GRUPO UPC

UNIDOS POR EL CANAL

DESIGN AND CONSTRUCTION OF THE THIRD SET of LOCKS
PANAMA CANAL EXPANSION PROGRAMME

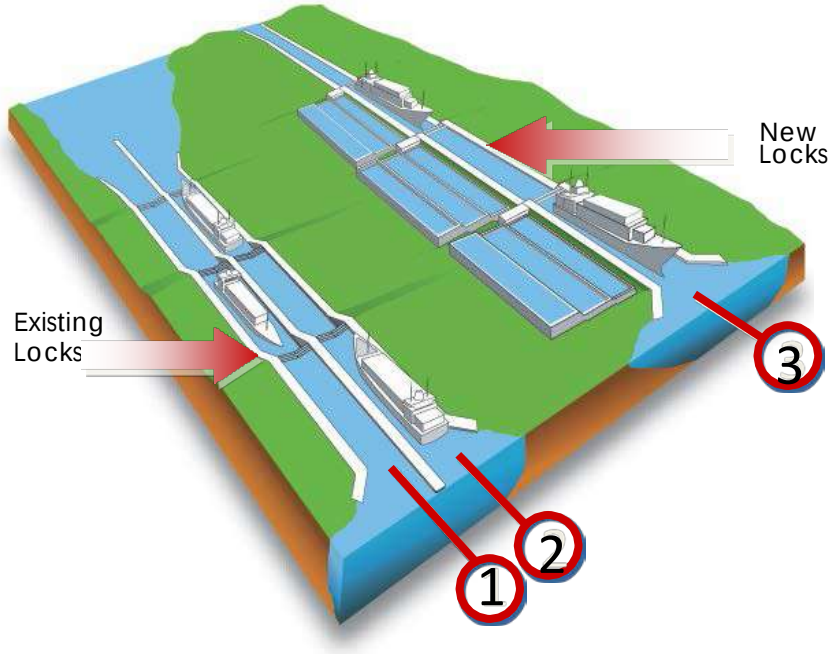
Chief Executive Officer: Giuseppe Quarta

Panama, March 23, 2015

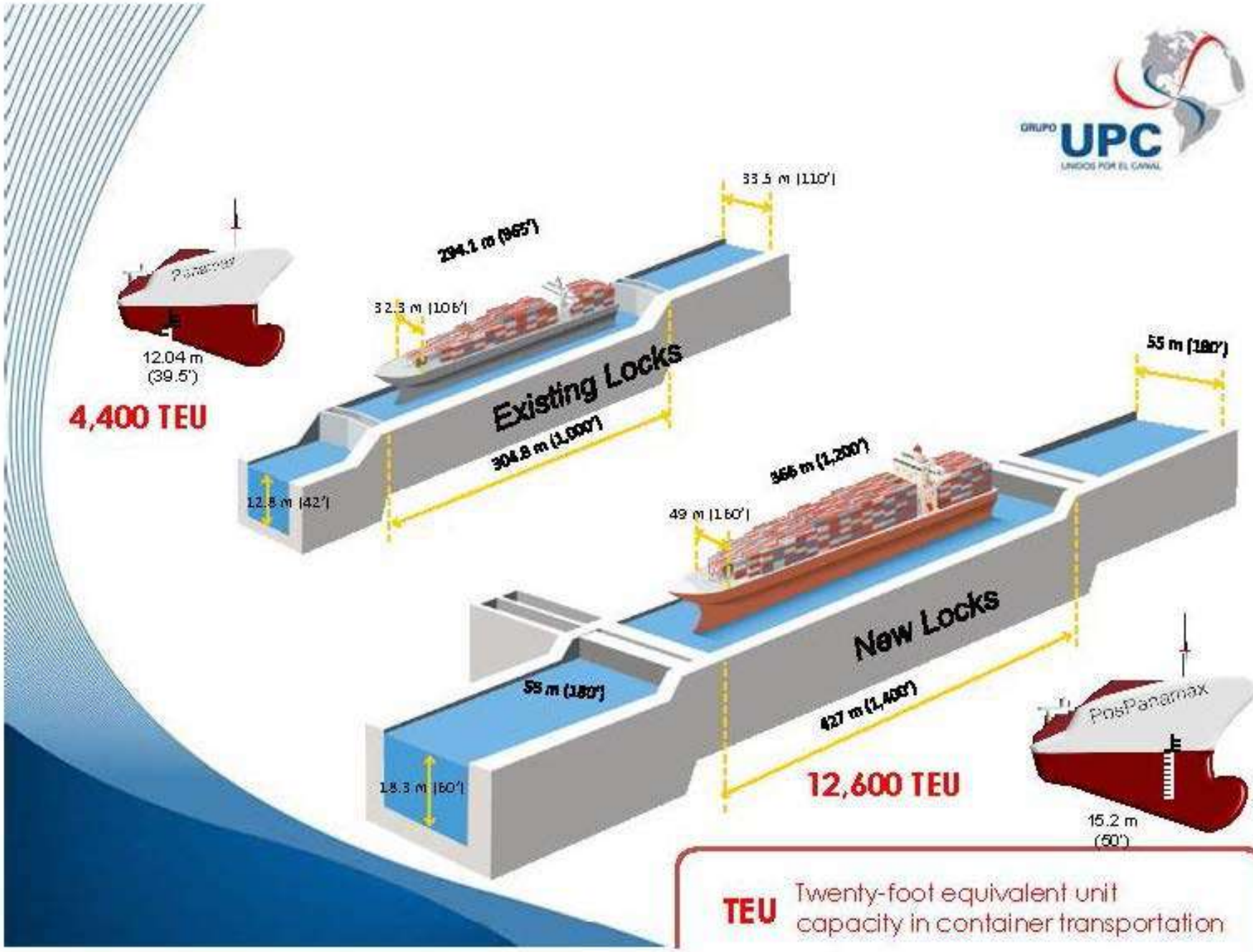

Caribbean Sea
Bocas del Toro
El Porvenir
Cristóbal
Coco Solo
Colón
PANAMA
Lago Gatún
Lago Bayano
Golfo de los Mosquitos
COSTA RICA
Volcán Barú
Panama Canal
Balboa
Vacamonte
David
ARCHIPIÉLAGO DE LAS PERLAS
Isla del Rey
La Palma
Yaviza
Santiago
Golfo de Chiriquí
Chitré
Gulf of Panama
Isla de Coiba
Isla de Cébaco
COLOMBIA
0 40 80 km
0 40 80 mi
NORTH PACIFIC OCEAN
82
80
78
9
8
7

The existing locks consists of 3 complexes:

- Miraflores (2x9m) (Pacific)
- Pedro Miguel (1x9m) (Pacific)
- Gatún Locks (3 x 9 meter) (Atlantic)

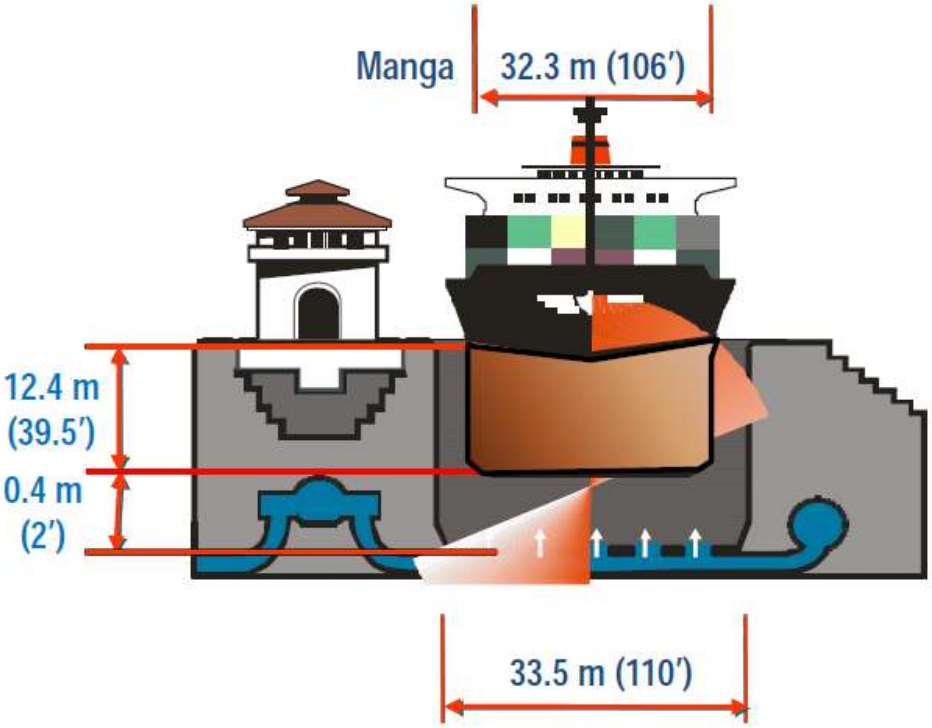



Atlantic Approach Channel
New Gatun Locks
Existing Gatun Locks
Gatun Lake

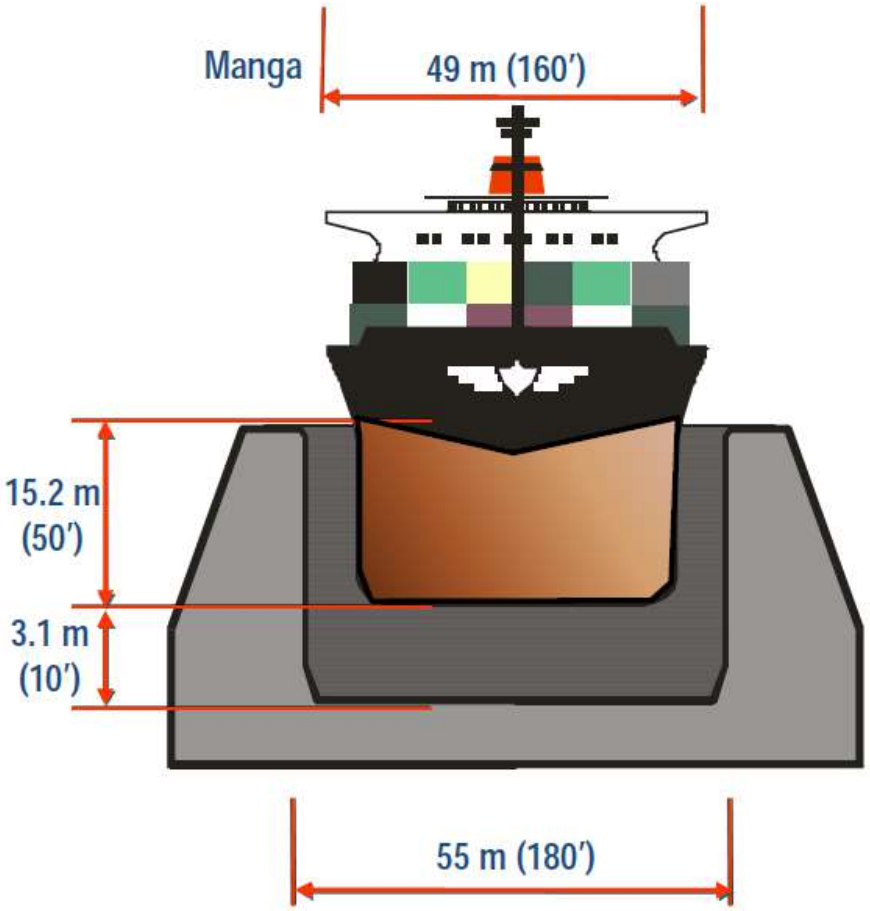

GRUPO UPC
UNIDOS POR EL CANAL
Panamax
12.04 m
(39.5')
4,400 TEU
294.1 m (965')
32.3 m (106')
33.5 m (110')
Existing Locks
304.8 m (1,000')
12.8 m (42')
366 m (1,200')
49 m (160')
55 m (180')
New Locks
427 m (1,400')
55 m (180')
18.3 m (60')
12,600 TEU
PosPanamax
15.2 m
(50')
TEU
Twenty-foot equivalent unit
capacity in container transportation

Dimensions of the Locks

Panamax
Length: 304.8 m (1,000′)
Ship: 294.1 m (965′)

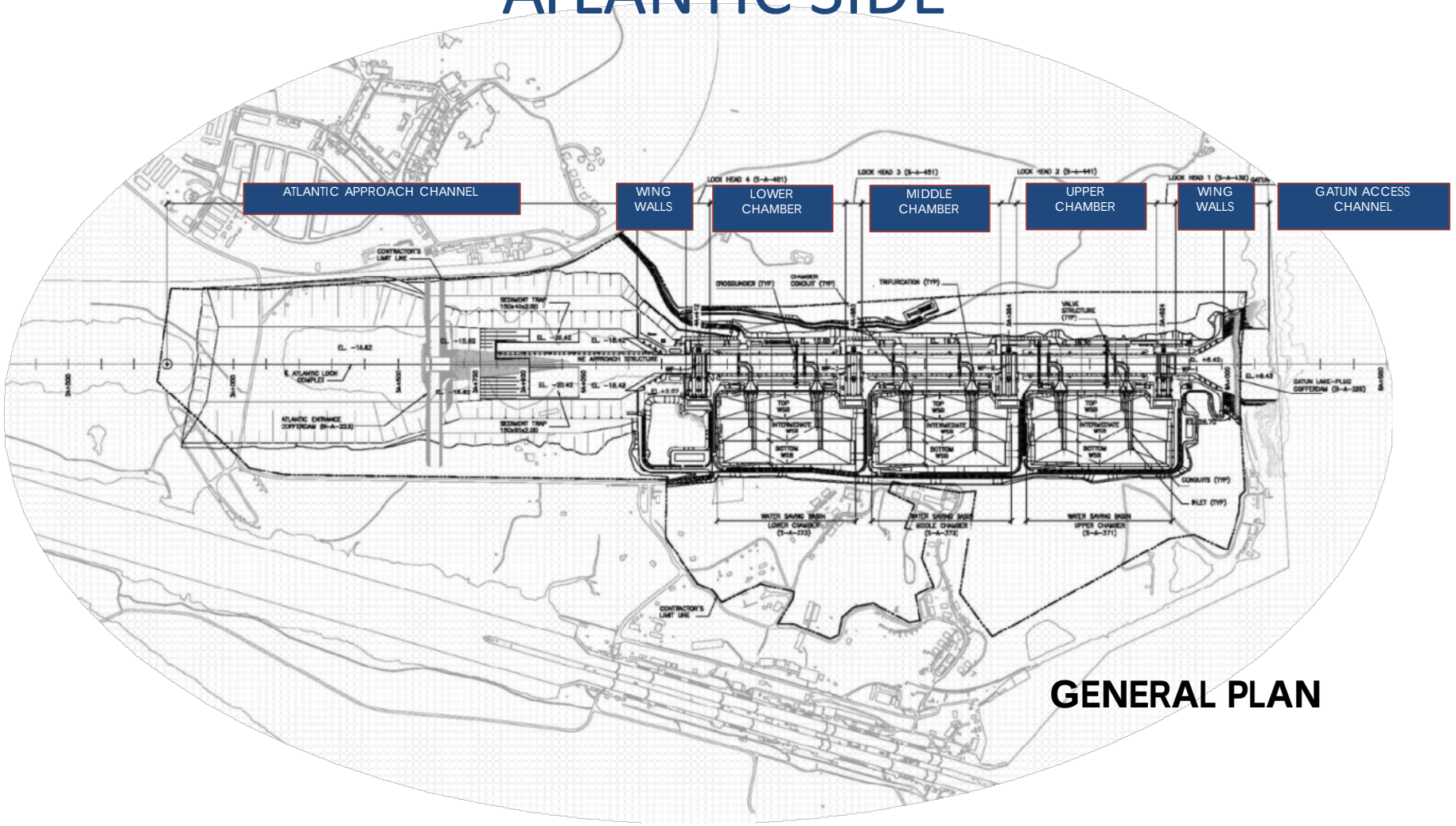


Post-Panamax
Length: 427 m (1,400′)
Ship: 366 m (1,200′)



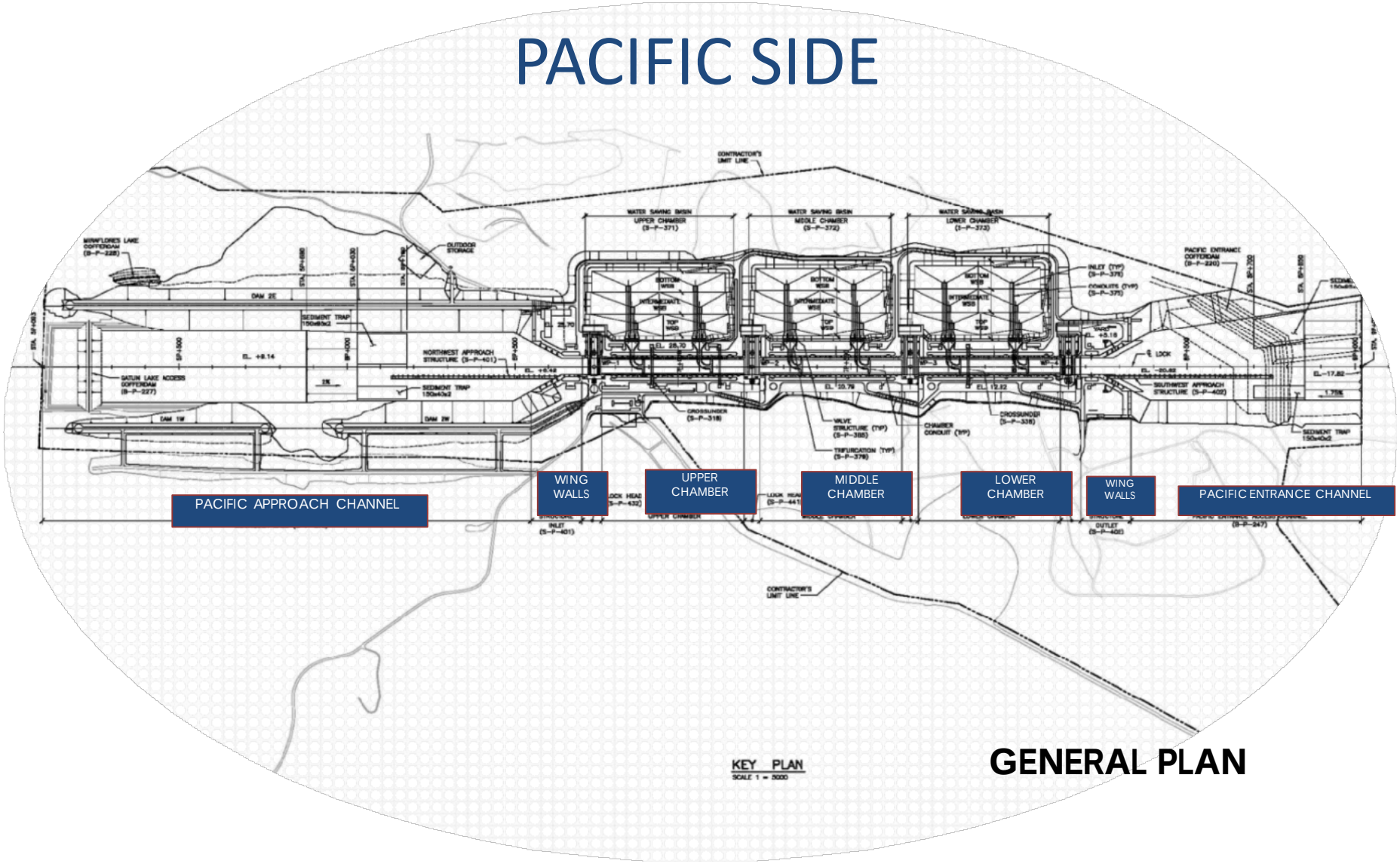
Pacific Locks Rendering

THE THIRD SET OF LOCKS
ATLANTIC SIDE



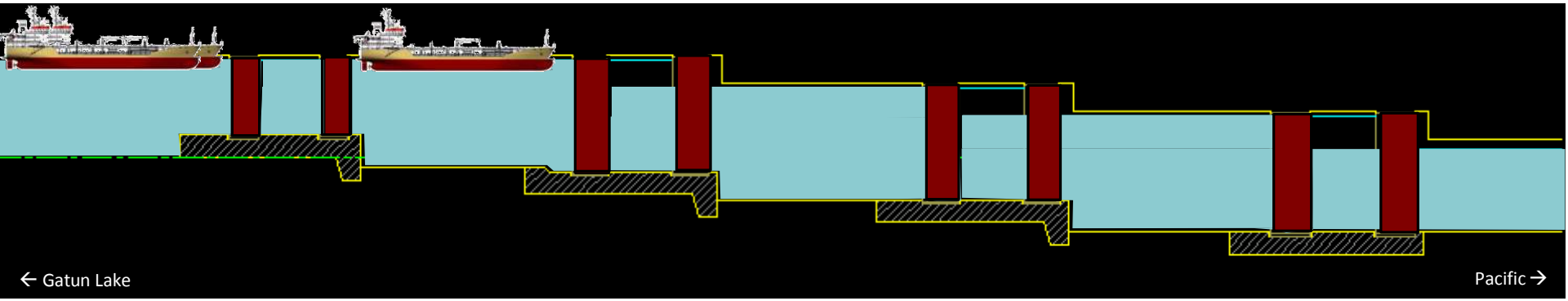
THE THIRD SET OF LOCKS

PACIFIC SIDE



Standard Lockage Scenarios

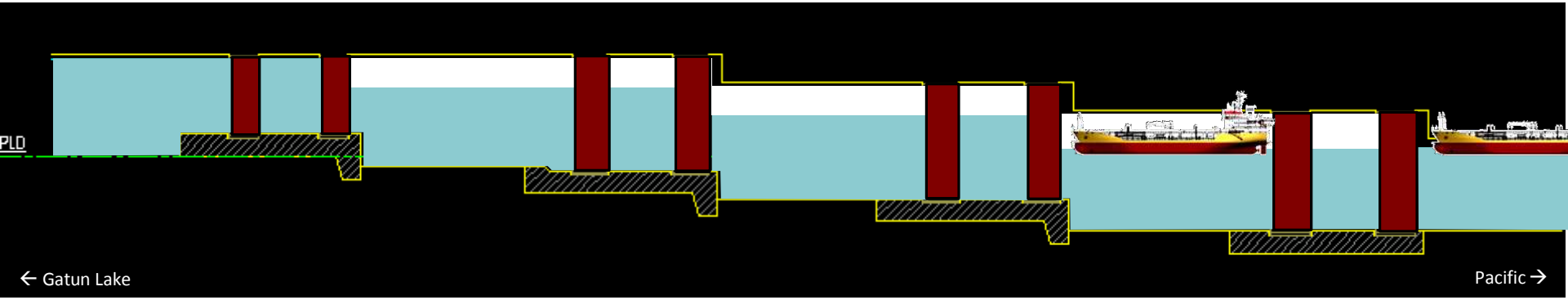
Down Lockage (Lake → Ocean)



G1 G2	G3 G4	G5 G6	G7 G8
Lock Head 1	Lock Head 2	Lock Head 3	Lock Head 4

Standard Lockage Scenarios

(Ocean to Lake)

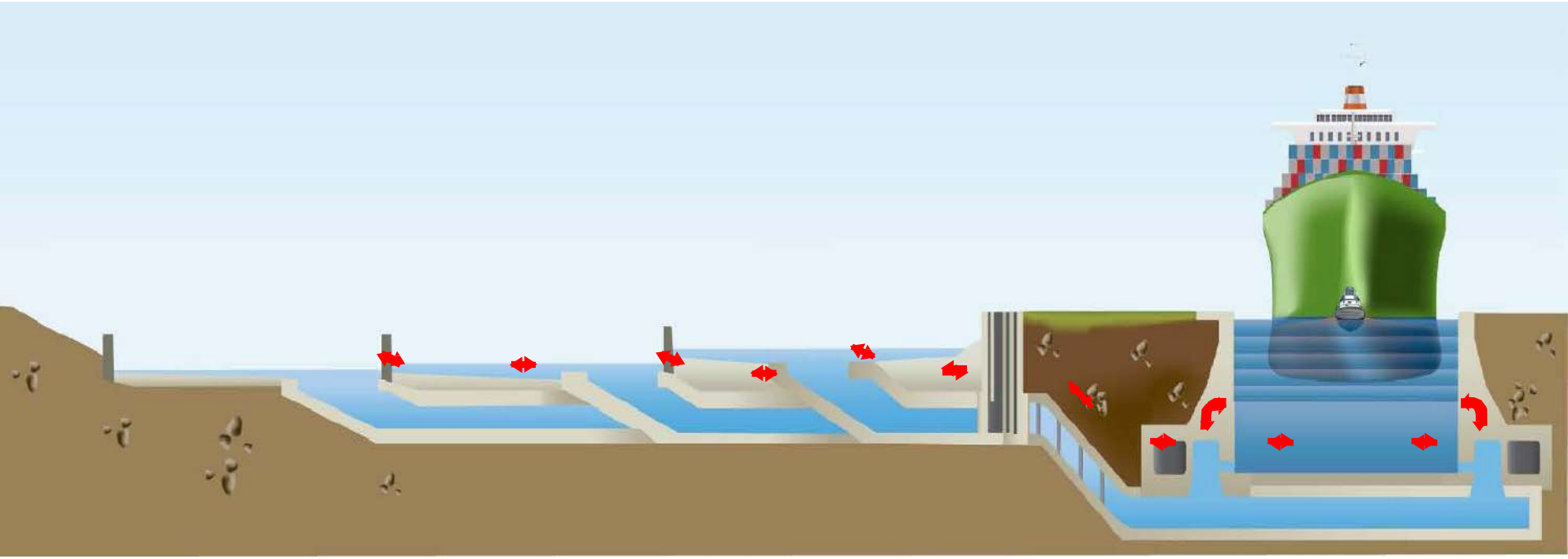


G1 G2	G3 G4	G5 G6	G7 G8
Lock Head 1	Lock Head 2	Lock Head 3	Lock Head 4

Maximum Operation Time:

Duration of filling/emptying chamber: 10 mins without water saving basins
Duration of filling/emptying chamber: 17 mins with water saving basins

Simulation of Locks Operation: Cross Section of the Water Saving Basins



The new locks will accommodate a ship that will carry 2 ½ times the cargo as ships that fit in the existing locks but will use 7% less water because of the Water Saving Basins.

ATLANTIC & PACIFIC SIDES - PROGRESS AS OF FEBRUARY 2015 - MAJOR QUANTITIES

Works	Mu	Foreseen	Current	%
Dredging	m3	6,405,091	2,744,357	42.8%
Excavation : *Structures*	m3	45,002,309	41,496,243	92.2%
Excavation : *Quarries & Borrow Pits*	m3	20,440,092	16,099,117	78.8%
Backfills : *Struct., WSBs, 1939 Excav.,* (1)	m3	11,598,200	9,419,706	81.2%
Fills *: Borinquem Dams*	m3	6,891,395	4,949,737	71.8%
Fills *: Cofferdams, Platforms, Disposals,*	m3	32,870,957	29,695,851	90.3%
Concrete Locks (2)	m3	4,303,692	4,260,330	99.0%
Concrete Others	m3	206,595	117,451	56.9%
Concrete Lean	m3	353,500	333,852	94.4%
Reinforcing Steel	ton	221,370	220,114	99.4%
Cement & Pozzolan	ton	1,600,000	1,578,397	98.6%
Gates & Valves *(Fabrication and Delivery)* (3)	ton	71,000	71,000	100.0%

Note (1) - Include Structures and 1939 Excavation

Note (2) - Staus as of Feb.28, 2015 - Do not include Overbreak

Note (3) - Based upon current Physical Progress and its equivalent accruals

- **Concrete Production**

. Republic of Panama	118,000 m3 / month Total
. Works in the Atlantic and Pacific Sites	100,000 m3 / month each
	Total 200,000 m3 / month

- **Reinforcing Steel Cutting and Bending**

. Republic of Panama	3,500 ton / month Total
. Works in the Atlantic and Pacific Sites	4,500 ton / month each
	Total 9,000 ton / month

- **Aggregates Production**

. Republic of Panama	180,000 ton / month Total
. Primary Crushing in the Pacific Site	600,000 ton / month Total
.Coarse and Fine Aggregates in the Pacific and Atlantic Sites	300,000 ton / month each
	Total 600,000 ton / month

For a better idea about the quantities of structural concrete poured in the project:

Keops Pyramid:  2,200,000 m3

20 floor building  10,000 m3

Pacific Locks - 2,550,000 m3 = 1.2 Keops pyramids
= 255 buildings x 20 floors

Atlantic Locks - 2,270,000 m3 = 1 Keops Pyramid
= 227 buildings x 20 floors

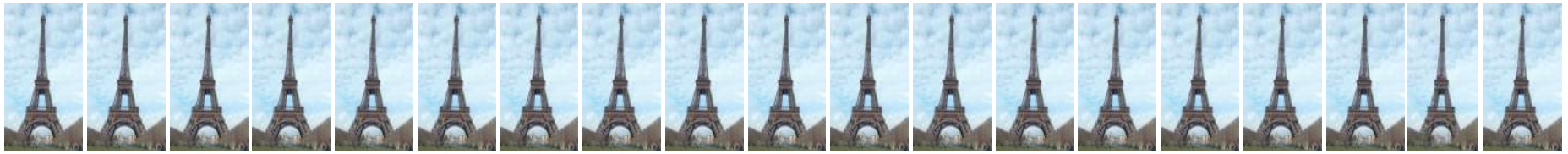
For a better idea about te quantities of reinforcing steel installed in the project :

Eiffel Tower:  10,000 ton

Pacific Locks 102,000 ton = 10.2 Eiffel Towers

Atlantic Locks 90,000 ton = 9.0 Eiffel Towers

19 Eiffel Towers



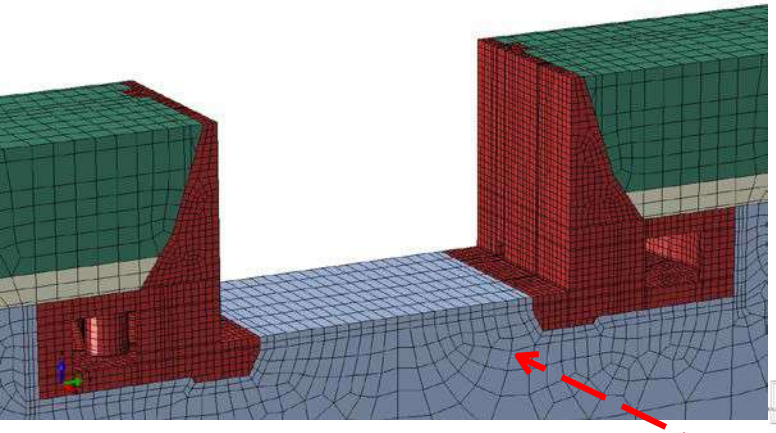
Key Project Dates

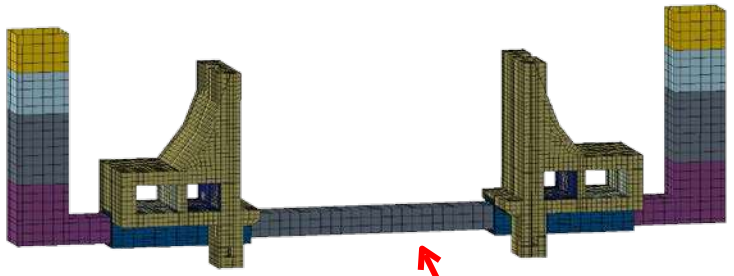
Order of Commence	**Aug.18, 2009**
Commencement Date	**Aug.25, 2009**
Current estimated time for completion	**1st quarter 2016**
Actual Contract Price:	**US$ 3,600 million**

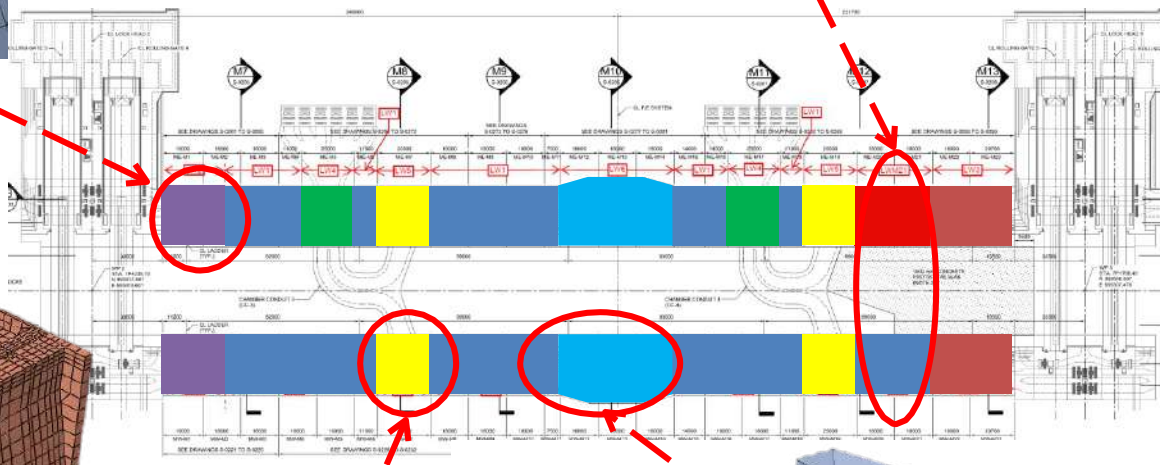
Design

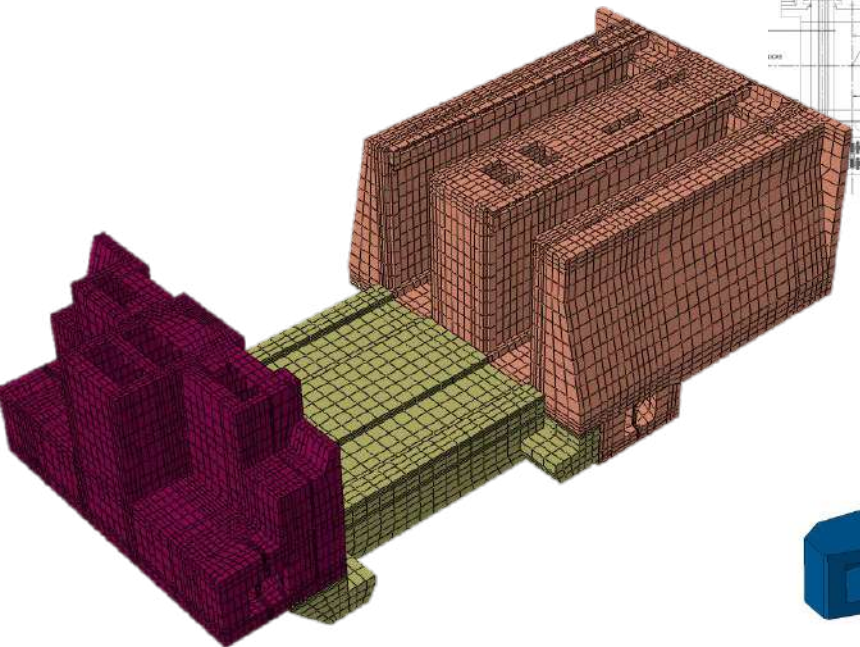
- 900 man-years of design
- More tan 200 engineers in average
- Peak of 300 engineers working
- Over 20,000 hours of supercomputer time for designing the 8 lockheads alone

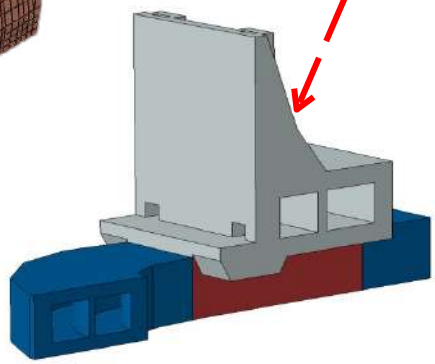
Diseño estructural. Elementos finitos.

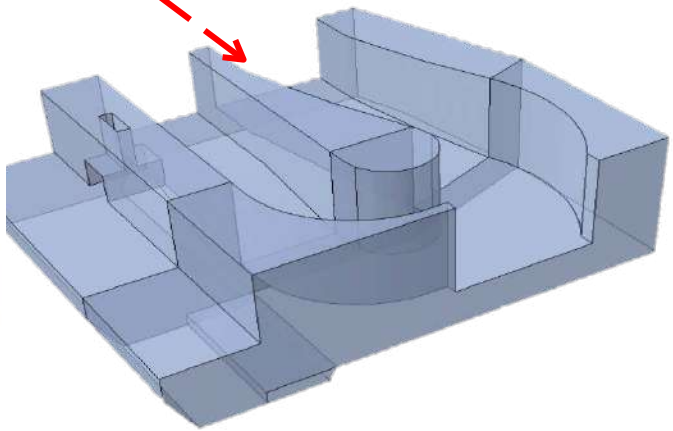




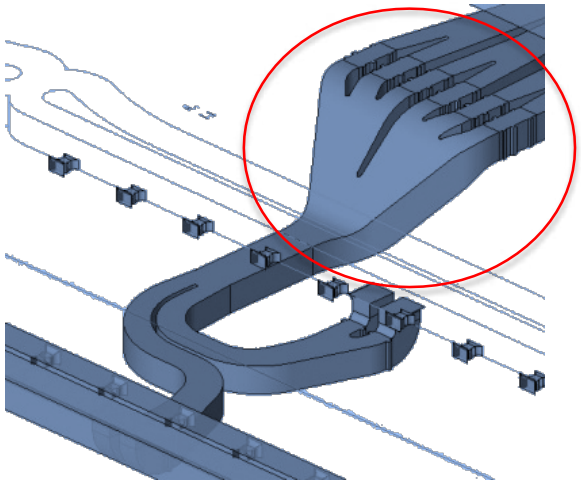


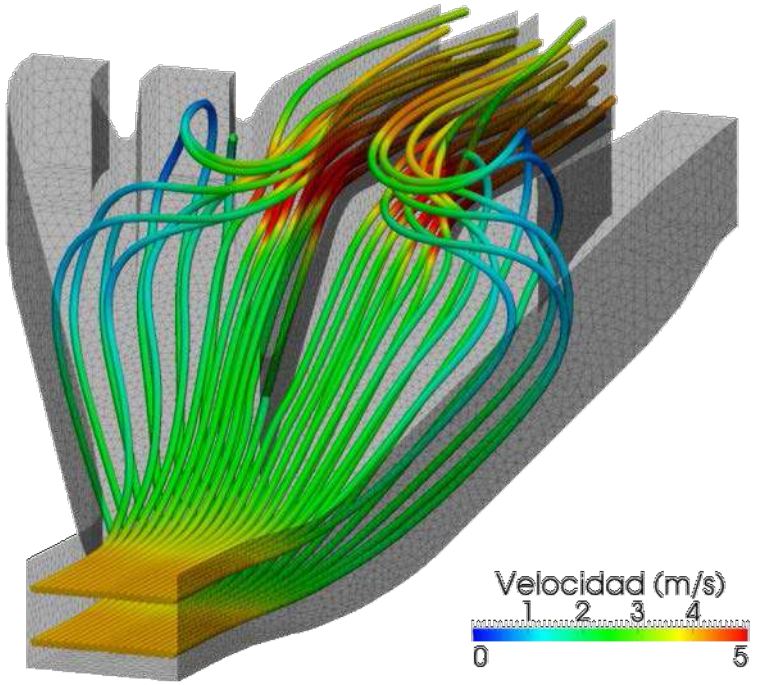


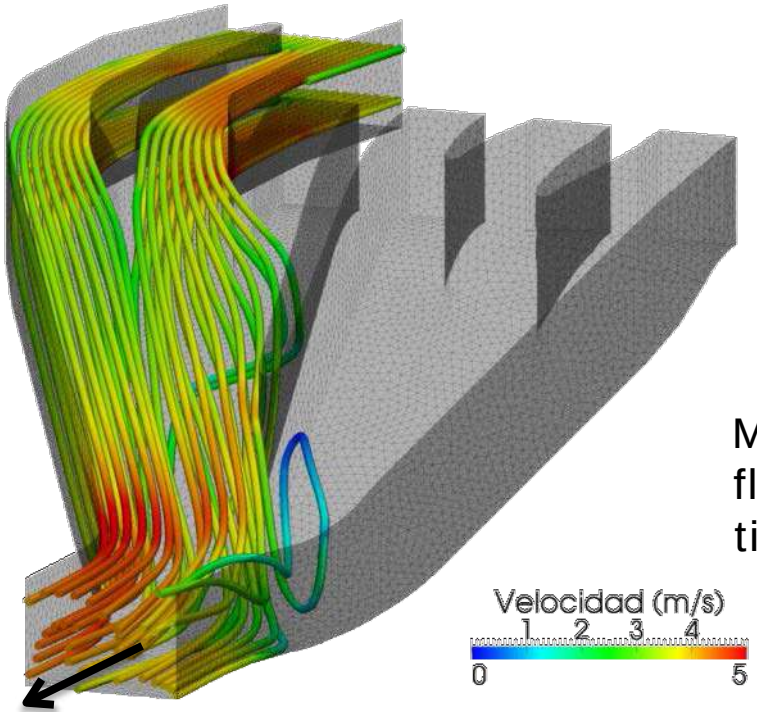




Hydraulic Design – Calculation Process







Multiple Calculatations used to achieve minimum flow velocities and minimum filling and emptying times.

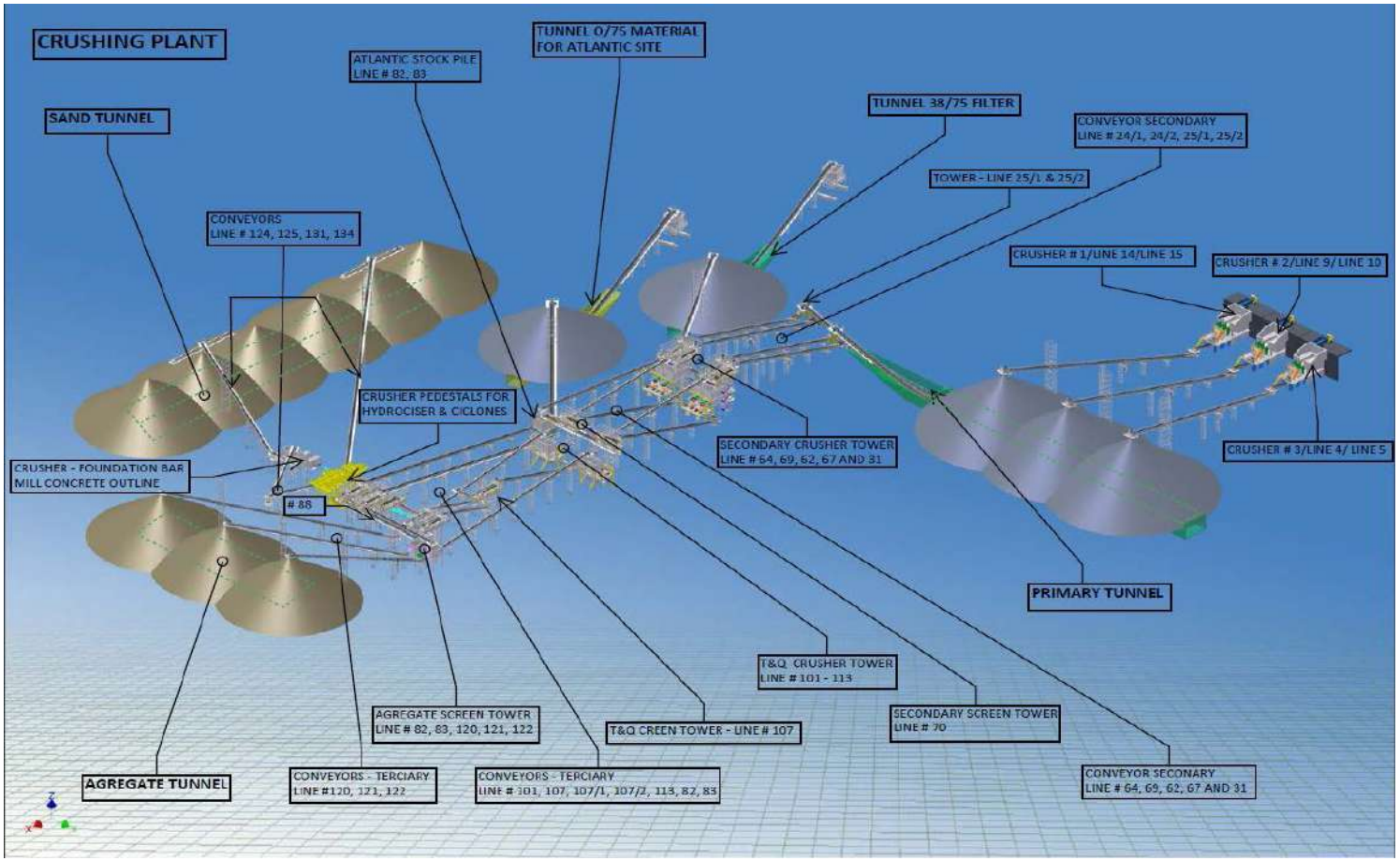
Infrastructure to Build the Main Works

- Power generation and distribution systems;
- Aggregate Processing Plants
- Lighting systems;
- Industrial water and compressed air generation & distribution systems;
- Main and detached offices;
- Labor Camp in the Atlantic Side;
- Mechanical and Electrical repair and assistance shops;
- Warehouses and store yards;
- Reinforcing steel cutting and bending yards.

Atlantic Industrial Area

Pacific Industrial Area

Aggregates and Sand



Primary Crushing Plant:

Capacity 3,300 ton per hour (PAC)

Secondary and Tertiary Crushing Plants:

Capacity 1,300 tons per hour PAC and ATL)

Concrete Plant Atl/Pac – Four Mixers

Maximum Plant Capacity: 540 m3/hour

Aerial View of Atlantic Plant

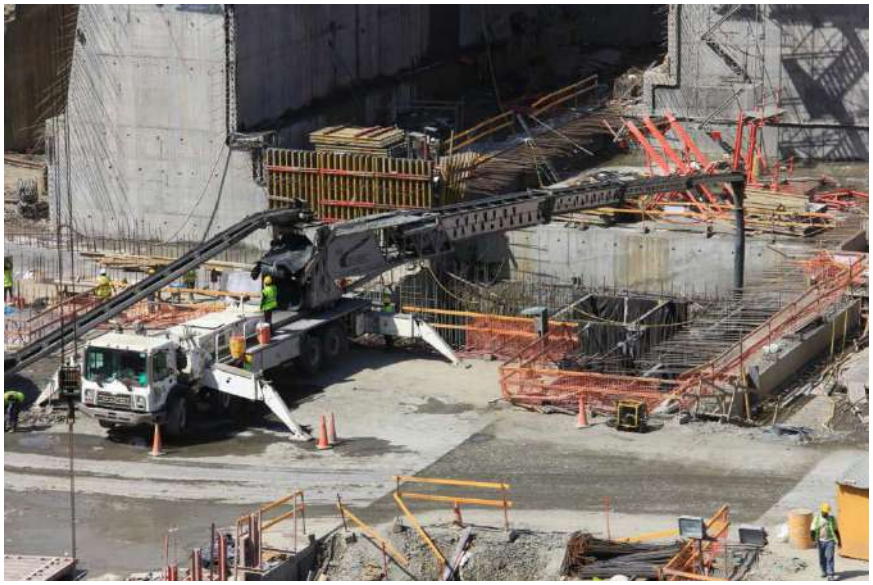
Concrete Placement Equipment

Transporte y distribución de hormigón	Capacidad nominal	Atlántico	Pacifico
Baby Tower Belt Rotec	180 m3/h	4	4
TeleBelt Putzmeister TB 130	130 m3/h	6	5
TeleBelt Putzmeister TB 200	200 m3/h	-	1
Creter Crane Rotec 24x200	150 m3/h	1	1
Bombas Putzmeister BSF 58	60 m3/h	-	3
Bombas Schwing S52	60 m3/h	3	-
Camiones agitadores Maxon y Gicalla	9 m3	38	38

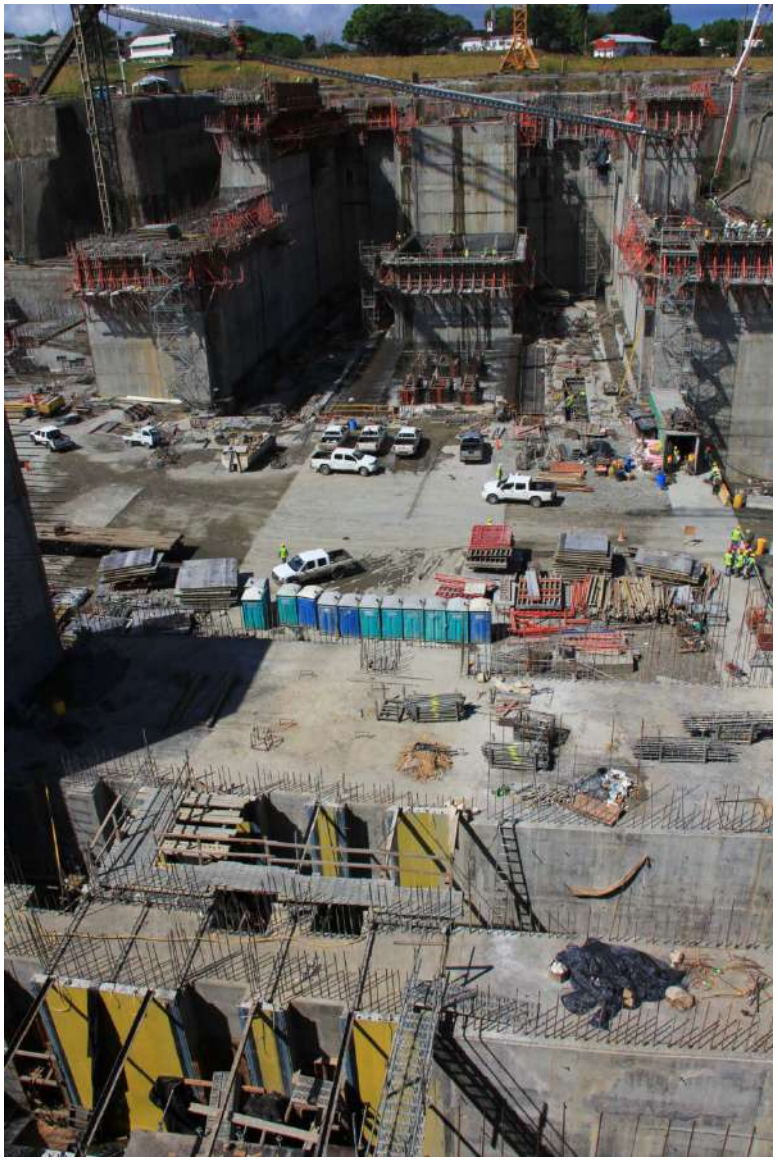
Concrete Delivery Trucks

Steel Reinforcement Fabrication

Concrete Placement and Formwork

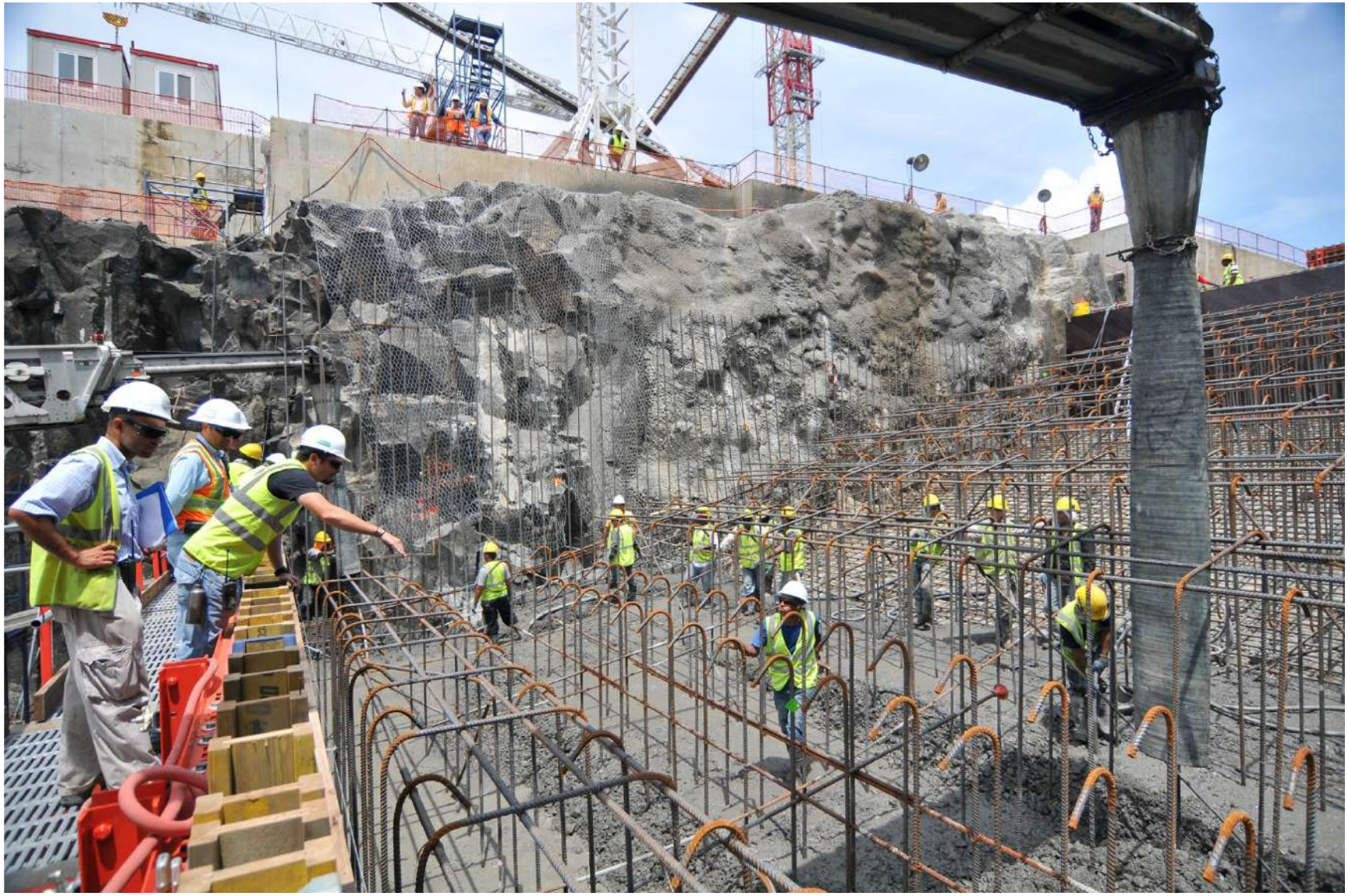


Concrete Placement and Formwork

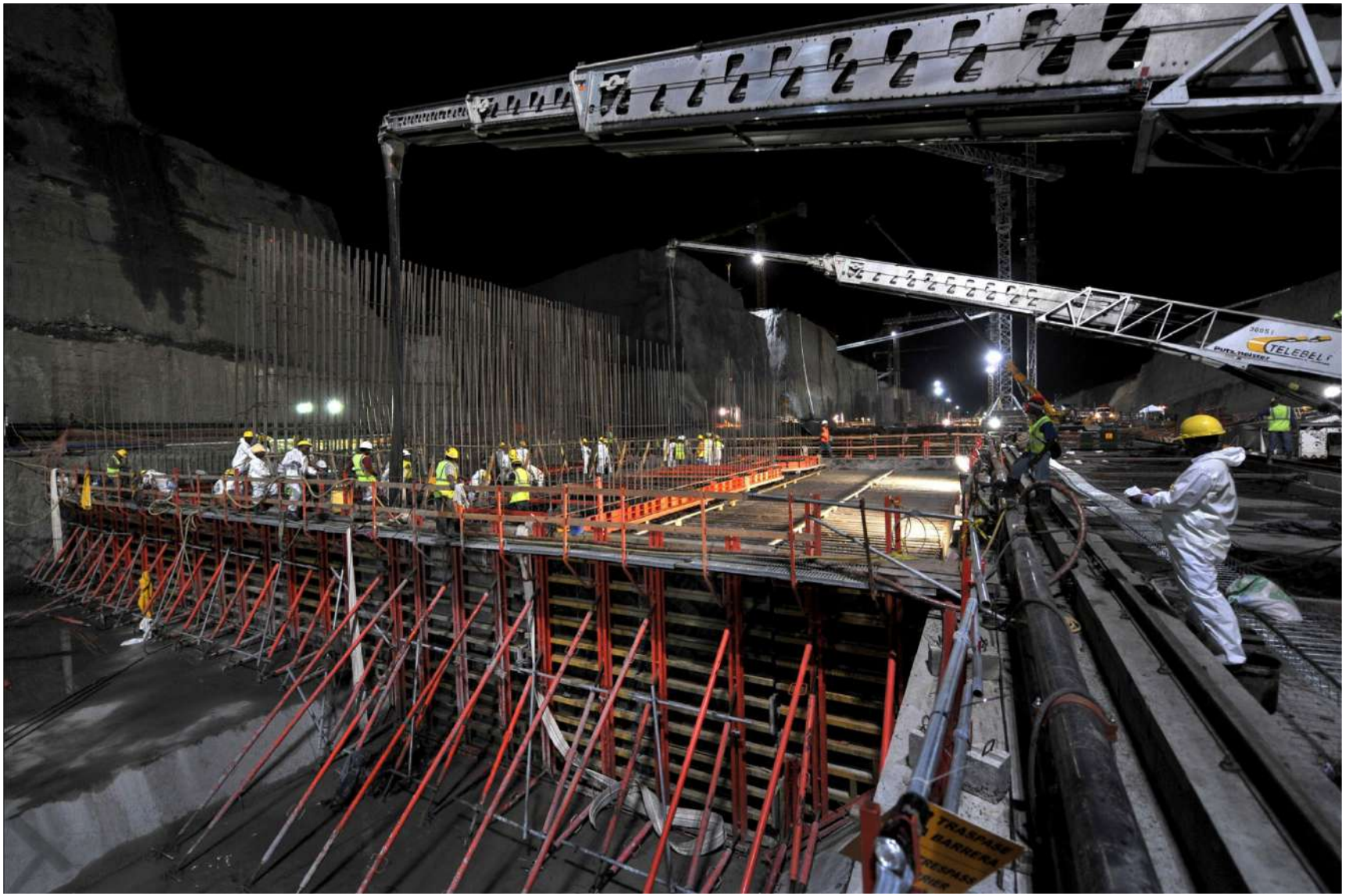


Concrete Placement and Formwork

Concrete Placement and Formwork



Concrete Placement and Formwork

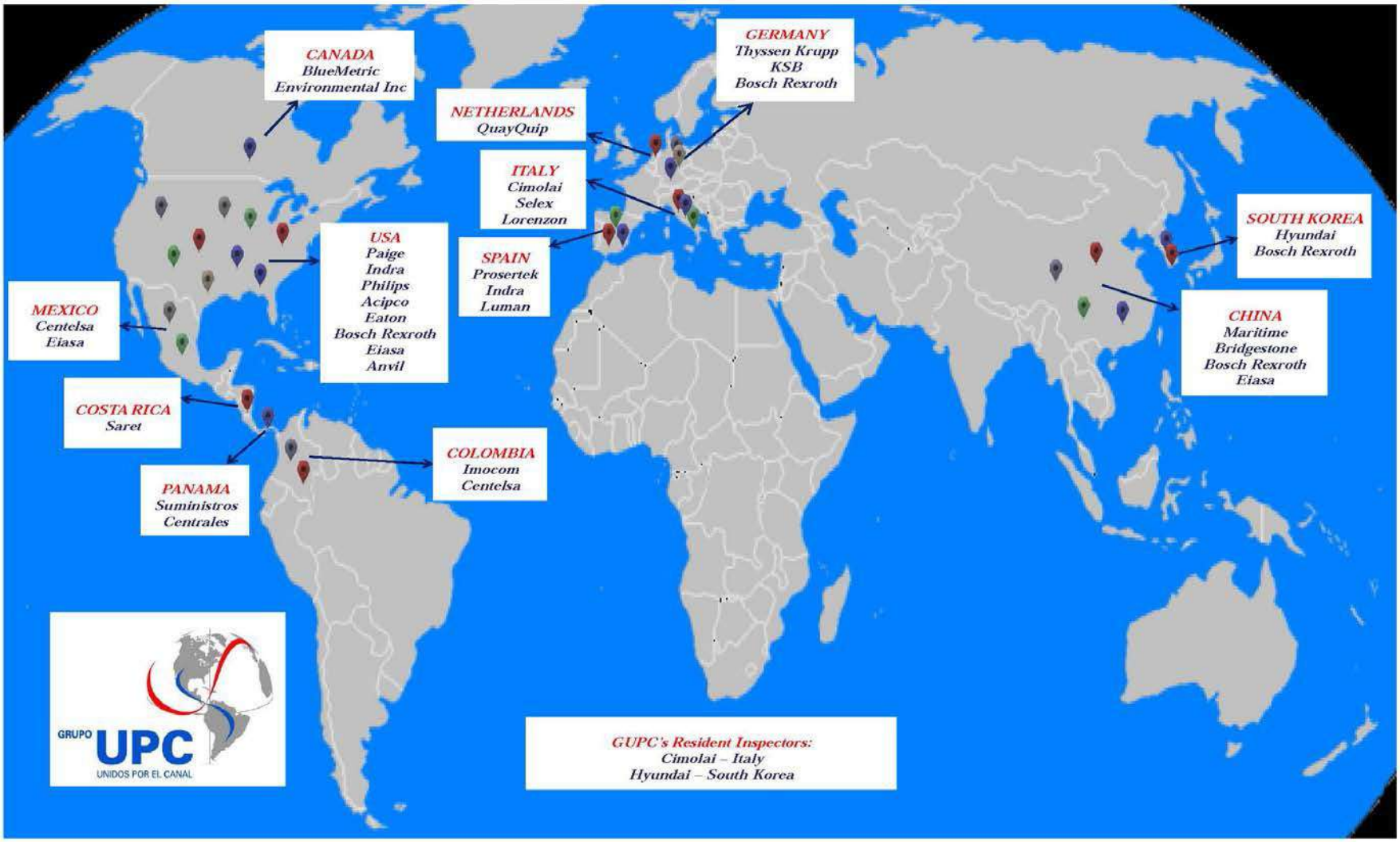


EXCAVATIONS

Power Generation (Pacific 14 MW / Atlantic 10 MW)

Electro Mechanical Components

Electro Mechanical Suppliers - Worldwide



The **16 Lock Gates** are the most important electromechanical elements with major schedule implications and require, due to their dimensions and weight, careful study of the assembly method.

Approximate Dimensions

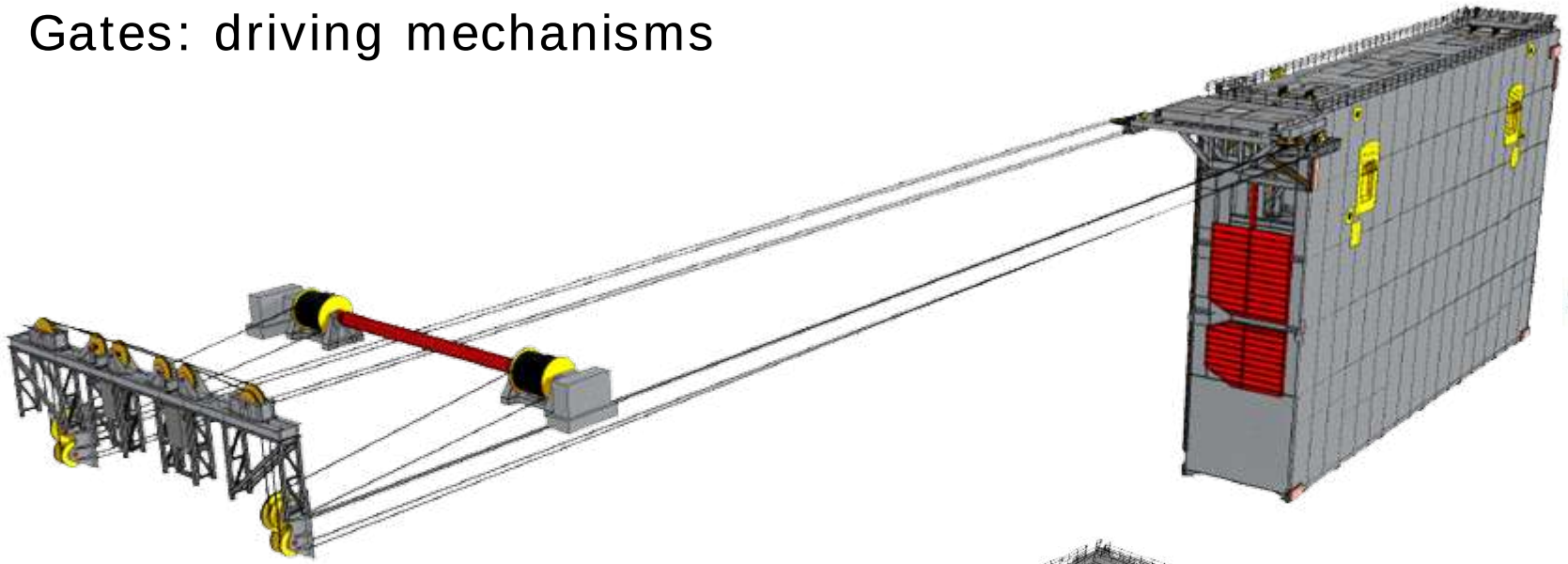
55 m length x 35 m height x 10 m thick and 4,000 Tons each

In order to avoid concentrating the assembly in the last months and risk meeting the schedule, it was decided to install the Gates in the dry condition.

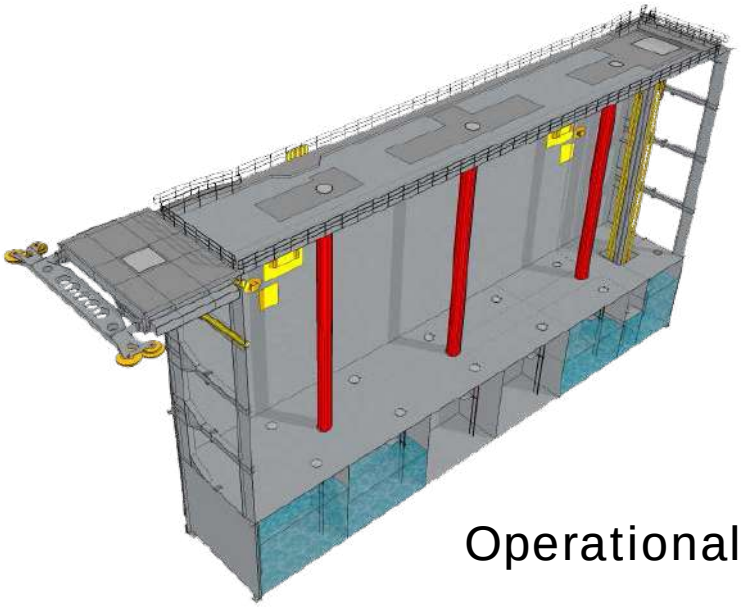
The dimensions of a Lock Gate are approximately equivalent to the Treasury Building in Panama City.

Principle Rolling Gate

Gates: driving mechanisms



wagon



Operational weight control

Machinery Building 1 – Gate Drive Mechanism

Construction of the Gates in Blocks – Cimolai (Italy)

Construction of the Gates in Blocks – Cimolai (Italy)

Gate Arrival – Atlantic Gate Landing Dock

Movement of the Gates

Unloading the first four Gates in the temporary dock with the self propelled transporters.

Atlantic Gate Landing Dock & 1st Four Gates

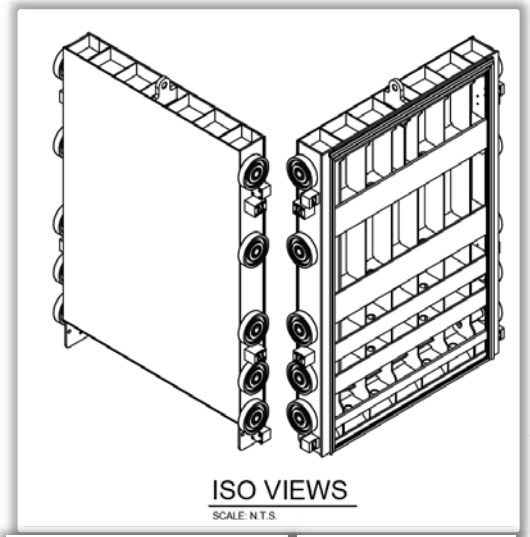
Gates transportation

Atlantic - Gate Transport to Chamber


Sarens

First Gate installation in Atlantic Site

Pacific – Lock Head 1

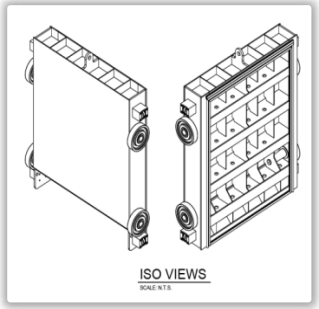


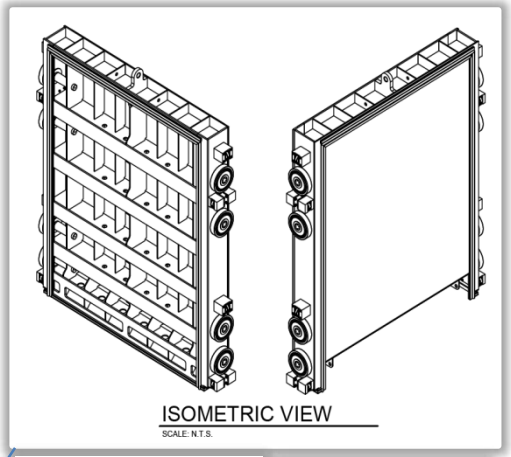
Main culvert valve
4.69m x 6.786m

64 + 2
(spares)

Equalization
valve 3.545m x
4.285m

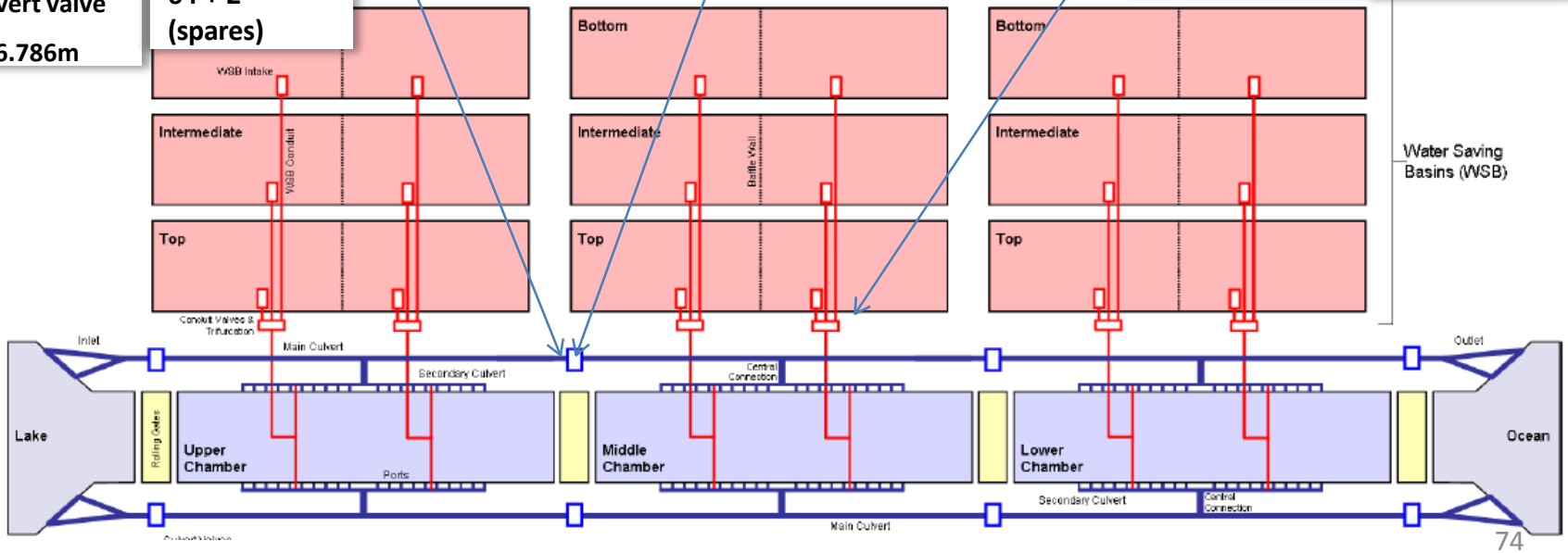
16 + 2
(spares)





Conduit valve
4.69m x 6.786m

72 + 2
(spares)



Hyundai (Korea) : Fabrication of Valves

Valve Fabrication in Korea


2012/04/06 14:45


2012/04/06 14:48

Pacific – Valve Structure 1

Environment

- Communities :
  - On going a satisfactory communication between the communities and the project with the coverage of the activities being carried out in the Project and the social and economical compromise on the Environmental Impact guiding the Design and Build the Third Set of Locks;
  - Two offices for communities relations, one in the Atlantic Side and other in the Pacific Side;

- Environment Monitoring :
  - Environmental monitoring of eventual impact of the Project on natural water, air, noise and waste water;
  - Ongoing routine scheduled internal and ACP's environmental and social audits;
  - Routine environment and social inductions for each and every labor starting in the Project, besides short awareness approaches in the field. To date 25,800 persons have received the standard 16 hr induction;

- Wild Life Rescue :
  - In the Atlantic Site 2654 individuals, including 200 species classified with certain degree of national or international protection have been rescued and realocated;
  - In Pacific Site, for 1000 individuals, including 147 species classified with certain degree of national or international protection status.

GRUPO UNIDOS POR EL CANAL – WILD LIFE RESCUE

QUANTITIES AS OF MARCH 2015
(IN VARIOUS SIZES AND SPECIES)

Mammals	**un**	**1,786**
Reptiles	**un**	**2,187**
Amphibians	**un**	**261**
Crocodiles	**un**	**381**
Snakes	**un**	**402**

All animals are checked by a veterinarian and relocated to a nearby national park.

Quality Assurance

- Comprehensive coverage of the Works by the Team of Quality Control Inspectors, Civil and Electrical Mechanical ;

• Subcontracted Inspectors follow up the activities of more than thirty Manufacturers, located in twelve countries all over the World ;

- Internal and external audits regularly performed to identity improvement measures ;

• Quality Assurance Teams from the Designers (CICP and SENER, for the buildings) perform inspections and audits in Panama and abroad, to verify compliance with design and specifications ;

• Statistics demonstrate declining trends in most of the deficiencies and issues encountered ;

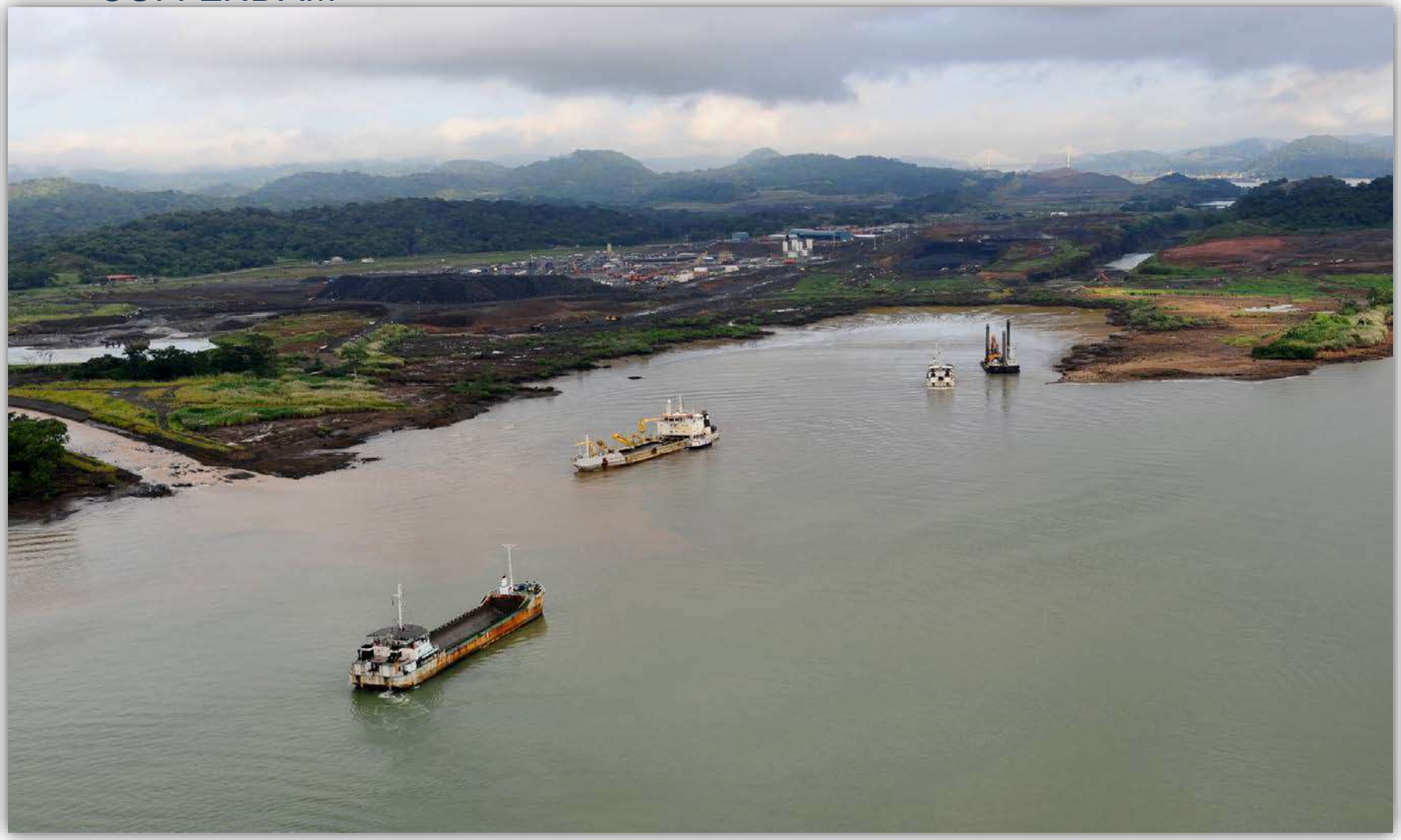
· Concrete Hydraulic Surface repairs ongoing being performed in a systematic and continuous way.

ATLANTIC SITE – BEFORE START IN 2009

ATLANTIC – CURRENT – WATER SAVING BASINS & CHAMBERS

PACIFIC SIDE COFFERDAM

BEFORE START WORKS IN 2010 – OCEAN SIDE



PACIFIC SIDE COFFERDAM

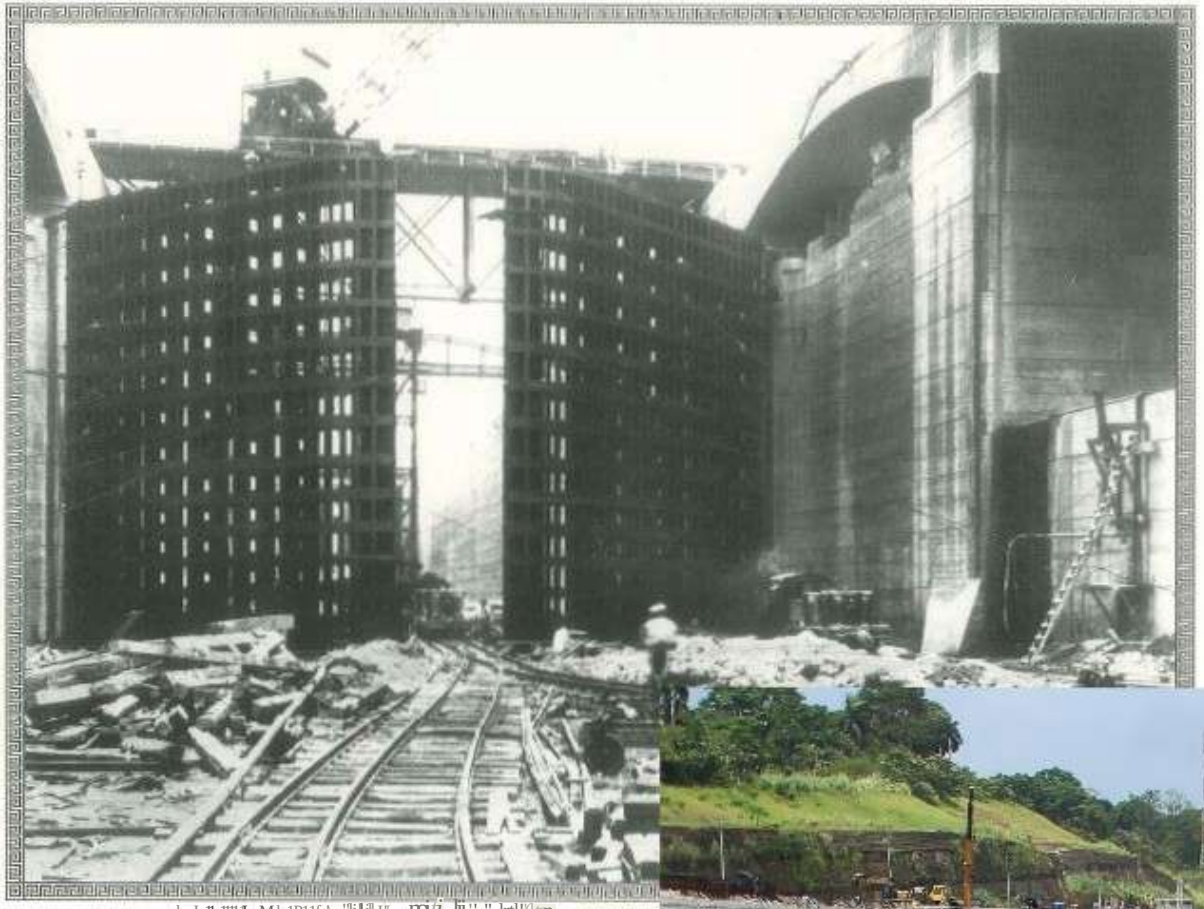
FINISHED COFFERDAM – BEFORE DEWATERING

PACIFIC SIDE COFFERDAM

FINISHED COFFERDAM – AFTER DEWATERING

PACIFIC – CURRENT – WATER SAVING BASINS & CHAMBERS

Excavadora francesa trabajando en el Cerro de Oro. ~ 18



THANK YOU!