



PREEMPTIVE
Feb 2019
San José, Costa Rica

COSTA RICAN PACIFIC COAST

GENERAL INFORMATION

Geography

The geography of the Pacific Coast of Costa Rica is irregular, with swampy areas of mangroves near the city of Puntarenas and some of the largest islands in the country (Chira Island, Venado, Negritos, San Lucas, Tortuga, etc.), as well as Coco's Island. The main cities are Puntarenas (the largest and most developed in the Region), Orotina, San Mateo, Miramar, Esparza, Jacó, Parrita and Quepos.

In the North Pacific is located the Gulf of Nicoya, which is characterized by a winding coastal perimeter, with cliffs and mangrove areas. On the east coast of the Gulf, a tongue of land stands out, where the city of Puntarenas is located. Towards the south-east of Puntarenas, is the port of Caldera, the most important of the Costa Rican Pacific.

In the Central Pacific there is a plain and more rectilinear sector with numerous beaches, ranging from Herradura Bay to Coronado Bay. On this long coastline there are a large number of towns, among which Jacó, Parrita, Quepos, Dominical and Uvita. Also, in the South Pacific is the Osa Peninsula with the Golfo

Dulce and the western half of Punta Burica, and the city of Golfito, the most important commercial free warehouse.

The Parrita, Savegre and Naranjo rivers stand out in the central area of the province. The Grande de Tárcos River, which drains the waters of the Western Central Valley, drains into the entrance to the Gulf of Nicoya. Other important rivers are the Barranca River and the Jesús María River, which flow near the city of Puntarenas.

Weather

It is characterized by narrow coastal plains, with short rivers and torrential character. The climate is a transition from tropical dry forest to humid tropical, with maximum temperatures of around 34 °C (93 °F), and minimum temperatures that rarely drop below 20 °C (68 °F).

Culture

Art is an important exponent also for the City of Puntarenas. Currently has more than 25 stone sculptures product of national and international symposiums and are located along the "Paseo de los Turistas" and on the boulevard of the open-air cathedral.

There is a community of Puntarenas artists that brings together different disciplines such as: theater, dance and folk dance, painting, sculpture and music, which seeks to project local artists to a national and international level.

In the southeastern region of the province of Puntarenas, there are several indigenous reserves of the towns that occupied the T rraba Valley and the Osa Peninsula during the pre-Columbian era. These aboriginal peoples conserve their values, customs and traditions, although threatened by poverty and the process of acculturation. There are numerous archaeological remains in the region, such as those located in Palmar Sur de Osa, where a large number of stone spheres can still be found in their original site, which are currently considered a symbol of national identity.

Infrastructure

Puntarenas is the largest province of Costa Rica and is connected to the rest of the country by several routes, such as Route 1 (San Jos  - San Ram n) and Route 27 (San Jos  - Caldera). The most important ports of the province are Puntarenas, Caldera, Quepos and Golfito. Multiple regional airports are located in the province.

EARTHQUAKES IN THE PACIFIC COAST

Costa Rica is located at the intersection of four tectonic plates: Cocos Plate, the Caribbean Plate, Nazca Plate and Panama Microplate. The interaction of these plates and the stresses that are created on the boundaries of the plates and beyond cause multiples earthquakes every year. Being in the confluence of tectonic plates is a conditions that Costa Rica share with other countries located in the Ring of Fire (a major area in the basin of the Pacific Ocean where a large number of earthquakes and volcanic eruptions occur) such as Japan, Mexico, Peru and Chile. (Alvarado, 2017)

Several big magnitude earthquakes have occurred through Costa Rica's history, many of them causing severe damages. Recent examples of these earthquakes are the 2012 S mara Earthquake (7.6 Mw) and the 1990 C bano Earthquake (7.0 Mw). (Alvarado, 2017).

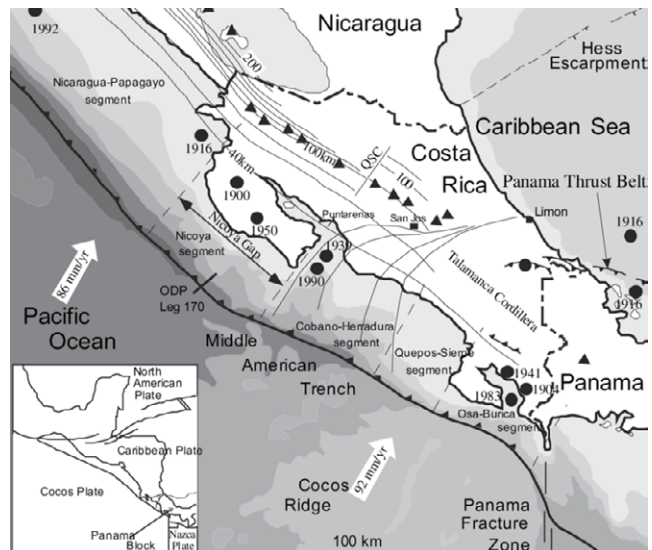


Figure 1. Interaction of tectonic plates in Costa Rica.

1990 C bano Earthquake

The 1990 C bano Earthquake occurred on March 25, at 7:22 am local time. The depth of its epicenter was at 24.2 km and its magnitude was around the 6.9 Ms (7.0 Mw). The people of Puntarenas and C bano where affected the most. They reported 32 damaged houses, 8 destroyed and 79 buildings. There were no reports of deaths, but as consequence, there were different coastal zones that had problems of liquefaction on roads and lands (Santana, 1990).



Figure 2. House affected by Cobano earthquake in 1990

2010 Sámara Earthquake

This earthquake occurred on September 5, 2012 at 08:42 am local time. The epicenter was located at the Nicoya Peninsula, 24 kilometers south-south-west of Sámara. A tsunami warning was issued shortly afterwards, but later cancelled. Two people are known to have died, one from a heart attack and another, a construction worker. It was the second strongest earthquake recorded in Costa Rica's history, following the 1991 Limon earthquake. (RSN, 2015).



Figure 3. Nosara's neighbors were affected by the earthquake in 2012

The earthquake was felt in all Costa Rican territory as well in Nicaragua, Guatemala, El Salvador and Panama. The depth of its epicenter was at 15.4 km and was caused by the subsidence between Cocos and Caribbean plate. Apparently, there were around 540 aftershocks following the quake. Most of them between 3 and 5 on the Richter Scale, which is pretty typical after a tremor of this magnitude. The seismic energy released was of approximately 158 atomic bombs just like the one of Hiroshima on 1945. Some effects of this event are destroyed houses, including broken windows, cracks on walls, and materials detached from the buildings, also some roads were closed and schools closed for precaution. (RSN, 2015)

BOCA BARRANCA BRIDGE

Its located in Esparza, a rural town on the pacific coast of our country, on National Route 23. The Lanamme Bridges Unit inspected this bridge in 2013 and found damages on its joints and barriers. (Lanamme, 2013)

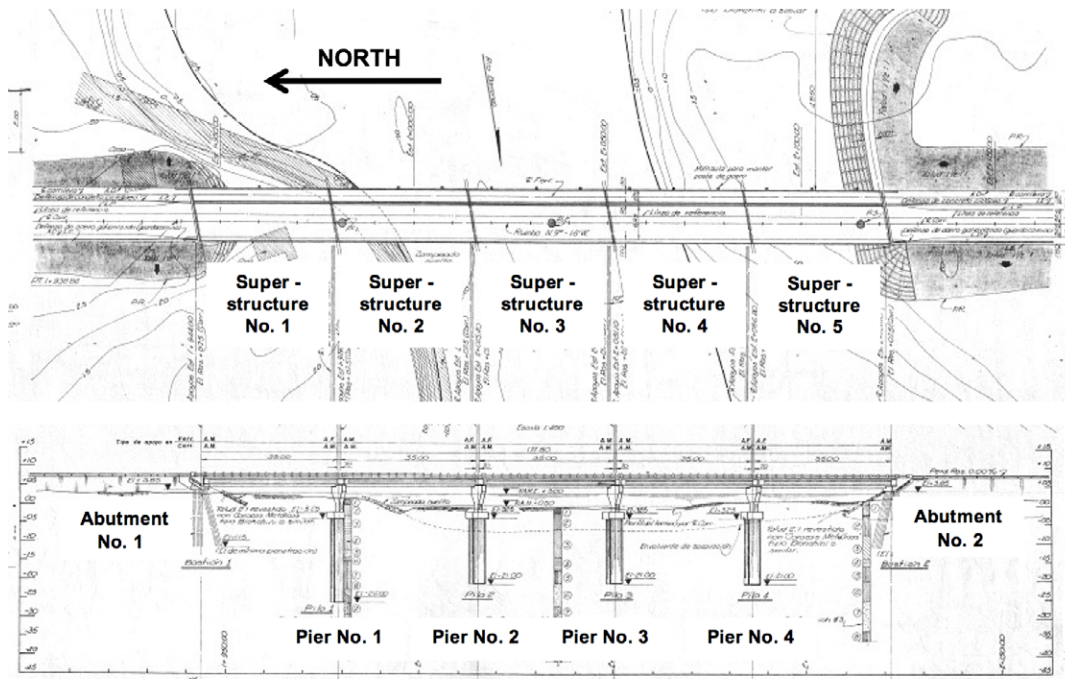


Figure 4. Longitudinal and lateral view of the Barranca bridge

Table 1. Characteristics of the Barranca Bridge

Geometry	Total length	178,7 m
	Total width	10,7 m
	Width of road	9,0 m
	Number of spans	5
Super-structure	Type of principal elements	Simply supported concrete "T" beams
	Type of road surface	Concrete reinforced slab
	Number of elements	Abutments: 2 Piers: 4
Substructure	Type of piers	Concrete reinforced column
	Foundation	Piles

Lanamme, 2013



Nomenclature used for the main components of the Bridge

Identified damages

The Bridges Unit of Lanamme performed an inspection in July, 2013. In this inspection, they found several damages in different locations of the bridge. Some of the damages identified are

- Shear failure on the bolts of the bearings
- Permanent deformation or cracking of the neoprene pad
- Degradation of the concrete, cover detachment and exposed rebar
- Bearing pedestals with cracks or concrete detachment



Crack on the neoprene pad on a bearing at Abutment No. 2



Damage on Pier No. 4. There is no connection between bolt and the bearing's steel angle, as well as cover detachment.



Transverse displacement of the Superstructure No. 5 over the Abutment No. 2. There is failure of the bolt, corrosion of the steel angle and evidence of water filtration.



Damage on north side of Pier No. 1.
There is no cover and therefore the rebar is exposed.



Damage on the bolts of a pedestal of Abutment No. 2,
induced by the lateral force of the girders.

Recommendations for the inspection of the bridge

- Use sunblock
- Wear sunglasses
- Bring insect repellent
- Wear closed shoes (preferably hiking boots or safety boots)
- Wear long pants

Recommendations for the beach

Please see the recommendations from the National Parks Service of Costa Rica



REFERENCES

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