>	6-man crew
<i>Type of accident/near- accident</i>	Collision with dolphins
<i>Date and time</i>	15 October 2012, 12.02 hours local time
<i>Position and location of accident/ near-accident</i>	Nockeby Bridge, County of Stockholm, Sweden Position: 59°19,7N 017°54,5E
<i>Weather conditions</i>	Semi overcast, + 9°, wind SE approx. 3 m/s, Visibility >10km
<i>Other circumstances</i>	Ongoing maintenance work, replacement of fendering
<i>Consequences</i>	
<i>Personal injuries</i>	No
<i>Environment</i>	No
<i>Vessel</i>	Hole in bow above water line
<i>Dolphins</i>	One dolphin ¹ destroyed, and had to be replaced and the other dolphin cracked but could be repaired.

¹ A **dolphin** is a man-made marine structure that extends above the water level and is not connected to shore. Dolphins are usually installed to provide a fixed structure when it would be impractical to extend the shore to provide a dry access facility.



Fig.1 M/S Liva Greta. Photo: J. Dohrn.

1.2 Course of events

The dry-cargo carrier Liva Greta was en route from Liepaja, Latvia, to Hässelby with a cargo of wood pellets. The vessel had a crew of 6, two of whom held nautical qualifications. The chief officer had made the voyage to Hässelby before, but it was the first time the master was passing Nockeby Bridge. The vessel was owing to its size, not subject to compulsory pilotage within the Södertälje Pilotage Area, to which Lake Mälaren belongs.

M/S Liva Greta called VTS Södertälje on VHF Channel 68 when crossing the reporting point at Landsort approach at 05.20 hours, and provided information on her position, destination and current draught. VTS² Södertälje gave in turn information to the effect that M/S Liva Greta would meet the vessel Tärndal which was on her way out, and another vessel (Sternö) was aground at Sankhällan.

The master commenced his normal watch on the bridge at 06.00 hours and then navigated the vessel all the way to Nockeby Bridge, a journey of about 50 nautical miles within the archipelago that took just over 6.5 hours, including passing the lock at Södertälje. Liva Greta reported her progress at every reporting point en route to Hässelby, and VTS Södertälje confirmed that they had received the information.

At Nockeby Bridge, extensive maintenance work was in progress on the fendering at the bridge (see Fig. 2). Any changes in navigation channels are to be reported to the Swedish Maritime Administration (Sjöfartsverket), which

² VTS (Vessel Traffic Service) provides with navigational safety information and service in a limited geographical area.

publishes them in Ufs (Swedish Notices to Mariners). The maintenance work had been announced on 18 July 2012 in Ufs 2012:409/8033(T). According to the notification, caution advised when passing the bridge. On board M/S Liva Greta, a BA Chart (British Admiralty Chart) and an electronic sea chart plotter was used. The NtM (Notices to Mariners, which is the BA's equivalent to the Swedish Ufs Notices), contained no information about the reconstruction works being carried out on Nockeby Bridge. Neither did VTS Södertälje provide the Liva Greta with any information about the construction works when the vessel reported her position at the various reporting points en route to Hässelby.

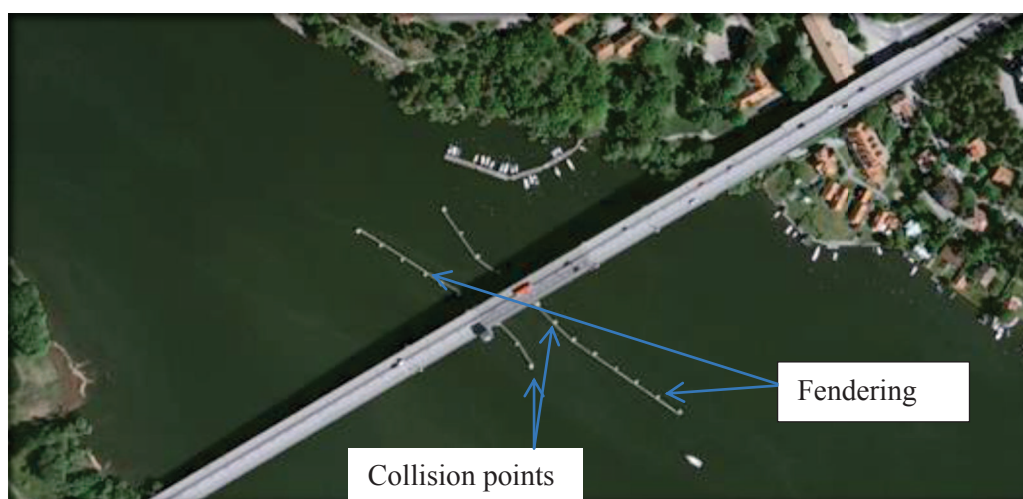


Fig 2. General view, the scene of the collision taken at a point in time when the fendering was in position. Photo: © Lantmäteriet Diary No: R61749_130002

When M/S Liva Greta approached Nockeby Bridge, she steered down towards the red spar buoys on the port side of the channel and was far out to one side of the channel. According to the AIS³-recording, the vessel had a speed of 9.2 knots when she passed the first red spar buoy, which is situated 2 cable lengths⁴ from the bridge. After this, her speed decreased to 8.6 knots, at the same time as she changed course to port.

³ Automatic Identification System (AIS) is an automatic tracking system used on ships and by vessel traffic services (VTS) for identifying and locating vessels by electronically exchanging data with other nearby ships, AIS base stations, and satellites.

⁴ 1 cable length = 185.2 m (1/10 of a nautical mile).

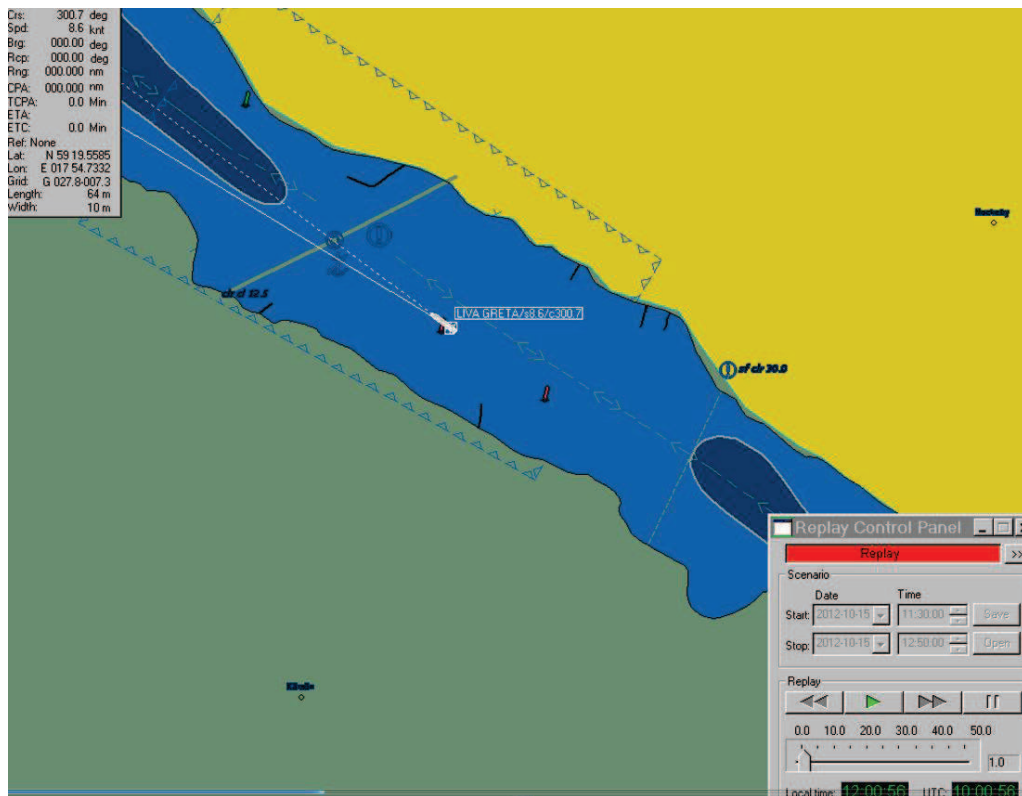


Fig. 3. AIS recorded when passing the second red spar buoy.
 © Sjöfartsverket No: 10-01518.

A general speed limit of 5 knots begins to apply at a distance of some 4 cable lengths (about 750 m) from the bridge. M/S Liva Greta held a steady course of 301° and a speed of 8.6 knots until the second buoy had been passed about 1 cable length from the bridge, when the vessel began to reduce speed and change course to starboard (see Fig 3).



Fig. 4. Fouled dolphin, which was shifted approximately 1.5 m out of position.

The vessel continued to reduce speed and change course to starboard until the collision occurred. The stern of the vessel collided first with a dolphin on one side of the channel, after which she continued over to the other side of the channel where she collided bow-on with another dolphin (see Fig. 4). The speed of the vessel at the time of the collision was just over 4 knots, which meant that it was a serious collision (see Fig. 5).

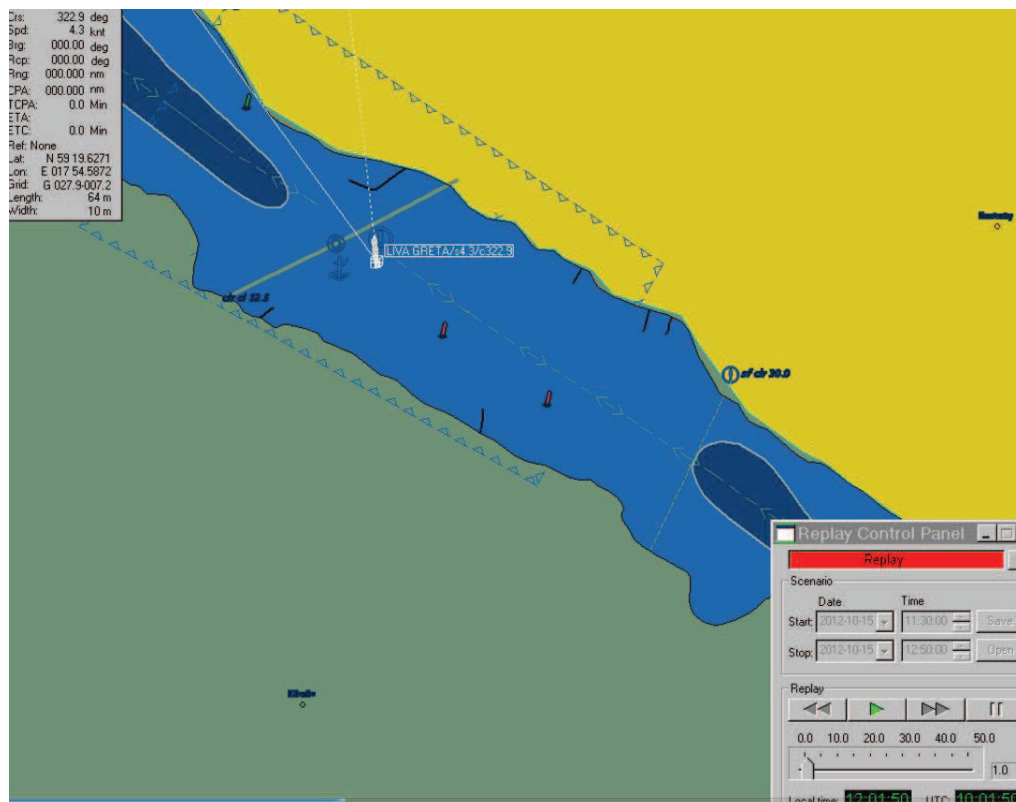


Fig. 5. AIS recording at the time of the collision.

© Sjöfartsverket No: 10-01518.

On both fenders alongside the bridge, there were a dozen or so people carrying out various kinds of repair work. They had seen the vessel and her strange movements, and realised that M/S Liva Greta was about to collide with the repair site. While running away to avoid being hit by the vessel, one person fell into the water, but managed to climb out of the water himself without being hurt. A number of pontoons moved and rocked about, in connection with which barracks that were supported on them were displaced – some by as much as 30 cm.

According to some of the people who were present on board the construction pontoons, the master – or some other member of the crew – went out on to the bridge wings after the collision. However, the vessel did not stop but continued on its journey towards Hässelby.

During the course of an interview, the master stated that he and the chief officer had been on the bridge, that the vessel had been under manual steering and that something had suddenly happened with the steering which meant that they lost control over the vessel. In connection with this, they put the engine into full astern, whereby the vessel veered to starboard and collided with the fendering.

The chief engineer stated that he ran up to the bridge when he heard the engine were going astern and was informed verbally that the steering was not working properly. He immediately ran down to the steering gear room but could not find anything wrong with the steering equipment. During the course of a subsequent visual inspection of the rudder position indicator on the bridge he was unable to find anything wrong with it either. The master has in a written report to the shipping company stated that they had been within the speed limit and slowed down to approximately 4.7 knots before negotiating the bridge. The master stated in the same report that he had not received any information from VTS Södertälje to the effect that the bridge was being repaired. Radio traffic between the vessel and VTS Södertälje supports this claim.

The accident occurred at the position 59°19,7N 017°54,5E.

1.3 Personal injury

One person fell into the water, but was not injured.

1.4 Damage to the vessel

The damage to the vessel was limited to a hole in the forepeak above the water line immediately beneath the starboard anchor (see Fig. 6). The damage was repaired during the stopover at the harbour in Hässelby.



Fig. 6. Damage to the Liva Greta.

1.5 Other damage

Damage to two dolphins, one of which had to be replaced by a new structure, whereas the other one was only cracked and could be repaired.

1.6 The crew

The master, was 62 years old, a Russian citizen with Latvian master's qualifications, had been at sea for 35 years, 23 of which serving as master, and had been working on board the Liva Greta for 1 month and 3 days.

The chief officer was 52 years old, a Latvian citizen and with Latvian master's qualifications. He had worked at sea for 33 years, 15 of which as a chief officer, and had been employed on board the Liva Greta for 8 months.

The chief engineer was 43 years old, a Russian citizen and held qualifications as a ship's engineer, Second Class, Category B. He had worked at sea for 18 years, 7 of which as a chief engineer and had been on board the Liva Greta for 4 years.

The remaining operational crew consisted of two able-bodied seamen and an apprentice officer. One of the seamen also served as the ship's cook.

1.7 Sea chart corrections

Ufs contain, among other things, corrections to sea charts and other information on changes and conditions at sea. The information can either be sought directly in the Swedish Maritime Administration's daily updated Ufs database or be read in the PDF files that are published each week (the same as the weekly Ufs journal).

Changes in the BA sea charts and other information of importance to shipping are published in the Notices to Mariners (NtM) by the United Kingdom Hydrographic Office, which receives current information on Swedish waters from Ufs.

Information on the ongoing repair works at Nockeby Bridge was announced in Ufs No. 409 published on 18 July 2012. The announcement contained the following data:

Mälaren och Södertälje kanal / Lake Mälaren and Södertälje kanal

*** 8033 (T) Sjökort/Chart: 111**

Sverige. Mälaren. Stockholm. Nockebybron. Underhållsarbeten.

Tidpunkt: 1 augusti 2012 - 31 januari 2013

Stockholm Hamnentreprenad kommer att genomföra byte av ledverk och renovering av dykdalber vid Nockebybron.

Försiktighet anmodas vid passage.

Position: 59-19,7N 17-54,5E

Bsp Mälaren 2010/s35, Mälaren 2012/s37

Sweden. Lake Mälaren. Stockholm. Nockebybron. Maintenance.

Time: 1 August 2012 - 31 January 2013

Stockholm Hamnentreprenad will do maintenance works on the bridge Nockebybron.

Caution Guidelines when passing the bridge.

Position: 59-19,7N 17-54,5E

Stockholm Hamnentreprenad.

Publ. 18 juli 2012

The announcement was available both on the Swedish Maritime Administration's home page as well as in the paper version of the Ufs-brochure. However, the announcement was not made in NtM.

1.8 Meteorological information

Semi-overcast, + 9°, wind SE approx. 3 m/s, Visibility >10km.

1.9 Navigation aids, trip and sound registrators

The vessel was equipped with radar, GPS⁵ and AIS (Furuno FA-100) linked to an electronic sea chart plotter with BA-sea charts.

VDR⁶ was not installed and was not needed because the vessel were less than 3000 gross⁷ (see Chapter 3, § 26, Swedish Transport Agency Regulations and General Guidelines on Navigation Safety and Navigation Equipment [TSFS 2011:2]).

1.10 Vessel Traffic Service (VTS)

According to 2 § 13 p. ordinance (2007:1161) with instructions for the Swedish Maritime Administration, one of the main tasks is to provide with marine traffic information. For those vessels that serve the VTS area in question, the Swedish Maritime Administration provides sea traffic information (VTS) via VHF communication.

VTS Södertälje uses VHF Channel 68 as its operating channel in the traffic area. The same channel is also used by Södertälje Canal and the openable bridges (apart from Liljeholm Bridge) in the VTS area.

Within the Södertälje VTS area, some of the points were voluntary reporting points provided the vessel had a switched-on and updated AIS, where the AIS information is shown graphically in the vessel's ECDIS⁸, ECS⁹ or on its radar screen.

Exactly how vessels are to interact with VTS Södertälje (which is organisationally part of the VTS Eastcoast) can be seen from the Swedish Transport Agency's current Regulations and General Guidelines on Maritime Transport, TSFS 2009:56. More detailed provisions on the information service and its content are to be found in § 6 of the above regulations.

§ 6 Information services are provided to a vessel when it reports in, at specific points in time, when necessary or when the vessel requests it.

Through the information service, the vessel can receive information on:

1. other vessels within the VTS area that could have an impact on its progress,
2. faults or deficiencies in the maritime safety devices,
3. restrictions in accessibility,
4. weather and ice conditions,
5. water level and other hydrological conditions,
6. changed conditions for VHF communication, reporting points and other compulsory reporting routines, and

⁵ GPS is a device that receives Global Positioning System (GPS) signals to determine the device's location on Earth.

⁶ Voyage data recorder, or VDR, is a data recording system designed for vessels in order to collect data from various sensors on board the vessel.

⁷ Gross is a unitless comparative which is based on the vessel's total enclosed volume.

⁸ ECDIS (Electronic Chart Display and Information Systems) is the standard for electronic charts. A certified and approved ECDIS system may replace the use of paper charts.

⁹ ECS (Electronic Chart System) is a simpler version and may not replace the use of paper charts.

7. other circumstances that could be of importance to safety in the shipping traffic.

When it is necessary for reasons of safety, a certain vessel can be given warnings and guidelines of importance to its operation.

The existing VTS regulation is primarily applying the ships using the VTS. According to the Swedish Transport Agency, they have no authorization for regulating how the VTS is performed. The Swedish Transport Agency, in cooperation with the Swedish Maritime Administration, is working on a proposal for a national legislation, taking into account IMO Resolution A.857(20) Guidelines for Vessel Traffic Services.

1.11 Scene of the accident

1.11.1 Channel

The compulsory pilotage limit in the Södertälje pilotage area in which Lake Mälaren is included was – according to the Swedish Transport Agency regulations and general guidelines on pilotage (TSFS 2012:38) for the type of vessel in question – 70/14/4,5 m (length/breadth/draught). Liva Greta – with a length, breadth and draught of 64.33/10.5/3.4 m respectively – was therefore not subject to compulsory pilotage and did not have a pilot on board during the voyage in question. According to the general guidelines in 2nd chapter 1 § TSFS 2012:38, a master should engage a pilot if it is considered needed, taking into account safety or protection of the environment, even though it is not compulsory. In addition, the Swedish Transport Agency may in certain cases decide for the master to use one or two pilots, if it is deemed necessary for safety or protection of the environment.

It is the Swedish Maritime Administration that is responsible for making sure that fairways are kept open, that they are safe and that they are kept in good condition. The Administration also deals with the operation and maintenance of the maritime safety devices in the general channels.

The channel beneath the Nockeby Bridge normally has a horizontal clearance of 24 m and a vertical clearance of 12.5 m. The bridge pier nearest the channel is protected against collision by fendering on both sides of the channel, which also serves as a visual aid that is also clearly visible on radar in the event of poor visibility.

On those occasions when, for example, an adjustment in course needs to be made before entering a narrow section of channel, such as under a bridge, where the fairway and the bridge crossing require different courses, it is an advantage if the vessel has finished turning and is on a steady course in as good time as possible before the beginning of the narrow section. This technique can be referred to as “opening the bridge hole” (see Fig. 7).

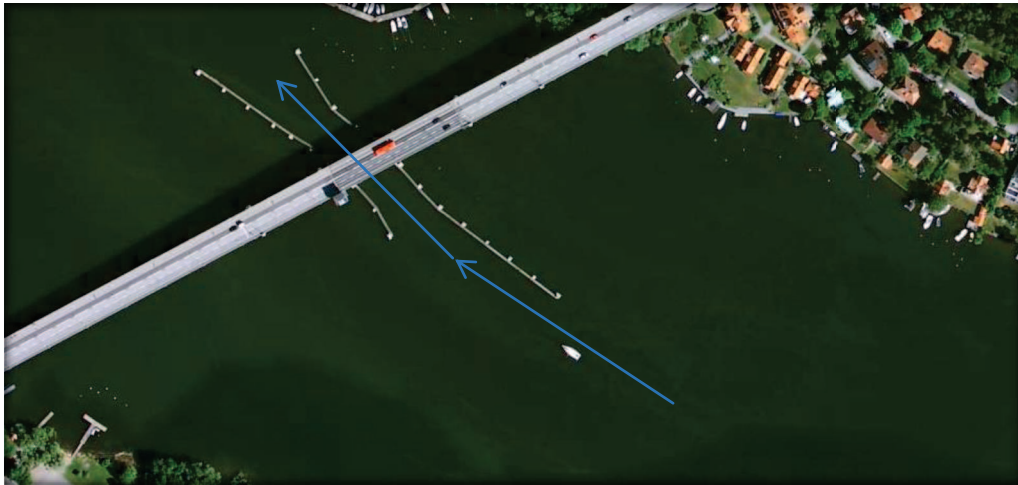


Fig.7. Nockeby Bridge viewed from above. The arrows on the photo illustrate the required change in course for the purpose of “opening the bridge hole” and thereby acquiring the largest width of channel or fairway for the vessel as it crosses under the bridge. Photo: © Lantmäteriet Diary No. R61749_130002.

1.11.2 Nockeby Bridge

General

The Nockeby Bridge was built in 1973 and connects Drottningholm with Bromma in the County of Stockholm (see Fig. 8). The bridge is 694 m long and is openable by means of a swing span.



Fig.8. Nockeby Bridge viewed from the side. Photo: Holger Ellgaard

The bridge has a theoretical mean day traffic flow across the bridge of 19 500 vehicles and is an important part of the land-based infrastructure in the region.

Repair works

During previously inspection of Nockeby Bridge, serious damage was observed to the fendering. In order to be able to maintain the future function of the fendering to protect the bridge piers from the impact of vessels colliding with them, it was the intention of the Swedish Transport Administration to repair the fendering. The repair work comprised repairs to the concrete on 23 dolphins and the replacement of 21 fender beams. The planned contract implementation period was between 29 August 2012 and 30 January 2013. However, work started earlier than expected with the construction initiation meeting on 13 June 2012 and establishment of the works equipment at Nockeby Bridge on 2 July 2012.

Old timber fender beams were removed on both sides of the channel and bridge. The fendering protection had been largely removed at the time of the incident. According to plan, the fendering protection was then meant to be replaced by protection structures made of steel. At the time of the collision the dolphins were connected together by timber beams. However, the actual

fendering protection had been dismantled on the north-western side of the bridge. Consequently, it failed to serve as protection but could to a certain extent provide visual assistance to passing vessels.

On the south-western side of the bridge, where the collision took place, all the fendering beams had been dismantled at the time. Instead they had laid out logs in the water and tied them between the dolphins so that passing ships could visualise the channel alignment through the bridge, although without providing a protective function for the bridge.

The width of the channel was in practice somewhat restricted and in addition there were a number of construction craft and barges moving around while the work was in progress compared with the normal situation.

The investigation has not received any information that signs or signals, e.g. with signal flags according to the IMO International Code of Signals¹⁰, were displayed.

Risk analyses conducted before the repair works, etc.

The Swedish Transport Administration is responsible for the technical standard of the Nockeby Bridge. The risk analysis work carried out for shipping prior to the repair work consisted of contacts between the Transport Administration's unit for construction works and the Swedish Maritime Administration's infrastructure unit during January 2012 with a limited exchange of information concerning the planned work, that there was a certain amount of shipping activity in the area and that the repair work should not obstruct shipping from passing under Nockeby Bridge. From what is gathered, this information was not passed on to the Södertälje Pilot Area. The Maritime Administration's infrastructure unit never received any formal referral from the Swedish Transport Administration and was not present at the construction initiation meeting.

The Swedish Transport Administration pointed out in its Bill of Quantities (MB), see Enclosure, measures that need to be considered in conjunction with repair works related, for example, to safety issues, and noted the importance of following the Swedish Transport Agency's requirements concerning maritime safety issues, restrictions, regulations and markings. It also identified the Lake Mälaren Shipping Area (Södertälje Pilotage Area) as being responsible for ensuring that the navigation channel in question is kept open, safe and in good condition, and that it is responsible for dealing with the operation and maintenance of the maritime safety devices.

In addition, the Swedish Transport Administration notes in its MB that "staged demolition and construction shall be assumed in order on the one hand to influence shipping as little as possible and on the other to maintain the protection of bridge piers that is given by fendering."

From what can be concluded from the investigation, the Maritime Administration's Södertälje Pilot Area was neither informed nor contacted at the planning stage during winter 2012. When the building contractor Stockholms Hamnentreprenad had been awarded the project and had started its

¹⁰ IMO ICS Rev ed 2005.

planning work, they tried to contact the Södertälje Pilot Area in May with questions concerning the marking and reduction in width of the channel without, however, receiving any response.

Stockholms Hamnentreprenad also contacted the Ufs editors at the Swedish Maritime Administration concerning the work, which resulted in the insertion of an announcement in Ufs as noted in Section 1.7 above.

On 17 August 2012, i.e. 6.5 weeks after the contractor's initial site establishment at Nockeby Bridge, the pilotage area manager informed everyone concerned within the Södertälje Pilot Area, such as pilots and VTS, about the ongoing repair work at Nockeby Bridge. After this, it appears that a regular dialogue was maintained between the Södertälje Pilot Area and Stockholms Hamnentreprenad concerning the channel, shipping operations and routines followed between them.

At interviews held with representatives of Stockholms Hamnentreprenad, it was stated that their routines included maintaining contact with vessels on VHF and maintaining a visual monitoring of vessels that were due to pass under the bridge in order not to obstruct their passage. It was felt that there was good cooperation with the Södertälje Pilot Area. Liva Greta was spotted visually without any kind of previous warning.

1.12 Rescue operations

Rescue operation means in the Act (2003:778) on protection against accidents (LSO) those rescue measures for which the State or the local authorities are responsible in connection with accident incidents in order to prevent and limit injury and damage to people, property or the environment.

No special rescue measures were necessary in connection with the accident. The construction workers at the Nockeby Bridge informed their contact at the Södertälje Pilot Area, who in turn informed VTS Södertälje, the police and the Swedish Transport Agency of the incident. The vessel contacted none of these bodies.

1.13 Miscellaneous

1.13.1 Statistics

Since the year 2000, a number of occurrences have been reported in connection with ships negotiating bridges. There have also, in previous investigations, been reports of deficiencies in calculations and the signage of vertical clearances under bridges as well as shortfalls in vessels' air draft calculations. The collision between the crane barge Lodbrok and Essinge Bridge in 2005 is one of several examples of accidents that have been reported and investigated (Swedish Maritime Administration Investigation Diary No. 080201-05-17033).

According to statistics available from the Swedish Transport Agency, 18 different incidents involving bridges have occurred over the past 10 years, all 10 of which have taken place in the County of Stockholm. Collisions with bridges can have serious consequences for the infrastructure both on the land side as well as for maritime traffic. Often, these kinds of incidents are a result

of deficient routines and shortfalls in the cooperation between the various players involved.

In 2003, a vessel ran aground in Malmö Harbour, the M/S Oosterbrug. The accident was investigated by the Swedish Maritime Administration (Diary No. 080202-03-16863). During the investigation it was concluded that a contributory cause of the accident was that the British sea chart that had been used had not been correctly updated. A Swedish Ufs on reconstruction work being carried out in the harbour had not been published in the British NtM.

2. ANALYSIS

2.1 Preconditions

2.1.1 *Planning and performance of bridge repairs*

The Accident Investigation Authority can confirm the fact that the Swedish Transport Administration, prior to the repair work, identified certain risks during the production of the Bill of Quantities and that the Swedish Transport Administration noted certain measures that needed to be considered in connection with bridge protection. Furthermore, the importance of following the requirements and recommendations of both the Transport Agency and the Maritime Administration was pointed out with regard to both maritime transport and its safety. It appears, however, that the risk analysis work was largely discontinued after the Bill of Quantities had been drawn up.

It therefore seems as though no further detailed analysis was made of the risks and consequences of a vessel colliding with the bridge during the course of the bridge repair works, when the bridge protection was limited. An analysis of this type could have led to the conclusion that the observance of further caution over and above an announcement in Ufs was necessary when it came to the use of the channel during certain periods of the repair work, for example when there was a lack of any real protection for the bridge piers. It could have been a recommendation to use a pilot for masters on vessels where otherwise a pilot was not compulsory, or a request to the Swedish Transport Agency to extend the obligation to use a pilot for the time in question. Also signs or signals according to the International Code of Signals may have been a result.

It can be noted that at the time of the collision there was no collision protection in the form of fendering in place, apart from a short stretch immediately beneath the bridge, despite the fact that the Swedish Transport Administration in its Bill of Quantities noted that “staged demolition and construction shall be assumed on the one hand in order to have as little effect as possible on shipping and on the other to maintain the protection of the bridge piers that is given by the fendering”. This intention does not appear to have been fully implemented in connection with the repair work.

The Accident Investigation Authority can also conclude that the cooperation and information channels between the players before and in conjunction with start of construction did not function fully satisfactorily. It was not until 17 August 2012, or in other words 6.5 weeks after work started on the contractor’s establishment at Nockeby Bridge, that a cooperation meeting was held between the contractor and the Södertälje Pilot Area when everyone concerned in the area, for example pilots and VTS, was informed.

In conclusion, it is clear that there have been flaws regarding information flow between the actors concerning the bridge repairs and that available information did not reach the shipping in a satisfactory degree. These are risk factors when it comes to safe shipping. It is the opinion of the Accident Investigation Authority that there is room for considerable improvement in these respects and hence recommends the Transport Administration and the Maritime Administration to, based upon their responsibilities respectively, work for an enhanced collaboration in order to secure that different actors have enough

information for adequate risk assessments and safety measures to ensure safe shipping and protect infrastructure and others that may be on the work site.

2.1.2 *Vessel Traffic Service (VTS)*

According to information given by the master, which is supported by VHF audio recordings, VTS Södertälje did not inform the vessel at any of the reporting points during the course of the voyage of the major repair works that were in progress on Nockeby Bridge, despite the fact that contact was made at the reporting points and that the vessel's destination was known to VTS.

In § 6 of the Swedish Transport Agency's regulations and general guidance on maritime traffic, TSFS 2009:56, it is stated that – through the information service – vessels *can* receive information about, inter alia, restrictions in accessibility. Furthermore a certain vessel *can* receive warnings and guidance of importance to their progress and operation when it is necessary for safety reasons.

In the opinion of the Accident Investigation Authority, the use of the word *can* allows room for interpretation that it is VTS who decides whether or not a vessel is given relevant information. If the word *can* were to be replaced by the word *shall*, no room is allowed for individual interpretation on the part of individual VTS-operators. In this case it is obvious that the vessel should have been given information on the repair works being carried out on Nockeby Bridge.

The Swedish Transport Agency is however hindered to change the legislation in such a way due to lack of authorization to regulate the way the Swedish Maritime Administration is performing their duties. The Accident Investigation Authority notes that a development of the national legislation is on-going. Until that work is finished, the Swedish Maritime Administration should ensure that vessels are given relevant and necessary traffic service.

2.1.3 *Notices to Mariners (Ufs)*

The master was furthermore unaware that an announcement had been published on work in progress on the bridge in Ufs in both Swedish and English since this information was never reproduced in Notices to Mariners published by the United Kingdom Hydrographic Office with respect to the British sea charts that M/S Liva Greta used for navigation purposes. The Accident Investigation Authority views this as a shortfall. The Accident Investigation Authority has been unable to clarify why the information was not passed on. The fact that the vessel had been completely unaware of the ongoing repair work on the bridge probably affected the master's actions and contributed in part to the accident.

In the opinion of the Accident Investigation Authority, the United Kingdom Hydrographic Office should review its routines for making sure that important, relevant and known information is published in NtM.

2.2 **The part of the journey from Landsort – Hässelby**

The master on board the vessel Liva Greta was on the bridge and made the navigating throughout the 6.5-hour and approximately 50 nautical mile-long

journey within the archipelago between Landsort and Hässelby by himself. The vessel was not subject to compulsory pilotage, had two nautically qualified crew on board, including the master, and the voyage was undertaken without a pilot, which was in accordance with the applicable regulations.

As the vessel approached Nockeby Bridge, the master positioned Liva Greta on the port (left-hand) side of the fairway probably with the intention of “opening the bridge hole” before turning to starboard to take the intended course through the bridge hole.

In the opinion of the Swedish Accident Investigation Authority, the master made a correct and carefully considered assessment in readiness for the bridge passage by positioning the vessel far out on the port side of the fairway with the probable intention of opening up the bridge hole in good time. However, the turn to starboard came too late to be able to turn up into the fairway under the bridge. The speed, which according to the AIS recording had not been reduced to 5 knots in accordance with the applicable speed restrictions. This may be because the master was surprised when he saw the ongoing construction work and quickly had to examine the implications for the bridge passage, whereby the speed limit possibly was forgotten. The higher speed probably had a negative impact on the continued sequence of events.

At the point where the bridge hole had “opened up” sufficiently the rudder was moved to starboard. The master felt that the steering was not functioning satisfactorily so he put the engine into full astern in order to avoid colliding with the dolphin bow on.

In the opinion of the Accident Investigation Authority, a relatively substantial decrease in engine power was applied in order to reduce the excessively high speed at which the vessel was heading immediately before the turn to starboard was initiated. This in turn led to an impaired steering effect since the propeller wash had by then decreased or stopped altogether. This meant that only water movement around the rudder remained, which could have been experienced as though there was something wrong with the steering since the anticipated turning speed was either partially or entirely lacking. This could explain the master’s experience of there being a fault in the steering system on the occasion in question since the vessel did not turn to starboard at the speed the master had anticipated. The Accident Investigation Authority can in this context state that it has not been possible either before or after the incident to prove the existence of any form of technical fault in the vessel’s steering system, even though the master stated that the rudder indicator failed to show any response when the turn to starboard was initiated.

When the required turning speed was not obtained, the engine were thrown into full astern in order to avoid colliding with the dolphin bow on. In similar situations, when the engine is running full astern, the turn is accelerated and takes place in a partially uncontrolled manner – in this case to starboard owing to the direction of propeller rotation. In this case, the stern section turned and collided with the southern dolphin, which caused cracking in the dolphin structure. After this, the vessel continued towards the northern dolphin where the starboard bow hit the dolphin and the vessel was holed just below the starboard anchor.

It was a serious collision and the dolphin that was hit by the vessel's bow was shifted about 1.5 m out of position. No collision protection in the form of, for example, fendering was in place at the point of the collision at this point in time.

During similar circumstances, when a vessel "loses steering capacity", the most effective way is to increase the speed ahead for a short period of time in order to increase the flow of propeller wash around the rudder thereby increasing the rudder power.

In the opinion of the Accident Investigation Authority, the fact that the master had no forewarning of the bridge repairs and of the cautionary measures that were recommended in Ufs probably contributed to the fact that the conditions for a safe passage under the bridge were not optimal.

2.3 Previous incidents in connection with bridges in the County of Stockholm

According to available statistics, incidents involving bridges are not entirely unheard of. Bearing in mind the serious consequences that a collision can have both on safety and on the infrastructure should the bridges that go over major public fairways being examined to ensure that they have appropriate and sufficient collision protection, either underwater or above water at the bridge piers, with regard to the size and speed of vessels permitted to pass.

3 CONCLUSIONS

3.1 Results of the Investigation

- a) Nockeby Bridge had no collision protection in the form of fendering at the time of the accident.
- b) The vessel had not been informed of the repair work by VTS.
- c) The United Kingdom Hydrographic Office, which was the sea chart producer concerned, had not passed on the Swedish Maritime Administration's Ufs as NtM.
- d) The vessel did not observe current speed restrictions when negotiating the bridge.
- e) The vessel probably lost steering capacity owing to a major reduction of power to propulsion before the turning movement.
- f) The Swedish Maritime Administration's infrastructure unit received no formal referral from the Swedish Transport Administration concerning bridge repairs at the planning stage.
- g) No direct risk analysis was made concerning risks to the bridge and to passing vessels in cooperation between the Swedish Transport Administration and the Swedish Maritime Administration before the accident.
- h) No limits or restrictions on shipping were introduced.
- i) Internal communications within the Swedish Maritime Administration do not appear to have functioned in a satisfactory way at the planning stage or during the site establishment stage.
- j) During the establishment stage, the building contractor had experienced difficulties in establishing communications with the Södertälje Pilot Area.

3.2 Causal factors

- The vessel had no knowledge of the work in progress on the bridge fendering owing to lack of information from VTS and an absence of NtM from the producer of the sea charts.
- The vessel failed to observe current speed restrictions in the area around Nockeby Bridge.
- The turn made by the vessel into the bridge hole was unsuccessful and going astern with the engine resulted in an uncontrolled turn to starboard that was not corrected.

4. RECOMMENDATIONS

The United Kingdom Hydrographic Office is recommended to:

- Secure its routines regarding the introduction of Ufs notices from the Swedish Maritime Administration to the British Notices to Mariners. *(RS2014:01 R1)*

The Swedish Transport Agency (Transportstyrelsen) is recommended to:

- In consultation with the Swedish Maritime Administration take action for a national, fully covering, legislation concerning VTS. *(RS2014:01 R2)*

The Swedish Maritime Administration (Sjöfartsverket) is recommended to:

- Ensure that relevant VTS information is given. *(RS2014:01 R3)*

The Swedish Transport Administration (Trafikverket) is recommended to:

- In consultation with the Swedish Maritime Administration, make sure that bridges in the large navigation fairways have sufficient protection to avoid serious damage as a consequence of collision. *(RS2014:01 R4)*

The Swedish Maritime Administration and the Swedish Transport Administration are recommended, individually and in consultation, to:

- Review routines and regulations regarding construction work in, or in connection to, fairways to ensure that involved actors have sufficient information, that relevant risk are assessed, and that adequate safety measures are taken in order to maintain safety for shipping, infrastructure and others concerned. *(RS2014:01 R5)*

SHK requests a response, no later than **13 June 2014**, on the action that has been taken as a result of the recommendations made in the Report.

On behalf of the Swedish Accident Investigation Authority,

Mikael Karanikas

Jörgen Zachau

Enclosure

Trafikverket		Nockebybron, knr 2-228-1				
Byggnadsverk Öst/Stockholm		Reparation Nockebybrons ledverk				
Mängdbeskrivning		2011-09-09				3
Handling 10.1						
Kod	Text	R/OR	Enhet	Mängd	å-pris	Summa
BC	Hjälparbeten, tillfälliga anordningar och åtgärder m m					
BCB.7	Åtgärd för allmän trafik					
	Åtgärder som medför begränsningar i framkomlighet skall godkännas av beställare.					
	Transportstyrelsens krav beträffande sjösäkerhetsfrågor, restriktioner, regler och utmärkning mm för arbeten till sjöss i Mälarens sjötrafikområde skall inhämtas och efterföljas. Farkoster och flytetyg skall visa de signaler som föreskrivs i de internationella sjöfartsreglerna.					
BCB.711	Tillfällig väg, plan o d					
	Utförning av tillfälliga vägar bestäms av entreprenören i samråd med beställaren. Ett uppritat förslag innehållande det tillfälliga trafiksystemet med tillhörande trafikanordningar lämnas till beställaren för godkännande före igångsättning av arbetet.	-	-	-	-	-
BCB.712	Tillfällig bro, gångbrygga, o d					
	Tillfälliga konstruktioner får ej belasta befintliga konstruktioner utan beställarens medgivande.					
BCB.73	Åtgärd för sjötrafik					
	Arbete skall bedrivas så att sjötrafiken inte påverkas i nämnvärd grad. Farleden ska vara öppen dygnet runt med de breddbegränsningar som gäller enligt sjökort. Eventuella avsteg från detta beslutas av Mälarens sjötrafikområde.	-	-	-	-	-
	Etappvis rivning och byggnation ska förutsättas för att dels påverka sjöfarten så lite som möjligt, dels för att upprätthålla det skydd av brostöden som ledverket ger.					
	Fyrlyktorna på de yttre dykdalbena skall ersättas med tillfällig farledsbelysning då lyktorna är demonterade.					

Trafikverket Byggnadsverk Öst/Stockholm Mängdbeskrivning		Nockebybron, knr 2-228-1				
Handling 10.1		Reparation Nockebybrons ledverk				4
Kod	Text	R/OR	Enhet	Mängd	å-pris	Summa
	<p>Förslag till tillfällig farledsbelysning och ev. andra åtgärder i farled skall utarbetas i samråd med Mälarens sjötrafikområde i god tid innan arbetenas planerade start.</p> <p>Entreprenören ska hålla personal anträffbar på telefon såväl efter arbetstiden som över helger och semesterperioder för underhåll och skötsel av arbetsplatsens sjötrafikanordningar. Lista över personal med respektive telefonnummer skall överlämnas till beställaren samt sjötrafikområdet senast vid startmöte.</p> <p>Entreprenören skall under arbetstid hålla radiopassning på VHF kanal 16.</p> <p>Tillsyn, skötsel, underhåll och eventuella incidenter ska antecknas särskilt i dagboken.</p> <p>Utmärkning av temporär farled, pontoner, bryggor, arbetsbåtar och andra flytetyg i samråd med beställaren och Mälarens sjötrafikområde.</p> <p>Upprätthållande av utmärkning och andra åtgärder för sjötrafik dygnet runt.</p>					
BCB.8	<p>Diverse hjälparbeten i anläggning</p> <p>Byggtrafik, anordnande av upplag, eldning, skärmings-, svetsnings-, sågnings- eller bilningsarbeten o d får inte förekomma på eller i sådan närhet av trafiken att skada uppstår. Detta avser alla typer av skador, såväl mekaniska som estetiska, t ex nedsmutsning och missfärgning orsakad av petroleumprodukter, gnistbildning, rost eller damm etc.</p> <p>Om skada uppstår kontaktas beställaren eller dennes byggledare och entreprenören skall på egen bekostnad återställa till befintliga förhållanden.</p>	-	-	-	-	
BCB.87	<p>Tillfällig skyltning till allmänheten</p>	-	-	-	-	

Swedish Transport Administration
Construction Works East/Stockholm
Bill of Quantities

Nockeby Bridge, knr 2-228-1

Repair of Nockeby Bridge Fendering

Document 10.1

2011-09-09

Code	Text	R/OR	Unit	Quantity	Unit Rate	Total
BC	Auxiliary works, temporary facilities and measures, etc.					
BCB.7	Measures for public traffic Measures that require restrictions in accessibility shall be approved by the client. The Swedish Transport Agency's requirements for maritime safety issues, restrictions, regulations and markings etc. for works at sea in the Lake Mälaren maritime traffic area shall be obtained and followed. Ships and vessels shall show the signals that are prescribed in the international shipping regulations.					
BCB.711	Temporary roads, hard standings, etc. The design of temporary roads shall be determined by the contractor in consultation with the client. A proposal containing the temporary traffic system with appurtenant traffic devices shall be submitted to the client for approval before commencement of the works.					
BCB.712	Temporary bridges, pedestrian bridges, etc. Temporary structures may not burden existing structures without the consent of the client.					
BCB.73	Measures for maritime traffic Works shall be conducted so that maritime traffic is not influenced to any significant extent. Navigation channels shall be open round the clock with the limits that apply with respect to width as indicated on the charts. Any departure from this shall be decided by the Lake Mälaren maritime traffic area. Staged demolition and construction shall be assumed on the one hand to disrupt maritime traffic as little as possible and on the other to maintain the protection of the bridge piers that is afforded by the fendering. The lights on the outer dolphins shall be replaced by temporary navigation channel lights if the permanent lights have been removed. Proposals for temporary navigation channel lights and any other measures introduced in channels shall be worked out in consultation with the Lake Mälaren maritime traffic area in good time before the planned commencement of the works. The contractor shall keep personnel available by phone both after working hours as well as at weekends and public holidays for upkeep and maintenance of the worksite traffic devices. Lists of personnel with their respective phone numbers shall be submitted to the client and the maritime traffic area no later than in conjunction with the initial meeting. The contractor shall during working hours maintain radio contact on VHF Channel 16.					

BCB.8	<p>Inspection, upkeep, maintenance and any incidents shall be specially noted in the Journal.</p> <p>The marking of temporary channels, pontoons, jetties construction boats and other vessels shall be conducted in consultation with the client and the Lake Mälaren maritime traffic area.</p> <p>Markings and other measures for maritime traffic shall be maintained on a round-the-clock basis.</p> <p>Various auxiliary works</p> <p>Construction traffic, the arrangement of stockpiles, heating, cutting, welding, sawing or breaking-up works etc. may not be carried out in or so close to traffic that damage could occur. This refers to all types of damage, both mechanical and aesthetical, for example soiling and discolouration caused by petroleum products, flying sparks, rust or dust, etc.</p> <p>If any damage should occur, contact shall be made with the client or his construction manager, and the contractor shall at his own expense restore the surface, etc. to its original condition.</p>					
BCB.87	<p>Temporary signage and the general public</p>					