

## FAQ – Hallandsås Project

### **Why is a tunnel being constructed through the Hallandsås ridge?**

The need to transport goods and people is increasing. For example, the 15,000 vehicles that currently pass the Hallandsås ridge on a daily basis will grow to 35,000 in 20 years, including 5,500 heavy vehicles. An expansion and modernisation of the Swedish railway system will create opportunities for safer, more efficient and more environmentally friendly transports.

The construction of the tunnel through the Hallandsås ridge is part of the expansion of the West Coast Line that links Gothenburg with Malmö and Copenhagen and continues down to the continent. Today, approximately 85 per cent of the line has been converted to a modern double track. Several bottleneck areas still exist, however, the single largest is the stretch through Hallandsås.

The current railway line over the Hallandsås ridge comprises a single-line track from 1885. Due to its steep climbs and tight bends, the section over the ridge has always been a problem. Hallandsås restricts capacity and creates delays along the entire West Coast Line. Without a double-track line through the ridge, combined with other expansion work along the West Coast Line, the situation will soon resemble a motorway transitioning into a narrow gravel road that becomes backed up and causes problems throughout system.

### **How will the tunnel improve train capacity?**

A double-track line through the Hallandsås ridge will enable trains to double the weight of the goods they carry, boosting capacity from the current level of four trains per hour to 24 and increasing train speed from 80 kilometres per hour to 200 kilometres per hour.

A fully loaded goods train is equivalent to 33 transport lorries. Accordingly, a fully built-out West Coast Line would be comparable with a 16-lane motorway in terms of goods capacity.

### **How long will the tunnel be?**

The two parallel railway tunnels through the Hallandsås ridge will both measure 8.7 kilometres in length and stretch between the towns of Båstad and Förslöv in north-west Skåne.

### **What distinguishes Hallandsås from other tunnel projects?**

Hallandsås has a complex geological environment, even compared with international standards. The ridge is a so-called primary horst and mainly comprises gneiss, as well as amphibolite and diabase. What makes work on Hallandsås so complicated is that the rock in certain areas contains severe fissures and is thus highly water-bearing. Combined with the high water pressure at the tunnel level approximately 150 metres below ground level, this makes the project even more challenging. In many tunnel projects, it is possible to drain the groundwater during the construction phase, but this is not permitted in the Hallandsås Project according to the environment judgement received. Therefore, extensive cement grouting must be carried out to seal the rock.

Another difficulty is that the rock is also so disintegrated in places that it essentially resembles clay. When you start boring in these conditions, the disintegrated rock close to the tunnel boring machine (TBM) dissolves due to the high pressure of the groundwater. However, this only occurs during the construction phase and will not be an issue during the operating phase once the tunnel has been opened for railway traffic.

Rock conditions in the tunnel can vary from metre to metre. Sometimes the bottom of the cutter head hits hard rock at the same time as the top comes up against clay-like rock.

### **How is the Hallandsås Tunnel being constructed?**

The new TBM Åsa began work in autumn 2005. The shielded TBM is approximately 250 metres long and is specially adapted to the varying geological conditions found in the Hallandsås Tunnel. The TBM lays a waterproof pipe as it bores through the rock to prevent groundwater from leaking into the tunnel. This method, known as lining, consists of concrete rings each containing eight concrete sections, measuring 2.2 metres in width and weighing 12 tonnes apiece. Approximately 40,000 concrete sections will be required to build the finished tunnel.

### **Who is performing the work?**

Trafikverket (Swedish Transport Administration) is the authority responsible for developing and administering the Swedish railway. When the government decided to complete the Hallandsås Tunnel in 2001, the Swedish-French consortium Skanska-Vinci HB was selected as the general contractor.

The consortium comprises two of the world's largest construction companies: Skanska, with solid knowledge of traditional tunnel construction in Sweden and experience of the complex geological environment in Hallandsås, and Vinci, with long-standing experience of building tunnels using TBMs.

### **How many people are involved in the project?**

About 400 people are involved in the project and 12 nationalities are represented. The TBM Åsa is in operation 24 hours a day, seven days a week, and the people operating the TBM work in shifts. Each shift comprises 20 people and one shift manager. The person who drives the TBM is known as the TBM pilot.

### **Why has work on the tunnel been delayed?**

Although construction work on the tunnel commenced in 1992, the years that followed were plagued with problems. The first attempt using an open-type TBM failed. In the mid-1990s, the large volume of groundwater leaking into the tunnel made conditions unworkable and the industrial sealant Rhoca Gil was used to stop the water. This resulted in the release of the poisonous substance Acrylamide, causing the project to be called to a halt.

The project subsequently invested major resources to rectify the effects of the accident through remediation, sealing and claims settlement. The Hallandsås ridge has had a clean bill of health for some time now. After the Skanska-Vinci consortium was commissioned to complete the construction of the tunnel, tunnel boring work using the TBM Åsa began in autumn 2005.

### **How is the environment of the area being protected?**

It is impossible to implement major infrastructure projects without impacting the environment. Tunnel construction, for example, can affect natural conditions, crops, forestry and living conditions. The aim of the Hallandsås Project is to minimise the impact of the construction process and to avoid lasting effects on plant and animal life in the area.

Important knowledge and lessons were gained from the problems the project encountered in the 1990s. The environmental controls currently in place are unique. The project has a comprehensive ecological control programme for such aspects as chemicals, water and ecology.

### **When will the tunnel be finished?**

Traffic is scheduled to commence in 2015.

### **How much will the construction project cost?**

The total cost of the project is estimated at SEK 10.5 billion in 2008 monetary value.