Facts and figures

The total cost of building Södra Länken has been estimated at SEK 7.7 billion (June 2002 price level) including land acquisition costs. Stockholm City is contributing about SEK 1.3 billion of the cost. The Swedish National Road Administration was commissioned by the Government to build and finance Södra Länken. The Stockholm Region of the Swedish National Road Administration was assigned the overall responsibility for implementing the project. The financing is managed by Stockholmsleder AB (owned by Statens Väg- och Baninvest AB, a company under the supervision of the Ministry of Industry, Employment and Communications) that raises loans on the capital market and subsequently lends money to the Swedish National Road Administration as works progress, in compliance with the guarantee frameworks laid down by Parliament and the government. Repayment of the loans will begin once Södra Länken is opened to traffic.

<table>
<thead>
<tr>
<th>Specification</th>
<th>Quantity</th>
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<tbody>
<tr>
<td>Length of Södra Länken</td>
<td>6 km</td>
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<tr>
<td>Total rock excavation</td>
<td>2,035,000 m³</td>
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<tr>
<td>Total soils excavation</td>
<td>747,000 m³</td>
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<td>Total volume of concrete</td>
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<td>Lateral safety barriers</td>
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<td>Height of ventilation towers at Åbyvägen and Hammarby Fabriksväg</td>
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<td>Fans</td>
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<td>Excavation routes</td>
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<tr>
<td>Minimum speed limit, tunnels and exits</td>
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</tr>
<tr>
<td>Minimum vehicle height</td>
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<tr>
<td>Minimum vehicle height clearance under signs and fans</td>
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</tr>
<tr>
<td>Hammarby Fabriksväg</td>
<td>AADT 35,000 / AADT 17,000</td>
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<td>Förhammar</td>
<td>AADT 90,000 / AADT 78,000</td>
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<td>Årstaleden</td>
<td>AADT 40,000 / 0 east of Airport</td>
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<td>Värmdöleden</td>
<td>AADT 50,000 / AADT 30,000</td>
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Södra Länken
– a new traffic route in Stockholm
Long traffic queues on city access roads, enclosed park and ride lots, and crowded on the Stockholm Metro. For decades, this has been what it looks like in and around Stockholm at rush hour. Prognoses indicate that the already heavily overloaded traffic system in Stockholm must make room for even more road users. In its forecast from 2000, the Swedish Institute for Transport and Communications Analysis (SIKA) showed that road traffic was expected to increase by 25 percent by the year 2030. This all represents people who will be living in Stockholm and travelling in their schools, jobs and recreational activities.

The construction of the completely new city quarter at Hammarby Sjöstad is one way to accommodate the increase in population. Some 25 000 people will be living, and 5 000 working here. Additional building developments are being planned in Stockholm County, and transportation opportunities are decisive in where they can be located. The politicians in the 26 municipalities comprising Stockholm County are working on solving housing and transportation issues.

The Dennis Agreement

In 1992, a political agreement known as the Dennis Agreement was drawn up for the transport system in Stockholm County. As far as traffic was concerned, the main transgression would be supplemented with Norra Länken, Österleden and Södra Länken and together function as a ring around Stockholm. In 1997, the coalition behind the Dennis Agreement collapsed. Södra Länken is one of the projects that had progressed far enough along that construction could begin. Among others, it would have a line that started and terminated at Hájemönster, the light rail line and the road but zero economics can be mentioned.

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Södra Länken – a new underground road system

Södra Länken is a new road traffic system that links Essingeleden, Huddingevägen, Nynäsvägen and Värmdöleden. It is some 6 kilometres long, of which 4.5 kilometres run through tunnels under suburbs immediately south of Stockholm’s inner city. Södra Länken is Sweden’s largest road tunnel construction ever and the most extensive road project undertaken in the Stockholm region since Essingeleden was built in the 1960’s. This highly sophisticated road system also includes interchanges above ground at Åbyvägen, Årsta, Johanneshov, Nynäsvägen, Hammarby, Sickla and Värmdöleden.

Better flow in traffic

Södra Länken is part of the national road network and is designed as an urban motorway with a speed of 70 km/h. On some of the access and exit ramps the speed is limited to 50 km/h. Södra Länken helps reduce through traffic in the inner city areas by offering a smooth and easy alternative. Further, Södra Länken replaces the cross route to the E4/E20 European Highways via Hammarby Fabriksväg, Gullmarsplan, Huddingevägen and Årsta- länken on the southern periphery of the city. The uninterrupted traffic flow due to the absence of intersections means a reduction in travel time across the entire stretch at rush hour from about 35 to about 5 minutes.

Södra Länken connects Värmdöleden with Essingeleden and Södertäljevägen, linking the road networks in Nacka, Värmdö and the southern city suburbs with other road networks in the region.

Traffic below ground improves the local environment

The living environment along Nynäsvägen by the Stockholm Globe and Johanneshovsvägen (formerly Huddingevägen) is also much better. Residents, drivers and public transport all benefit, and conditions are created for building residential and business developments like Hammarby Sjöstad and Sickla. In 2004, when
Södra Länken is expected to be completed, about 60 000 vehicles a day will be able to drive through the tunnels. Moving through traffic underground improves the environment in Årsta, Johanneshov and Hammarby-höjden.

**Safer for pedestrians, cyclists and drivers**
Södra Länken entails better road safety for all categories of road user. Pedestrians and cyclists can move around more safely on local roads in the southern suburbs once through traffic has disappeared, and driving is safer in the tunnels where traffic lanes run through parallel tubes without on-coming traffic.

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**1960’s**
The city transport plan drawn up in 1960 resulted in the construction of Essingeleden. This plan also included Södra Länken along an alignment above ground. Both were included in the plans for a ring road around Stockholm.

**1988**
Decision to locate Södra Länken in a tunnel.

**1990 and 1992**
Signing of the Dennis Agreement, which included Södra Länken.

**1993**
Detail design for today’s Södra Länken initiated.

**1997**
Construction begun on Södra Länken.

**1998**
First blasting for the Södra Länken main tunnels in December.

**2004**
Södra Länken opened to traffic.

Map: Södra Länken is a new road traffic system that links Essingeleden, Huddinge-vägen, Nynäs-vägen and Värmdöleden.
Advanced tunnel engineering techniques

Stockholm is largely built on bedrock. Below ground is an extensive system of tunnels for distance heating, sewage treatment, stormwater, telecommunications, the Stockholm Metro, etc. There is also space here to move road traffic down into tunnels, and thereby protect the natural environment and buildings above ground.

Södra Länken extends from the wholesale markets in Årsta through tunnels under Årsta, Johanneshov and Hammarbyhöjden. From there it crosses the Sickla Canal over a low bridge and continues on through tunnels to Värmdöleden. Along large parts of this alignment the tunnels have been blasted through the rock. Concrete tunnels have been built on the stretches without sufficient rock cover, for example at tunnel mouths. Accesses to the Södra Länken tunnels are located at Huddingevägen, Nynäsvägen, Gullmarsplan and Hammarby Sjöstad.

Tunnel blasted through rock

Stockholm’s new tunnels were blasted using modern tunnelling technology. Careful, controlled blasting methods were applied at places where Södra Länken crosses other tunnels as well as at sensitive environments by tunnel mouths.

The Stockholm bedrock is mostly compact and impermeable. However, to avoid any groundwater drainage and the consequential threat to vegetation and buildings, the rock was sealed by grouting (see below). This ensured compliance with the provisions of the Water
Rights Court concerning sealed tunnels. The groundwater table will continue to be carefully monitored once the tunnel system is in operation.

Concrete tunnels and tunnel mouths
Concrete tunnels have been constructed at such places as Åbyvägen, Huddingevägen, Gullmarsplan and Nynäsvägen. This is necessary where the rock cover is either very slight or non-existent. Structural engineering differs for rock and concrete tunnels. Concrete tunnels require specialist knowledge about groundwater, how it is affected as well as the effect it has in turn. Consideration has been given to leakage, pressure and the water table: the tunnels are sealed to prevent groundwater from leaking in. A lowering of the groundwater table must be avoided so as not to risk settlement of nearby buildings.

Two of the largest concrete tunnel constructions on Södra Länken can be found on Åbyvägen and Nynäsvägen. The construction of the tunnel at Åbyvägen entailed the excavation of a 500 metre long and 50 metre wide section of Årstaället immediately adjacent to high-rise buildings. Subsequent to this, the tunnel was constructed in such a way as to ensure that the groundwater was not affected more than what is legally permissible. The tunnels at Nynäsvägen were also constructed under
extremely complex technical conditions. The ground there consists of esker, which is easier to work with and less prone to settlement than the clay on Åstafältet. On the other hand, at Nynäsvägen enormous demands were placed on managing a daily traffic volume of almost 100 000 vehicles, complicated by the immediate proximity of buildings. The works were conducted as close as three metres away from buildings.

Empty tunnels filled with fittings, fixtures and installations

Once all the tunnels have been blasted or cast and interconnect to form a continuous system, it is time for the interior fittings and installations. The suspended ceiling, light fittings, collision protection barriers and the carriageway are just a few of the important interior details. Apart from this, a great number of cables and systems must be installed (see facts and information box below). The installations and interior design works for a tunnel system like Södra Länken are extensive and require careful planning, co-ordination and monitoring to be able to function. Once the work has reached completion, only a fraction of all the installations are visible to road users. Most lie concealed in special recesses behind the rock face.

Same official opening day

Improving road safety is one of the primary aims behind the Södra Länken project. Driving in tunnels will be safer than driving the same stretch of road above ground. All the fittings and installations are designed to meet stringent safety regulations. The work on safety considerations includes a long breaking-in phase, and comprehensive testing and evaluation will be conducted before opening Södra Länken to the public. Hence, no sub-stretch will be opened independently. The day when the Södra Länken tunnels are ultimately opened to traffic, everything will have been examined, tested and approved.

Basic installations:
- Ventilation
- Water
- Wastewater
- Drainage
- Electrical and control systems
- Lighting

Installations for traffic management:
- Route guidance signs
- Lane signals
- Traffic and incident detection using video cameras
- Road closure barrier bars

Installations for tunnel safety:
- Tunnel information signs
- Close circuit TV
- Radio and mobile telephone network
- Emergency telephone and push button system
- Fire ventilation
- Fire hydrants and empty pipes for firefighting water
- Manual fire extinguishers
- Explosion protection in the waste water system
- Fireproof laying of cables for safety-related equipment
- Stand-by lighting
- Guide lighting and emergency exit signs
- Emergency equipment and rescue rooms
- Evacuation routes.
Road tunnels inside a city, with underground access and exit ramps differ from normal tunnels on rural roads. An urban tunnel system must be perceived by drivers as a safe and attractive choice of route where they find it easy to orient themselves. Hence, a high level of road safety, a good environment and good orientation facilities are combined in Södra Länken. Architects, designers, installation engineers and behavioural scientists all worked together to find solutions that satisfy both human needs and technical requirements.

**Artistic design facilitates orientation**

In order for people to find it attractive to drive down underground, the tunnel environment must seem like part of the city above. This can be exemplified by the Stockholm Metro, where art décor is a distinctive part of the system.
Those driving through the Södra Länken tunnels are able to orient themselves in a similar way. However, conditions are different in the Metro where passengers experience most of the artistic decoration while waiting at the station. Drivers in Södra Länken will be travelling at a speed of about 20 metres per second, meaning that the artistic design will be experienced from a vehicle in motion. In this kind of environment, art becomes a matter of light, space and large-scale themes.

Obvious and safe
People feel comfortable when it is light and they can see where the road is heading. The road geometry on Södra Länken with its wide curve radii and few gradients provides good sight conditions. The white, light and airy ceiling, which is found everywhere except in the caverns at the access and exit ramps, hangs like a canopy high up above the road. The slits between every white ceiling
module are intended to make the bends in the road even clearer to the driver.

Signs installed in the tunnel ceiling forewarn drivers about each exit well ahead of time. There is also a motorway control system, MCS, with variable message signs, which are used to inform drivers to slow down and keep on the alert. This can involve a closed exit, whereby drivers will be guided to another, an obstruction blocking the lane ahead, or a lower recommended speed due to queue formations.

The tunnel walls consist largely of sprayed concrete over the rough rock surface, the varied texture of which is experienced as a kind of ever-changing natural landscape. This helps drivers judge distances, thereby improving road safety.

Running along the walls are 160 centimetre high collision protection concrete barriers. Any vehicle that veers off the carriageway and crashes into these barriers will be caught up and guided forward until coming to a stop. Amber coloured vertical lines marked on this concrete barrier at ten metre intervals help drivers judge speed and movement. Another regularly recurring feature in the environment are the amber-coloured emergency exits with their distinctly prominent doorframes.

The light-coloured asphalt wearing course makes the 3.5 metre wide lanes stand out against the darker asphalt on the shoulders. It is also light-reflective, which intensifies the lighting in the tunnel.

Throughout the entire tunnel system are longitudinal
white fluorescent strip lights to provide real colour reproduction. Extra lighting is provided at all the access and exits. These automatically adjust to the level of outdoor light to provide a comfortable transition between daylight and tunnel lighting.

**Access and exits in specially designed rock caverns**
The 15 large caverns at the access and exits on Södra Länken are clearly recognisable places that create a natural division of the tunnel system into sub-stretches. The lighting is different than in the rest of the tunnel system and artistic design is used to individually identify each cavern. The idea is to break away from the white line of the suspended ceiling and alert drivers to the realisation that this is where they want to drive out of Södra Länken. It also makes them more observant of other vehicles entering the tunnel from the access ramp.

**Safety provides security**
There is a high level of road safety all throughout Södra Länken. Drivers are encompassed by sensors that detect the traffic rhythm as well as numerous other safety installations. All electricity, ventilation, emergency alarms, lighting etc are designed and protected to meet stringent safety regulations. Everything continues to function even in the event of a power failure or fire. The wastewater system is also designed to be able to collect and purify both surface water and other liquids to prevent anything ecologically harmful from seeping out into nature.

Södra Länken is also monitored through the traffic surveillance system in Stockholm. This system is manned around the clock and alerted automatically if anything disrupts or stops traffic. Staff at ”Trafik Stockholm”, the Traffic Management Centre, can check what triggered the alert via a system of monitors. They can then dispatch the police, rescue services or ”Road Assistance” vehicles as needed. The ”Road Assistance” team is on duty on weekdays to help keep traffic lanes free from vehicles that have run into trouble or been involved in accidents. They can also assist in evacuation and rescue operations at accidents.

**Emergency exit always close at hand**
In the event of an accident, it is easy for road users to get themselves to safety. It is never more than 50 metres to the closest emergency exit in the main tunnels, and no more than 75 metres on the access and exit ramps. All in all, there are 70 clearly marked evacuation routes and 140 emergency rooms with life-saving equipment and fire extinguishers. The safety concept also means that there is normally never any on-coming traffic in a tunnel tube. Drivers travel through parallel tubes, one in each.
direction of travel. Should a major incident occur in one of these, everyone can leave their vehicle and quickly make their way to an amber-coloured emergency exit to get to the adjacent tunnel. This tunnel can also be used to facilitate rescue services reaching the scene of the accident.

If an accident involving a heavy build-up of smoke occurs, jet fans come on automatically. Smoke and combustion gases are ventilated out in the direction of travel. Those road users who are behind the site of the accident are supplied with fresh air, making it safe for everyone to leave their vehicle to get to the closest emergency exit. In such an event, the parallel tunnel tube will also be closed to traffic.
Emergency exits with fire locks en route to the adjacent tunnels are located every 100–150 metres. There are stations by these emergency exits with emergency telephones, fire extinguishers, loudspeakers, a supply of firefighting water, etc.
Light ceiling

Lighting

Rough texture rock wall

Amber distance markers

Collision protection

Emergency exits

Light-coloured asphalt
Stringent demands have been placed on the air quality in Södra Länken. Levels of nitrogen dioxide and carbon monoxide are monitored constantly from a total of 40 meter points.

The air in Södra Länken is kept fresh through constant circulation. Vehicles pull fresh air along into the tunnels and take air mixed with emissions out with them. The traffic in each tunnel tube only moves in one direction, resulting in self-ventilation. The emissions content in the tunnel is monitored constantly. If the speed of traffic decreases, making self-ventilation insufficient, jet fans turn on automatically to get the air circulation going.

**Good air quality at all exits**

Natural draught in the Södra Länken tunnels is very effective. This means that large amounts of exhaust fumes will be pushed to the tunnel mouths. Constant air quality control is therefore carried out there. If the emissions content on an exit ramp gets too high, fresh air is pumped in by intake air fans to reduce the concentration outside the exit.

Fan control centres with ventilation towers at the mouths of the main tunnels help reduce the concentration of vehicle emissions. A twenty-meter tall tower is located at the western tunnel mouth at Årsta and at the eastern tunnel mouth at Sickla. The fan facilities are
used to suck up the air/exhaust fume mixture into the ventilation towers for expulsion at high speed. Those living close to the tunnel openings can feel secure. The concentration of nitrogen dioxide and carbon monoxide will never be too high.

Furthest to the left: The tunnels are normally self-ventilating as a result of the movement of vehicles through the tunnels. If the speed of traffic is reduced so that the draught becomes insufficient, jet fans turn on. It is expected that these fans, installed in the tunnel ceiling, will only be used in rare cases.

Closest to the left and below: The two twenty-metre tall ventilation towers on Södra Lännen are constructed in glass and stainless steel. Each ventilation tower has a huge fan facility, which normally does not need to be taken into use.

Below to the right: Air intakes at ground level are sited at 15 places along Södra Lännen. At these sites fresh air is pumped into the system to dilute the emissions at the exit ramps and exits, and to cool down the sub-stations and electricity distribution centres underground. The air intake in the photo is about three metres tall.
Södra Länken is an integral part of the road network in the Stockholm region. Clearly identified accesses and tunnel entrances are therefore important. Anyone approaching Södra Länken must be able to understand that they are on their way into a tunnel system and where it is heading.

For those living and working in the vicinity, Södra Länken will be an established feature in the local environment. It is therefore essential that the architectural design of Södra Länken is well integrated in the environs.

Södra Länken is an extensive road tunnel system that runs through vastly different environments, from the inner archipelago by Värmdöleden, via the Nacka nature reserve...
S'architecture of the city character

at Sickla to the densely populated residential suburbs at Gullmarsplan, Johanneshov and Årsta. Several different types of landscape with various considerations to building developments and recreational areas are found here. Careful consideration has been given to the particular characteristics of each when designing the access ramps and road stretches above ground. (This is described in more detail on pages 22-31.) Tunnel entrances consist of everything from sunken placement below grade, such as at Värmdöleden and Nynäsvägen, to portals straight into the rock wall, like at Sickla. The common denominator is that a distinctive portal is constructed around all tunnel entrances.
Södra Länken connects to Essingeleden in the west

Södra Länken consists of both tunnels, roads and access roads of different kinds. Farthest to the west, Södra Länken connects to Essingeleden and the E4/E20. As a result of traffic disappearing down into the Södra Länken tunnels, it became possible to completely take away the part of Årstalänken east of Åbyvägen. This improves accessibility to green areas for those living in Årsta.

A somewhat sunken access to Södra Länken and a new interchange have been constructed. This interchange means that the old bridge across Årstalänken at Åbyvägen has been replaced by a modern roundabout and that new access roads have been provided for local traffic. The land around the interchange and the tunnel mouth is designed with rock walls and groves of trees to emulate enclosed fields. Gravel, boulders, trees and bushes have been used to accentuate this theme.

Distinctive portal
Immediately east of the Åbyvägen interchange, the road begins its descent towards the entrance to the Södra Länken tunnel system. The adjacent retaining walls are covered with structural concrete to prevent groundwater penetration, and designed with horizontal bands inlaid with coloured stone. The transition to the actual road-way consists of a raised granite curb.
As for all the Södra Länken tunnel entrances, stained concrete has been used on the approach at Årstaфältet. Above the tunnel opening is a fan building for the tunnel traffic and one of the two ventilation towers on Södra Länken. The roof of the fan building is covered in vegetation to help it blend into the greenery of the surroundings. The 20 metre tall tower is designed in glass and steel.

**Concrete tunnel built under the open field**
Immediately inside Södra Länken’s western entrance is a tunnel some 450 metres long. Constructing tunnels in the clay earth on Årstaфältet without affecting the groundwater table more than permitted necessitated highly advanced engineering technology. The excavation for the tunnel construction required good stabilisation using sheet piling before the tunnel could be cast. Afterwards, the excavation was re-filled and the ground landscaped.
That Södra Länken reduces the amount of through traffic in Stockholm’s southern suburbs is particularly evident in Årsta, in the vicinity of the former Huddingevägen. Of the almost 45 000 vehicles passing through every day, 30 000 now drive down into the tunnels. This means an enormous reduction in the noise from traffic. Air pollution is also reduced through directing traffic down into Södra Länken where it can flow freely. The remaining traffic on Huddingevägen no longer requires as many traffic lanes. For the section between Årstafältet (where traffic on Huddingevägen has been provided another entrance to Södra Länken) and the viaduct at Gullmarsvägen, the former four traffic lanes can be reduced to two. This minimises the predominance of Huddingevägen in Årsta’s residential area and provides more safe space for pedestrians and cyclists.

The Johanneshov interchange links Södra Länken with Gullmarsplan

Some of the traffic on Södra Länken emerges into daylight at the re-constructed interchange at Johanneshov and continues on to Gullmarsplan. The actual openings are located about 150 metres west of the roundabout at Gullmarsplan. On a stretch of about 350 metres between Gullmarsvägen and Gullmarsplan, Huddingevägen has been upgraded from two to four traffic lanes. This has meant that the actual road reserve...
Design adapted to the environment

Careful attention has also been paid at this access and exit to making it clearly apparent that this is part of Södra Länken. The distinctive tunnel structure is, like the retaining wall at Gullmarsplan upper secondary school, covered in natural stone and blends in well with the surroundings. The tunnel portal is designed in stained light-grey concrete. The retaining walls and separation wall between the carriageways have horizontal bands with inlaid coloured stones.

Huddingevägen south of the Södra Länken tunnels

Södra Länken's southern exit and access to Huddingevägen is housed in a 350-metre long concrete tunnel. South of that, Huddingevägen has been given a new alignment: it has been straightened and moved eastwards between its intersection with Sandfjärds gatan/Älvkällevägen and Huddingevägen/Östbergavägen/Sockenvägen. It has also been widened and given two traffic lanes in each direction. Moving the road has improved conditions for local residents and allowed Arstafältet to expand eastwards and become one large coherent green area (read more about this on page 22 “Södra Länken connects to Essingeleden in the west”).
Major changes at Nynäsvägen

Nynäsvägen, with its near 100 000 vehicles a day, is one of Stockholm’s most heavily trafficked access roads. Södra Länken will receive 20 000 of these vehicles and thereby lessen the burden on both Nynäsvägen and the roads feeding on to Huddingevägen and Essingeleden: Arenavägen/Palmfeltsvägen/Bolidenvägen.

At the Stockholm Globe Arena, some 1 500 metres of Nynäsvägen has seen substantial environmental changes. Its alignment has been lowered on the part between the Southern Stadium and the intersection at Enskedevägen/Sofielundsvägen. At its lowest point at Enskedevägen/Sofielundsvägen, it is as much as eight metres below its former level. This has made it possible to reconstruct the interchange at Sofielundsplan. Local traffic has been moved up onto a newly constructed roundabout with ramps connecting down to Nynäsvägen, where the mouths of the Södra Länken tunnels have been located. Local traffic now crosses the throughway above it. Noise levels have been reduced by up to ten decibels, which seems like it has been cut in half.

Better flow for all road user categories
Traffic from Arenavägen out onto Enskedevägen has seen the traffic lights replaced by a roundabout. Running parallel to Nynäsvägen on its western side from the Globe Hotel southwards is a new pedestrian and cycle

Closest to the right: Nynäsvägen has been lowered about 5-8 meters from the Southern Stadium to the intersection at Enskedevägen/Sofielundsvägen.

Farthest to the right: The deck covering Nynäsvägen at the Globe is 40 metres wide and has space for pedestrian and cycle traffic as well as landscaped areas.
path that crosses Enskedevägen via an underpass and connects to local streets west of Nynäsvägen. The roundabout at Enskedevägen/Sofielundsvägen has a separate bridge for pedestrian and cycle traffic crossing Nynäsvägen. At the Globe Arena, Nynäsvägen has been covered by a 40 metre wide deck with landscaped trees. This "pedestrian mall" provides a better link between Skärmarbrink and the area around the Globe. The entire area around Nynäsvägen and its access roads is framed by landscaped areas.

The traffic environment at Nynäsvägen along with its feeder roads is well nuanced. The design of the wide overpass with a pedestrian and cycle path at the Globe blends well into the surroundings with its white concrete and yellow glazed clinkers.

The interchange at Enskedevägen/Sofielundsvägen has in part been cast with rippled profiles in a reddish brown hue edged by a cobalt-blue clinkers profile that also runs horizontally. Below this are more sparsely placed fields cast in natural concrete. The tunnel mouths are marked by portals in light-coloured concrete.
Södra Länken connects to Värmdöleden in the east

Södra Länken has meant major changes in the area between Sickla and Värmdöleden. It gives Hammarby Sjöstad a natural connection to the traffic system around Stockholm, and those travelling from Nacka and Värmdö towards Essingeleden or the E4/E20 no longer need to wait in queues around the Lugnet interchange and crowd together with some 40 000 other vehicles per day on Hammarby Fabriksväg.

25 000 new residents and 5 000 new places of work in Hammarby Sjöstad entails the need for effective communication links, which has resulted in its own access and exits to Södra Länken. Somewhat further east are the mouths of the main tunnel, after which traffic continues on the sunken road towards the Sickla Canal. The number of lanes has been doubled to four on this stretch. Between the tunnel entrance and the canal, a 40 metre wide bridge has been constructed over the road and covered with trees, shrubs and grass, a so-called ecoduct. It also accommodates a local street and pedestrian/cycle path. The idea was to link Hammarby Sjöstad with the Nacka Reserve on the other side of Södra Länken. This verdant bridge allows unobstructed movement for people and wildlife animals alike over the highway.

Closest to the right: At Hammarby Fabriksväg people and wildlife animals can cross Södra Länken on two wide bridges covered with trees, shrubs and grass, a so-called ecoduct.

Furthest to the right: New interchange at Sickla.
New bridges and locks at Sickla Canal

On the other side of the ecoduct the road runs on new bridges across Sickla Canal. Here, the lowering of Hammarby Fabriksväg has entailed building new bridges and the addition of another lock for recreational boats. In order to protect fish, the new lock has been designed with a salmon ladder.

Past the Sickla Canal, Södra Länken runs under another ecoduct, 20 metres wide, and continues on towards the new interchange at Sickla, where a roundabout above the highway has replaced the former intersection at Järlaleden for traffic connecting to and from Älta.

Strict requirements on environmental considerations

The entire stretch at Sickla is designed to blend into the surrounding environment and reduce the noise of traffic. The tunnel mouth at Hammarby Fabriksväg is located at the foot of the ski hill. Rising above the tunnel mouth is one of Södra Länken’s two 20-metre high ventilation towers designed in glass and steel. The tunnel mouth is designed with open arches in a façade shield that is angled outwards at the ends. The entire façade is cast in light-grey concrete dotted with core cutouts.

The carriageways are edged by granite barriers, with
landspeed central reserves and roadside areas. The road alignment has been lowered and the retaining walls alongside have a facing of red Åldalen quartzite. Glass shields have been installed for extra noise protection on certain parts, like on the bridges over the Canal.

**Eastern end of Södra Länken**

Past Sickla, Södra Länken continues in tunnels under Nobelsberg, and opens directly out onto Värmdöleden. Over a distance of 600 metres the carriageways on Värmdöleden diverge, in between which Södra Länken connects with two lanes in each direction. The continuation of Värmdöleden towards the Lugnet interchange has been reduced to two lanes in each direction for cars, with a lane reserved for buses towards the city.

The land around Värmdöleden lies adjacent to the inner archipelago. Here is Svindersviken bay and the natural rock face of Nobelsberg. The grey concrete encased by landscaped vegetation on Södra Länken as it runs through the central reserve harmonises well with this nature. The tunnel portals are of grey concrete surrounded by raw, grey rock. Along the descent, the concrete has been designed with pillars similar to those found at the rock face along Stadsgården further in towards Stockholm.

The entire stretch from the entrance at Hammarby Sjöstad covers 1 400 metres. 600 of these are housed in tunnels, with the rest on roads above ground.
The environment during the construction period

Constructing Södra Länken directly under Stockholm’s southern suburbs has involved several kinds of environmental impact. The vibration noise from the drilling was transmitted through the rock and buildings, blasting works continued under a relatively long time, truck transports removing excavated materials had to drive through local neighbourhoods, etc. In order to reduce the disruption during the construction period, the Swedish National Road Administration required all contractors working on any part of Södra Länken to follow controllable routines, so-called environmental management systems. These specified permissible noise and vibration levels, the transport routes that could be used, the times at which the works could be executed, etc.

Controlled work procedures made it possible to limit the disruption for those living nearby. One example was that all transports were directed to four work tunnels built in areas where few people live. Another example involved the excavation works for the access and exit ramps for Södra Länken. As these had to be built in the midst of housing developments, the Swedish National Road Administration minimised disturbance through using the quietest methods possible.

Noise and vibration unavoidable

The drilling down in the tunnels generated noise. The sound from the drilling machinery was transmitted through the air, and the sound produced by the steel bits striking against the rock was transmitted through the bedrock. This noise was reproduced in the structural framework of the buildings above.

Blasting is another kind of sound that causes several types of disturbance, partly at the actual detonation, and partly as shock waves that carry vibrations. The Swedish National Road Administration provided information on planned blasting via a constantly updated call service. People who experienced the blasting as particularly upsetting were offered the opportunity to borrow a
“minicall” which emitted a warning signal 30 minutes ahead of a detonation. Local residents were also offered temporary evacuation quarters.

The works on Södra Länken have also caused vibration. Buildings around Södra Länken had their own individual maximum vibration limits, which were monitored using automatic vibration meters. The vibration limit values were calculated on the basis of the condition of the specific building and its foundation. All buildings were inspected both before and after the blasting works.

The excavated rock was high quality road-building material. For environmental reasons, contractors were responsible for making optimal re-use of this.

**Groundwater table to remain constant**

The protection of groundwater and keeping the water table constant has been a key consideration throughout the project. A lowering of the water table can have a negative impact on the surrounding natural environment and nearby buildings. In the construction of Södra Länken, the tunnels and other engineering structures were sealed to prevent water drainage, and water infiltration methods were also employed to ensure a constant water table level. More than 200 groundwater pipes have been placed along Södra Länken to continuously measure the groundwater level.

**Monitoring and control**

Stockholm City has specified limits for the maximum permitted noise and vibration levels caused by construction works. The Swedish National Road Administration has stipulated that all contractors must comply with applicable laws and ordinances as concerns environmental impact. It regularly controlled and monitored contractors’ environmental endeavours.
Information for all concerned

The time required to construct Södra Länken, Sweden’s largest road tunnel project throughout time, is seven years. Such an enormous project in an area that affects some of Stockholm’s most heavily trafficked roads, which entailed a great many work sites and affected about 20 000 households, naturally gives rise to many questions. The construction of Södra Länken has been a major element in the daily lives of drivers and local residents alike.

The road tunnel project has demanded precise information and a good dialogue with all concerned. A construction project lasting such a long time becomes part of people’s everyday life. Information about how the works were progressing, the disturbance that could be expected and how to contact the Swedish National Road Administration was given top priority. Answering concrete questions about the traffic situation on Värdöleden, Hammarby Fabriksväg, Nynäsvegen, Huddingevägen and Årstalängen has been an important goal in information routines.

Information channels for local residents and road users

- Information meetings for local residents once a month.
- Fact sheets distributed to the households affected once a month.
- Telephone number for queries and complaints.
- Telephone answering service with regularly up-dated information on blasting times and sites.
- Information tours in residential areas – wandering bus exhibition manned by a public information officer.
- Open house with information about the progression of the tunnel works.
- Traffic advisories via radio with continuous information on current traffic diversions.
- Website www.sodralanken.nu.
- “Aktuellt om Länken” – notices and supplements in daily newspapers concerning traffic diversions, road and tunnel works and the significance of Södra Länken once it is open to traffic.
- Progress reports on video – regular documentation of how the works at the Södra Länken work sites is progressing.
- Brochures and fact sheets with information about the construction of the different connections to Södra Länken and certain specific areas.