Segmental Concrete Bridges

«Autovía del Cantábrico» (A8), Soto del Barco to Muros del Nalón, Asturias, Coastal Region, Central Spain

Project
The major new highway «Autovía del Cantábrico» (the A8) is between Soto del Barco and Muros del Nalón in the coastal region of Asturias in central Spain, and the construction works are close to being completed in early 2006. The Project consultant and contractor is FERROAL. The two main Viaducts are the Nalón Viaduct and the Rio Mayor Viaduct. The former has a length of 1’200 m, which is the longest in this region of Spain and it crosses the Nalón River. The construction has been achieved using Self Compacting Concrete (SCC) to produce the precast elements for Segmental Construction.

Requirements
The SCC for the Rio Nalón Viaduct has been produced at an external concrete plant in Somao by the Horvatsa ready mix company. From there it was taken to the west border of the site and poured into the moulds. The SCC design has a compressive strength of 40 MPa, and the concrete for the piles 35 MPa. The temperature during the works ranged between 5º C and 25º C, and the works were located near to the coast in effectively a corrosive marine environment.

Sika Solution
Products used:

- Segments
  - Sika® ViscoCrete®-9800
  - Sika® Stabiliiser®-229

- Piles
  - Sika® FerroGard®-701

- Viaduct Nalón 1’200 m
- Viaduct Remolinos 400 m
- Viaduct Rio Mayor 400 m
- Viaduct Pontigo 150 m

- Total Length 2’335 m
- Total Concrete Consumption 120’000 m³

Improvement to San Antonio Avenue / Periferico West, Mexico City, Mexico

Project
Mexico City had vehicular traffic problems on the Periférico West Highway and San Antonio Avenue at their junction with the Patriotismo and Revolución Highways. The total concrete volume was 600’000 m³, The construction period was from 2002-2005.

Requirements
Four segmental bridges were constructed using precast elements, crossing from north to south, and thereby allowing through traffic to continue uninterrupted along San Antonio and Rio Becerra.

West Bridge, length 440m, width 7m to 10m (2 and 3 lanes), North - South direction.
East Bridge, length 440m, width10m to 7m (3 and 2 lanes), South - North direction.

Sika Solution
Concrete production was with OPC using Sika® ViscoCrete®-4, to achieve an extended slump life of 50 minutes, despite the high temperatures, and maintaining excellent fluidity (hyperfluid concrete) and cohesion within the mix, resulting in an excellent fair faced finish.

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Segmental Concrete Bridges

Woodrow Wilson Memorial Bridge, Washington, D.C. Area, USA

**Project**
The Woodrow Wilson Memorial Bridge is a replacement for an old bridge which was originally opened to traffic in 1961. As part of the Capital Beltway, an Interstate Highway that circles Washington, D.C., the original four lane bridge had been designed to carry a maximum of 75'000 vehicles per day. Today, the bridge handles almost 200'000 vehicles every day. As a result, the existing bridge was in a continual state of disrepair, and this was also considered by many to be the site of some of the worst traffic in the entire USA!

**Requirements**
The existing bridge was now required to open an average of 1'100 times per year, slowing traffic on Route 35 over the Raritan River. The new bridges, with four associated ramps and two short off-ramps, each one being 1'850 m long, will provide a total of twelve lanes of traffic to ease congestion. In addition to the new bridge, a total of four new interchanges are also being built to accommodate future development in Virginia and Maryland.

**Sika Solution**
Sika was selected to provide several key products for the construction of the new bridges. SikaDur®-31 SBA was used to structurally bond the precast v-shaped piers that give the bridges their distinctive arch appearance. SikaGrout®-300 PT was used to fill post-tensioning ducts to provide corrosion protection for the steel. SikaViscoCrete®-20 HE was used for the production of the precast concrete segments producing an excellent finish and allowing fast turn around of the forms.

**Viaduct Metro Line 4, Santiago, Chile**

**Project**
Total Project Details: Length: 7.6 km, Segment Concrete Volume: 35'000 m³, typical Segment weight: 37 tonnes, typical Segment length: 3.5 m. Total number of segments: 2213. Start/End: 2003 Nov/ 2004 August, Consultant: Cade Idepe, Client: Metro S.A., Contractor: VEI (local consortium) - VSL (international)

**Requirements**
For the concrete: To achieve the desired initial and ultimate strength of concrete it was necessary to use advanced SikaViscoCrete® to obtain 60 Mpa at 28 days strength and over 21 Mpa in 24 hours, allowing for fast mould release and turnaround. The concrete was produced in a local ready mixed concrete plant and the time for transport and pouring was about 45 minutes, the high concrete workability was maintained even in summer.

For the segment bonding: Due to different temperatures during the day over the construction period it was necessary to deliver two types of SikaDur®-31 SBA adhesive. The adhesive can therefore always have optimum workability during application at different high or low temperatures on the segments, but then quickly harden.

**Sika Solution**
For the concrete: SikaViscoCrete®-0,7% cement weight, 112'000 kg used. For the segment bonding: SikaDur®-31 SBA, 27'000 kg used.

**Victory Bridges, New Jersey, USA**

**Project**
The Victory Bridges, connecting Perth Amboy and Sayreville, are the first precast segmental bridges to be built in the State of New Jersey. When complete they will replace the existing Victory Bridge, a low-level swing bridge that was originally constructed in 1927.

**Requirements**
The existing bridge was now required to open an average of 1'100 times per year, slowing traffic on Route 35 over the Raritan River. The new segmental bridges, with precast piers as tall as 40 m to allow ships to pass unhindered below, and they also have fully match cast main spans of 134 m (the longest in the United States). These parallel bridges, when completed shortly, will be 1'210 m in length.

**Sika Solution**
Sika was selected to provide key products for their construction. SikaDur®-31 SBA was used to structurally bond the precast concrete box girders as well as the support piers. SikaGrout®-300 PT was used to fill the post-tensioning ducts to provide corrosion protection for the steel.

**«Autovía de la Meseta»**
Molledo to Pesquera and Pesquera to Reinosa, Northern Spain

**Project**
The new highway is called «Autovía de la Meseta» and it was started in 2003 and is on schedule for final completion in 2006. It connects the regions of Castilla León and Cantabria, located in the north of Spain. The contractor, FERROVIAL AGROMAR, was responsible for the two last sections of the new highway, from Molledo to Pesquera and from Pesquera to Reinosa. There are several tunnels and viaducts in these sections because of the topography of this region. When completed the new highway will therefore greatly shorten and facilitate the journey between Cantabria and the capital Madrid, which is in the centre of the country.

**Requirements**
The additional special requirements for this huge infrastructure development were for the concrete to be placed at an altitude of 860 m and in temperatures between minus (-) 10°C and plus (+) 30°C. For this project the Contractor has built his own concrete plant to manufacture all of the concrete, including the necessary Self Compacting Concrete (SCC). The Sanjurde Viaduct alone has a length of 600 m and was constructed from SCC (incorporating SikaViscoCrete® technology) with a compressive strength of 40 MPa.

**Sika Solution**
Sika ViscoCrete® was used to structurally bond the precast concrete box girders as well as the support piers. SikaGrout®-300 PT was used to fill the post-tensioning ducts to provide corrosion protection for the steel. SikaDur®-31 SBA was used to structurally bond the precast concrete box girders as well as the support piers. SikaViscoCrete® was used to obtain 60 Mpa at 28 days strength and over 21 Mpa in 24 hours, allowing for fast mould release and turnaround. The concrete was produced in a local ready mixed concrete plant and the time for transport and pouring was about 45 minutes, the high concrete workability was maintained even in summer.

**Products used:**

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<thead>
<tr>
<th>Products used:</th>
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<tr>
<td>Segments Sika ViscoCrete®-9800</td>
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<tr>
<td>Piles SikaGrout®-400</td>
<td>Viaduct Barranco del Haya 300 m Viaduct Ferrocarril 101 m</td>
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<tr>
<td>Diaphragm Walls SikaGrout®-300</td>
<td>Viaduct Barranco de la Haya 295 m Viaduct Tunel (2) 216 m</td>
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<td>Segmental Adhesive SikaDur®-31 SBA</td>
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Segmental Concrete Bridges

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Project
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Requirements
The new crossing consists of two separate bridges, each one being 1,850 m long giving a total of twelve lanes of traffic to ease the congestion. In addition to the new bridge, a total of four new interchanges are also being built to accommodate future development in Virginia and Maryland.

Sika Solution
Sika was selected to provide several key products for the construction of the new bridges. SikaDur®-51 SBA was used to structurally bond the precast v-shaped piers that give the bridges their distinctive arch appearance. SikaGrout®-300 PT was pumped into the post-tensioning ducts to provide corrosion protection for the steel. Sika ViscoCrete®-20 HE was used for the production of the precast concrete segments producing an excellent finish and allowing fast turn around of the forms.

Victory Bridges, New Jersey, USA

Project
The Victory Bridges, connecting Perth Amboy and Sayreville, are the first precast segmental bridges to be built in the State of New Jersey. When complete they will replace the existing Victory Bridge, a low-level swing bridge that was originally constructed in 1927.

Requirements
The existing bridge was now required to open an average of 1,100 times per year, slowing traffic on Route 35 over the Raritan River. The new segmental bridges, with precast piers as tall as 40 m to allow ships to pass unhindered below, and they also have fully match cast main spans of 134 m (the longest in the United States). These parallel bridges, when completed shortly, will be 1,210 m in length.

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Viaduct Metro Line 4, Santiago, Chile

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Requirements
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For the segment bonding: Due to different temperatures during the day over the construction period it was necessary to deliver two types of SikaDur®-51 SBA adhesive. The adhesive can therefore always have optimum workability during application at different high or low temperatures on the segments, but then quickly harden.

Sika Solution
For the concrete: Sika ViscoCrete® 0.7% cement weight, 112'000 kg used.
For the segment bonding: SikaDur®-51 SBA, 27'000 kg used.

Molledo to Pesquera and Pesquera to Reinosa, Northern Spain

Project
The new highway is called “Autovía de la Meseta” and it was started in 2003 and is on schedule for final completion in 2006. It connects the regions of Castilla León and Cantabria, located in the north of Spain. The contractor, FERRÍVAL AGRIOMA, was responsible for the two last sections of the new highway, from Molledo to Pesquera and from Pesquera to Reinosa. There are several tunnels and viaducts in these sections because of the topography of this region. When completed the new highway will therefore greatly shorten and facilitate the journey between Cantabria and the capital Madrid, which is in the centre of the country.

Requirements
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Sika Solution
Products used:
- Sika ViscoCrete®-9000
- SikaMent®-600
- SikaMent®-500 HE
- SikaViscoCrete®-300
- SikaDur®-51 SBA

Project Dimensions
- Viaduct Sanjurde: 600 m
- Viaduct Rio Besaya: 62 m
- Viaduct Barancito del Haya: 300 m
- Viaduct Ferroncini: 101 m
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- Viaduct Cañada: 110 m
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Viaduct Nalón 1’200 m
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Total Length 2’335 m
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