



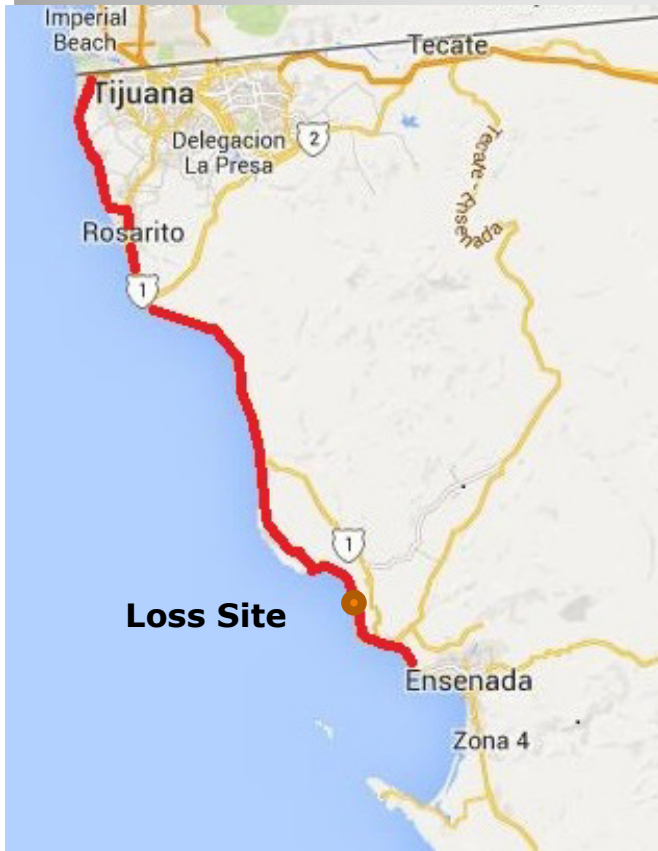
## **Collapse of Section of Motorway Tijuana - Ensenada**

Date of Loss 28th December 2013

# Landslides at Scenic Motorway at Coast of Mexico

## Collapse Road Section Tijuana – Ensenada

Date of Loss 28th December 2013



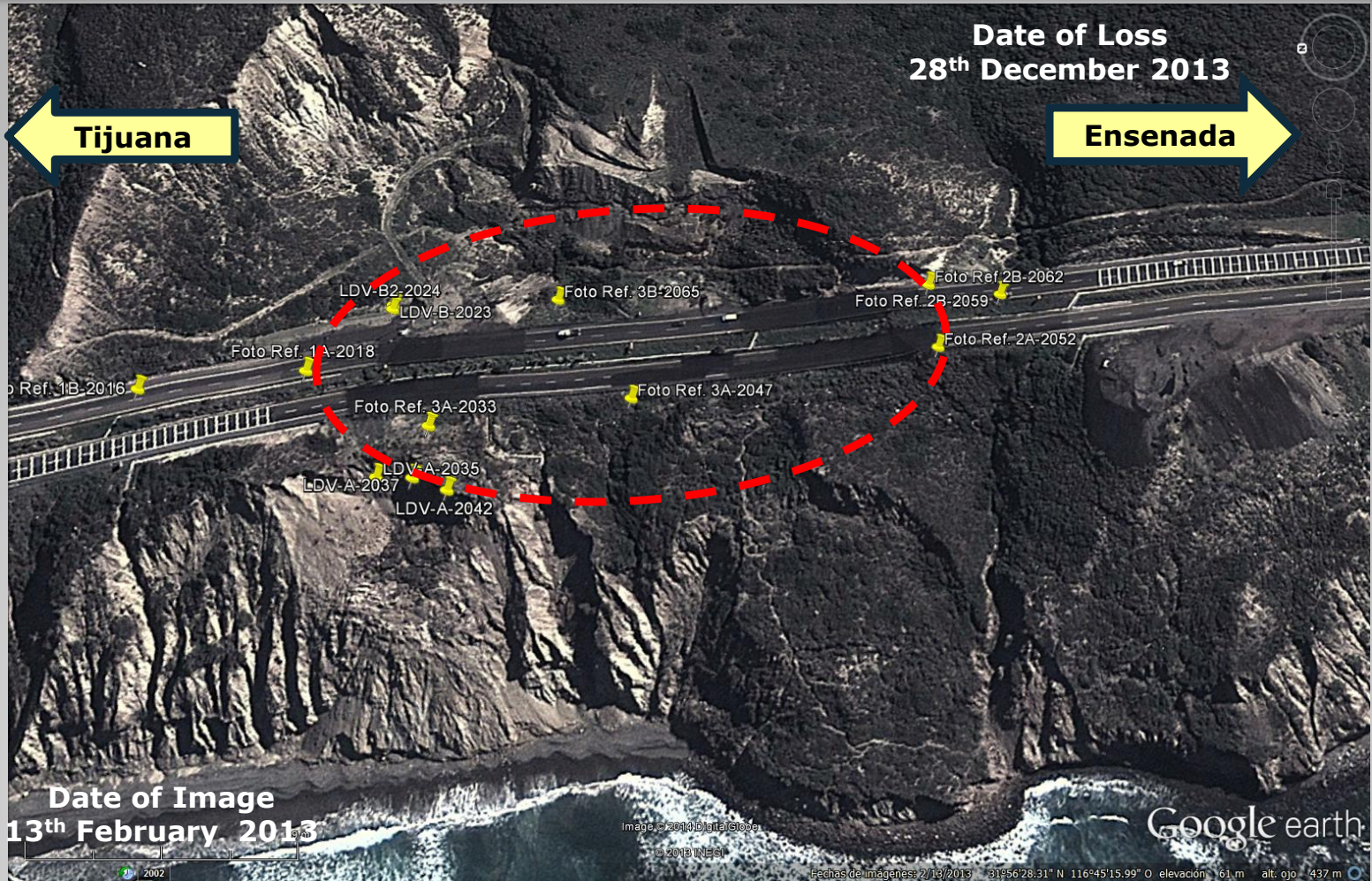
## **Collapse of Section of Motorway Tijuana - Ensenada**

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- Loss of around 300 m motorway at Km 93.00 partly out of the "Right of Way" in about 60m of width.
- Settlement of approximately 30m
- Date of the incident: 28 December 2013 at 2:00 a.m.
- No fatal injuries.
- Insured: BANOBRAS.



## Collapse Road Section Tijuana - Ensenada





## Collapse Road Section Tijuana - Ensenada

Source Internet

Date of image: not know



## Collapse Road Section Tijuana - Ensenada

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### POLICY

#### Sum Insured

Total Declared Value (nationwide):	MXP 83,002'819,015 (aprox USD 6.334.832.231)
Value of section Tijuana – Ensenada:	MXP 2,156'264,012 (aprox USD 165.866.461)

#### Maximum Limit of Responsibility

At First Risk:	MXP 900'000,000 per event and in the annual aggregate (aprox USD 69.230.769)
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#### Sub-limits per event:

Removal of Debris and Extraordinary Expenses.	MXP 90'000,000 per event (aprox USD 9.923.076)
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#### Deductible:

	MXP 5'000,000 for sudden subsidence of ground, landslide... (aprox USD 384.615)
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## Collapse Road Section Tijuana - Ensenada

31° 56' 28.41" N  
116° 45' 11.43" W





## Collapse Road Section Tijuana - Ensenada

31° 56' 30.19" N  
116° 45' 15.04" W

**MOTORWAY**  
**Body A**

**ROW**





## Collapse Road Section Tijuana - Ensenada

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POLICY: TJ2000220100

- ***“11.-CONDITIONS AND CLAUSES”.***

2. **New Replacement Value.**

For the effects of this Policy, it is established that losses should be indemnified to BANOBRAS, S.N.C., INSTITUCIÓN FIDUCIARIA, EN EL FIDEICOMISO NÚMERO 1936, “FONDO NACIONAL DE INFRAESTRUCTURA” at new replacement value without exceeding the stipulated maximum limit of responsibility.

Understood as the new replacement value is the new amount of money necessary at the time of the loss for the replacement of the affected item for a new item of the same type, size, characteristics and capacity, not considering any reduction at all for its physical depreciation, by way of the reconstruction, repair and in the case of construction or installation, including all the material, labour, transport of material, freight, cost of financing and customs duties, if applicable, until it is rendered fit for use, considering that the replaced items must comply with the in force standards of the “Secretaria de Comunicaciones y Transportes (S.C.T.)” (Transport and Communications Secretary).

## Collapse Road Section Tijuana - Ensenada

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POLICY: TJ2000220100

- ***“14.-ADDITIONAL OBSERVATIONS FOR THE ADJUSTMENT OF LOSSES”***
  1. **The Adjuster may not at any time request the Insured to provide the original project designs, the constructive drawings, classification reports issued by the SCT, geo-technical reports and on-site physical surveys used in the design and construction of the motorways and structures, for the adjustment of losses, given that the entire completed civil works complies with the standards in force at the time of its construction.**

Underlined: Miller

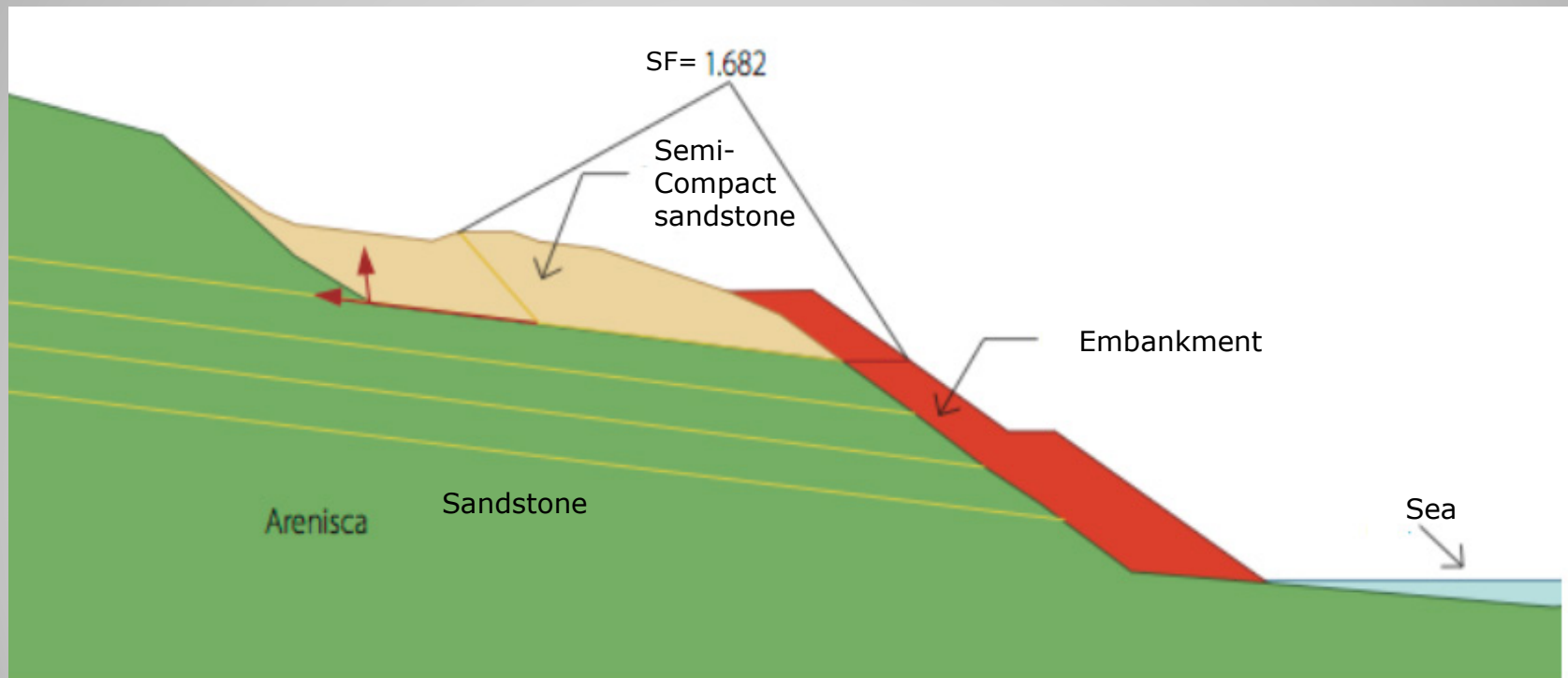


## Collapse of Section of Motorway Tijuana - Ensenada

### Methods to Increase Stability

- Retaining Walls
- Gabions

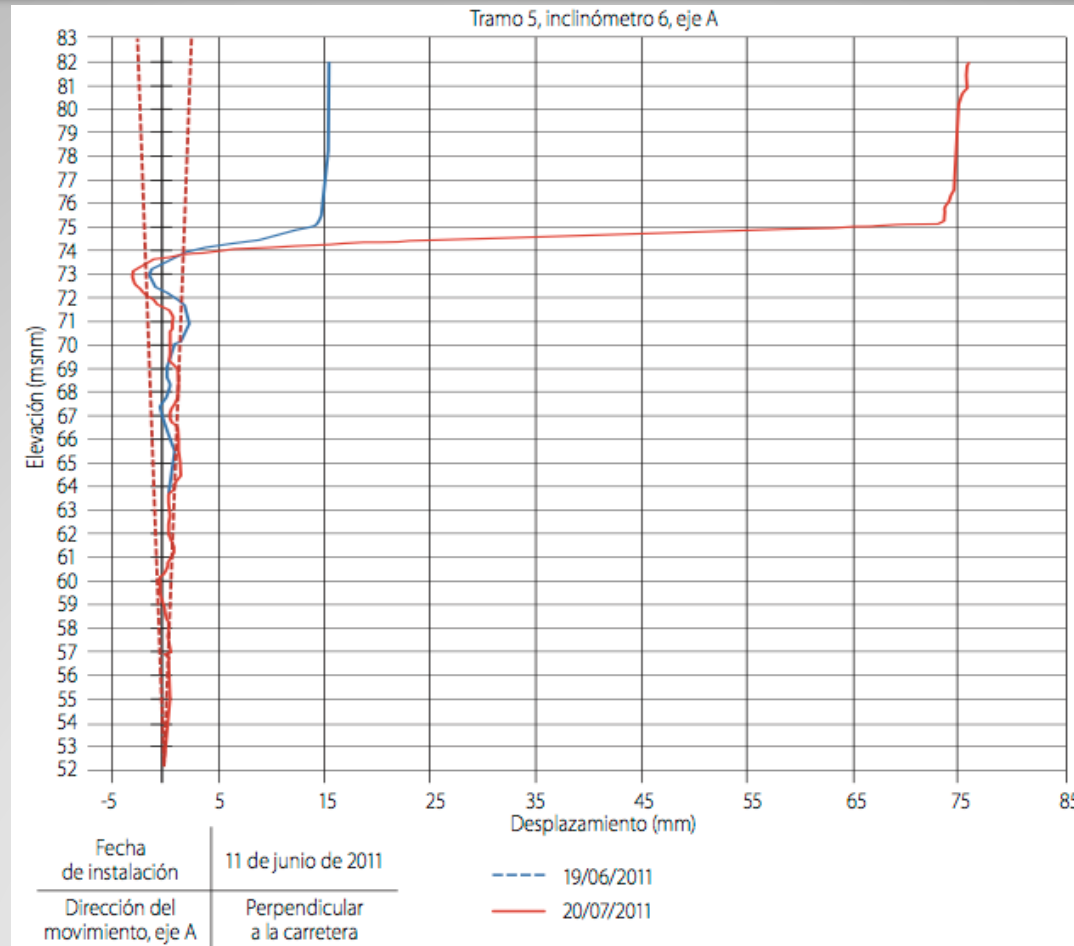
All these are not long lasting because of lack of bearing capacity of underlying soil stratas.





## Collapse of Section of Motorway Tijuana - Ensenada

- Installation of inclinometers at that place some years ago (2012).
- Special problems at the site of the incidence Km 93,00
- Show of stability problems.



**Record of displacements registered with the inclinometer installed in the unstable zone**



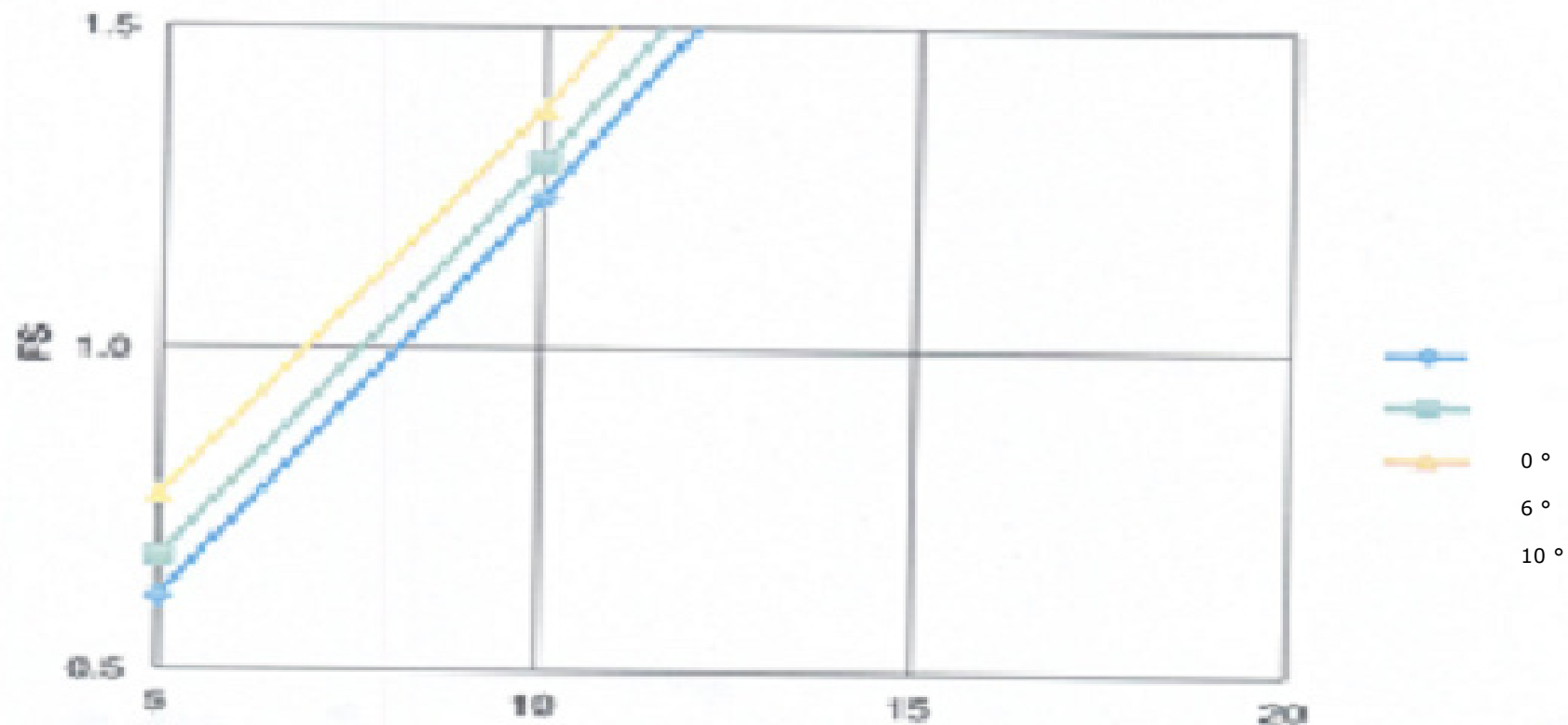


## Collapse of Section of Motorway Tijuana - Ensenada

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### Analysis of Stability

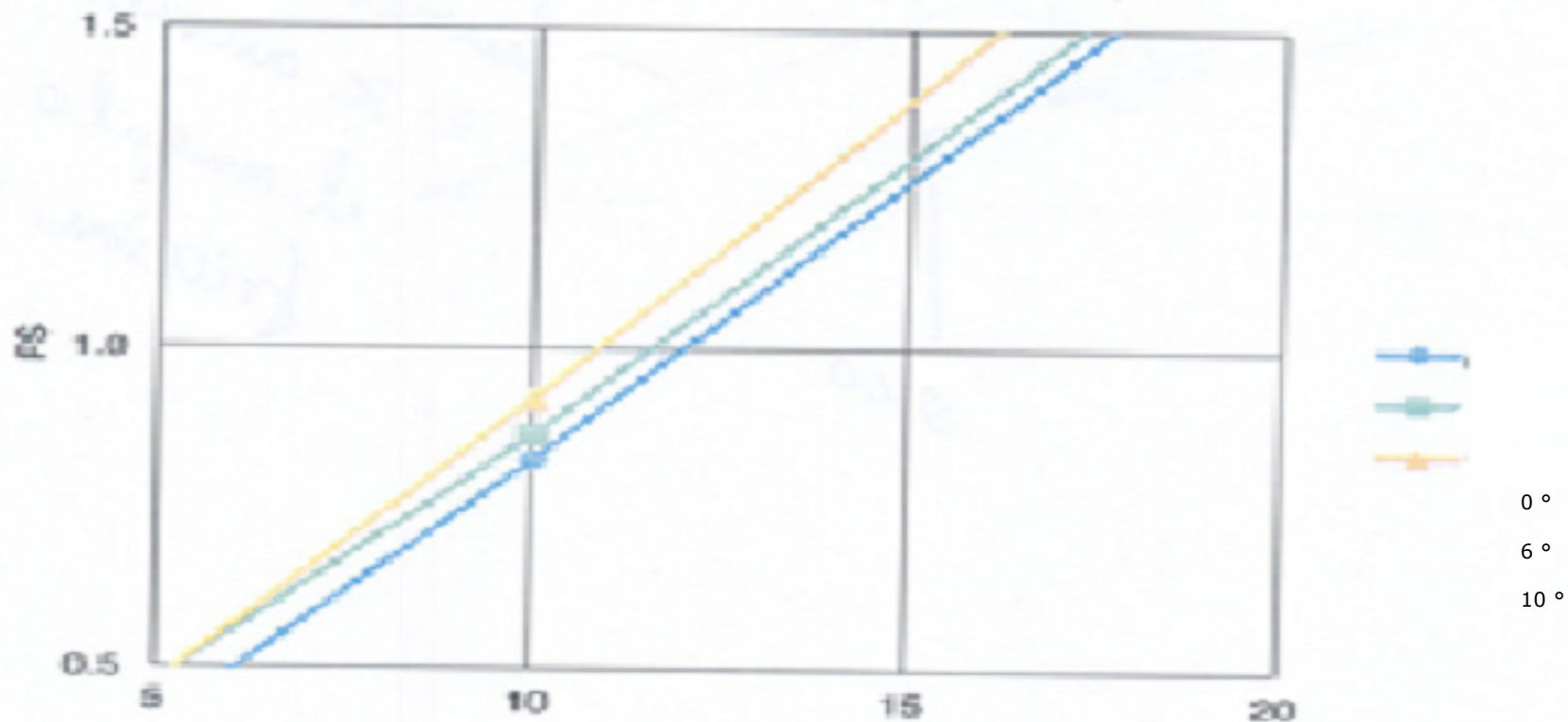
- Topographical measurements of slipped earth mass.
- The earth mass was then defined as prismatic.
- Probe borings showed coincidence with a shale strata underlying, with approximately  $10^\circ$  decent to sea.
- Experimental definition of the cohesion coefficient (angle of internal friction) for a security factor of  $SF = 1$ , which means equilibrium.
- Drafting of diagrams for different characteristics of the slipped soil block (composition of materials, inclination of fault).
- Considering of humidity of soil mass slide.
- The graphs were made for different declines of the possible fault ( $0^\circ / 6^\circ/10^\circ$ ) and with different humidity factors.



Angle of friction (degrees)

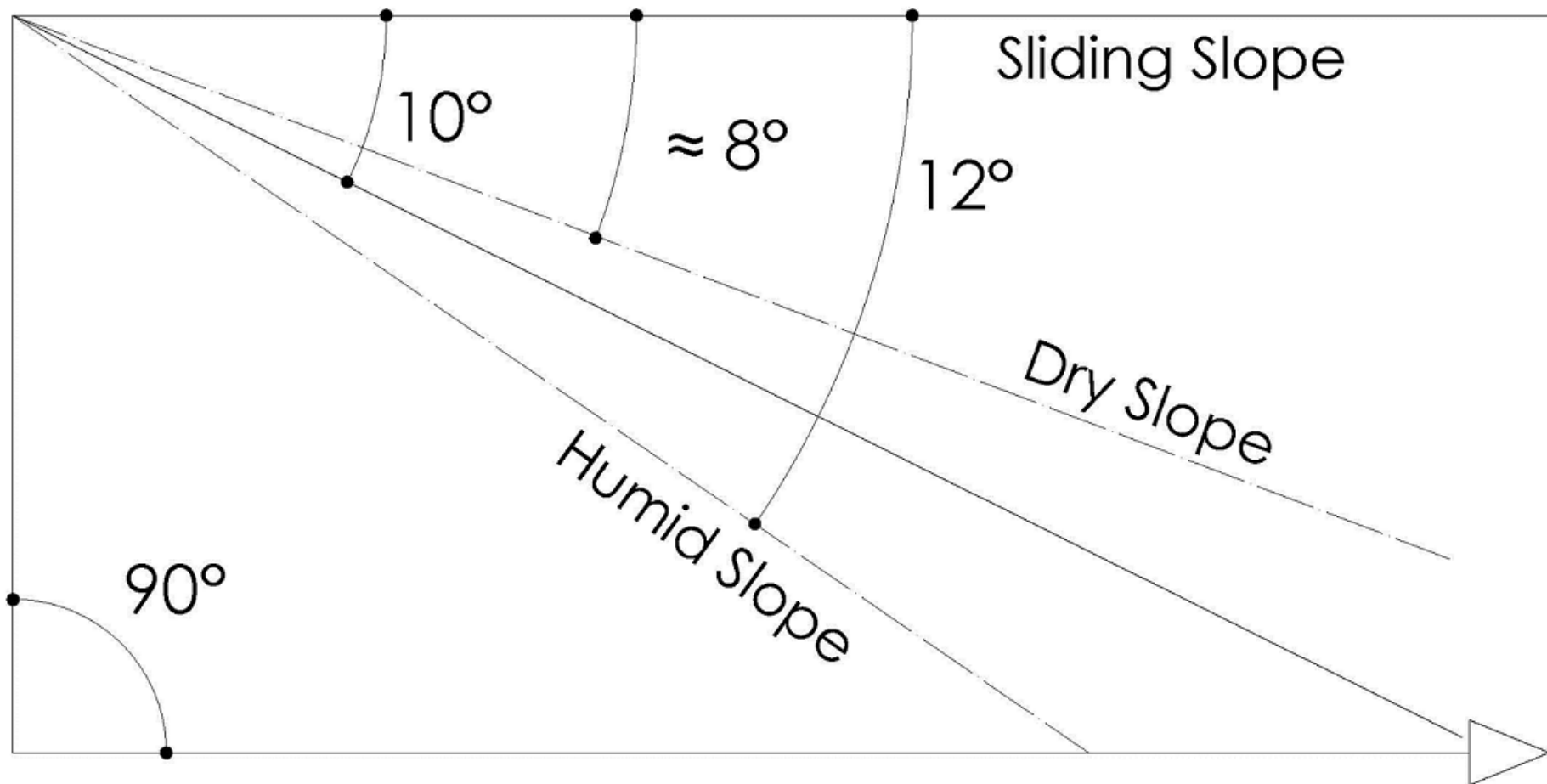
Figure: Relation between angle of friction of slope deposit and safety factor with respect to dry slope





Angle of friction (degrees)

Figure: Relation between angle of friction of slope deposit and safety factor with respect to level of humidity



Geological Model



## **Collapse of Section of Motorway Tijuana - Ensenada**

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### **Cause: GEOLOGY – CLIMATE - SEISMICS**

- Alongside the coast and in parts of Baja California peninsula, geological faults in NNE direction prevail.
- Those faults are causing shearing effects together with certain transversal movements.
- Contributing effect through rainfall – approximately 450 mm/yr in 50 year recurrence period, mainly from Nov-Feb. 24 hr peaks up to 100 mm.
- Geological strata from up to down (down = seaside).
  - Flow zone of lava, andesite and basalts.
  - Sediment rock, shale (clay), sandstone and conglomerates
  - Concentration of eroded material from the coastal slope and seabed rocks.
- Earthquake: low activity, but in 2013 there were two, on 10-12-13 and on 19-12-13, around 5.2 (Richter), contributing effect epicenter: Bahía de Salsipuedes, close to the loss event.



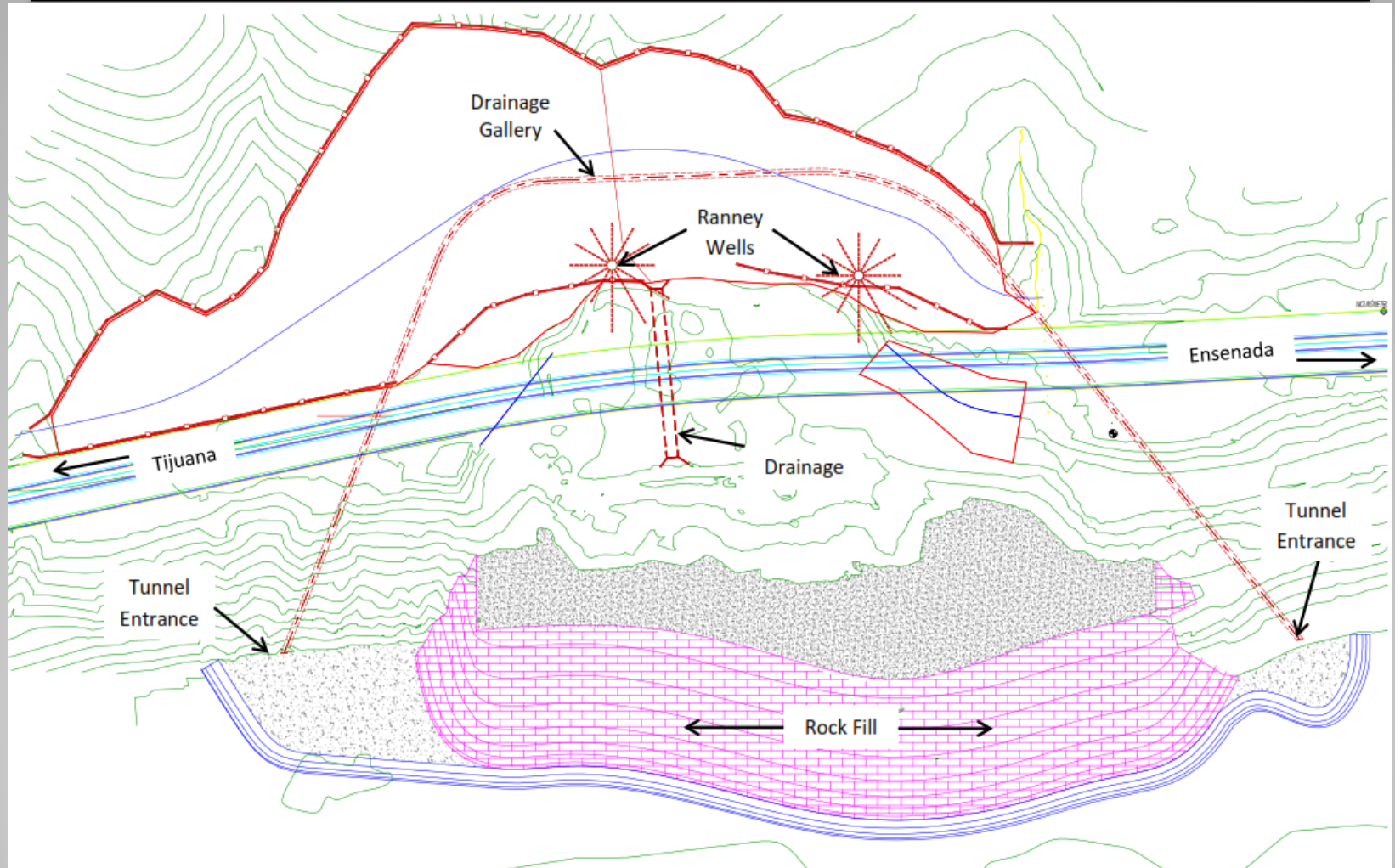
## **Collapse of Section of Motorway Tijuana - Ensenada**

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### **Conclusions on Cause:**

- Water bodies close.
- Faults with filtering water.
- Characteristics of soil (angle of internal friction) and low shearing resistance.
- Loads (rock fill, retaining walls etc.), deemed to stabilize increased only the movements of soil (creeping).

## Collapse Road Section Tijuana - Ensenada



## Collapse Road Section Tijuana - Ensenada

31° 56' 25.28" N  
116° 45' 14.20" W





## Collapse Road Section Tijuana - Ensenada

**Repairs Underway**

31° 56' 31.44" N  
116° 45' 12.42" W

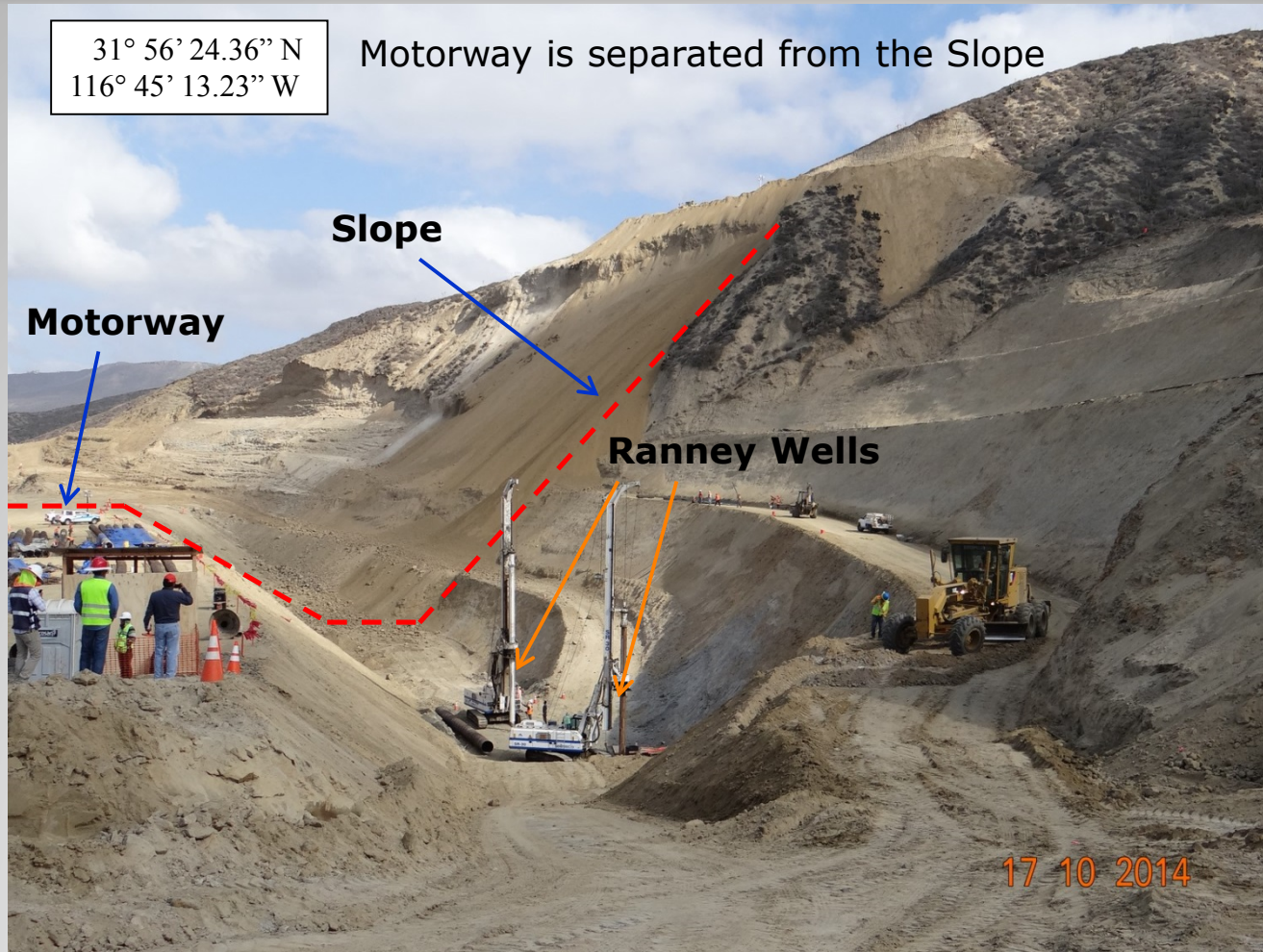
Landslide



## Collapse Road Section Tijuana - Ensenada

31° 56' 24.36" N  
116° 45' 13.23" W

Motorway is separated from the Slope

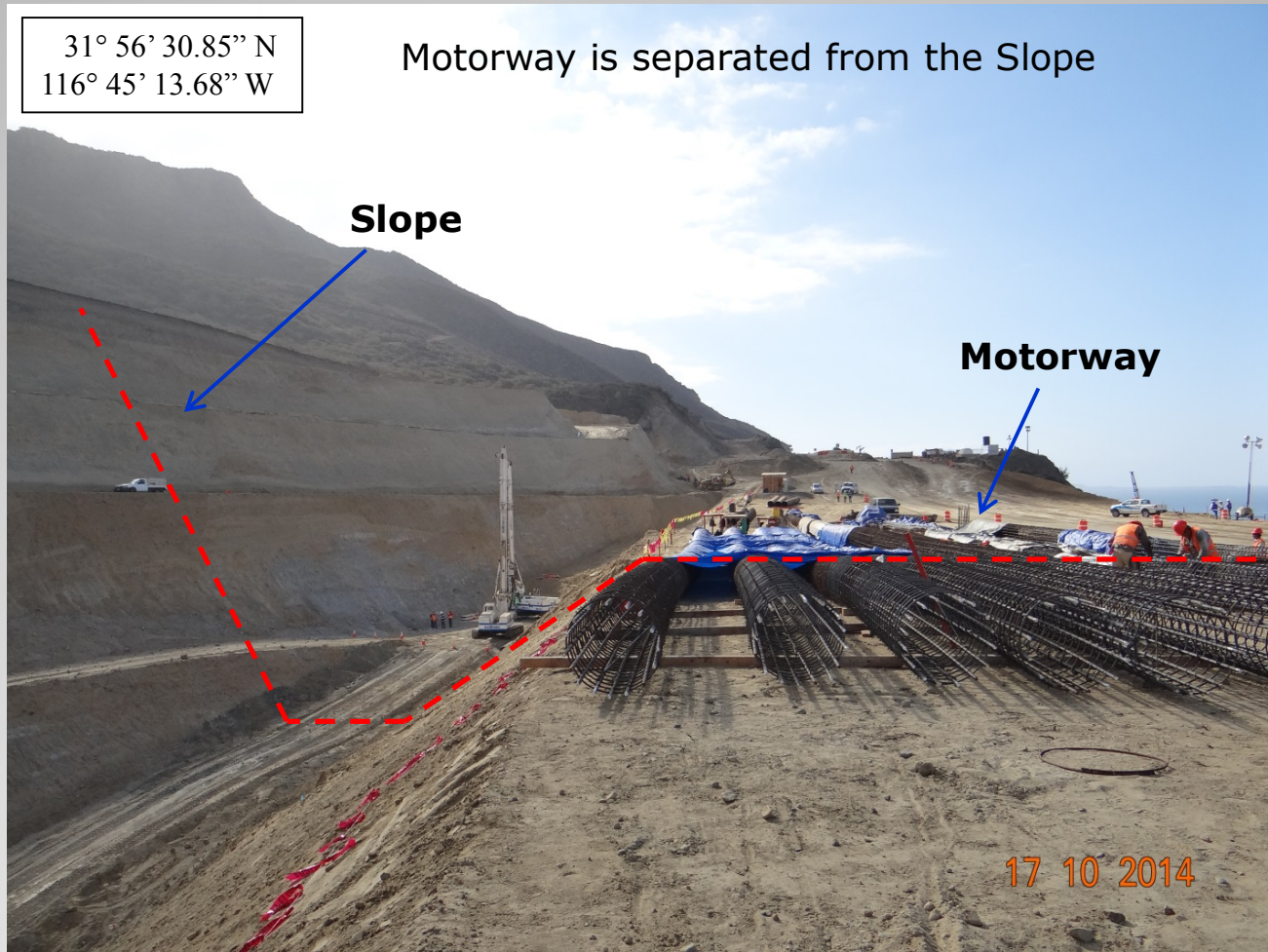




## Collapse Road Section Tijuana - Ensenada

31° 56' 30.85" N  
116° 45' 13.68" W

Motorway is separated from the Slope



17 10 2014



## Collapse Road Section Tijuana - Ensenada

31° 56' 19.20" N  
116° 45' 19.78" W

**Tunnel Entrance**



17 10 2014



## Collapse Road Section Tijuana - Ensenada

31° 56' 29.47" N  
116° 45' 16.47" W

### New Drainage Work





## Collapse Road Section Tijuana - Ensenada

### Original Drainage Work



09 01 2014





## Collapse Road Section Tijuana - Ensenada

Contractor & Concept	Claimed Amount (MXP)	Claimed Amount (USD)	Adjusted Amount (MXP)	Adjusted Amount (USD)
MAKRO (Construction)	819.621.609,02	47.912.875,75	99.414.510,57	5.811.505,02
ALDESEM (Debris Removal)	38.779.625,90	2.266.952,67	33.945.232,11	1.984.347,01
PACCSA (Supervision)	40.221.787,79	2.351.257,58	6.250.465,82	365.385,43
TGC GEOTECNICA (Studies)	38.962.625,90	2.277.650,36	15.585.050,36	911.060,14
	<b>937.585.648,61</b>	<b>54.808.736,36</b>	155.195.258,86	<b>9.072.297,60</b>
		Deductible :	5.000.000,00	292.286,56
		<b>LOSS ADJUSTMENT :</b>	<u>150.195.258,86</u>	<b>8.780.011,04</b>

**Thank you for your attention!**

## Miller International Latinoamerica

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- Brasil
- Venezuela

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- Puerto Rico
- Colombia
- Ecuador
- Perú
- Chile
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