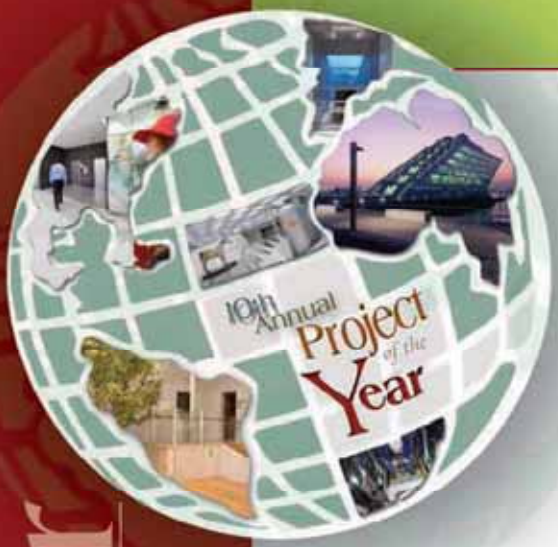


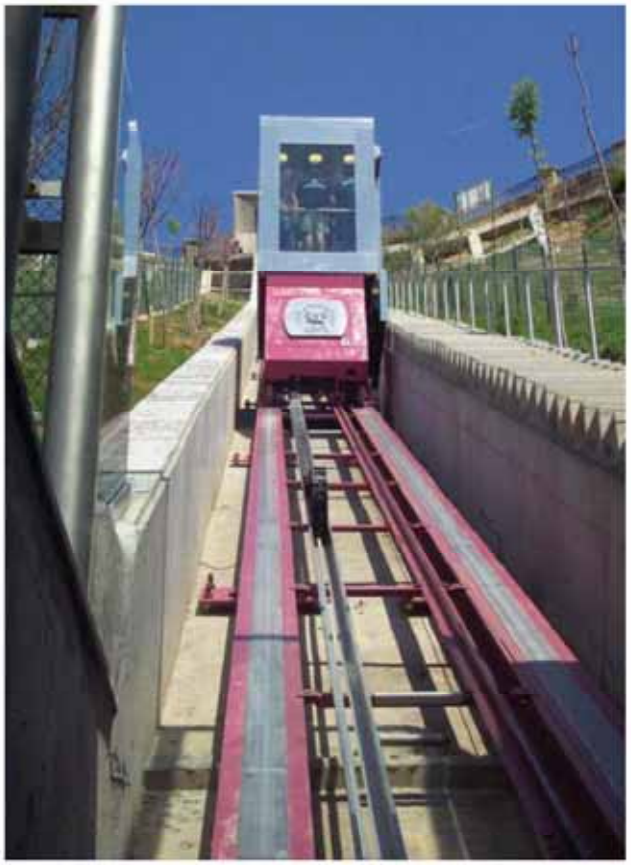
Inclined Elevator at Ereaga Beach

by Louisa Kellie

Description of Project

This project consists of the installation of an 1875-kilogram (25-person) inclined elevator to connect the Ereaga Beach with the high area of the Algorta neighborhood in Getxo in northern Spain. It covers a distance of 72 meters with an inclination of almost 34° – a height difference of 40 meters.

Getxo is a coastal town in Vizcaya, located on the right bank of the estuary of the river Nervión, 17 kilometers from Bilbao, with a population of around 90,000. The town is characterized by its complex orography, with steep cliffs and numerous beaches (Las Arenas, Ereaga, Arrigunaga, Azkorri and Barinatxe). The old town is Puerto Viejo ("Old Port"), and the new town is Puerto Deportivo ("Sports Marina"). It is a popular tourist and leisure area. Following a questionnaire given to the population of the town, it was found that there was a great demand for this kind of service, especially with regard to the elderly, handicapped and mothers with strollers. It was estimated that there would be some 80,000 users a year. In reality, this figure has been more than doubled, with around 200,000 users in the first year.



The project, with a budget of almost EUR1.4 million (US$2 million) and an execution time of one year (beginning on June 17, 2005), included work to adapt the terrain which, as it was unstable (corroborated by topographical, geological and geotechnical studies), required the installation of a matrix (including 262 anchoring micro-pylons). The elevator was then installed, including the riding structures and machinery. Finally, the external spaces were adapted by building the vestibule with an entrance from the Plaza de María Cristina at the top of the hill. A reception hall was built at the bottom of the elevator, where ticket machines were installed and access was provided to the end of Ereaga Beach where the promenade to the Old Port begins. The area was also replanted with different vegetation so as to decrease the impact on the environment.

This project forms a part of the accessibility plan of the Getxo Town Council. It has

been proposed that another inclined elevator be installed in Punta Begoña and that the fixed steps in the Old Port be replaced. Furthermore, other towns, such as Leioa, which plans to build an elevator to connect Lamiako and Txorierri, might take part in this initiative. The Bilbao Metro may even follow the lead of other metros such as that of Madrid so as to provide total accessibility to its stations.

This project has also created job opportunities in the form of surveillance, security and cleaning, which are carried out by a company that contracts handicapped personnel. The high level of comfort and the quality of the finishing of the installation are noticeable, as is the amount of use to which it has been put under popular demand. It is a good solution for an area with difficult access by road, with advantages over a funicular. Since there is no need for a driver in the car, the civil works were cheaper, simpler and have less impact on the environment.

The Getxo inclined elevator will doubtless become a tourist attraction similar to the Hanging Bridge or Vizcaya Bridge in the same city. It is perfectly integrated in its environments and provides access to Ereaga Beach. It avoids parking problems along the promenade. It is an installation using new technology, both in its safety systems and in those that provide high levels of comfort in the car, taking into account length of the trajectory and average speed. It also helps both the handicapped and the elderly become more integrated into the local community.

Guiding System

This inclined elevator uses a new guiding system with HEB commercial profiles that support a large amount of the weight of the vehicle, the load and the counterweight, which are greater the lesser the inclination of the trajectory. The vehicle moves along the top rail and the counterweight inside the aforementioned profiles, as can be seen in the diagram. The center guide rail is 1,200 millimeters long. Additionally, a T-18c (ISO T125/B) guide rail is used for gripping with a progressive safety gear and to avoid lateral displacement. The assembly work was crucial so as to achieve satisfactory levelling of the anchoring plates supporting the riding profiles and to ensure that the level of comfort within the car is high, even for a long trajectory.

Frame

The frame is a totally new design, specifically adapted to the characteristics of this installation. It is wedge shaped to ensure that the car remains horizontal throughout the trajectory. The items that would go on the frame or above the car in a vertical elevator (wedges, forced ventilation, inspection button panel, lighting, remote alarm device, electronic car control, operator control, etc.) inside the car. The speed governor is joined to the frame.

The new frame riding system consists of four trains each with two Type I wheels located on each corner of the frame. These transmit the forces of the vehicle toward the guide rails.

Continued

Characteristics of the Installation

Load	1875 kg
Number of people	25
Nominal speed	1.6 mps
Distance traveled	71.8 meters
Height traveled	39.8 meters
Inclination	33.67° constant in a straight line
Duration of trip	50 seconds
Number of stops	two
Boarding platforms	two on the same side
Car	Panoramic in safety glass with stainless-steel frames; one side-boarding door, measuring 1.6 mm X 2.4 mm x 2.2 mm
Traction control	Control by variable volt and variable frequency to guarantee smooth starting and stopping
Location of the machine room	At the top of the elevator well just below the upper boarding area
Car doors	Automatic door with two glass panels, 900 mm X 2,000 mm; central opening and stainless steel
Floor doors	Automatic doors with two glass panels, 900 mm X 2,000 mm; central opening and stainless steel

Inclined Elevator at Ereaga Beach

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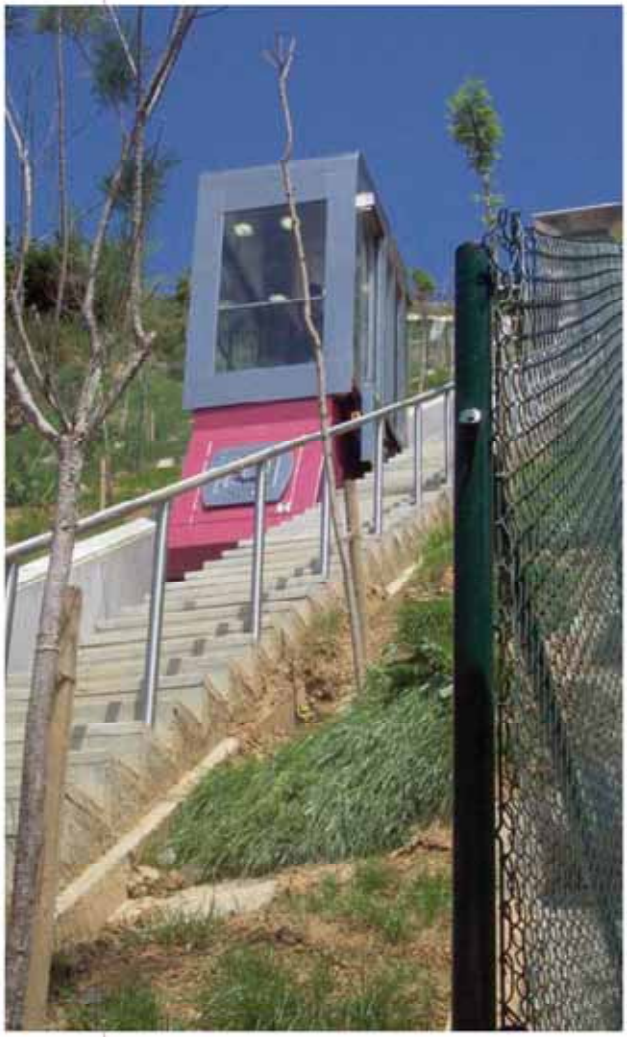


Each of the four trains of wheels also has a Type 2 wheel to prevent the vehicle from overturning. There are also two trains of four Type 3 wheels that go along the gripping guide rail and prevent lateral displacement.

Counterweight

This elevator incorporates a new riding system for the counterweight, consisting of four trains of two Type 4 wheels, each located in a corner of the counterweight, which transmit all the force of the counterweight to the inside of the wings of the HEB profiles. There is one Type 5 wheel on each train, which runs along the inside of the profiles and avoids lateral displacement.

The counterweight has thickness restrictions to allow it to roll within the HEB profiles and beneath the frame without interference from other elements. There should be sufficient space for introducing the weights once the counterweight has been installed within the profiles.

Bedplate

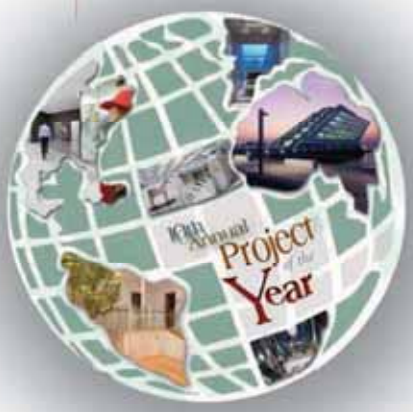
The bedplate is formed by a structure of beams capable of supporting the forces exerted on the machine by the vehicle and counterweight in the direction of the trajectory and downward. Somewhat similar to conventional lateral traction.

Traction System

The traction system used is a machine with a gearbox controlled by a current-frequency controller (governed by our standard maneuver) achieving maximum comfort at 1.6 mps.

Door Operator

The door operator was designed specifically for this installation, as, due to the inclination of the trajectory, the operators used for vertical elevators could not be used. It is a mechanism below the door for lateral embarking (thereby hidden and better protected against extreme external conditions). This also means



it is not necessary to have access to the roof of the car.

Gripping System

The lever system that activates the safety gear is totally different from that used in a vertical elevator. In this case, the speed governor travels together with the car frame (it is not fixed to one point), and when it is blocked, it acts on a tray that is responsible for activating the safety gear (not through a cable that activates a lever system). A single safety gear is used, which acts on a single gripping guide rail. The ascending car overspeed protection means is based on a system of controlled breaking in the machine shaft.

Speed Governor

Although the speed governor is of the type already standardized for vertical elevators (meaning cost savings), it has a special layout and operation. It is mounted on a sliding tray in the vehicle together with two deflection pulleys that give a deflection angle of 180°. At the moment of gripping, while the tray with the governor and pulleys remains fixed, the frame continues to travel, and the movement itself activates the wedge. When released, a recovery spring takes the wedge and tray back to their original position.

Tensioning Pulley

This keeps the governor-cable tension (a single pull on the cable) in a vertical plane by means of a reduced counterweight, transmitting the movement from the inclined plane to vertical movement. The weight of the tensioning pulley changes according to the inclination angle of the installation.

Cable Carrying Chain

The operation cord, given that the trajectory is not vertical, must be guided through the inclined plane. In order to achieve this movement, a system has been assembled with a cable carrying chain, which is displaced over a stainless-steel channel, avoiding possible interferences with other moving components. The chain operates in silence, is very reliable and has been tested and prepared for outdoor operation.

Bearings for Traction Ropes

To avoid interferences between the traction ropes, which produces a catenary through their own weight, and other moving and fixed elements, rope support bearings have been installed along the trajectory.

Car

The car is panoramic, so passengers can enjoy the beautiful views afforded them during the trip. It has been adapted for outdoor operation in strong winds, heavy snow and rain.

Rescue

There is an escape stairway along the entire trajectory of the elevator to enable the rescue of passengers trapped inside the elevator. Direct access is given from the door of the car.

Continued

Louisa Kellie is the communications manager for ThyssenKrupp Elevator Business Unit, Southern Europe, Africa and Middle East.

Credits

Promoter: Ayuntamiento De Getxo

Management: Typsa Ingeniería, S.A.

Builder: Balzola Construcciones, S.A.

Designer, Manufacturer, Installer and Maintenance: ThyssenKrupp Elevadores, S.A.

Suppliers: ThyssenKrupp Aufzügswerke, GmbH; Selcom Aragón, S.A.; Industrias Nudo; MACLA; AKO Electromecánica, S.A.L.; Micelect; Savera; Schneider Electric España, S.A.; Pfeifer Drako; Disseny Electrónic Integral, S.L.; Memco; Igus Polymer Innovations, S.L.; Ceham, S.L.; Cotumer, S.L.; and Sertu, S.A.

Draughtsmen: Tracer Line, S.L.

Notified body: Inpección y Garantía de Calidad, S.L.

Others: Servicontrol, S.L.