



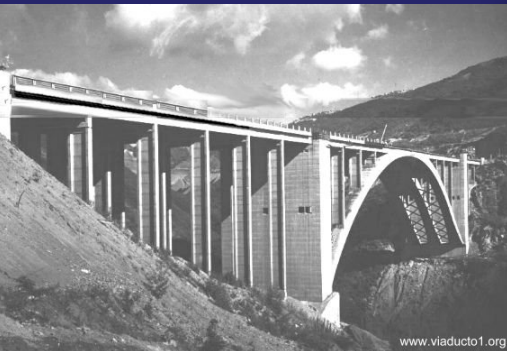
Schnabel
ENGINEERING

High Capacity Micropiles for Caracas-La Guaira Viaduct



The 12th International
Workshop on Micropiles

Kraków, Poland, June 11-14, 2014



www.viaducto1.org



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PILEBUCK

THE INTERNATIONAL PILE DRIVERS', DEEP FOUNDATIONS
& MARINE CONTRACTOR'S MAGAZINE

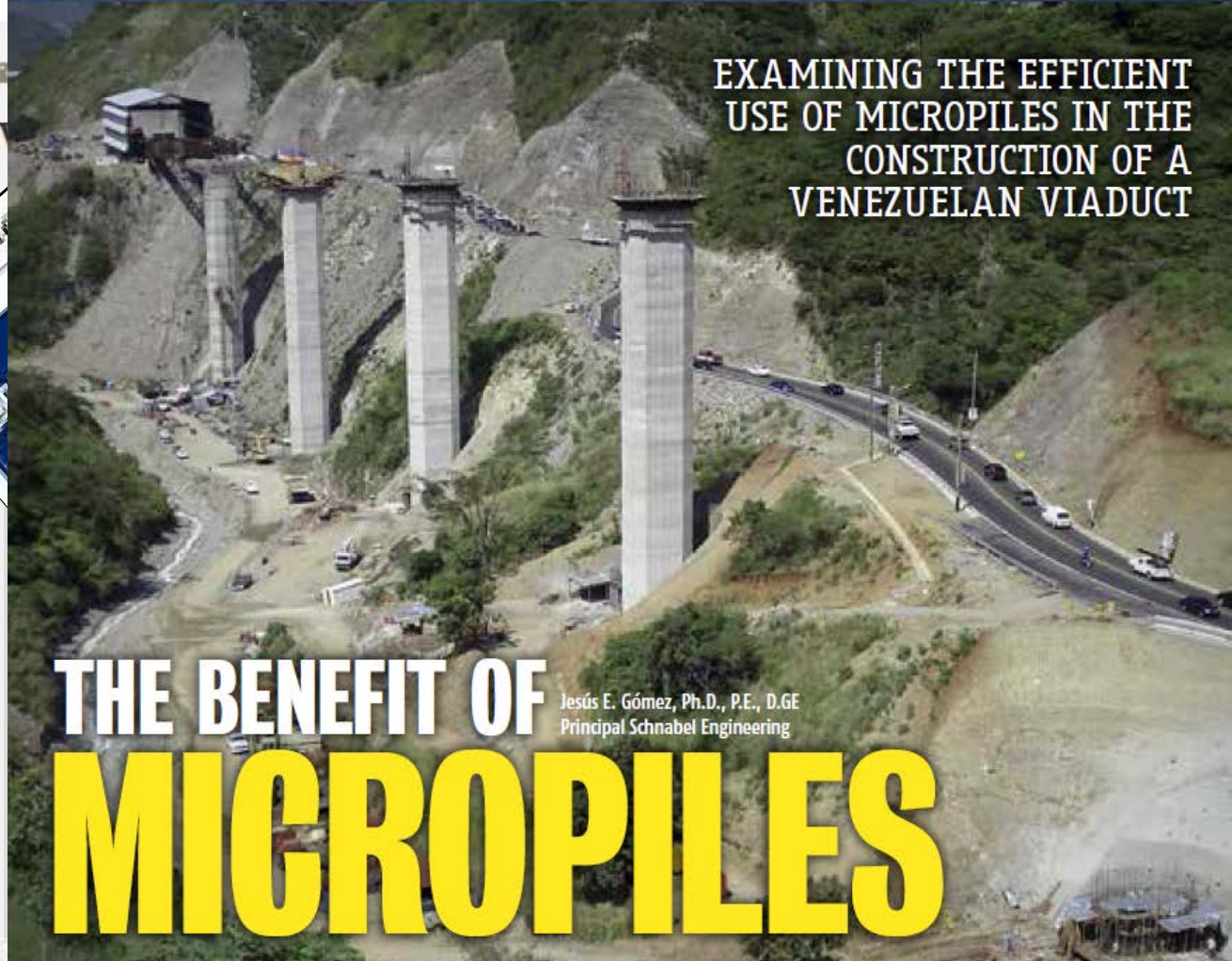
2014
VOLUME 30
ISSUE 1

EXAMINING THE EFFICIENT
USE OF MICROPILES IN THE
CONSTRUCTION OF A
VENEZUELAN VIADUCT

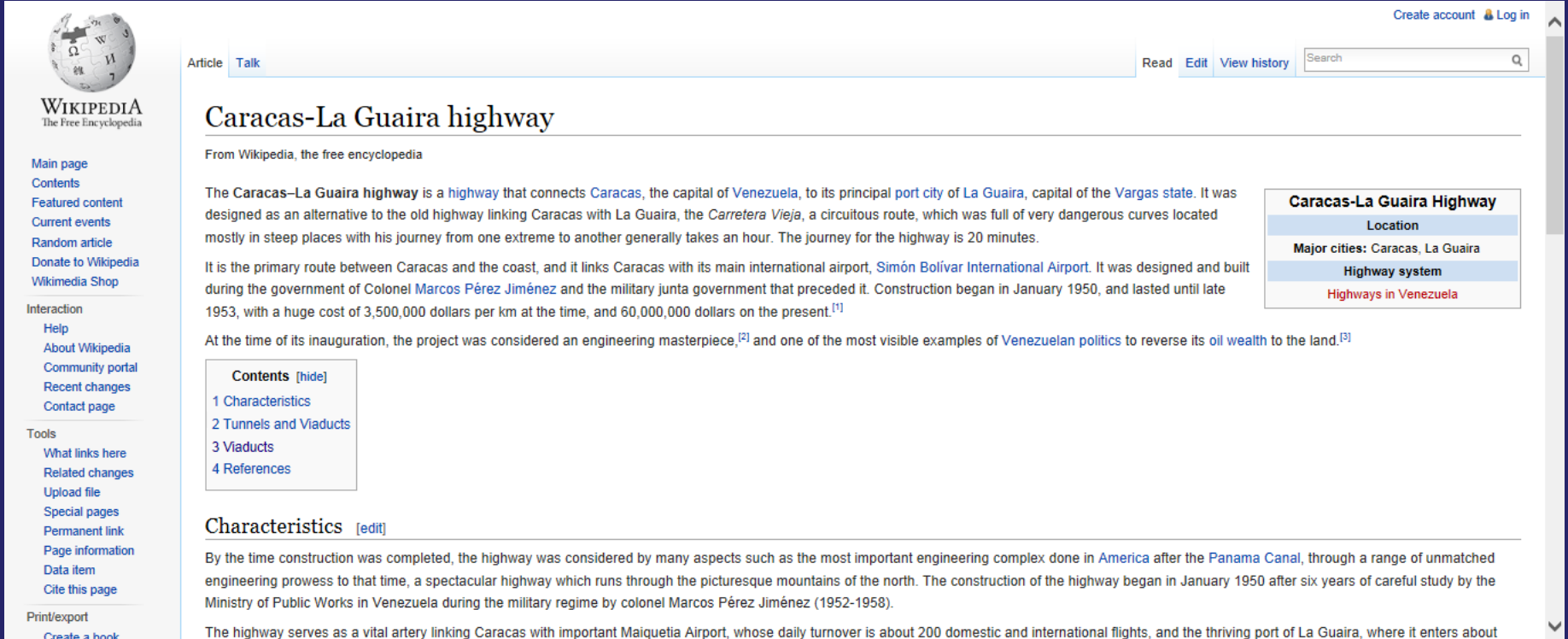
THE BENEFIT OF

Jesús E. Gómez, Ph.D., P.E., D.GE
Principal Schnabel Engineering

MICROPILES



Wikipedia tells it all!



The screenshot shows the Wikipedia article for "Caracas-La Guaira highway". The page includes the Wikipedia logo, navigation tabs for "Article" and "Talk", and a search bar. The main text describes the highway as a route connecting Caracas to La Guaira, designed as an alternative to the old "Carretera Vieja". It mentions the highway's construction in 1950 and its cost. A table on the right lists the highway's location, major cities, and system. A "Contents" box lists sections: Characteristics, Tunnels and Viaducts, Viaducts, and References. The "Characteristics" section is expanded, detailing the highway's engineering significance and construction history.

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Caracas-La Guaira highway

From Wikipedia, the free encyclopedia

The **Caracas–La Guaira highway** is a **highway** that connects **Caracas**, the capital of **Venezuela**, to its principal port city of **La Guaira**, capital of the **Vargas state**. It was designed as an alternative to the old highway linking Caracas with La Guaira, the *Carretera Vieja*, a circuitous route, which was full of very dangerous curves located mostly in steep places with his journey from one extreme to another generally takes an hour. The journey for the highway is 20 minutes.

It is the primary route between Caracas and the coast, and it links Caracas with its main international airport, **Simón Bolívar International Airport**. It was designed and built during the government of Colonel **Marcos Pérez Jiménez** and the military junta government that preceded it. Construction began in January 1950, and lasted until late 1953, with a huge cost of 3,500,000 dollars per km at the time, and 60,000,000 dollars on the present.^[1]

At the time of its inauguration, the project was considered an engineering masterpiece,^[2] and one of the most visible examples of **Venezuelan politics** to reverse its **oil wealth** to the land.^[3]

Caracas-La Guaira Highway
Location
Major cities: Caracas, La Guaira
Highway system
Highways in Venezuela

Contents [hide]

- 1 Characteristics
- 2 Tunnels and Viaducts
- 3 Viaducts
- 4 References

Characteristics [edit]

By the time construction was completed, the highway was considered by many aspects such as the most important engineering complex done in **America** after the **Panama Canal**, through a range of unmatched engineering prowess to that time, a spectacular highway which runs through the picturesque mountains of the north. The construction of the highway began in January 1950 after six years of careful study by the Ministry of Public Works in Venezuela during the military regime by colonel Marcos Pérez Jiménez (1952-1958).

The highway serves as a vital artery linking Caracas with important Maiquetia Airport, whose daily turnover is about 200 domestic and international flights, and the thriving port of La Guaira, where it enters about

Print/export
Create a book

Served a Country



National Pride



"Infogramed"

CINCUENTA Y TRES AÑOS BATALLANDO CONTRA LOS ELEMENTOS

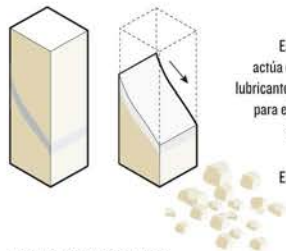
El viaducto Nro.1 de la autopista Caracas-La Guaira sucumbió ante un factor que lo había condenado desde su nacimiento: un terreno compuesto por materiales propensos a fracturarse en la ladera sur y con tendencia a desplazarse hacia el norte. Además la construcción de viviendas en la zona también pudo haber disminuido la vida útil de la estructura

CERRO GRAMOVEN

Forma parte de la cordillera de la Costa y está constituido principalmente por un tipo de roca conocida como esquisto muscovítico. Además está afectado por una inestabilidad natural producto de la disposición de las capas que lo componen

INESTABILIDAD MECANICA

La capa superior del terreno, al no poseer apoyo en el norte y debido al ángulo de la brecha, tiende a desplazarse hacia el vacío



Brecha
Esta capa actúa como un lubricante natural para el estrato superior

Esquistos

ESQUISTO MUSCOVITICO

Del griego scrihistos: dividido



Es una roca de estructura laminar y aspecto pizarroso y homogéneo. Es propensa a fracturarse por acción del agua y otros agentes ambientales

APOYO EN EL NORTE

La formación rocosa que soporta al viaducto en el estribo La Guaira está constituida por materiales más resistentes a la acción de los elementos como: cuarzo, gneises, anfíbolitas y cuarcita

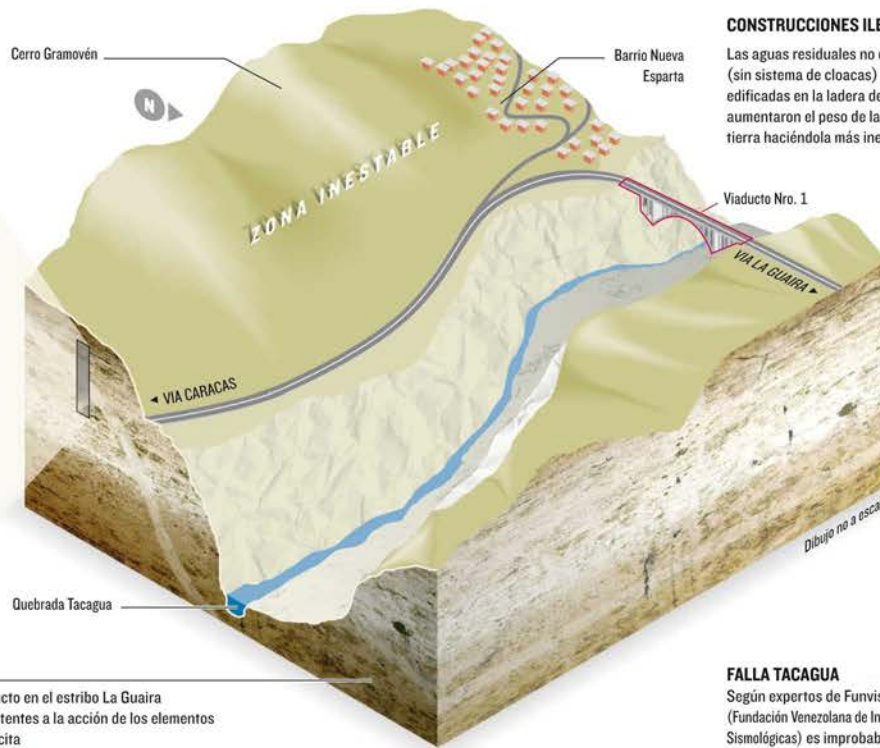


Cuarzo

Gneises

Anfíbolita

Cuarcita



CONSTRUCCIONES ILEGALES

Las aguas residuales no canalizadas (sin sistema de cloacas) de las casas edificadas en la ladera de la montaña aumentaron el peso de la masa de tierra haciéndola más inestable



- ANTES



- DESPUES

FALLA TACAGUA

Según expertos de Funvisis (Fundación Venezolana de Investigaciones Sismológicas) es improbable que este accidente geológico interviniera en la deformación del viaducto N°1 ya que, si bien representa un riesgo potencial de sismos, su actividad ha sido muy baja en los últimos años



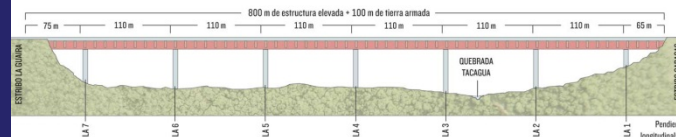
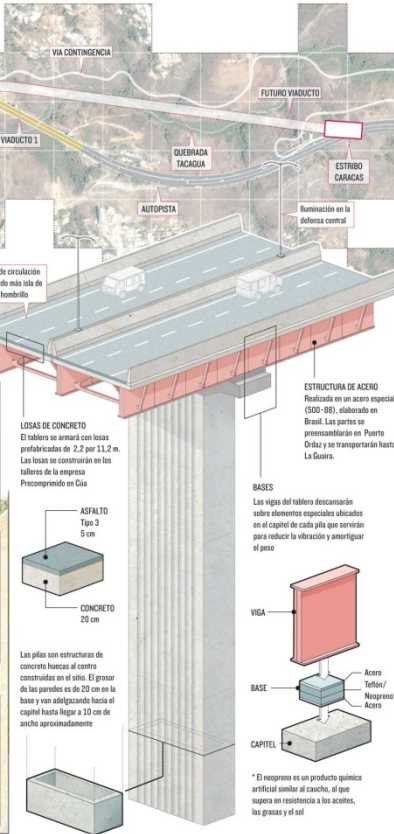
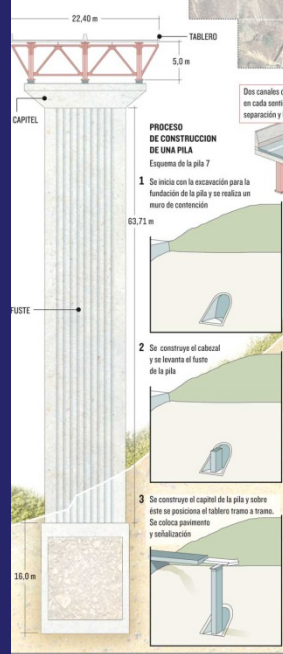
— — Falla

"Infogramed"

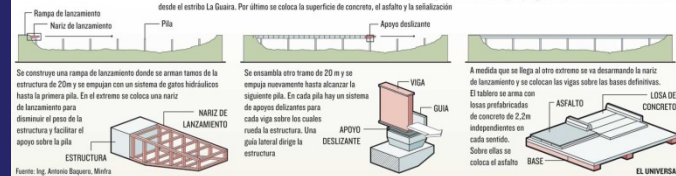
EL PROCESO DE CONSTRUCCION

Para el primer trimestre de 2007 se espera inaugurar el nuevo viaducto de la autopista Caracas-La Guaira con una inversión de 140 millones de bolívares. La construcción de este nuevo puente normalizará el tráfico entre Caracas y la capital del estado Vargas, mientras se siguen estudiando nuevos proyectos para otras vías alternas

ESTRUCTURA BASICA DE UNA PILA

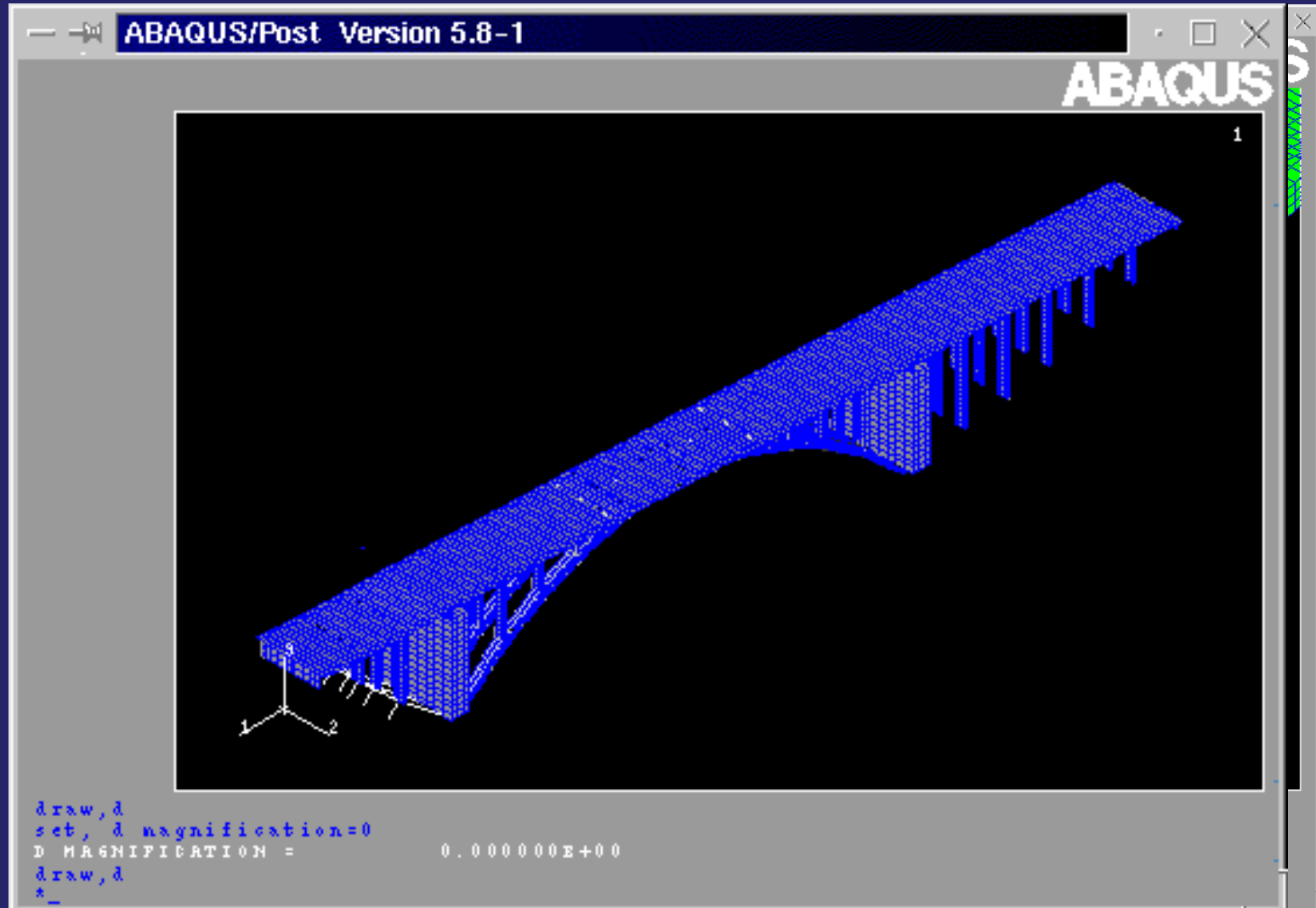


EL SISTEMA DE CONSTRUCCION



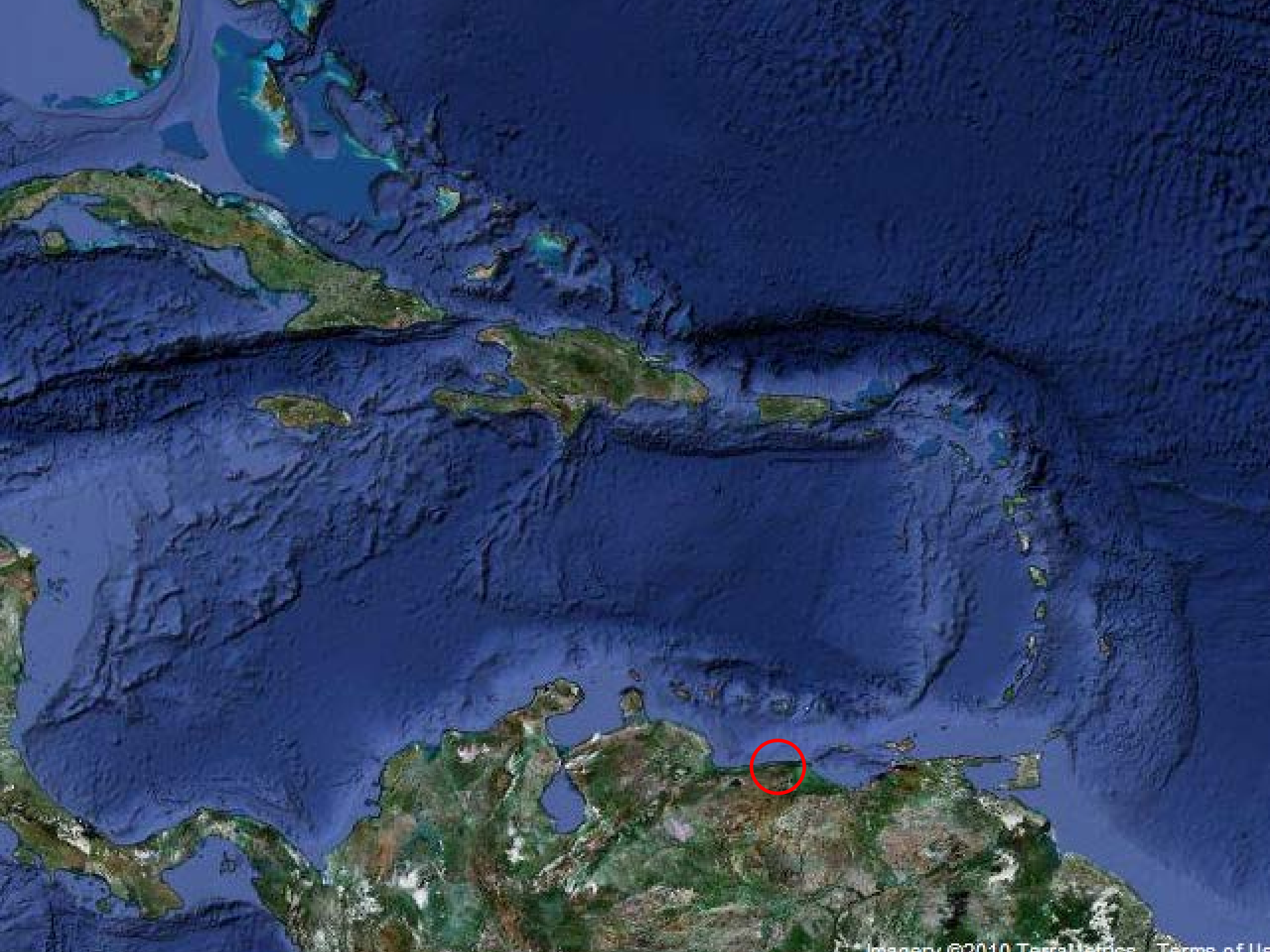
Fuente: Ing. Armando Bagnara, Mtro

“Finite Elementized”



Micropiles benefited the entire Society

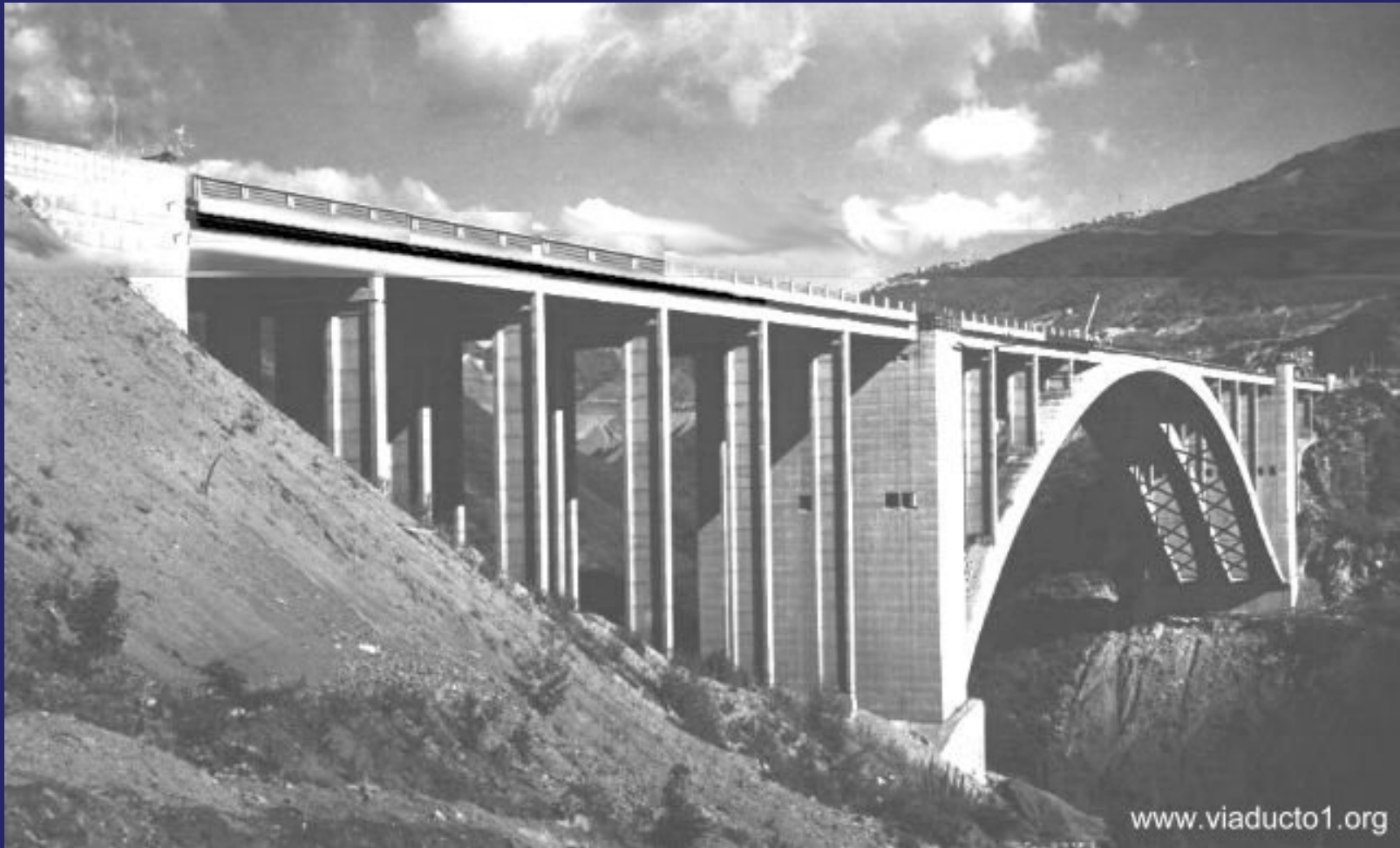




Nuevo Viaducto Caracas-La Guaira



Caracas-La Guaira Viaduct No 1





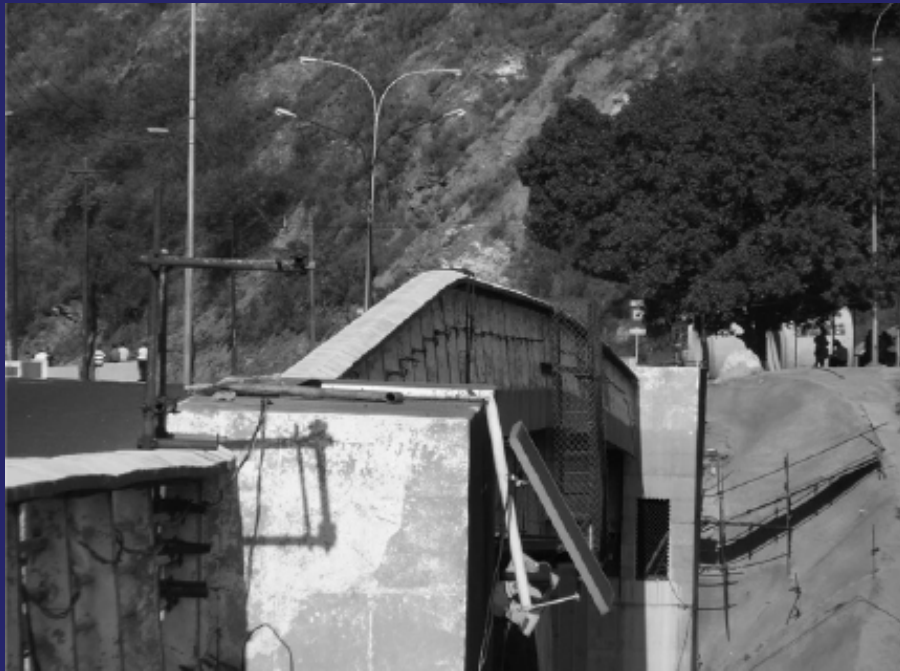
1000 ft
500 m

Imagery ©2010 DigitalGlobe, GeoEye, Terms

Caracas-La Guaira Viaduct No 1

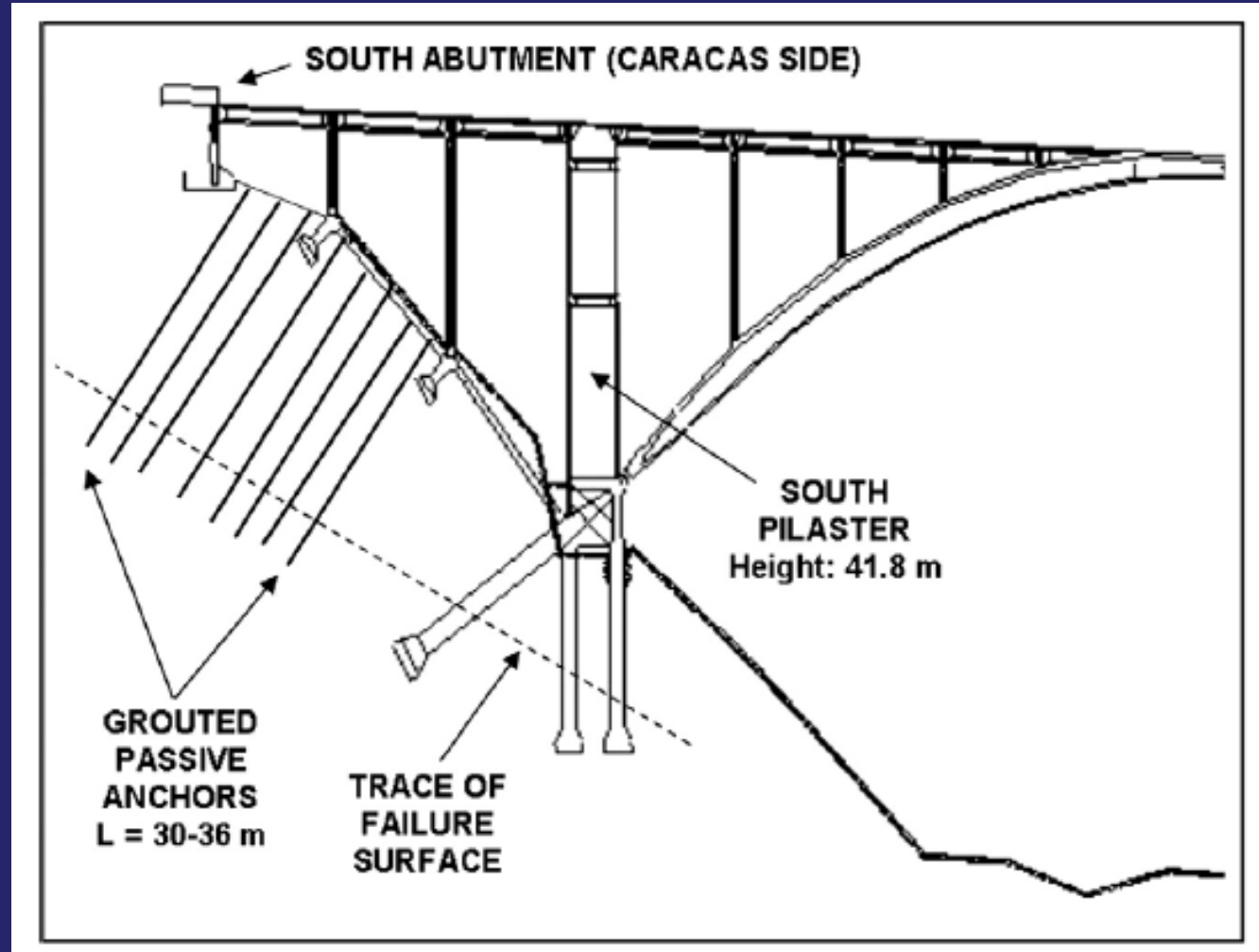


Caracas-La Guaira Viaduct No 1



Taken from Salcedo (2009)

Ancient Landslide Evidence



Taken from Salcedo (2009)

Ancient Landslide Evidence



Taken from Salcedo (2009)

Nuevo Viaducto Caracas-La Guaira



Caracas-La Guaira Viaduct No 1



Caracas-La Guaira Viaduct No 1



Caracas-La Guaira Viaduct No 1



Caracas-La Guaira Viaduct No 1



Caracas-La Guaira Viaduct No 1



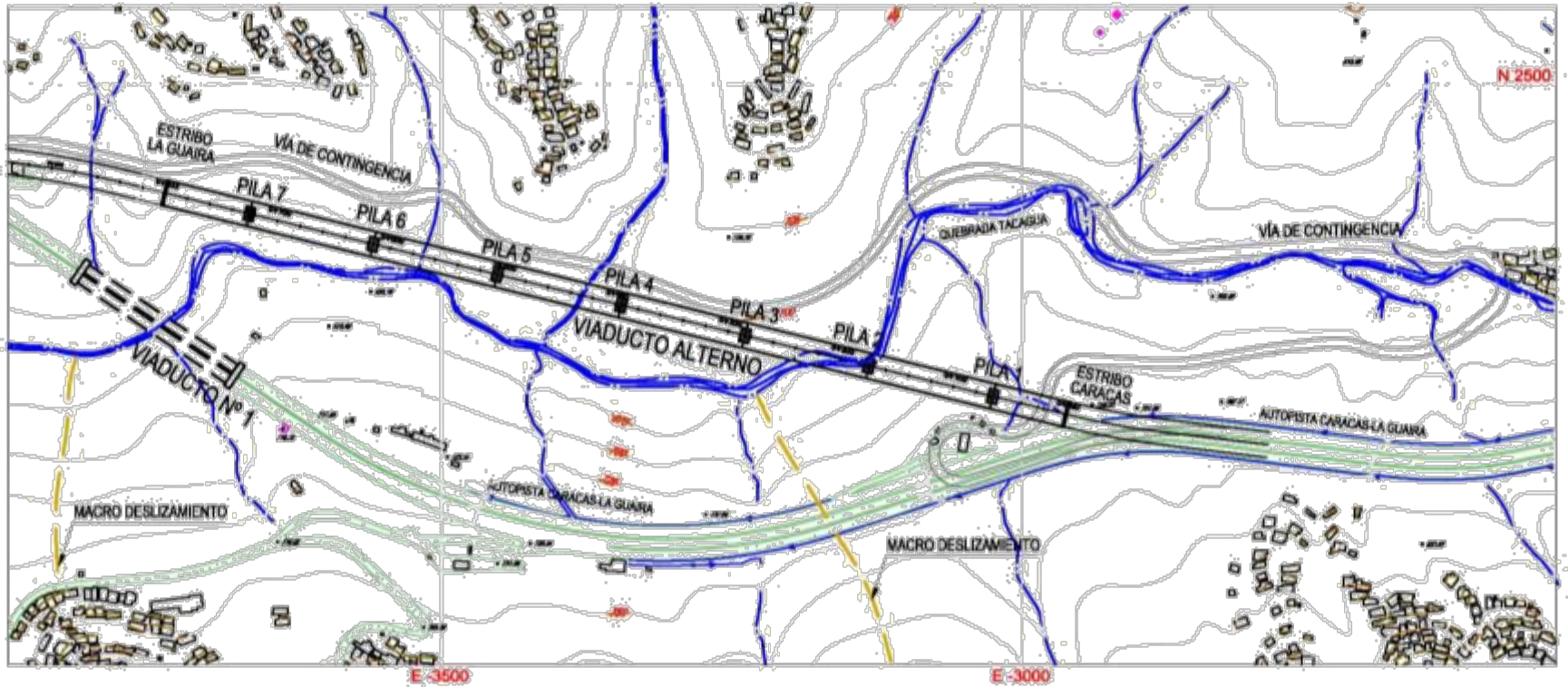
Caracas-La Guaira Viaduct No 1

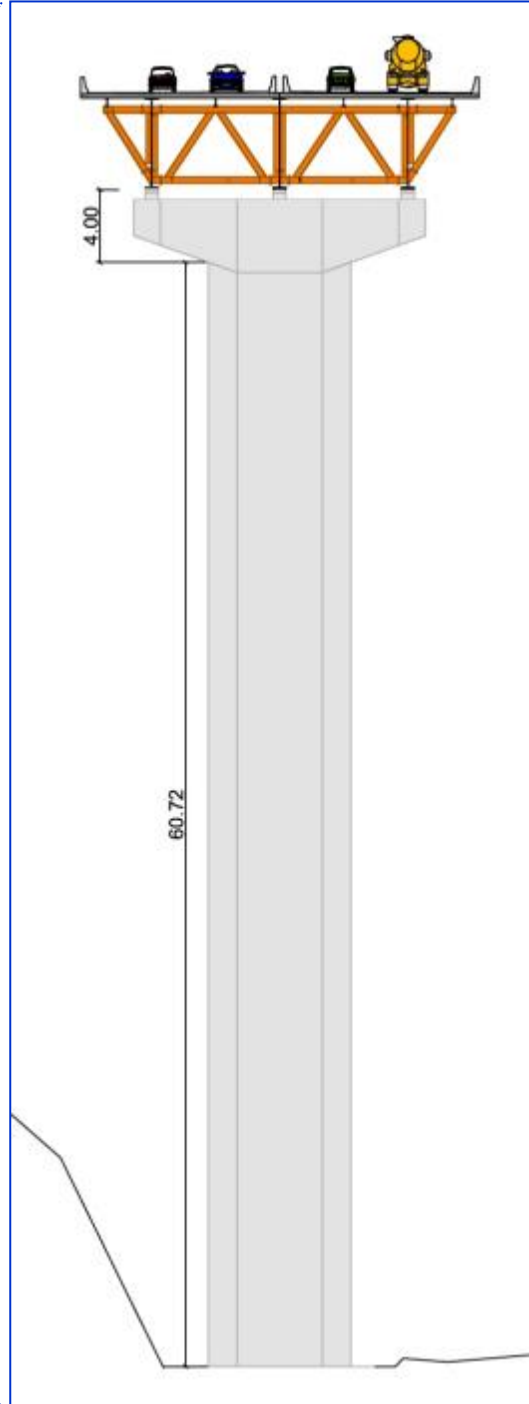
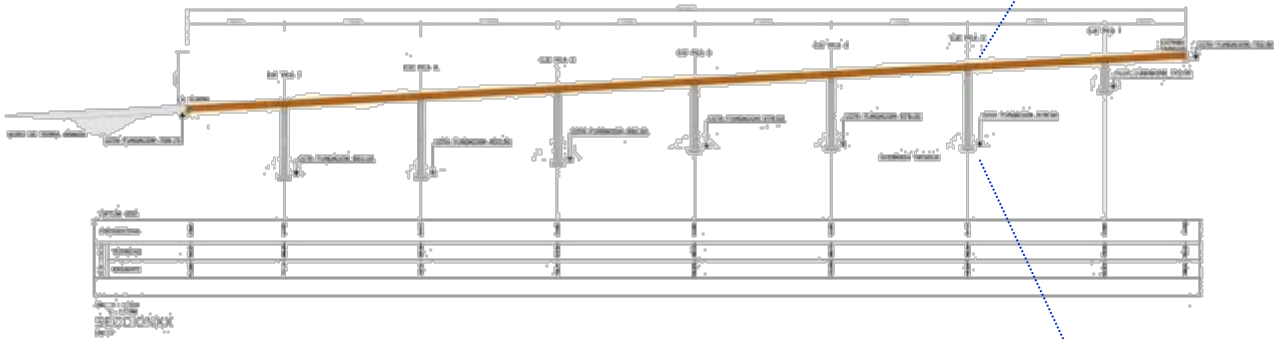


Caracas-La Guaira Viaduct No 1

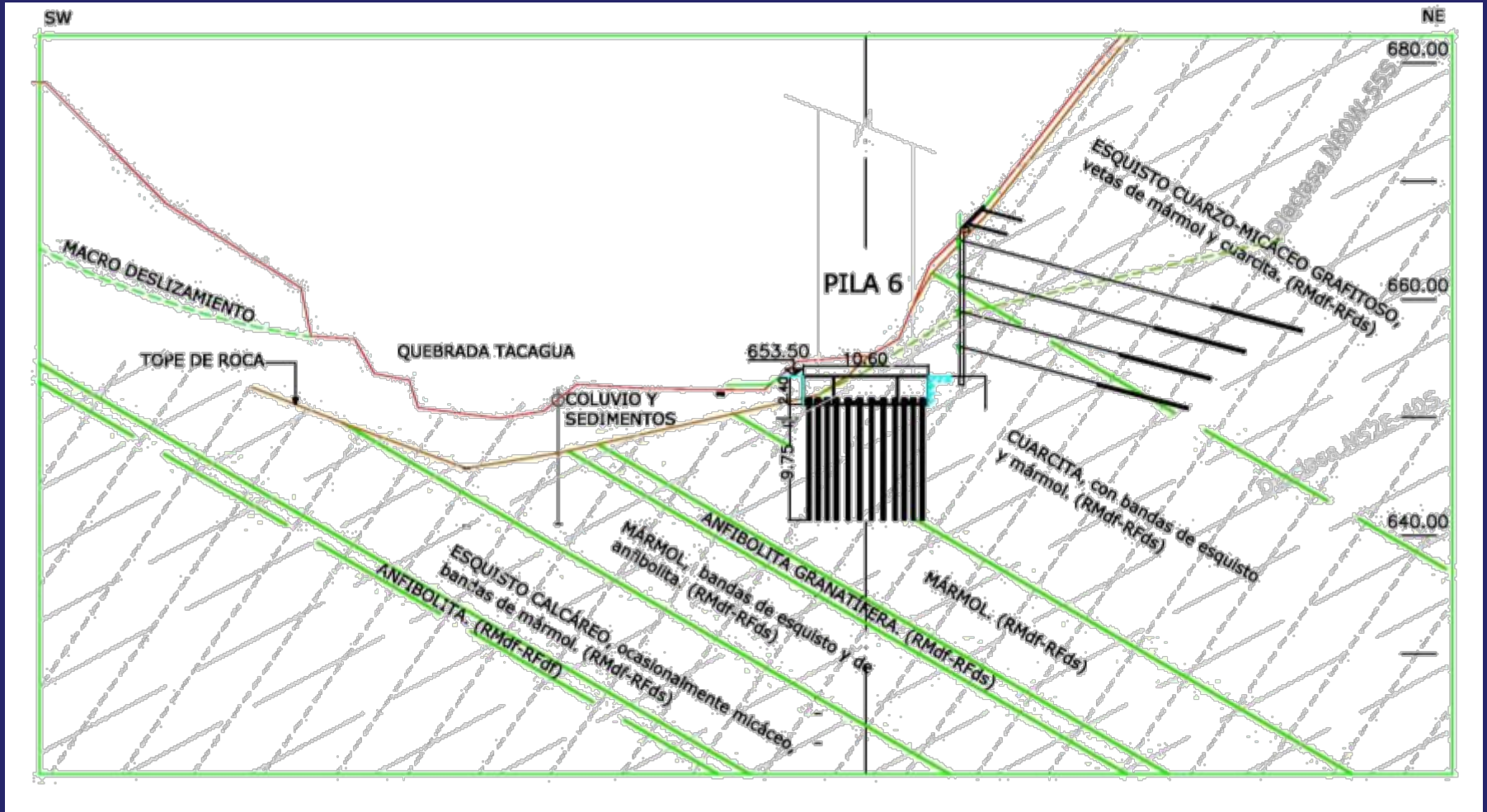


New Viaduct

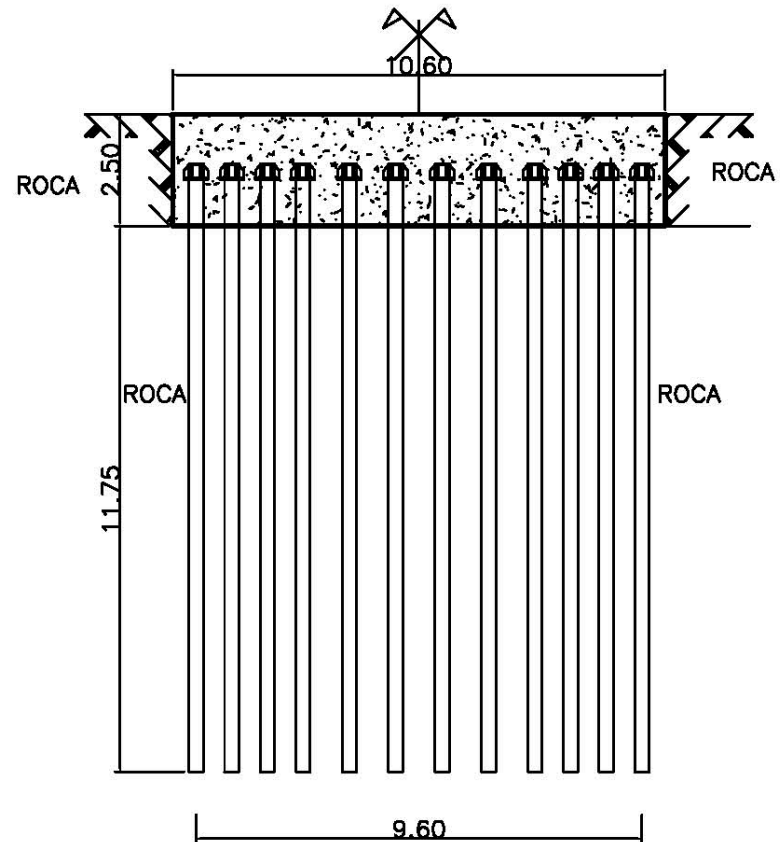
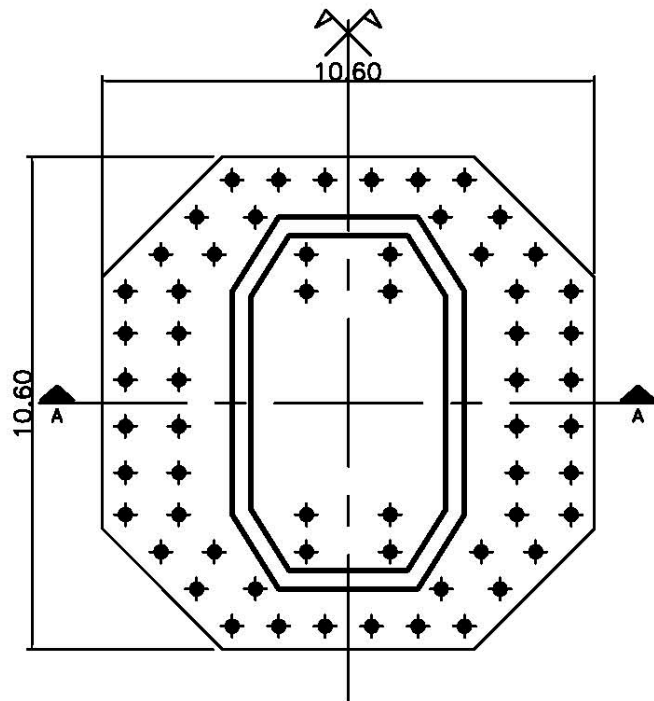




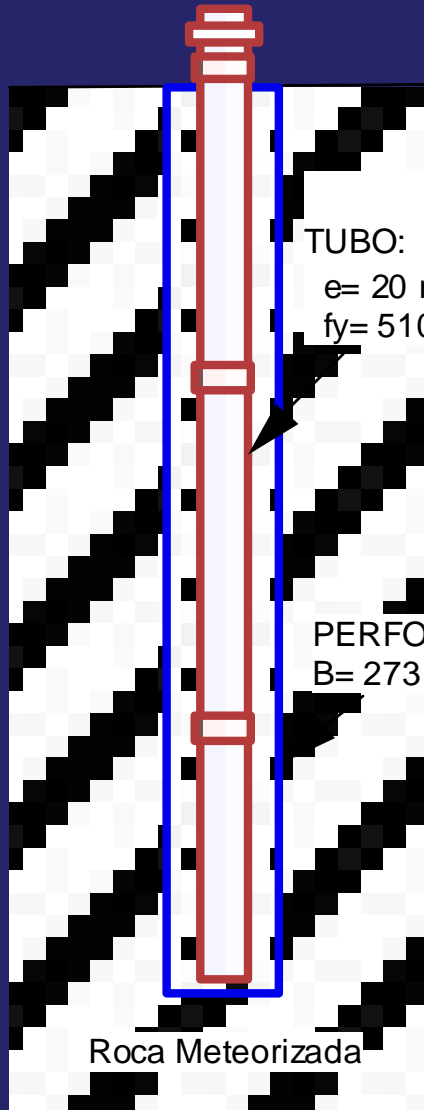
New Viaduct



New Viaduct



Pilaster No 6

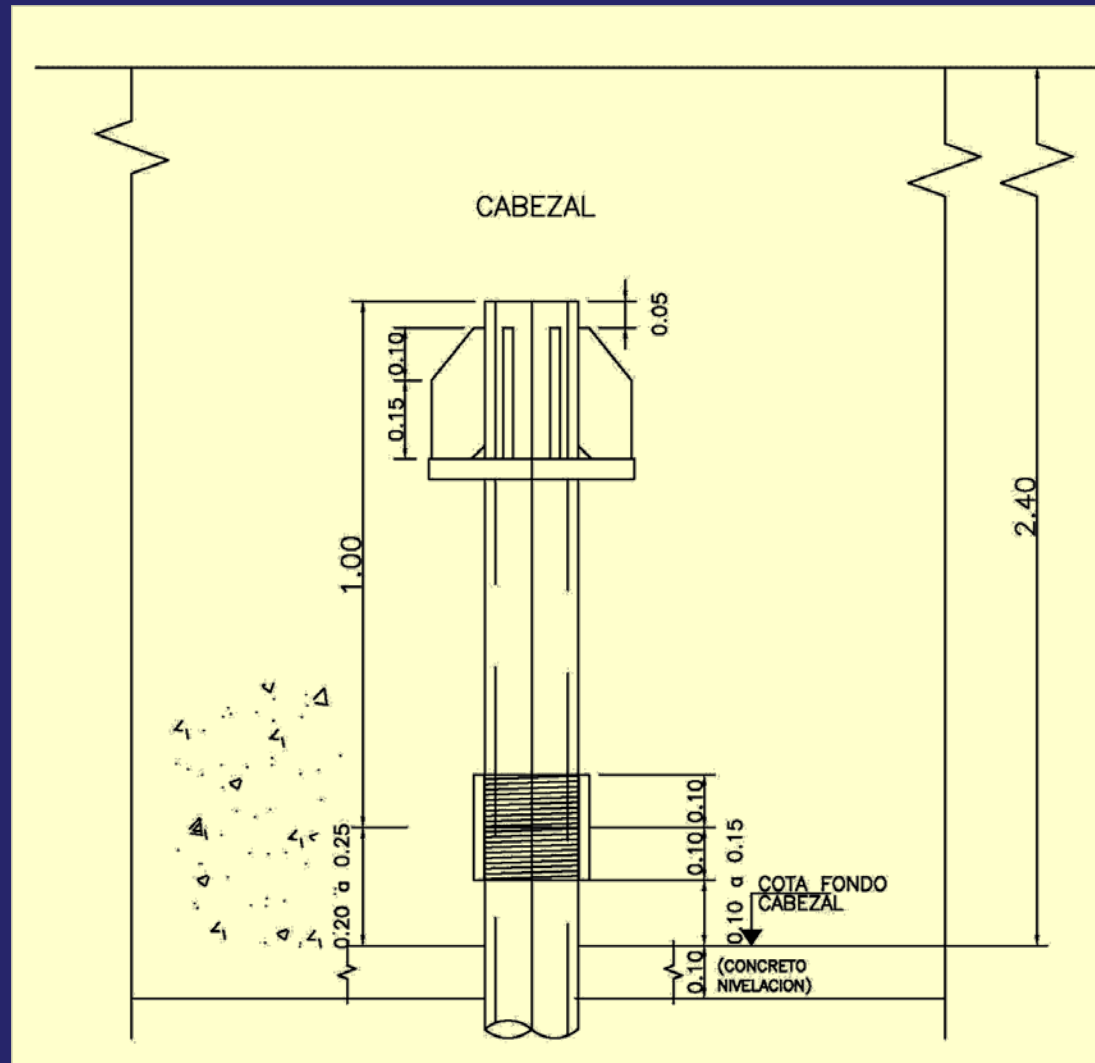


TUBO: $\varphi = 177 \text{ mm (7")}$
e= 20 mm
fy= 5100 Kg/cm²

PERFORACIÓN:
B= 273 mm



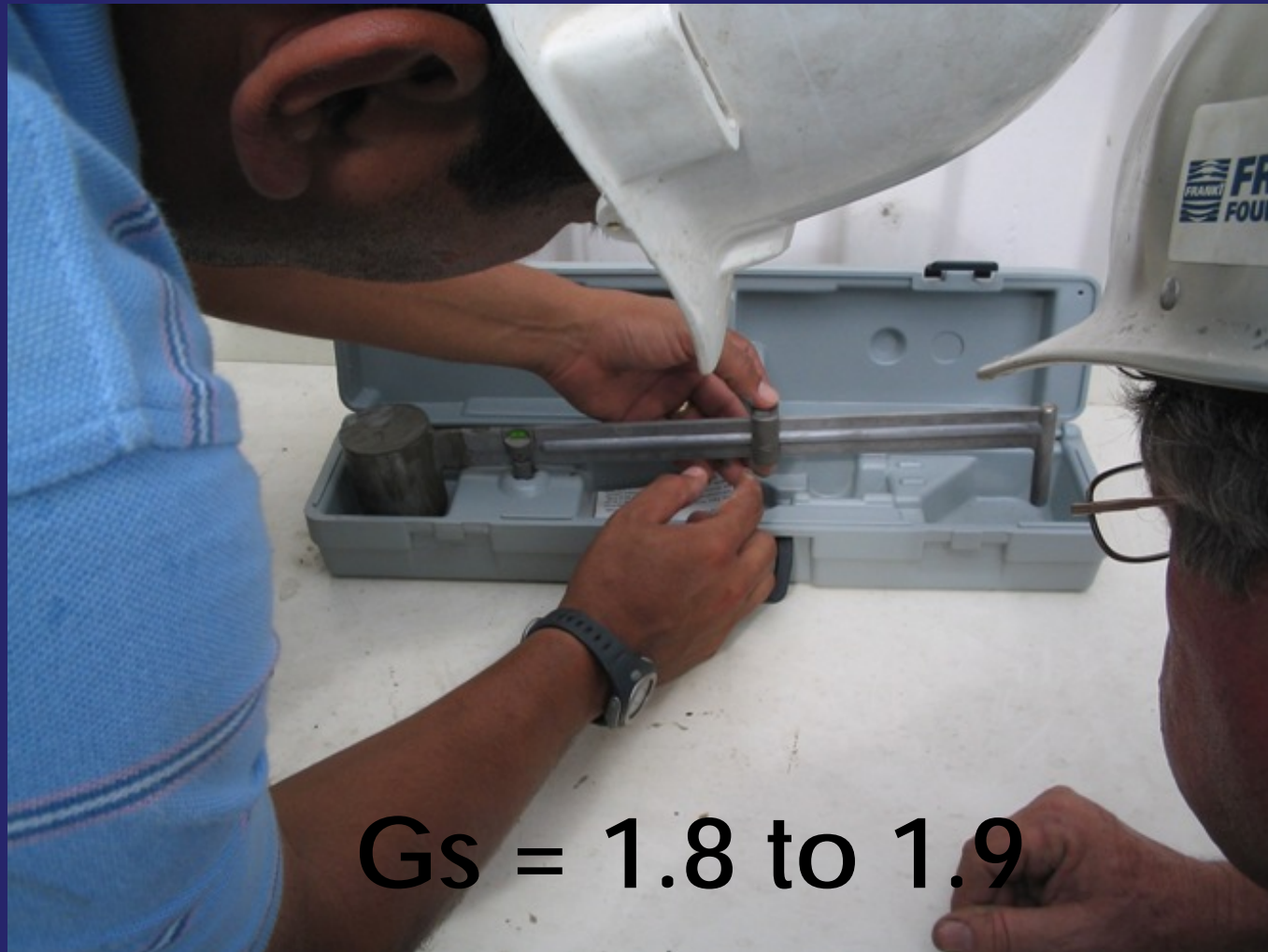
New Viaduct



Pilaster No 6



Grout Quality



$G_s = 1.8 \text{ to } 1.9$

Overall View



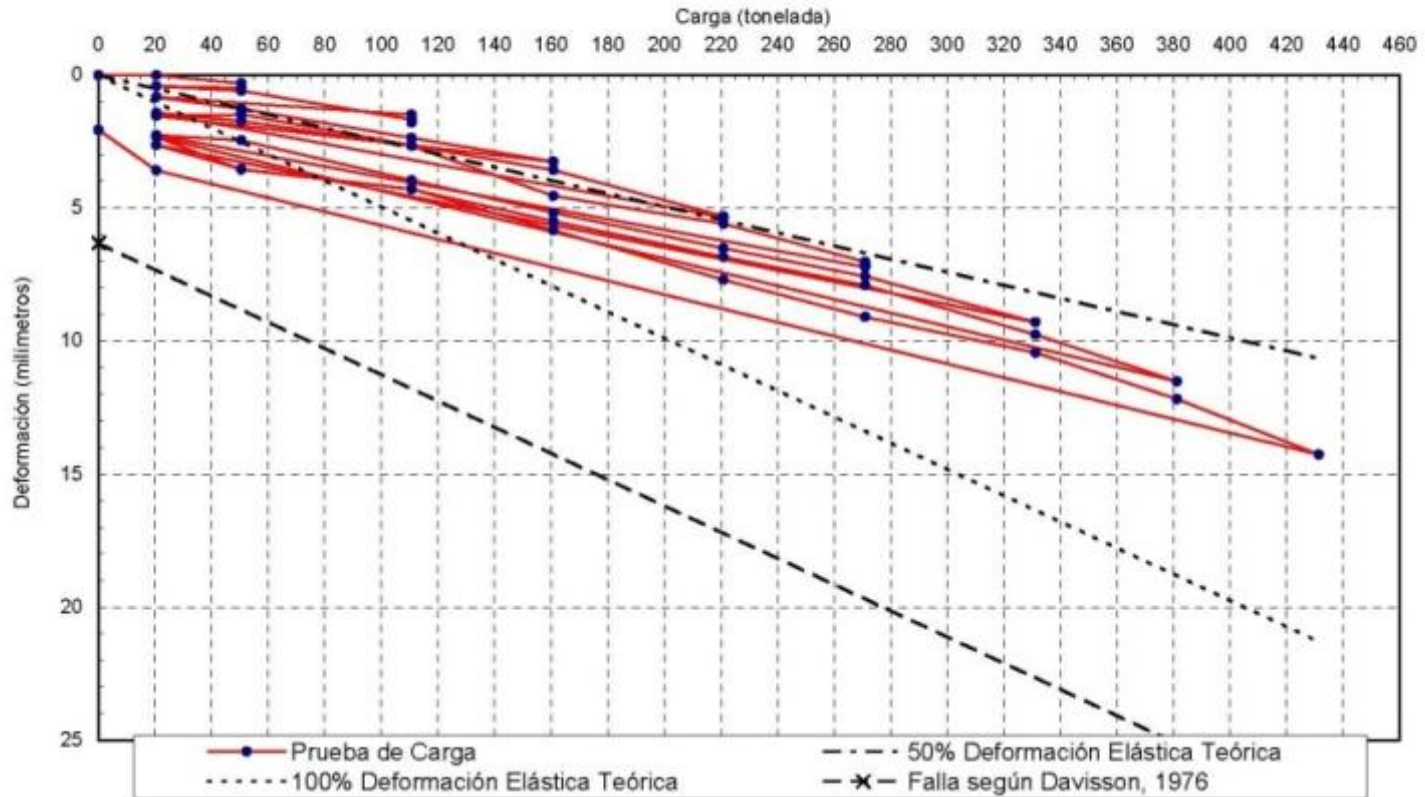
New Viaduct





Load Test Pilaster No 5

PRUEBA DE CARGA A COMPRESIÓN
Viaducto Paralelo Caracas-La Guaira - Prueba P5





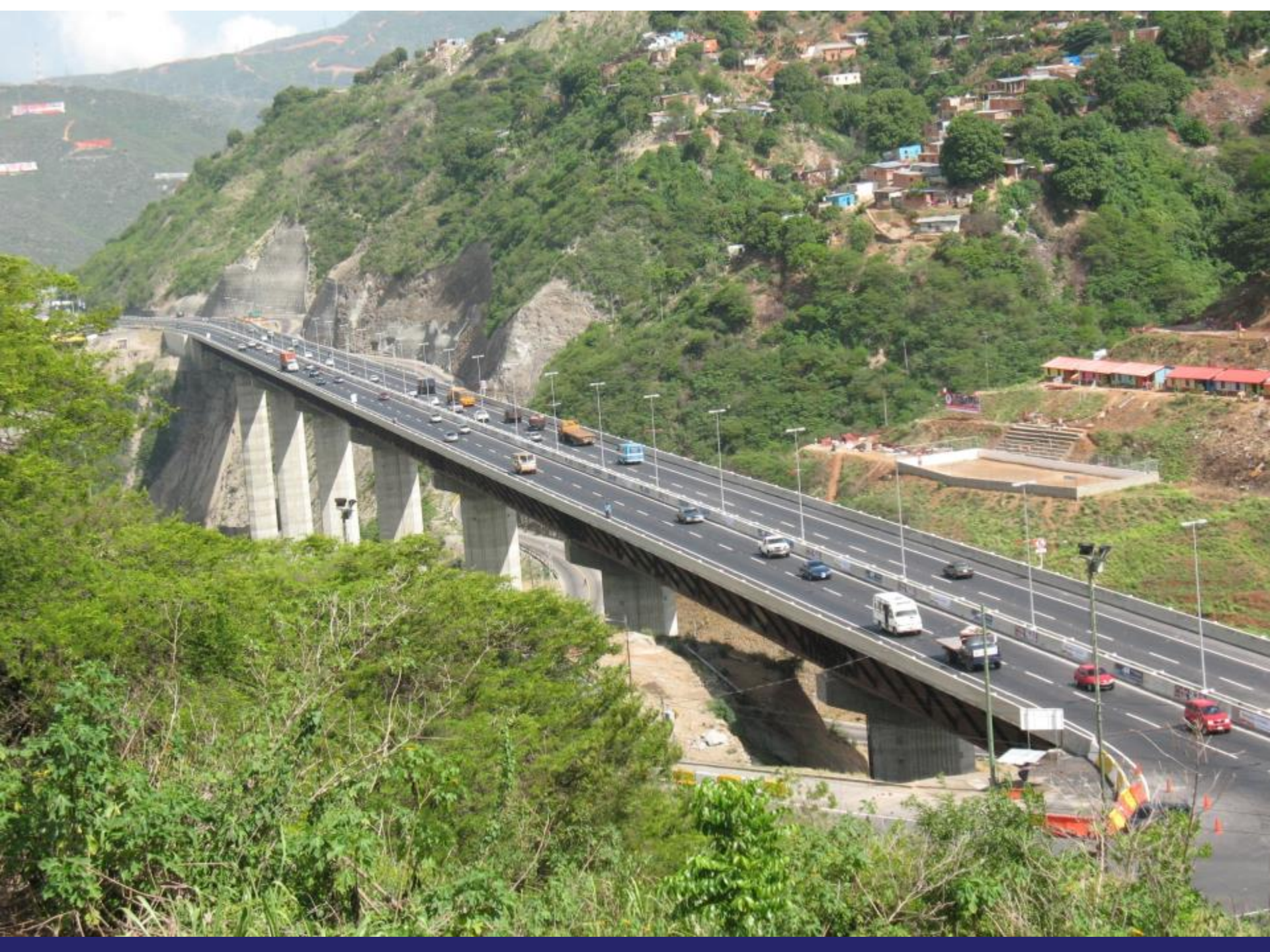


Arq Ricardo Rodríguez Boades



Traffic center





Closure

- Micropiles made possible a solution to a big problem
- Incorporated virtually all elements of geotechnical and structural engineering
- Incorporated the state of the art in micropile technology
- Gave credibility to micropiles in South America and expanded their use in the region