COSTA RICAN CARIBBEAN COAST

GENERAL INFORMATION

Geography

The Province of Limón is located on the Caribbean coast of Costa Rica and has a territorial extension of 9,188 km^2. It is bordered north and east by the Caribbean Sea, northwest by Nicaragua, west by the provinces of Heredia and Cartago, southwest by the province of San José, south by the province of Puntarenas and southeast by Panama. It is located about 163 kilometers from San José.

South of Limón is located the Cordillera de Talamanca, where the highest peaks of the country are found. The highest peak of Costa Rica is Cerro Chirripó, at 3,820 meters above sea level. The hydrographic system formed by the Reventazón River and the Parismina River is the most important river on the Caribbean coast.

Weather

It has a torrid climate with an average annual temperature of 25.5 ºC (78 °F). The historical temperature marks in Limón are 11 °C (52 °F) and 35 °C (95 °F). The average annual rainfall is 4,100 mm, the highest in Costa Rica.

Culture

Afro-Costa Rican culture is a combination of African traditions and their own particularities added by Afro-Costa Ricans within their own territorial, social and cultural dimension.

The cuisine of Limón is mainly known for its dishes of Afro-Caribbean roots, a product of the Antillean immigration. Among the main condiments include Panamanian chili, ginger, clove, pepper, onion, tomato, leek, thyme, nutmeg, vanilla, oyster sauce and coconut oil.

The rhythm of the Caribbean is marked by the calypso. Other rhythms typical of the area are soca, Afro-Cuban musical rhythms (guaracha, chachachá, rumba), and music from the south of the United States, particularly from New Orleans (jazz, blues, swing) and reggae.

The Carnival of Limón takes place from October 8 to 16. They are highlighted by costumed dances, masks and parades of colorful floats through the streets, as well as banquets. On August 31 of each year, Black and Afro-Costa Rican Culture Day is celebrated.

Spanish is the official language, however, the Afro-descendant population communicates with Limonian Kryol, as well as Bribri and Cabécar within indigenous people.

Infrastructure

in 1871, the engineer and architect Ángel Miguel Velázquez Vidaurre developed the plans for the settlement of the city of Limón. Its streets and avenues are wide and well laid out; and it is the only Costa Rican city to have been planned at the end of the 19th century, so its quadrants are exact. The city is separated from the sea by a seawall called Tajamar that borders all its coastline in the urban area.

The city has a bus terminal that connects it with the rest of the province and the country, as well as with one of the most important airports in Costa Rica. Close to Limón is Puerto Moín, cataloged as one of the most important ports on a national level since it links the country with European, African and eastern United States trade. In this port, the Container Terminal of Moín is located, which is the largest in the country and will allow the capacity of the port to be expanded.

The city of Limón has several buildings of Victorian style, characterized by high ceilings with wooden ornaments as lace, generous corridors, turrets, railings and cross ventilation systems to alleviate the sensation of heat and humidity characteristic of the zone.

Among its main buildings, stand out for its antiquity and architectural beauty: Post Office building (also houses the Ethnohistorical Museum), the Costa Rica boarding house, Black Star Line building, the Adventist Church, San Marcos Anglican Church, Park Hotel, Tomás Guardia School, the House of Culture, the new Cathedral of Limón (considered one of the most modern in Latin America) and the Dr. Tony Facio Castro Hospital.

1991 LIMON EARTHQUAKE

The 1991 Limón Earthquake, also known as Bocas del Toro Earthquake, occurred at 3:57 pm local time (21:56:51 UTC) on April 22. The epicenter of the 7.7 Mw earthquake was in Pandora, Valle La Estrella, in the Caribbean region of Limon, Costa Rica, 225 kilometres (140 miles) southeast of San José. The earthquake was the strongest recorded in Costa Rica's history, and was felt throughout the country as well as in western Panama (RSN, 2017).

Damage caused by de Limon earthquake

The earthquake claimed 48 lives in Costa Rica and 79 in Bocas del Toro, Panama. There were 4 452 houses that collapsed in our country. Roads and bridges between Limon and Sixaola were all destroyed, and the epicentral region was only accessible by helicopter from the Panamaian side. It damaged 80% of Costa Rican territory and 20% in Panama. (RSN, 2017).

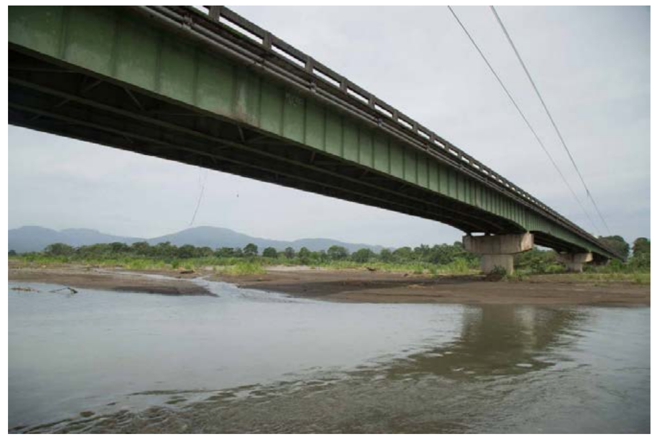
Liquefaction occurred by the
natural disaster in 1991

In Limon, hotels and other landmarks collapsed and a 1.85 meters (6 ft 1 in) uplift at the waterfront left coral and sand bluffs exposed. In Panama, extensive damaged also occurred in Guabito, Changuinola, Almirante and Isla Colon. The Chiquita Brands office building in Changuinola separated with a 3-meter breach (RSN, 2017).

The international bridge of Sixaola stayed intact because it was well constructed by the Costa Ricans. At the Changuinola "Capitán Manuel Niño" International Airport damage on the south end of the runway was severe, and very few planes were able to land. Helicopters were the primary aircraft bringing in relief workers, food, and supplies. (RSN, 2017)

By 1993, the Changuinola-Guabito road was reconstructed with $10 million USD funded by the Panamanian government, and new housing facilities were constructed in Finca 4 and Almirante. Reconstruction of the Limon-Sixaola road took months, and in 2010 the road was paved and coded as Highway 36 (RSN, 2017).

Longitudinal view of the Chirripó River Bridge.

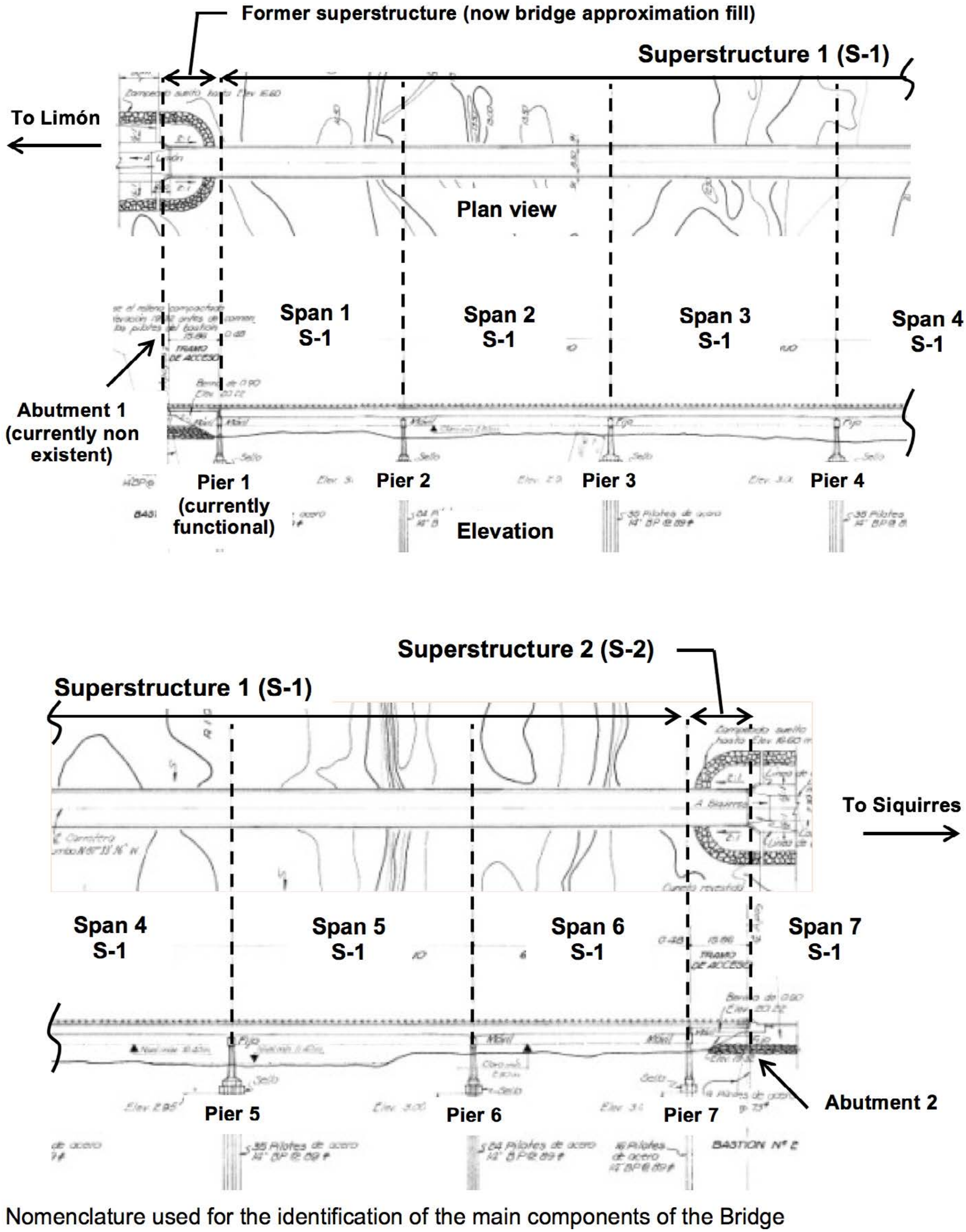


General view of the Chirripó River Bridge.

CHIRRIPÓ BRIDGE

The Chirripó bridge is located in Limón, has a length of approximately 471m, and a total width of 10.3 m of which 0.9 m correspond to the width of the sidewalk located on both sides of the bridge. Its structure was designed in 1969 and it was constructed between 1974-1978. The roadway surface is the same concrete slab of the superstructure.

Lateral view of the Chirripó River Bridge.



Nomenclature used for the identification of the main components of the Bridge

Table 1. Characteristics of Chirripó Bridge

Geometry	Total length	471 m
	Total width	10,3 m
	Width of road	8.5 m
	Number of spans	7
	Number of Superstructures	2
Superstructure	Type of principal elements	Steel beams of variable section, lower braces and diaphragm elements.
	Type of road surface	Concrete reinforced slab
	Number of elements	Abutments: 2 Piers: 6
Substructure	Type of abutment	Beam type at the east side Gabion wall for protection at west
	Type of piers	Concrete wall pier
	Foundation	Unknown

Lanamme, 2010

It has drains every 5 m and three expansion joints: one on each abutment and another at Pier 1. All the joints are covered with an asphalt overlay, so its type is unknown (Lanamme, 2010). The longest superstructure (A) has four main steel beams of variable section, lower braces and diaphragm elements. (Lanamme, 2010). The substructure consists of 5 concrete wall piers with a width of 4.20 m and 1.20 m in thickness. The bridge has rocker-type supports in the abutments, as well as expansive and fixed supports on the piers. The type of foundation of the piers and abutments is currently unknown.

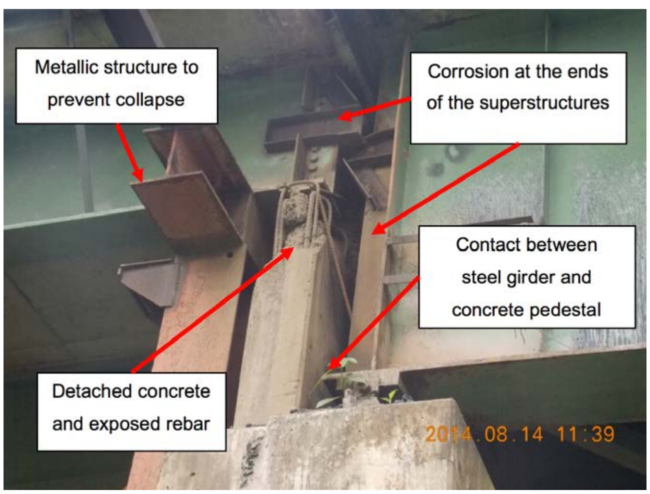
IDENFITIFIED DAMAGES AT THE BRIDGE

The Bridges Unit from LanammeUCR has carried out several inspections where it has determined that the bridge needs major restructuring due to natural disasters that have affected its structural integrity (Vásquez, 2017). Roy Barrantes of LanammeUCR explained that after the 1991 Limon Earthquake, the bridge suffered damage and needs repair, and though he emphasized that the bridge will not collapse, he did highlight that the damage goes beyond the surface (CRhoy, 2015).

Some of the damages identified by the Bridges Unit of LanammeUCR during their last inspection are:

- The metallic bearings (rocker type) were tilted towards the headwall on Pier 1 and towards the pedestal on Pier 7, because of the longitudinal forces induced by the 1991 Limon Earthquake. This causes that there is contact between the girders and the headwalls in both piers.
- The majority of the metallic bearings on Piers 2, 3, 4 and 5 are not completely attached to the superstructure (which is continuous over these piers). Also, the bolted connections no longer have the nuts.
- Corrosion was found in all the bearings, at different levels. In the central piles, there is slight signs of corrosion; at Piers 1 and 7, there is loss of section on the bearings because of the continuous flow of water through the expansion joints.
- The bearings of Superstructure 2 over Abutment 2 are displaced with respect to its lower steel plate.
- The concrete of the pedestal on Pier 7 is detached. This caused a reduction on the bearing length. Therefore, an additional metallic supporting frame structure was built in order to avoid collapse of Superstructure 2. This structure was meant to be temporary but it already has signs of corrosion.

View of the Pier 3 from the east side.



Damages found on Pier 7

Metallic support structure built after the earthquake to prevent collapse of Superstructure 2.

Rocking bearing tilted towards the headwall and corrosion found on Pier 1.

Displaced bearing on Abutment 2.

Damages found on south side of Pier 1

APM TERMINAL ACCESS BRIDGE

Video of the proyect:

The Moín Container Terminal (MCT) is built on an artificial island off the Caribbean coast of Costa Rica. Once operational in February 2019, its goal is to be the most efficient port in Latin America and a symbol of security and progress, in harmony with the environment in Limón, Costa Rica.

The Moín Container Terminal covers around 80 hectares with a 650-meter quay and a depth of 14.5meters. The access channel is 18-meters deep. Equipped with 29 electric container cranes and six Super-Post Panamax gantry cranes the terminal will be capable of handling container ships of up to 8,500 TEUs, 24 hours a day, 7 days a week, 365 days per year.

Important Characteristics:

- Ability to serve container ships of up to 8,500 TEUs (Twenty foot Equivalent Units).
- Uninterrupted operations 24/7, 365 days a year.
- Reduction in the logistical costs due to economies of scale.
- Reduction in waiting and docking times.

Ongoing Development

By Phase 2A, capacity to handle four times the size of the ships it currently handles. In later stages, the largest design ship: New Panamax, with 13,000 TEUs will be able to be received. It will attract investment as a consequence of a port that is efficient, effective and high-tech. Socio-economic development of the region due to direct and indirect employment opportunities.

Information obtained from APM TERMINALS.

REFERENCIAS

- APM terminals (2018) https://www.apmterminals.com/en/news/image-gallery
- CRhoy (2015) https://qcostarica.com/mopt-says-bridge-over-chirripo-river-is-ok-contradicting-last-years-almost-falling/
- Red Sismológica Nacional (2015) Terremoto de Limón, Informe final. https://rsn.ucr.ac.cr/rsn/comunicados/26-sismologia/sismos-historicos/3235-terremoto-de-limon-22-de-abril-de-1991
- Unidad de Puentes (2010) Inspección del puente sobre el Río Chirripó Ruta Nacional Nº 32, Lanamme. https://www.lanamme.ucr.ac.cr/repositorio/handle/50625112500/1217
- Vargas-Alas, L.G., Agüero-Barrantes, P., Barrantes-Jiménez, R., Loría-Salazar, L.G. (2014). Inspección del puente sobre el río Chirripó Ruta nacional No. 32. Programa de Infraestructura del Transporte (PITRA), LanammeUCR. (in Spanish).
- Vásquez, J (2017) "Advierten expertos: puente sobre Río Chirripó requiere intervención urgente", crhoy.com https://www.crhoy.com/reportaje-especial/advierten-expertos-puente-sobre-rio-chirripo-requiere-intervencion-urgente/