

# Cadagua Link, Spain

Client: UTE Enlace del Cadagua  
Location: Bilbao, Spain  
Products: Megashor

## Case Study

Megashor towers designed by RMD Kwikform Iberica were used to support four pillars up to 50m high, as two twin steel bodied viaducts were pushed across the Cadagua valley near Bilbao, to create the Cadagua Link on the new "Supersur" by-pass.

Faced with crossing the deep Cadagua valley, just outside the city of Bilbao in Northern Spain to create the much needed Cadagua link on the new "Supersur" by-pass, UTE Enlace del Cadagua, (a joint venture between Spanish construction specialists Sacyr and Exbasa) had to come up with a very different innovative approach, to create two 50m high twin viaducts - each with two lanes.

The solution was to construct two steel structures for each viaduct that were mounted on top of each other and pushed from one side of the valley to the next. Supported by Megashor towers, embracing Y shaped concrete pillars up to 50m high, once they reached the other side, the steel viaduct structures on the top were lowered into place on to the Y shaped pillars. Designed to support the overall load of the viaduct once completed, the slim pillars would not be able to cope with being subjected to large horizontal loads as the viaduct sections were pushed over them.

Therefore a specialist structure and method of supporting the viaducts using the pillars, without affecting their structural integrity was required. This is where the engineering and erection teams from RMD Kwikform Iberica, played a key role. By designing and constructing a number of specialist Megashor towers, (included the worlds tallest) to provide flexible support for the pillars, RMD Kwikform Iberica's contribution to the project was crucial to its overall delivery.

Commenting on the project Alberto Aldama RMD Kwikform engineer said: "Due to the steep inclines on both the South and North sections of the crossing, which lead down to the Cadagua river and on the east side also incorporate two busy train lines linking Bilbao with Santander and Balmaseda, the more traditional method of viaduct construction using in-situ or precast concrete sections supported by falsework was not possible.

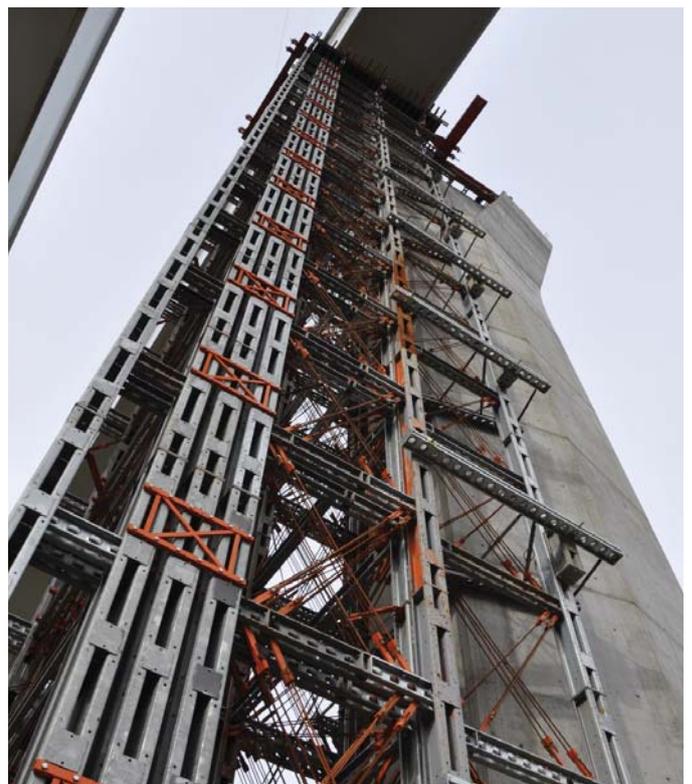
Similarly, the use of the push technique normally relies on very large and rigid concrete pillars, especially at such great heights. So with slimmer and therefore less rigid pillars, a new and more innovative method of supporting the construction was required.

This involved the fabrication of two steel structures for each viaduct, welded together on the north side in several 20m sections. They were then pushed across the valley, over our Megashor towers which embraced the pillars.

"A critical element to this option was the protection of the pillars for each viaduct, which were positioned at set intervals across the valley to enable the completed structure to cross the river and train line safely. With very tight tolerances and inbuilt flexibility required in order for the Megashor towers to embrace the pillars, three engineers from RMD Kwikform Iberica worked on the design and calculation, drawings and checking respectively.

Starting out from abutments at the north side of the valley the overall span to the abutments on the other south side is 430m with four Y shaped pillars for both viaducts requiring Megashor tower support.

The towers themselves were formed with vertical Megashor beams and horizontal Superslim beams tied together, with extra support provided by specially fabricated large bracing plates. Each tower was designed to support vertical loads of up to 800 tons and horizontal loads of 50 tons, which were produced by pushing of the bridge decks onto two jacks on top of each tower. In total six towers were erected, two measuring 50m, two of 45m, one of 20m and one of 43m.



Alberto added: "The greatest challenge to overcome was the design of the 50m high towers, (a record for RMD Kwikform) that could support the great loads of the pushed bridge decks. There was also the added difficulty of the movement of the pillars, as they could fissure and sway over 40cm at the top. We therefore had to make our towers especially rigid so that apart from supporting the high loads, they could avoid the swaying of the pillars and prevent any damage occurring.

In order to withstand the forces and maintain rigidity, we had to combine a total of six Megashor legs together to form the tower. This was achieved by using specially designed braces plates that were positioned at set intervals on both sides of the tower. We also designed some special parts for the tops of the towers, which allowed them to be tied to the pile, "embracing" it with Superslim Soldiers"

With safety and accuracy a key element to the overall design, in order to ensure the jacks that pushed the decks at the top of the towers were correctly adjusted, they had to be handled manually. This therefore involved working at height. In order to make this important part of the overall design safe, RMD Kwikform Iberica designed special platforms using plywood boards over T200 beams on top of Superslim soldiers. These were placed around the tops of the pillars and accessed using ladders and intermediate platforms attached to the Megashor legs.

In total 660 tons of RMD Kwikform Iberica equipment was used, including 1,000kN per leg Megashor, steel Superslim beams, standard steel beams and bracing plates.

