

VIII Congreso de la Asociación Española de Ingeniería Estructural ACHE

Transportation of 8.400t bow string Rail Bridge across A1 in The Netherlands.

Dimitri Laurent^a, José María Martínez Gutiérrez ^b

^a MSc International Management & Business Administration. SARENS Sales Manager HUB2 – Southern Europe/Africa/Latam ^b MSc Civil Engineer. SARENS Technical Solutions Spain Manager.

ABSTRACT

SARENS was contacted by VICTOR BUYCK STEEL CONSTRUCTION for the "SAAone" consortium to undertake the project of the moving and placement of an 8.400t bridge in the region of Amsterdam, the Netherlands. This involves to replace a railway bridge by a bigger new one over 16 traffic lanes without any intermediate support. It is the heaviest railway bridge ever moved by roads with SPMTs in the world and by far the longest single-span bridge across a motorway. The bridge had to be moved 400m from the location where it was assembled along the side of the A1 to its final place over the A1.

KEYWORDS: Bow string arch, world record, SPMT, transport, strand jacks, lifting

1. Introduction

The SAAone consortium was awarded a €1 billion contract by the Dutch government to build, upgrade and operate a 20km section of the highway between Amsterdam and Almere, the Netherlands. To avoid traffic jams, it was decided to add additional lanes.

This involved to replace a railway bridge on the A1 highway by a bigger new one over 16 traffic lanes without any intermediate support.

The A1 highway normally carries almost 200.000 vehicles per day, and traffic tends to be heavy during weekends as well. Considering the great amount of traffic inflow, the task was designated to be carried out during the night for which the A1 was closed from 20:00 hrs on Friday, May 6, 2016 till 12:00 hrs on Saturday, May 7, 2016.



2. Bridge characteristics

The Muiderberg bridge also known as Zandhaven Bridge, is a bow string bridge with inclined hangers composed by 242 steel parts, heaviest one weighing up to 120 tons.

To support extremely high forces and constraints when a 200m fully loaded train cargo crosses the 200m span, S460 high strength steel had to be used.

The main bridge in figures are:

- 255 m long.
- 17 m wide.
- 50 m high in the central part.
- 8.400 tons of just steel structure.
- No intermediate supports/piers.



3. SARENS scope of works

SARENS was contracted for performing two main operations: lifting of the central arch top part and transport the complete bridge from its fabrication area till its final position.

3.1 Lifting the central arch part

In September 15, SARENS lifted the central top arch section of 1.250 tons by means of 4x450 tons capacity strand jacks (SJs) placed on top of 4 towers (see Figure 3).



At each edge of this top arch section, two SJs were used on top of these towers (see Figure 4).







3.2 Transport the complete bridge

In 6th May'16, SARENS steered the huge steel bridge using 244 axle lines SPMTs Kamag K24-ST powered by more than 5.000 HP. The SPMTs were divided in two sets of 122 axle lines on each, each one at the edge of the bridge with a total distance between them of 220 m.

The bridge needed to be transported a distance of more than 400 m from the assembly area (along the side of the A1) to its final place over the A1. The complete manoeuver can be divided in the next main operations:

- The first operation was to jack up the bridge from its temporary steel supports. This operation was performed just with the hydraulic jacks of the suspensions of the two sets of SPMTs. These jacks have a maximum stroke of 600 mm.
- The second operation was a longitudinal movement from this assembly position by a skew crossing of all the lanes of the A1 motorway until the bridge was parallel to its final position.
- The third operation was a transversal shifting of the bridge along the A1 till reaching its final position on the abutments.

• The fourth and last operation was to jack down the bridge on its final bearings. For that, again the same hydraulic suspension of the SPMTs used for the first jacking up were used.

The high forces due to the large size and weight of the bridge, and the large spacing in between the two SPMT groups, made it challenging to design a sufficiently strong supporting structure.

Moreover, the entire SPMT combination was controlled by a single operator. Both SPMT groups, as commented spaced 220 meters apart, were linked together using a wireless data connection; it was the first time ever a wireless data connection was used among SPMT groups over such a long distance.

But with proficient engineering and our operations team, Sarens skilfully completed the task much before the initial schedule indicated.

The entire operation from driving start to set-down on the bridge foundations took about 6 hours and the motorway was opened three hours ahead of overall schedule.



Along the next Figures the reader can see a series of pictures of the full bow string arch, from its fabrication area (sees Figure 8 and 11 at the right side of the picture) till their final position of the bridge (see Figure 11).

Gratitude

This operation was performed on behalf of VICTOR BUYCK STEEL CONSTRUCTION for the account of SAAone consortium (made up of Hochtief, Royal Boskalis Westminster, VolkerWessels, and the Dutch Infrastructure Fund (DIF)). SARENS wants to thank the trust and confidence showed by these companies for awarding this job to us.

SARENS was also honoured to receive in 2017 the ESTA Award of the SPMT job of the year.

SARENS is pleased to have been part of such an ambitious project, and would like to congratulate everyone who helped make it a success from the safety point of view till fulfilling the tied schedule of this world record project.



Figure 8. Bridge ready to start moving



Figure 9. Bridge starting manoeuver at night.



Figure 10. Bridge ending manoeuver at dawning.



Figure 11. Bridge in final position