



COMISIÓN FEDERAL
DE ELECTRICIDAD



Hurricane Odile

La Paz - Los Cabos, BCS

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2015 PLS-CADD Advanced Training
and user group meeting

Monona Terrace Convention Center,
Madison, WI June 2-4, 2015

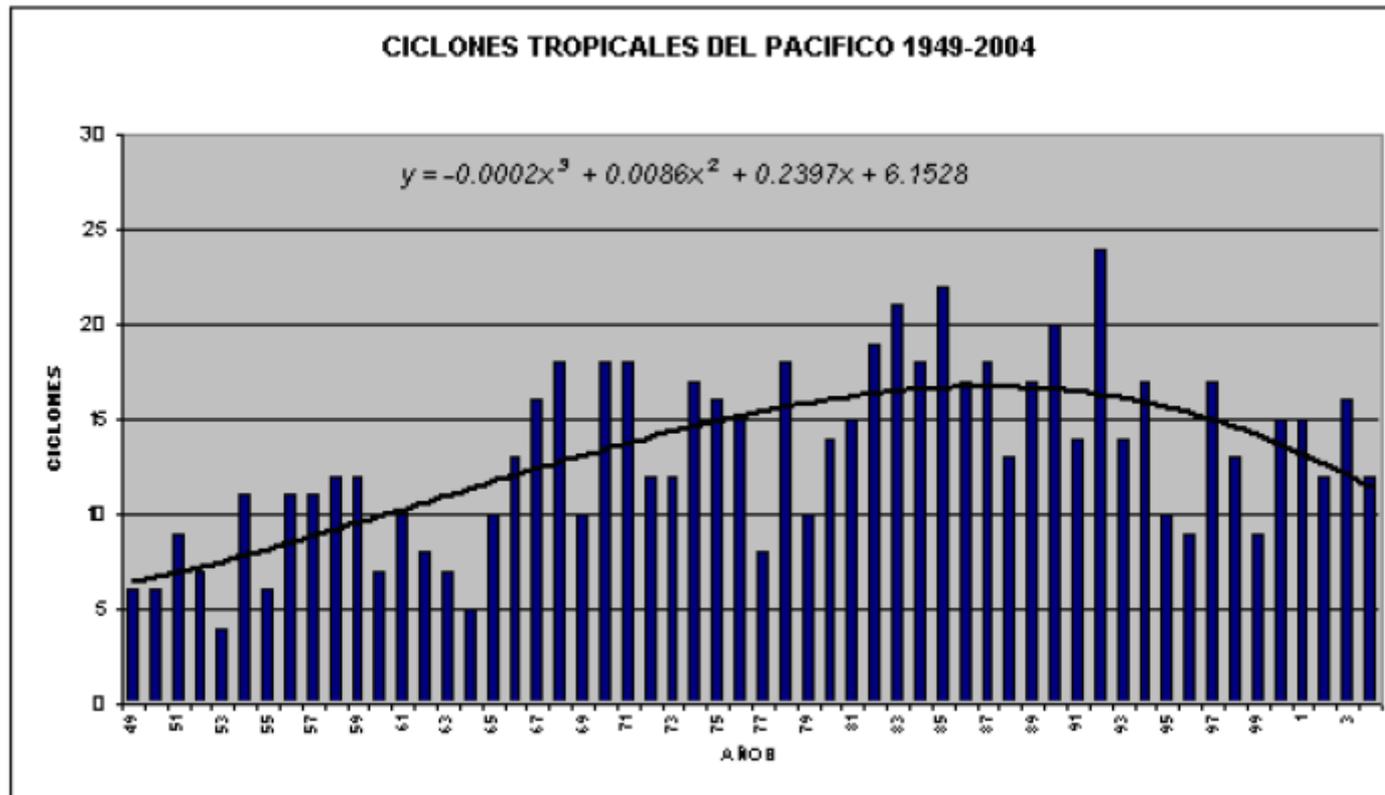
- 1.- BACKGROUND
- 2.- STRUCTURES LOCATION
- 3.- THE IMPORTANCE OF PLS-CADD
- 4.- ACTIVITY REPORTS
- 5.- PHOTOGRAPHIC REPORT.
- 6.- ACTUALMENTE

1.- Background



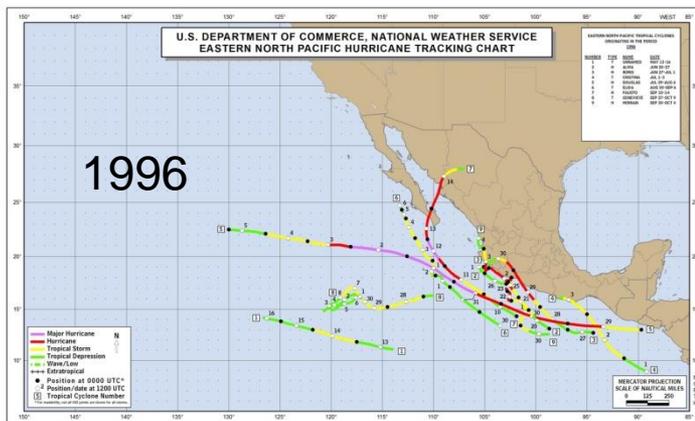
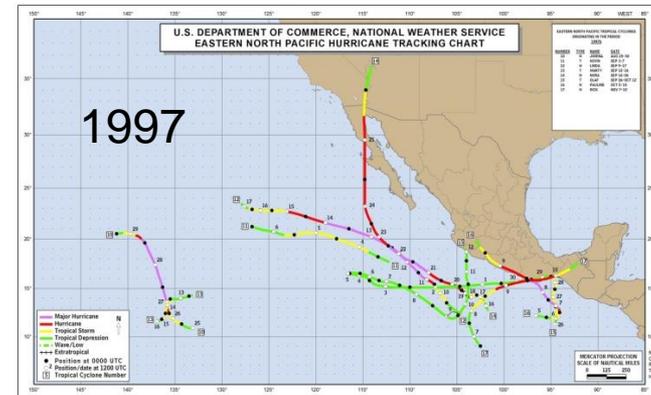
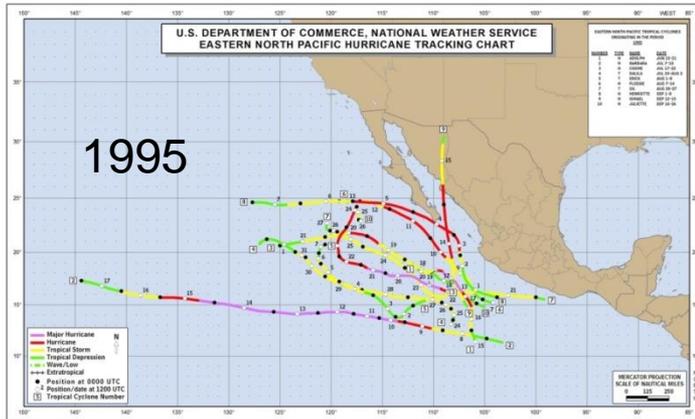
1.- Background

Incidence of hurricanes in the Pacific Ocean in the period 1949 – 2004



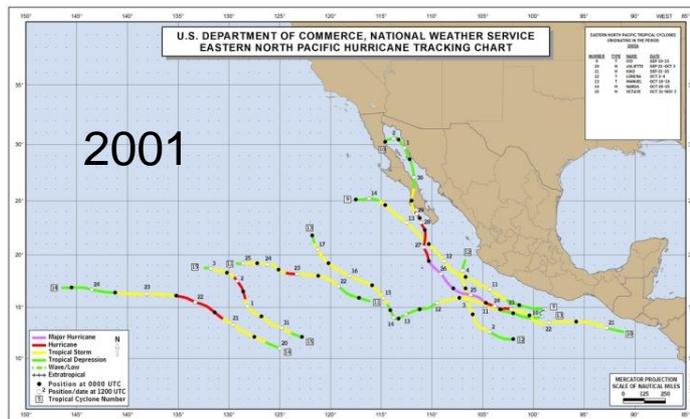
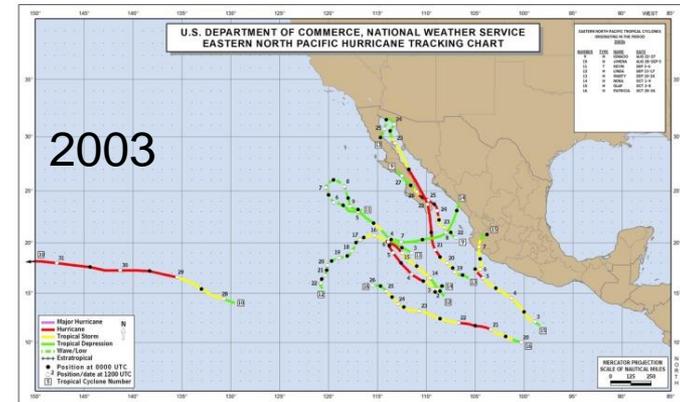
Fuente: www.cna.gob.mx

Hurricanes that hit Baja California Sur in the last 20 years

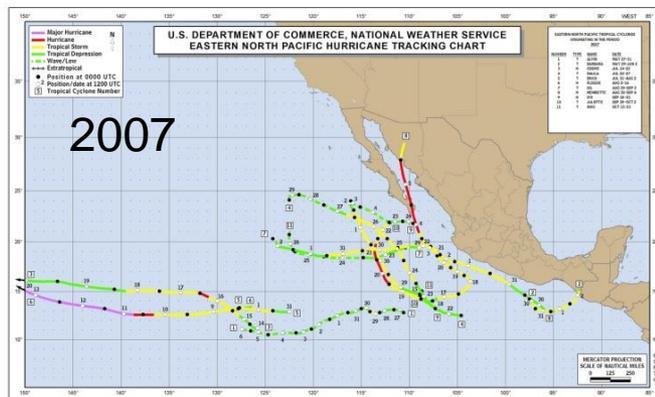
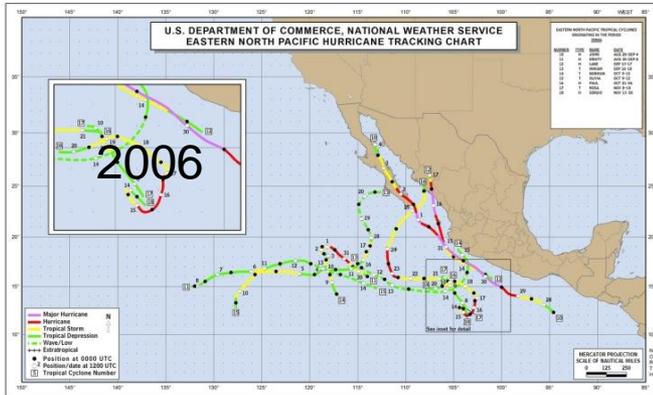


Fuente: www.cna.gob.mx

Hurricanes that hit Baja California Sur in the last 20 years



Hurricanes that hit Baja California Sur in the last 20 years



Fuente: www.cna.gob.mx

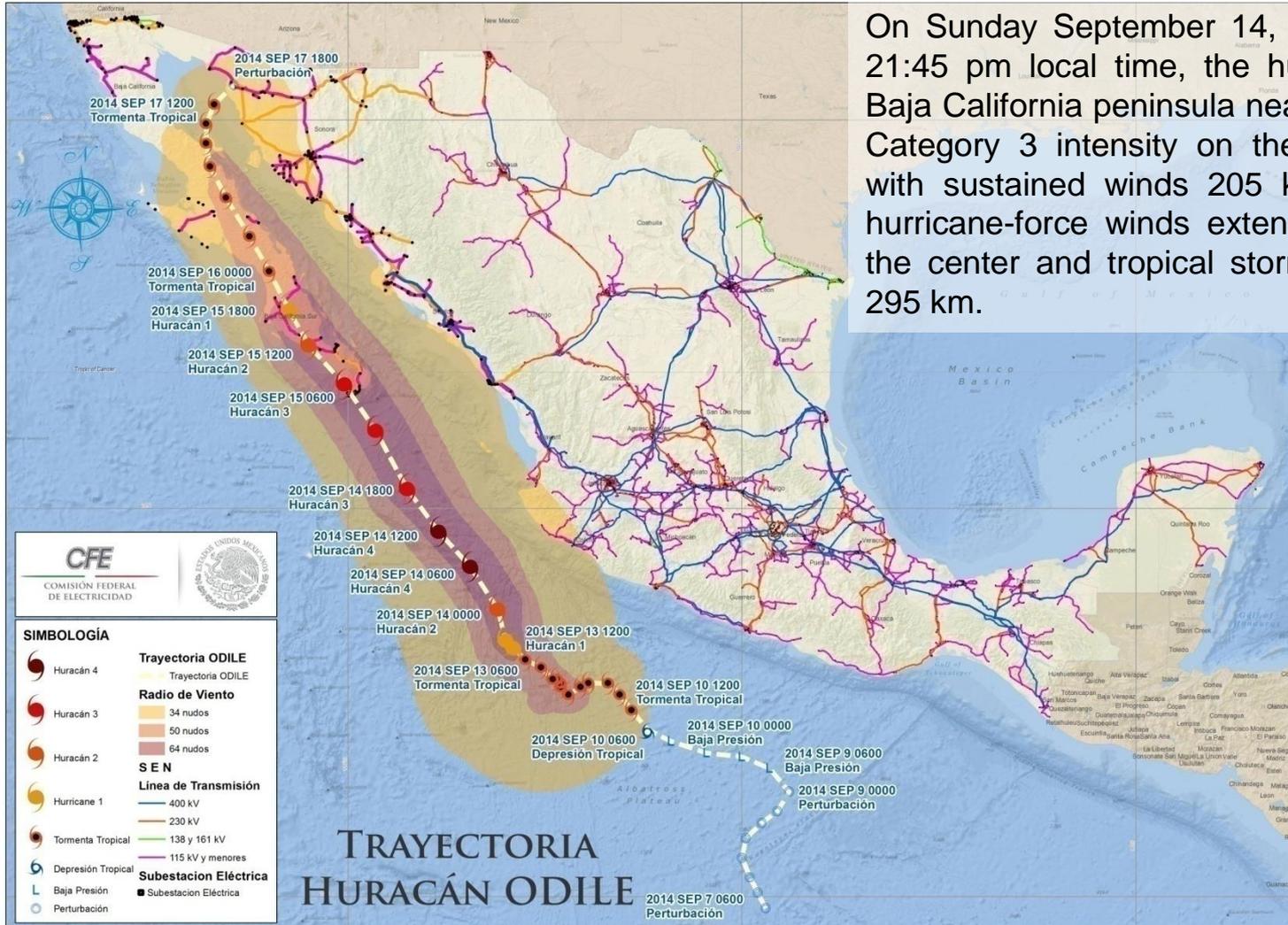
1.- Background

On September 7th 2014, was detected through the System of Early Response to Impacts of Hurricanes (SIRETIH), the formation of an atmospheric disturbance with potential to become the fifteenth tropical cyclone in eastern Pacific waters about 785 km south of Acapulco in Guerrero state, on September 10th was formed as a tropical depression "Odile" 415 km south of Port of Lazaro Cardenas, Michoacan with a parallel shift to the west coast of Mexico, becoming a Category 1 hurricane off the coast of Manzanillo, Colima on 13th September. During the September 14th he maintained its direction towards the Baja California Peninsula, registering a maximum intensity of 4 hurricane with winds up to 222 km / hr.

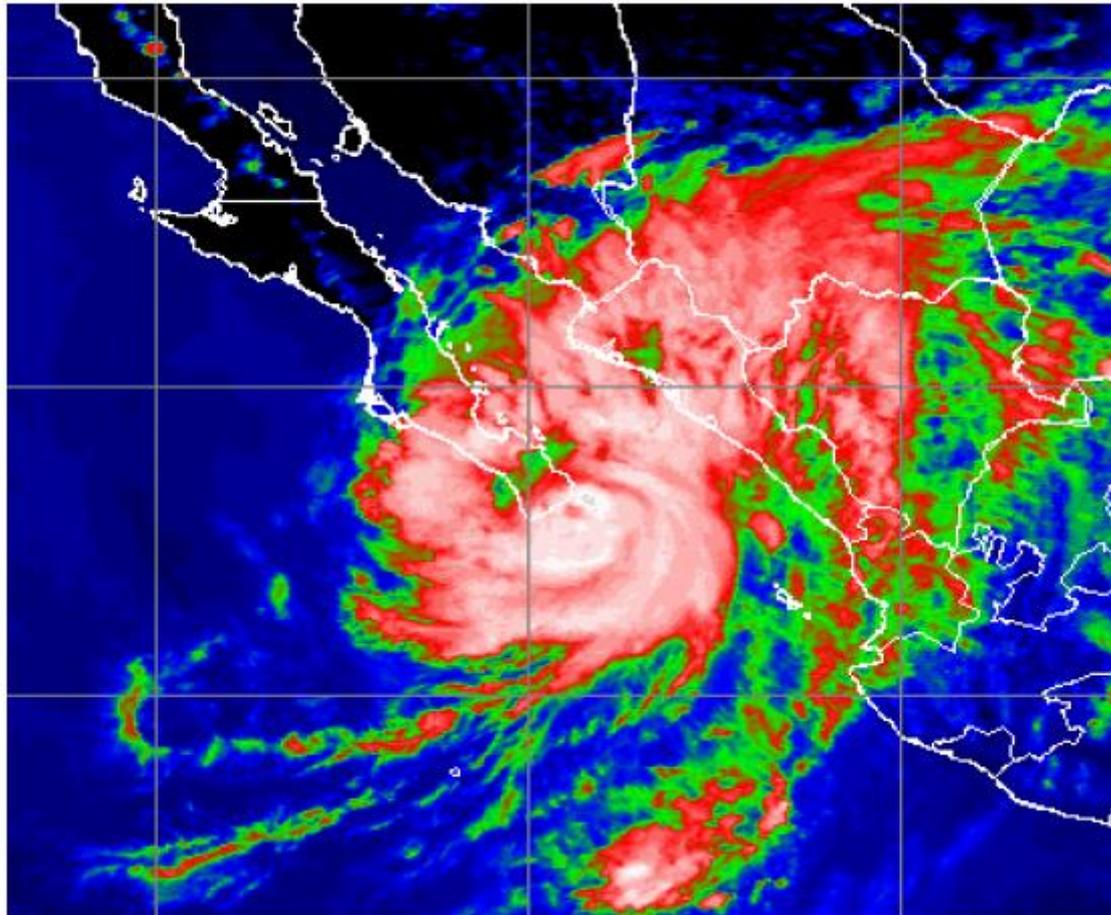


1.- Background

On Sunday September 14, 2014, at approximately 21:45 pm local time, the hurricane "Odile" hit the Baja California peninsula near Cabo San Lucas with Category 3 intensity on the Saffir-Simpson scale, with sustained winds 205 km / hr. The radius of hurricane-force winds extended up to 85 km from the center and tropical storm force winds reached 295 km.



1.- Background



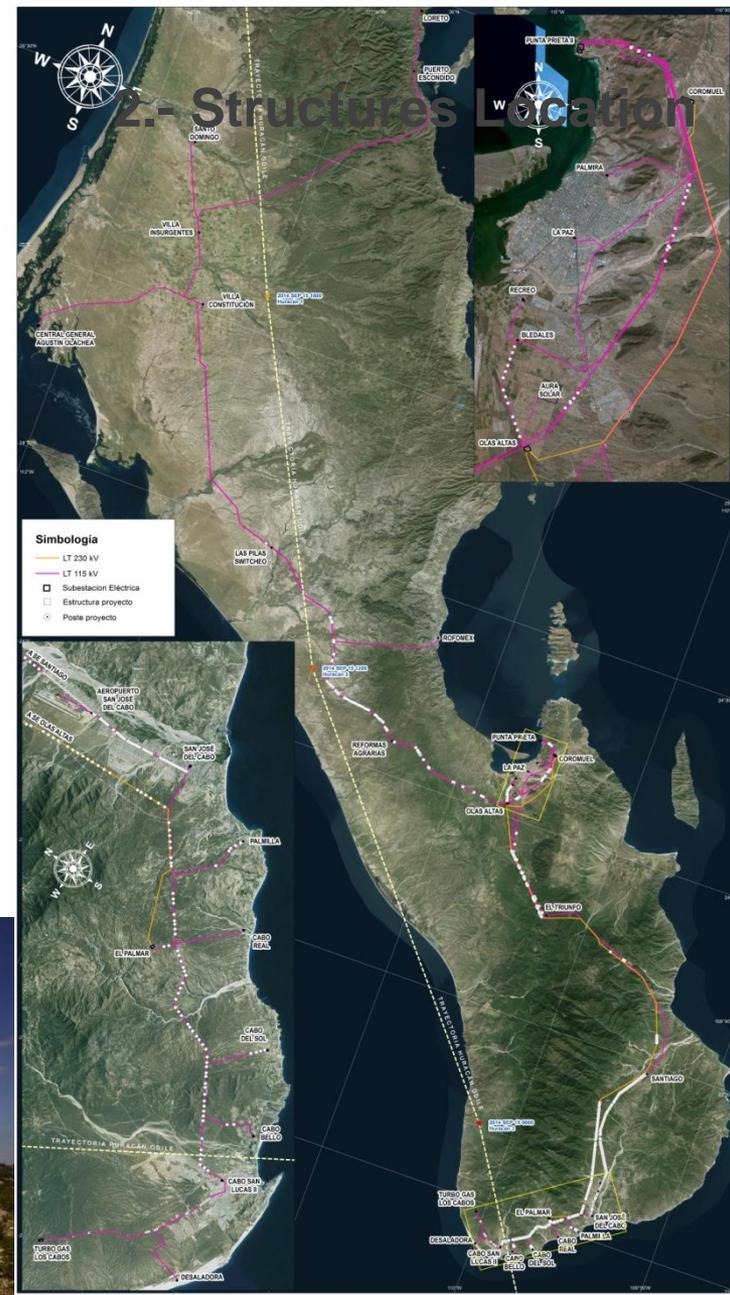
1.- Background

Date	Ubicación de Odile	Gráfico
14-Sept	<p>Huracán de categoría III en la escala de <i>Saffir-Simpson</i>, se localizó a 145 km al sureste de Cabo San Lucas, Baja California Sur, tiene movimiento hacia el nor-noroeste a 26 km/hr, vientos máximos sostenidos de 205 km/hr y rachas de hasta 250 km/hr.</p>	
15-Sept	<p>Huracán de categoría II se ubicó en tierra, a las 07:00 horas, tiempo del centro del país, a 40 km al este-noreste de Santa Fe, Baja California Sur, y a 60 km al oeste de La Paz, Baja California Sur; registra vientos máximos sostenidos de 175 km/hr, rachas de hasta 195 km/hr y desplazamiento a 26 km/hr hacia el nor-noroeste.</p>	

2.- Structures Location



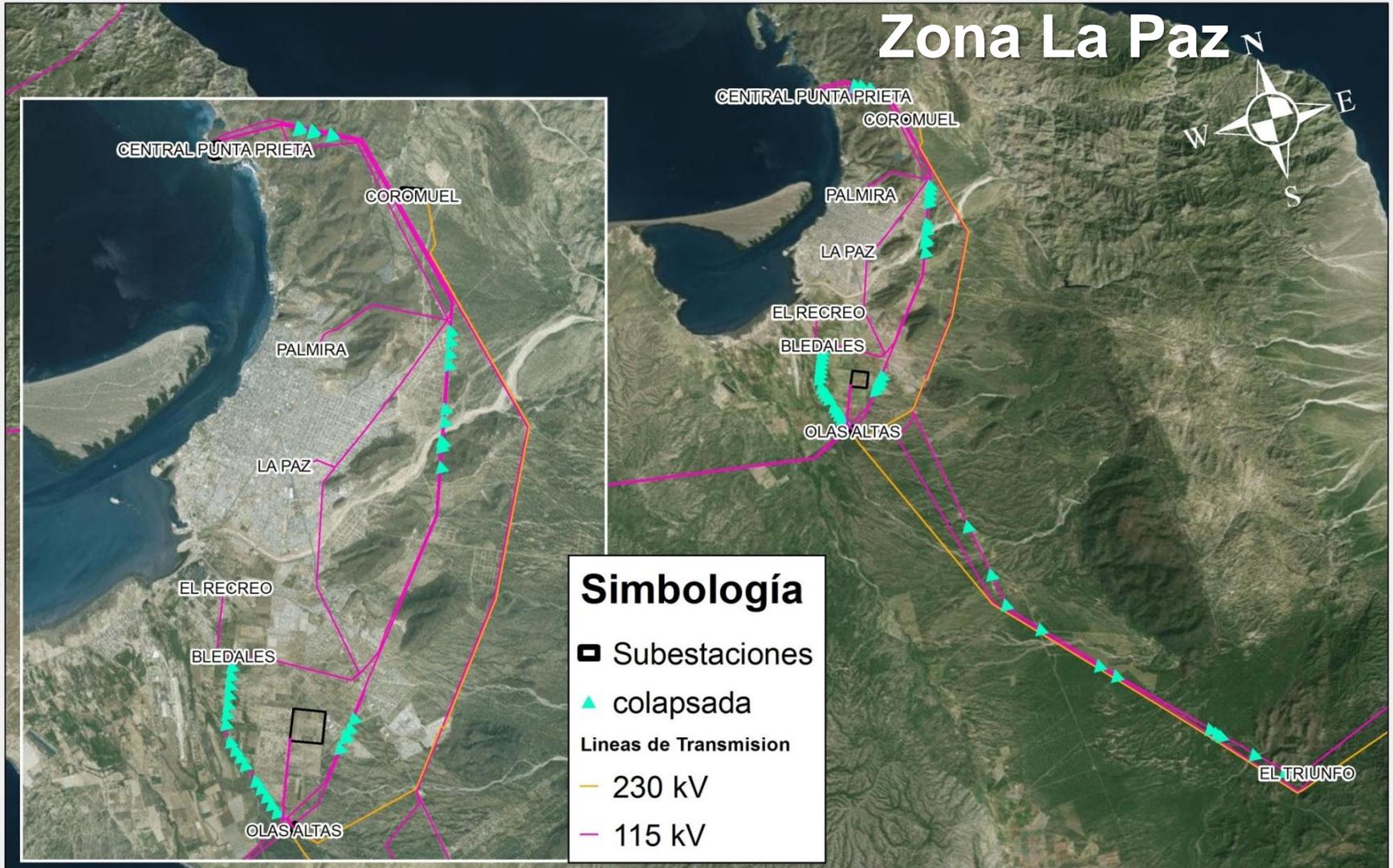
The amount of damaged structures from steel towers, poles and structures formed by pole woods, amounted to **534** of which **481** suffered total damage and 53 other structures were possible to repair. With this stay the entire grid of power transmission at high voltage (115 kV circuits 27 and two 230 kV circuits) out of service from the Las Pilas switching substation, located approximately 120 km north of the city La Paz to the substation Los Cabos near Cabo San Lucas, knocking out the power supply to the municipalities of La Paz and Los Cabos.



2.- Structures Location



2.- Structures Location



2.- Structures Location



2.- Structures Location

Cantidades de estructuras de reconstrucción definitiva

RESUMEN

RESUMEN	CANTIDAD DE ESTRUCTURA		TIPO DE ESTRUCTURA												
	Colapsadas	Reconstrucción Definitiva	MADERA				ACERO								
			MR	MS	POSTE MADERA	PAS221-2C	115 -1C (PA)	115 -2C (PA)	115 -1C (TA)	115 -2C (TA)	115-4C (TA)	230-1C (TA)	230-2C (TA)	230-4C (TA)	
INSTALACIÓN ORIGINAL	481		9	51	57	200	1	16	91	24	2		30		
PROYECTO DEFINITIVO		448	3	1			12	75	57	103		68	124	5	

MR: ESTRUCTURA DE POSTES DE MADERA DE REMATE **MS:** ESTRUCTURA DE POSTES DE MADERA DE SUSPENSIÓN
PAS221: ESTRUCTURA DE POSTES DE MADERA 2 CIRCUITOS **PA:** POSTES DE TRONCOCÓNICOS DE ACERO
TA: TORRES AUTOSOPORTADAS DE ACERO **1C:** UN CIRCUITO **2C:** DOS CIRCUITOS **4C:** CUATRO CIRCUITOS

3.- The Importance of PLS-CADD





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ENGINEERING

COORDINADORES

- Miguel Navarro Valle
- Claudio Aibar Sánchez

PROYECTISTAS

Recursos Humanos

- David Delgadillo Rodríguez
- Rodolfo Huitrón Hernández
- Daniel Juárez Razo
- Juan Pablo Gómez Olivera
- Ezequiel Vara Arres
- José Agustín Alcántara Hernández
- Luis A. Villegas Montenegro
- Edgar

HUMAN RESOURCES

TOPOGRAPHY

GRUPO TOPOGRAFÍA 1

Recursos Humanos

- Almanza
- Manuel León

Equipo

- 2 Estaciones Totales
- 1 GPS

GRUPO TOPOGRAFÍA 2

Recursos Humanos

- Manuel Falcón Alarcón

Equipo

- 1 Estación Total
- 1 GPS

GRUPO TOPOGRAFÍA 3 (RRC OCC)

Recursos Humanos

- Sergio Isaías Medellín
- Félix Castillo Ochoa

Equipo

- 1 Estación Total
- 1 GPS

GRUPO TOPOGRAFÍA 4

Recursos Humanos

- César Alquisira Luna

Equipo

- 1 Estación Total
- 1 GPS

GRUPO TOPOGRAFÍA 5

Recursos Humanos

- Miguel A. Castro Favela

Equipo

- 1 Estación Total

3.- The importance of PLS-CADD

Given the magnitude of the damage caused by Hurricane Odile, the participation of engineering group CFE was fundamental to restore fast as we could.

- [1] 100% of the structures installed in the final draft were analyzed with PLS, PLS Pole and Tower.
- [2] The electromechanical project was conceived with criteria considering civil and electromechanical engineering to increase the reliability of the national power grid in the area of Baja California Sur PLS-CADD tool. 23 projects were carried out for a month with ten combo licenses of PLS-CADD.
- [3] In a period of three months 448 structures and their foundations were installed.
- [4] The importance of the use and management software allowed an immediate response to develop projects efficiently and reliable.

3.- The importance of PLS-CADD

Engineering criteria applied in the final restoration

- [1] Project considered in the electromechanical wind pressures up to 180 km/hr
- [2] Install dead end structures in tangent each 2.0 km
- [3] Not very tall structures
- [4] Anti hurricane devices stubs to restore the structures using the existing foundations.
- [5] In structures in cross rivers and streams foundations were constructed based batteries girders league.

4.- Activity Report



4.- Activity Report

Given the magnitude of the damage caused by Hurricane Odile, the participation of all CFE area was required to temporarily restore the electricity service to the people of Baja California Sur.

Generating plants emergency were installed by the production area was coordinated with the area of energy supply fuel for them, the range was concentrated on repairing the medium voltage network and reconnection of services and the area transmission (supported construction) focused on the assembly of temporary structures for reconnection of the high voltage network.

Coordination of Transmission and Transformation Projects, was in charge of the process of final reconstruction of the infrastructure of high voltage transmission affected by Hurricane Odile in Baja California.



4.- Activity Report

For the final reconstruction installation of **508** structures were designed, this represents rehabilitate access roads to the 508 structures, dismantling **4442** tons of collapsed buildings, digging **5790** m³ by **1880** foundations, placing **690** tons of reinforcing steel for foundations, strain **5502** m³ concrete for foundations, build and assemble 3813 tons of structural steel and build about 700 km of cable conductor, 190 km of guard cable and 300 km of optical fiber.

To the above, we had the support of 12 contractors and 3 service providers with a human resource of 1167 workers and 382 units of machinery and equipment, while the part of CFE a team deployed to site 174 co of the 6 regional residences and national offices as well as 62 vehicles and 32 specialized equipment.

5.- Fotografic Report



5.- Photografic Report Equipment



5.- Fotografic Report Damage Verification



5.- Fotografic Report

Removing structures



5.- Photographic Report

Provisional structures



5.- Photographic Report

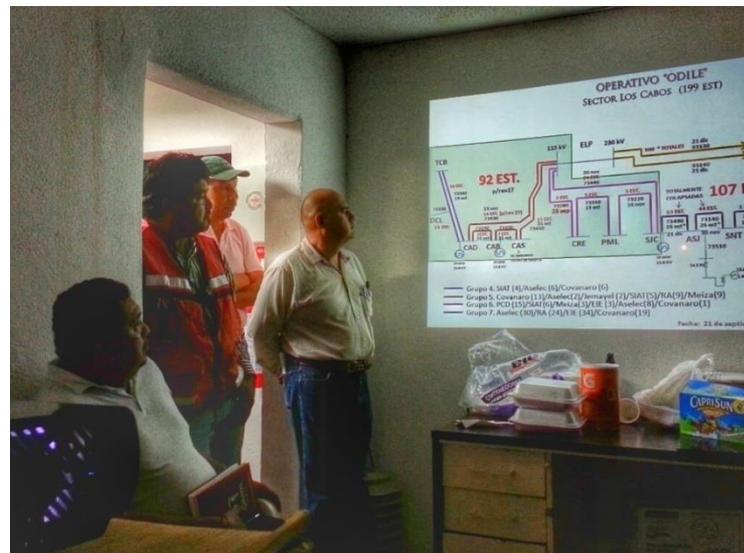
Road access



5.- Fotografic Report Projects Engineer

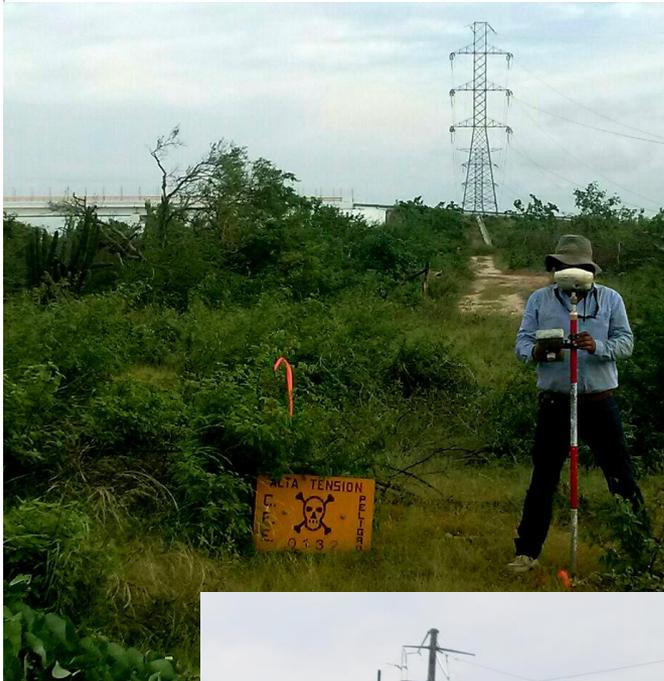


5.- Photographic Report Meetings



5.- Photographic Report

Locating structures



5.- Photographic Report

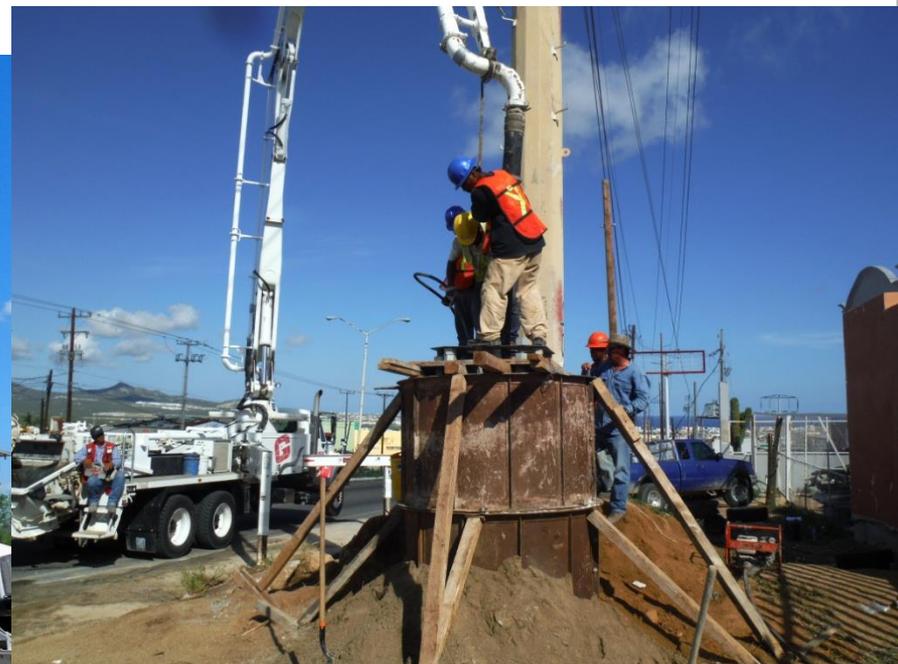
Digging foundations



5.- Fotografic Report Foundations



5.- Photographic Report concrete for foundations



5.- Photographic Report

Assembling structures



5.- Photographic Report

Assembling structures



5.- Photographic Report

Insulators and conductors



5.- Fotografic Report Conductor instalation



5.- Fotografic Report

Removing provisional structures



5.- Photographic Report Transmission Line rebuilt



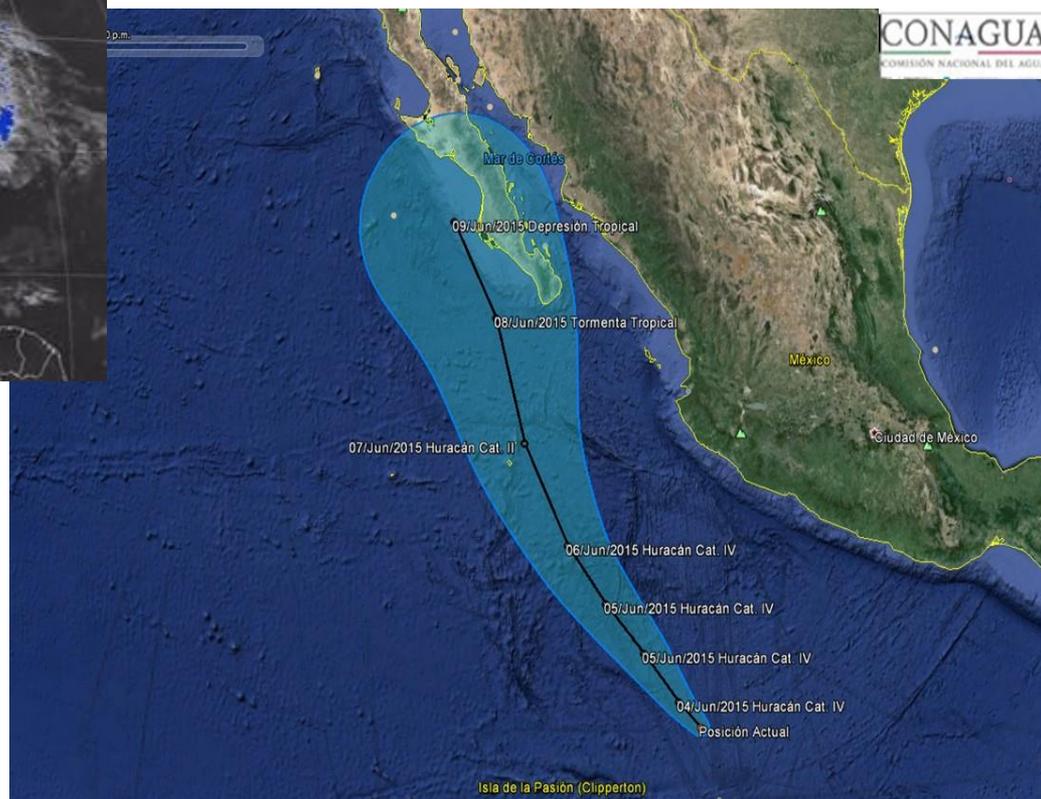
6.- Currently



6.- Actualmente

Huracán Blanca, categoría IV

Impact at 7th june



CFE

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THANKS!

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