Norwegian Safety Investigation Authority

INFORMATION DOCUMENT NO 1: PRELIMINARY INVESTIGATION OF THE BRIDGE COLLAPSE AT TRETTEN ON 15 AUGUST 2022

This information document is a preliminary presentation of the NSIA's investigations relating to the bridge collapse and does not provide a full picture. The report may contain errors and inaccuracies. The final report will constitute the NSIA's official document relating to the accident and the investigation.[1]

Date and time:	15 August 2022 at 07:33
Place:	Tretten bridge, Fv 254, Øyer municipality, Innlandet county
Type of accident:	Bridge collapse
Vehicles involved:	Heavy goods vehicle (lorry with trailer) and passenger car
Road users involved:	HGV driver and passenger car driver

All times given in this report are local times (UTC + 2 hours) unless otherwise stated.

Introduction

This information document is published to allow interested parties to familiarise themselves with some of the information that has so far been collected through our investigation. Its purpose is to provide a brief update on developments in the technical examinations and the findings made so far. The information document is based on factual information obtained and traces and parts secured from the bridge, and it contains no conclusions or safety recommendations.

Sequence of events

On the morning of 15 August 2022, at 07:33, Tretten bridge collapsed and fell into the Gudbrandsdalslågen river and onto the E6 road. One passenger car and one lorry with a trailer carrying lime were on the bridge when it collapsed. The driver of the passenger car evacuated herself from the vehicle and climbed to safety on the west bank of the river, while the lorry driver was evacuated by helicopter. Neither of the road users involved were seriously injured in the incident.

Organisation

The Norwegian Safety Investigation Authority (NSIA) arrived at Tretten on 15 August 2022 and began its preliminary investigation into the bridge collapse. Based on the preliminary investigation, the NSIA decided to initiate a full safety investigation of the incident.

The NSIA took over responsibility for the external expert group originally established by the Norwegian Public Roads Administration (NPRA) and Innlandet county authority in connection with the bridge collapse. The expert group consists of experts from building and construction consultancy company Aas-Jacobsen, the Norwegian University of Science and Technology (NTNU), SINTEF and engineering and architecture consultancy company SWECO. The expert group is led by the NSIA.

The investigation will seek to determine how and why the bridge collapsed, identify safety problems and map the incident's underlying causal factors. Based on the results, the NSIA will consider areas for improving safety.

[1] The object of the NSIA's investigations is to clarify the sequence of events and causal factors, elucidate matters deemed to be important to the prevention of accidents and serious incidents, and to issue safety recommendations if relevant. It is not the NSIA's task to apportion blame or liability under criminal or civil law.

Preliminary investigations

The NSIA has followed the demolition work on the damaged bridge at Tretten and has helped to secure parts from the bridge for further investigation. The NSIA has obtained and secured a lot of photographic and written documentation necessary for the continuing work to identify the causes of the bridge collapse. The NSIA has also begun to interview and meet with persons and organisations involved.

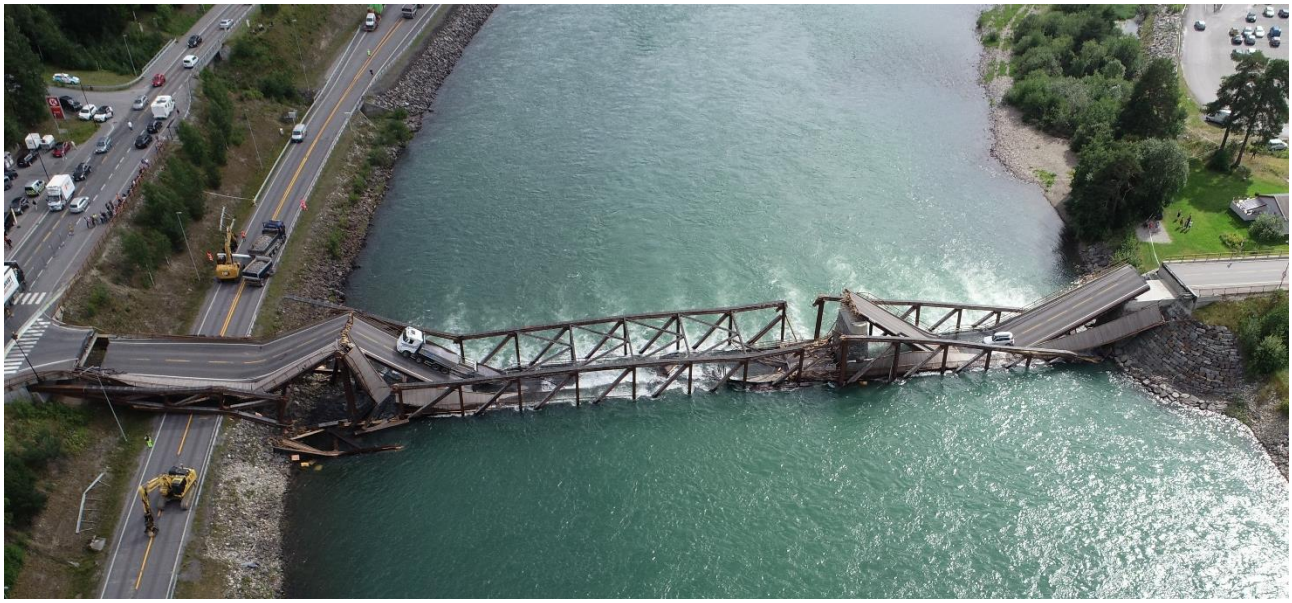

Figure 1: Tretten bridge at 14:45 on 15 August. Photo: NSIA

Innlandet county authority heads the demolition work in its capacity as road owner. Because of the urgent need to reopen the E6 road, priority was given to demolishing the parts of the bridge that had fallen onto the E6 on the eastern bank of Gudbrandsdalslågen. During the demolition process, a coordinated order of priority was agreed on, based on expert input and assessments, for which parts of the bridge to secure for more detailed technical examination based on approved work drawings of the bridge. Priorities were assigned based on how important it was to secure the different parts in as undamaged a condition as possible. The police led the work of securing, locating and registering parts from the bridge.

The dimensions of the bridge and considerations for the health and safety of those working on the site made it physically impossible to secure all the relevant parts from the eastern side of the bridge. The first batch of truss members and other bridge parts was collected, logged and transported to a suitable location on 17 August. On 18 August, magnets suspended by ropes from the basket of a mobile crane were used to search for bolts from the bridge upstream and downstream of the bridge piers at axis 3. Subsequent searches for bolts were conducted using a water-proofed excavator magnet. The E6 road was reopened for traffic on the morning of 26 August.

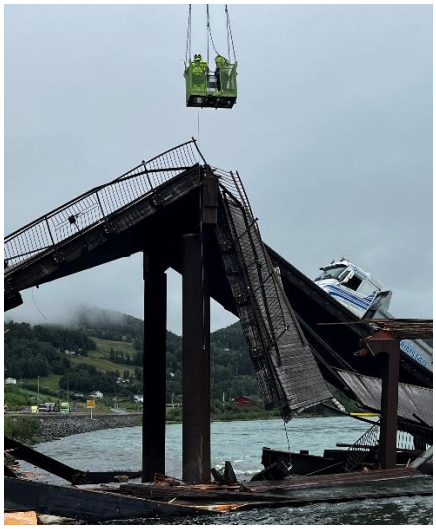

Figure 2: Search for bolts around axis 3 using a magnet. Photo: NSIA

Figure 3: The area where collected parts were logged and labelled for transport. Photo: NSIA

A corresponding assessment and prioritisation process took place for the remaining section of bridge on the western bank of Gudbrandsdalslågen that is yet to be demolished and salvaged. The parts of the bridge that were still intact following the collapse, as well as the deck and pedestrian walkway, were not given priority.

Figure 4: Temporary road by the western end of the bridge photographed on 7 September 2022. Photo: NSIA

Figure 5: Excavator magnet used to collect bolts. Photo: NSIA

Preliminary investigation results

The expert group has visually inspected photographic documentation from the bridge and the bridge parts secured from the western bank of the Gudbrandsdalslågen river. SINTEF received the bolts collected on 18–20 August. So far, SINTEF has submitted a report and a memo to the NSIA concerning the preliminary investigation results. A summary is provided below.

Report on examination of bolts from Tretten bridge

SINTEF has so far received and examined 21 half bolts used to connect the truss and crossbeams on Tretten bridge. The bolts were retrieved from the river in the area around axis 3 (see figure 2). They were grade 8.8 M24 bolts and grade 10.9 M27 bolts.

All the M24 bolts received (14 halves of 48 possible) have a shear fracture at an angle of 90° to their longitudinal axis, and have probably been sheared by relative movement in the plane between the crossbeam and the joint in the truss they were joining together. All of the M27 bolts have fractures caused by tension and bending forces acting along the bolts' longitudinal axis.

No signs of fatigue or previous damage have been found on the bolts received, and the fractures show ductility for both classes of bolts. These findings indicate that the bolts fractured as a result of overload when the bridge collapsed.

It cannot be ruled out at the present stage of the investigation that other bolts that have not been examined could be subject to fatigue or faults that developed over time.

Figure 6: Half bolts retrieved on 18 August and sent to SINTEF for further examination. Photo: NSIA

SINTEF memo on weathering steel in Tretten bridge

Steel was used in crossbeams, joints and vertical members in the truss, as well as in the two columns in axis 3 of Tretten bridge. Based on the parts of the bridge that have been available for inspection (more than half the bridge is still in the river), the steel does not appear to be more corroded than expected. So far, no signs of flaking of corrosion products or increased rate of corrosion were found on the inspected parts.

At this stage of the investigation, it cannot be ruled out that the parts of Tretten bridge still in the river could have an increased rate of corrosion.

Further investigations

The expert group has initiated work on modelling and calculations for the bridge design, but this work has not advanced far enough for any preliminary results to be published.

Concluding comments

The NSIA remarks that two thirds of the bridge are still submerged in Gudbrandsdalslågen, and that it will probably take another 4–6 weeks to retrieve and secure all the parts. This investigation is still in its early stages, and this information document only contains information about some of the technical examinations initiated. The information document does not provide a complete picture of the ongoing investigation.

Norwegian Safety Investigation Authority

Lillestrøm, 21 September 2022